A Practical Guide to Display Calibration
With CalMAN™ V4
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**Introduction**

In order to obtain the very best experience with your TV equipment, like a plasma/LCD/LED/CRT display, you want to "calibrate" the display characteristics to deliver the results that producers of the content intended. Most TV displays, out-of-the-box, do not deliver anything near the appropriate characteristics...they are oriented more towards bright retailer in-store environments. Additionally, your TV display will change its characteristics over time, and re-calibration is eventually necessary.

SpectraCal's CalMAN™ V4 is display optimization software for the calibration of HDTVs, monitors, projectors and display walls to the major display calibration standards used throughout the world. It is used in conjunction with many popular meters and has workflow wizards to guide you step-by-step through each calibration procedure.

This document is for users of CalMAN V4, and offers an easy-to-follow guide to accomplishing an accurate calibration for your system.

**Document Terms & Equivalents**

Instead of constantly referring to all of the possible choices, occasionally a more generic term is appropriate. Here is a table of those terms and their equivalents:

<table>
<thead>
<tr>
<th>Term</th>
<th>Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV display</td>
<td>Any display source that can be calibrated; LED TV, LCD TV, Plasma TV, CRT TV, Projection TV, Display Wall, Computer Monitor, etc...</td>
</tr>
<tr>
<td>Pattern Source</td>
<td>This refers to the source of a test pattern to be displayed on your TV display. This can be a:</td>
</tr>
<tr>
<td></td>
<td>• DVD that you play through your DVD or BD (Blu-Ray Disc) Player</td>
</tr>
<tr>
<td></td>
<td>• Electronic pattern generator: An electronic pattern generator can actually be controlled by CalMAN 4 and your computer, and will automatically display the test patterns that you have to manually move through if using a regular DVD. Often used by professional calibrators.</td>
</tr>
<tr>
<td>Meter</td>
<td>This is an electronic device designed to accurately measure your display characteristics. Types of these include colorimeters, spectrophotometers, and spectroradiometers.</td>
</tr>
</tbody>
</table>

These generic replacements are used in this instruction guide.
Assumptions About Your Setup

- These instructions were written assuming that you have a typical basic home setup. This includes:
  - DVD/BD player to be used as your "Pattern Source".
  - TV display to be calibrated (with or without a "receiver" between the DVD/BD player and the TV).
  - Computer on which you will be running the software and on which you'll be using a meter. This needs to be placed at or near your TV so that the meter will reach the screen.
- You do not have:
  - A separate electronic pattern generator.
  - Multiple meters.
  - A video equalizer/processor like the SpectraCal VideoEq Pro, DVDO iScan Duo, or one of the Lumagen Radiance series.

Navigating With Your "Pattern Source"

As mentioned in the above section, an electronic pattern generator can actually be controlled by CalMAN 4 and your computer. It will work with the CalMAN software to automatically display the required test patterns as you move through the workflow.

If, on the other hand, you'll be using your DVD or BD player in order to generate your test patterns, then you'll be navigating manually with your DVD/BD remote in order to get to the proper test pattern. Here is a list of the common navigation behaviors:

<table>
<thead>
<tr>
<th>Remote Button</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Menu&quot; Button</td>
<td>Will return you to the main menu of the pattern generator disc.</td>
</tr>
<tr>
<td>&quot;Disc Navigator&quot; Button</td>
<td>Occasionally an alternate to the &quot;Menu Button&quot;.</td>
</tr>
<tr>
<td>Arrow Keys</td>
<td>Will function for navigating around options on the menu screen.</td>
</tr>
<tr>
<td>&quot;Enter&quot; Button</td>
<td>Used to select an option.</td>
</tr>
<tr>
<td>Next Chapter ▶▶</td>
<td>Used to advance to the next test pattern when &quot;playing&quot; a selection.</td>
</tr>
<tr>
<td>Previous Chapter ◀◀</td>
<td>Used to advance to the previous test pattern when &quot;playing&quot; a selection. (You may have to hit the button twice.)</td>
</tr>
<tr>
<td>&quot;Pause&quot; Button ⏹️</td>
<td>Will pause the DVD/BD player, stopping it from advancing to the next test pattern screen automatically.</td>
</tr>
</tbody>
</table>
TV Control Terms & Equivalents

Various manufacturers use slightly different terms for common controls. Here is a table of those terms, their equivalents, and how they impact your TV display:

<table>
<thead>
<tr>
<th>Term</th>
<th>Term Equivalents</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness</td>
<td></td>
<td>This control impacts the low end of grayscale (0 to 50 IRE)</td>
</tr>
<tr>
<td>LED Backlight</td>
<td></td>
<td>This control impacts the low end of grayscale (0 to 50 IRE)</td>
</tr>
<tr>
<td>Contrast</td>
<td></td>
<td>This control impacts the high end of grayscale (50 to 100 IRE)</td>
</tr>
<tr>
<td>Offset</td>
<td>Cut, Cutoff, Cutoff, Sub-Brightness, RGB Brightness, Bias, or B Coefficient</td>
<td>This control impacts the low end of grayscale (0 to 50 IRE) when doing white/gray balancing</td>
</tr>
<tr>
<td>Gain</td>
<td>Drive, Sub-Contrast, RGB Contrast, or C Coefficient</td>
<td>This control impacts the high end of grayscale (50 to 100 IRE) when doing white/gray color balancing</td>
</tr>
<tr>
<td>Color</td>
<td>Saturation</td>
<td>The strength or amount of color</td>
</tr>
<tr>
<td>Tint</td>
<td>Hue</td>
<td>The tone of the color itself</td>
</tr>
</tbody>
</table>

Notes on the CalMAN Software Design Philosophy

- The CalMAN software was initially designed for professional calibrators, so you’ll see some features that facilitate that process, but are not needed for the typical home enthusiast:
  - Ability to track "Customer" data
  - Ability to design and alter the "workflows" in the software. This was incorporated so that the calibrator could remove or insert steps in the workflow that match his or her normal calibrating process.
- Many professional calibrators use an electronic hardware form of pattern generator. These are hooked up to both the TV and your computer. This leads to software design that outputs patterns on your computer screen that are also output to the TV. This approach is NOT used when you use your DVD/BD player to play the pattern directly on your TV, but it can get confusing if you expect the pattern on your computer monitor to play automatically on your TV.
What You Need Before Starting

- Your license key.
- A meter (color measuring device), optionally available bundled with the CalMAN software.
- The CalMAN device drivers (software for the meters) (http://www.spectracal.com/downloads.html, "Device Driver Kit").
- A computer on which you’ll be running the software and on which you’ll be using your meter.
- Microsoft’s .NET version 3.5 installed on your computer, available at the Microsoft web site or at http://www.spectracal.com/downloads.html .NET section.
- A "pattern generator" that you will play on your DVD/BD player to generate test patterns. Since we are assuming that we’ll be using a DVD/BD player, here are some of the common options:
  - GetGray (comes with the CalMAN software).
  - Alternatively, you can buy a commercial DVD pattern disk like the, "Digital Video Essentials" DVD.
- If you downloaded your pattern generator from the internet, you’ll need a utility to allow you to "burn" DVD’s from your computer. E.g., the freeware program, "ImgBurn". (http://www.imgburn.com/index.php?act=download).
- Finally, let your equipment warm up for at least an hour before performing your calibration on it.

Installation Process

1. "Burn" your pattern generator to DVD:
   a. Double-click on "AVCHD-v1_3.exe", located where you downloaded the software. This will generate an ".iso" file which you will burn to a DVD.
   b. Using a free DVD burning utility like "ImgBurn", burn the "AVCHD-v1_3.iso" image to DVD.
2. Install the CalMAN meter device drivers
   a. Double-click on "DeviceDrivers_v13.msi", located where you downloaded the software to install the required device drivers.
   b. Follow the on-screen instructions to install the software.
3. Install CalMAN 4:
   a. Double-click on "CalMAN_v410.msi", located where you downloaded the software to install CalMAN 4.
   b. Follow the on-screen instructions to install the software.
4. When the software installation is complete, run the CalMAN v4 software
**Initial Software Setup and Configuration**

1. Start the CalMAN 4 software. (Make sure to let your equipment warm up for at least an hour before calibrating it!)

   *NOTE:* You’ll see that the software fills the entire screen on your computer. If you’d rather it run in a window, push your mouse to the top right of the screen and click on the blue rectangles:

2. You’ll be greeted with a welcome screen that tells you about the latest developments:
3. You’ll be told to press the "Next" button in the lower right of the screen to advance through this introduction. (This button is common to all process steps throughout the software workflows):

![Image of the software interface]

4. Note that this is also your introduction to the "workflow" features of the product. As you advance through the screens, you note that you progress step-by-step through the workflow section on the upper left of the screen:
5. Continue to click through the screens that explain about the CalMAN user interface and the Navigation standards. The first actual setup screen that you’ll encounter is for the Licensing setup. Click on the "Settings" tab on the right:

6. Select the "License" option from the menu, and enter your new license key:
7. Now we’ll get ready for the next step, configuring the meter. Plug in your meter and let your computer go through the process to install that device.

8. Choose the "Meter Settings" option, and then click on the "Search" button:

You should see your meter type get populated in the drop-down box if the search is successful. If not, then check your driver installation again.

Also set your "Mode (Target Display Type)" at this time. Click on the drop-down box to select your TV type.
9. Hide the menu by clicking on the right arrow symbol, then click on the "Next" button, and we'll go onto setting the "source":

![Display Control Screen](image1)

10. Since we will not be using any sort of electronic pattern generator, ensure that "Optical player or video generator (manual control)" is selected:

![CalMAN4 Screen](image2)

11. Skip through the "Display Setup" screen. That is for direct control video display units only, and not applicable in this guide.

12. Next we get to the "Meter Initialization" screen. Depending on the type of meter you have, it may need "dark frame calibration". Simply put your meter on a dark and opaque surface and click on the "Initialize" button:

![Meter Initialization Screen](image3)
13. We are now done with the initial setup! To get started with the calibration of your TV, we now need to load one of the workflow templates. We are going to use the "Standard" one, accessible by either clicking on the "Standard" workflow icon, or by clicking on the aqua folder icon and opening the "standard.xml" workflow template:
Calibrating Your TV

Section 1, "Pre-Calibration"

This pre-calibration section is for initial session setup, as well as a few basic adjustments that we'll apply to your TV before really digging into the calibration process.

1. **Meter Profile:** The first step in the "Standard" workflow is entitled, "Meter Profile". You may recall that much of the philosophy behind the product is oriented towards professional calibrators, so a few of the workflow steps will be skipped. This is one of those steps. (This "Target"/"Reference" meter calibration is used to calibrate tri-stimulus colorimeter relative to a spectroradiometer, which is confused by sources such as LED-based TV screens.) Just hit the "Next" button to skip this and proceed to the next step.

2. **Session Setup:** The second step in the standard workflow is that of "Session Setup". Being oriented towards having multiple "customers", we also skip this step. Just hit the "Next" button to proceed to the next step.

At this time, turn on all of your gear...including your TV display and DVD/BD player (pattern source). Insert your selected DVD calibration disk into the BD player. For this example, we'll be using the AVS HD 709 – v1.3 disk. (You can use any one of a number of DVD calibration disks in the following steps. Each will have an equivalent screen...but you may have to dig for it.)

**NOTE:** Initial Color Setting On Your TV
Many modern TV's have a color setting that allows for adjustments towards either a "cool" (blue) setting or a "warm" (more red) setting. The default is usually too far onto the blue side, so set your TV to as warm a setting as possible, e.g., "Warm 3". This needs to be done first, as adjusting this setting later will change most of your calibration results.
3. **Preset Brightness:**

![CalMAN software interface](image)

Early TV's, which were CRT-based, did not allow for the broadest range of display values from black to white. So, instead of having the full range of 8-bit values from 0 (black) to 256 (white), the standard evolved to range from 16 (black) to 235 (white). "Below black", or the range from 0-16, is visible only while calibrating your TV and in your final calibration you don't want this signal visible. This "below black" information does not exist on any commercial DVD or BD other than your test disk. Similarly, the "above white" signal (234+) is not present in TV signals.

**NOTE:** See related Youtube video in the SpectraCal "Channel": [http://www.youtube.com/spectracal](http://www.youtube.com/spectracal)

**NOTE:** You may have to set up your particular DVD/BD player to "pass" the "below black" and "above white" signals in order for this calibration step to work.

On your DVD/BD player, navigate to the "CalMAN Windows" option, and select the "Bright & Cont." option on the next screen. We will be using the first screen that appears.

So in this "brightness" step, adjust the TV's "Brightness" control so that the ranges 17 and above flash, while 16 and below appear to be black. Hit the ➤➤ key twice to advance to the next section of the "Bright & Cont." section so we can work on contrast. Also hit the "Next" key in the CalMAN software.
4. **Preset Contrast:** We will now adjust the contrast so that areas above 234 appear totally white, while those below 234 demonstrate shades of gray. Use the TV's contrast control to accomplish this. Note that you may be unable to do this...today’s LCD/LED TV’s have such a wide display range (gamut), that you may note be able to totally accomplish this step. Don’t worry too much about it. We’ll be adjusting the strength of the 234 shade of white in the next step.

   NOTE: See related Youtube video in the SpectraCal "Channel":
   http://www.youtube.com/spectracal

   When done, hit the "Menu" or "Disc Navigator" key for your DVD/BD player and navigate back to the main menu for the "CalMAN Windows" option. Also hit the "Next" key in the CalMAN software.

5. **Preset Luminance:** This step is designed to adapt the whitest of display signals to best match your room lighting conditions. In a bright room, you’ll need brighter whites, while in a dark room, you’ll prefer less bright whites. In a darker room, the brightest whites will cause you eye strain as you watch your TV, so the white level needs to be lowered. For this adjustment, you will be using your TV’s "LED Backlight" control if you have one (LED TV’s typically do), or use the TV’s "Contrast" control if you do not.

   NOTE: See related Youtube video in the SpectraCal "Channel":
   http://www.youtube.com/spectracal

   In the DVD/BD disc navigation, select the "100% Color" option in the "CalMAN Windows" section. (Remember that you can hit the button once or twice to navigate back to an appropriate screen should the timing on the DVD advance past the screen you are working on at the moment. Alternatively you can use your pause key .)
For the first time, place your meter on your TV screen, so that measurements can be taken. Hit the "Infinity" button on the CalMAN screen to start the process of taking measurements, and hit the "Stop" button to stop taking measurements:

Here is what you are targeting:
- Bright room – 50-60 fL
- Dim room – 40-50 fL
- Theater room – 30-40 fL

Use your TV's "LED Backlight" or "Contrast" control to adjust the white level to best match your normal viewing conditions. When done, hit the "Menu" or "Disc Navigator" key for your DVD/BD player and navigate back to the main menu for the "CalMAN Windows" option. Also hit the "Next" key in the CalMAN software.

6. Select Gamma: The "gamma" setting is used to set your TV to display a linear (straight line) behavior as the signal goes up from 0% (black) to 100% (white). Virtually all displays do not naturally behave in a linear fashion, and so need a boost from a multiplier across the range of values. Locate the "Gamma setting" adjustment for your TV.

**NOTE:** Some displays, like projectors, have other controls that you may be able to use to flatten out any humps or curves in your gamma. For example, you might see:
- Blue gamma slope - which increases the amount of blue in the high end of the scale.
- Blue breakpoint - which adjusts the point along the curve where the blue gamma slope mentioned above starts to take effect.
- Red tones/lights - adjusts the amount of red around the middle of the range.
- Blue tones/lights - adjusts the amount of blue around the middle of the range.
These are all controls that are very useful in making changes to the shape of your gamma curve.

For your CalMAN software on the PC, you will see:

On the CalMAN Windows DVD/BD menu, select the "10% Grayscale" option. This will start with a totally black screen. You use this for the measurement for "0". Hit the "0" button on the lower left of the screen to tell the program that this is the current measurement point. Then hit the "play" button to take a single reading. (Remember that if the DVD/BD advances too fast for you, hit the \( \rightarrow \) once or twice to move back to the black screen.)

Either wait a few minutes for the DVD/BD to advance to the 10% screen, or hit the \( \rightarrow \) button to move to the 10% gray screen. When there, hit the "10" button on the lower left of the screen, and hit the "play" button to take another reading. Repeat this process all the way through the remaining values up to 100% (white).

**NOTE:** Don’t worry if the measurement line on the graph seems to disappear while you are taking the measurements. The final positioning will not be done until you take the final 100% measurement, at which point the proper results are displayed.
When complete this first run, you should see something like this:

Right-click on the "History1" tab on the top left of the screen, and rename the tab to something meaningful, like the current gamma setting on your TV.
On your TV, find the "Gamma" setting and alter it to a different setting. Then click the green "+" button at the top of the screen in order to create another tab to hold the next set of measurements. Again, right-click on it to name the tab something meaningful. Click on the "0" at the lower left of the screen, and take a measurement. Repeat this process all the way through the remaining values up to 100% (white).

Repeat this entire process of altering the gamma on your TV, and taking revised settings for all gamma settings for your TV. Leave the setting at the place that delivers the best results for your TV.
In this example, here was the final result:

More adjustments are possible if you use a video processor like the SpectraCal VideoEq Pro.

When done, hit the "Menu" or "Disc Navigator" key for your DVD/BD player and navigate back to the main menu for the "CalMAN Windows" option. Also hit the "Next" key in the CalMAN software.
Section 2, "Grayscale Tracking"

1. **Adjust Grayscale:** This grayscale adjustment is used to adjust the relative amounts of red (R), green (G), and blue (B) in each different grayscale level. This ensures that gray is really gray and does not have a particular color cast to it.

   Find the "White Balance" adjustment for your TV. In this menu area, you should see an adjustment for "Offset" (sometimes labeled as "Cut", "Cutoff", "Cutoff", "Sub-Brightness", "RGB Brightness", "Bias", or "B Coefficient") as well as "Gain" (a.k.a. "Drive", "Sub-Contrast", "RGB Contrast", or "C Coefficient") for each of the R, G, and B colors. It is a good practice to write down these settings at this point, and label the first tab on the "Adjust Grayscale" screen in the program with these settings.

   We will be doing our calibration at the 30% gray level for the dark and mid-tones, and at 80% for the appearance of the brighter tones. So, click on the "30" indicator at the bottom left of the screen:
Next, on the DVD/BD player, go back to the "10% Grayscale" option on the "CalMAN Windows" menu. With the ➤ button, advance to the 30% screen on the DVD/BD player, and take a measurement with the "Play" button. Next, with the ➤ button, advance to the 80% screen on the DVD/BD player. Click on the "80" on the program, and take a measurement for this value by hitting the "play" button. When done, you should see something like this:

Note that each of the colors is not at "100", and that the DeltaE (error) value is quite high, near 10 or so for both measurements. The object of this adjustment is to have each color at or near the “100” line, and have the DeltaE below “3”. Anything below “3” will not be visible to the human eye! Anything below "10" or so is more or less satisfactory. A value of "5" or less is considered to be pretty good.

Use your TV controls for "White Balance" to start adjusting. Basically, the "Offset" adjustment changes the point at which that color’s values start at the dark end of the scale. You can think of this as being similar to an individual brightness control for each color. "Gain" alters the curve for each color, especially on the light end of the scale, not unlike that which we experienced while doing the Gamma adjustment earlier. You can think of "Gain" as a contrast control for each individual color.
Use the process described earlier to create tabs for different settings, and play with the settings until our goal is obtained. You should see:
You have a choice at this point. You can either just go on, or you can attempt to measure and adjust for each and every measurement point. Since you can alter only the level and shape of the curve, this can be a long and drawn out process. You will not be able to succeed for each measurement point, but you can generate a result optimized for as many points as possible. E.g.:

When done, hit the "Menu" or "Disc Navigator" key for your DVD/BD player and navigate back to the main menu for the "CalMAN Windows" option. Also hit the "Next" key in the CalMAN software.
Section 3, "Color Gamut"

1. **Adjust Color Gamut:** This step is useful in applying corrections to the colors themselves, instead of the mix of colors within gray. When you get to this screen, you will see:

You will see the bow-shaped CIE gamut chart, along with the optimum display color balance and saturation points illustrated by the center triangle. The bow-shaped CIE space represents the full range of colors that we humans can perceive...which is much larger than TV displays can actually produce. The center triangle illustrates the range of colors that a perfect TV display will provide. On this imaginary perfect display, you will see colors inside the triangle, and nothing outside.
In terms of the CIE gamut chart, your controls for "Color" (meaning "saturation") will make the triangle formed by your actual measurement points larger (bigger values) or smaller (smaller values):
The tint control will rotate the CIE triangle:

**HUE (TINT):**
When adjusting CMS on a display, this is the direction the primaries and secondary’s move when increasing and decreasing Hue (Tint).
On the bottom of the CalMAN program screen, you have the ability to take measurements for the primary and secondary colors. All of these will be taken at 75%, except for the last measurement point which is "White" at 100%.

Under "CalMAN Windows" menu on your DVD/BD player, take the "75% Color" option to get to the screens where you can measure the individual colors. The "75% Color" option will provide the 75% strength for each of the colors then will also provide you with the 100% white selection at the end. When you are done with the measurements, you’ll see results like this:

Note the information at the right of the screen. For the primary colors, red/green/blue, the overall brightness or luminance is of the highest importance...more so than chrominance or hue. If your display’s primary points do not land on the triangle corners, every other color displayed will be off a bit, even if your grayscale adjustment was perfect. For the secondary colors, cyan/magenta/yellow, the color hue is of the most importance, rather than the strength or luminance.

Without a video processor, our ability to change these results is somewhat limited. (Look at the advantages provided by the VideoEq Pro on the SpectraCal web site, for example.) Since this step is particularly difficult without a video processor, don’t spend too much time trying to get this totally accurate. If you have a VideoEq Pro, see the document, "How to Calibrate a VideoEq Pro using CalMAN".

Your TV will provide you with controls for "Color" (meaning "saturation") as well as "Tint" (used for adjusting the "hue"). Adjusting the "Color" on your TV will make the triangle formed by your actual measurement points larger (bigger values) or smaller.
(smaller values). Don't push your results beyond the standard triangle, else your colors will become oversaturated, too strong, and look unnatural.

Using the "Tint" control on your TV, you can bias the color towards or away from red and green. Blue is kept as a rotation point relative to red and green. The tint control will rotate the CIE triangle. On some TV displays, the tint control may not have any effect when using the HDMI or DVI inputs. (The lower resolution inputs like the S-video or 480i composite inputs would still probably be affected by the tint control, however.) If you find that the tint control does nothing or is not adjustable, just go on to the next step.

Again, a best practice is to label the tabs so that you can keep track of the settings you try the various combinations. Again, this is a difficult adjustment, so don't worry about it too much:

When done, hit the "Menu" or "Disc Navigator" key for your DVD/BD player and navigate back to the main menu for the "CalMAN Windows" option. Also hit the "Next" key in the CalMAN software.
Section 4, "Picture Controls"

1. **Adjust Brightness:** Due to the fact that many of the adjustments above could have shifted the normal settings, now is the time to cycle back through them for another check. Re-do your brightness adjustment, as described in Section 1, Step 3 above. When done, hit the "Next" key in the CalMAN software.

2. **Adjust Contrast:** Re-do your contrast adjustment, as described in Section 1, Step 4 above. When done, hit the "Next" key in the CalMAN software.

3. **Adjust Luminance:** Re-do your luminance adjustment, as described in Section 1, Step 5 above. When done, hit the "Next" key in the CalMAN software.

4. **Adjust Color:** Earlier, we adjusted the color by taking measurements through the meter. Now, at this step, we do further adjustments by using a visual blue-filter technique.

Go back up to the "Basic Settings" option available on the main menu of the AVCHD disc. Once you choose this you’ll have to press ►►► a couple of times to get to the proper SMPTE screen. You’ll see what this looks like via the icon at the bottom right of the screen:
Now, go to your TV control for "Blue-Only Mode", generally in one of the advanced settings areas and turn it on. If this is not available on your TV, then get a pair of blue filters, which are available with most DVD calibration sets on the market.

Once in blue-only mode, adjust the "Color" setting on your TV so that that blue/gray (on the far left and far right of your screen), appear to be exactly the same. When done, hit the "Next" key in the CalMAN software.

5. **Adjust Tint:** While staying on the same SMPTE screen, and while still in blue-only mode, adjust the "Tint" control on your TV so that the cyan/magenta sections of the screen appear to be as identical as possible. When done, hit the "Next" key in the CalMAN software. Also turn off the "Blue-Only" mode at this time.

*NOTE:* See related Youtube video in the SpectraCal "Channel":
http://www.youtube.com/spectracal

6. **Adjust Sharpness:** On the DVD/BD player, hit the ▶▶ key in order to advance to the overscan/sharpness test screen. On your TV, reduce the sharpness so that any edge artifacts are eliminated. Over-sharpening causes harsh edges to appear. (By the way, raising the "Sharpness" control does not actually add any detail to the picture...it merely increases the contrast for the edges in a picture.) When raised too high, you'll see "glowing" around the edges. Reduce the sharpness setting on the TV just to the point where that glowing disappears.

*NOTE:* See related Youtube video in the SpectraCal "Channel":
http://www.youtube.com/spectracal

When done, hit the "Next" key in the CalMAN software.
Section 5, "Post Calibration"

1. **Visual Verification:** Now that the calibration process is done, it’s time for a reality check. Using some known reference material that contains a good range of content, especially including human flesh tones, take a good look at the display. Meter-based calibration gets you a lot of the way to a superior result, but since human perceptions differ, some tweaking at this point can certainly be beneficial!

We're pretty much done. Enjoy your newly-calibrated setup!