SECRETS of Home Theater and High Fidelity review

CalMAN Video Display Analysis System
July 2009

"CalMAN has over 50 charts available to measure every aspect of display performance."

BY CHRIS EBERLE

"The software can take continuous readings so you can make adjustments in real time."

INTRODUCTION

As little as five years ago it was nearly impossible to purchase a consumer-grade display that included a properly calibrated picture mode. Accuracy could only be obtained by careful adjustment of the service menu by an experienced calibrator. Today many displays have the ability to achieve correct color, gamma and grayscale tracking. This leads inevitably to the question – is calibration even necessary? The answer is a resounding YES. With the ability to calibrate a display comes added complexity. To achieve a truly correct image, there are a myriad of adjustments to be made. And yes, you still need some sort of instrument to properly adjust color and grayscale.

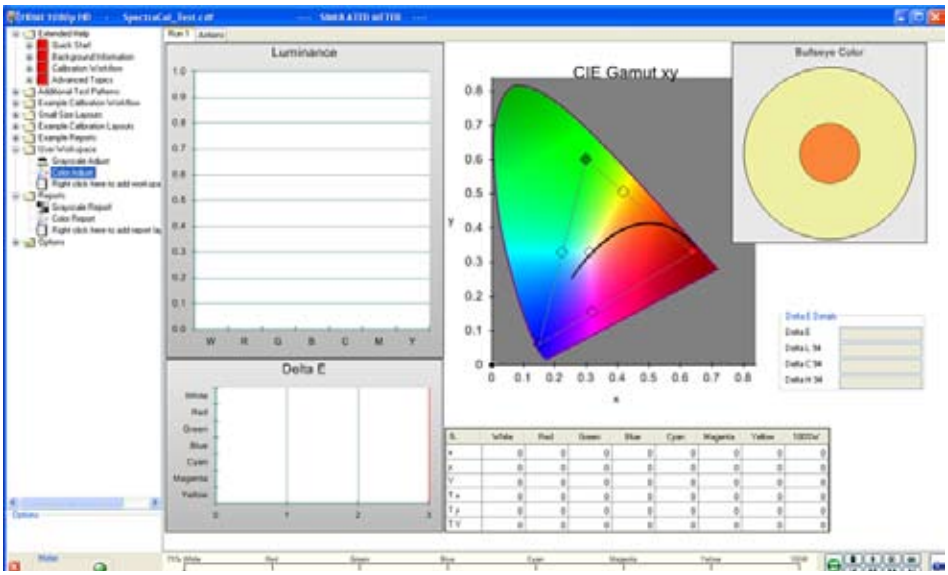
The decision to calibrate then becomes – do you hire a professional or do it yourself? It is quite feasible to do your own calibration with tools that don't cost much more than a pro calibrator's fee. The product that is squarely at the forefront of this market is CalMAN from SpectraCal. CalMAN is a package that can be used by anyone interested in display calibration from the hobbyist to the professional. Not only does CalMAN include every function and feature necessary to measure a display, there is thorough and well-written documentation to guide you every step of the way.

VERSIONS AND FEATURES

The CalMAN software (current version 3.3) comes in three flavors: Home, Enthusiast and Professional. All versions include step-by-step guides to walk you through the calibration process. The Home version is the least expensive package. It supports only the meter you purchase with it and does not automate pattern generation. The Enthusiast package supports multiple meters and provides automatic control of SpectraCal's new DPG-1000 digital pattern generator.

The Professional version allows you to use as many meters as you like. It also works with all signal generators and includes features to create a customer database, store contact information, and design custom reports. All three versions support Basic, Intermediate, Advanced and Design operating modes. That way, you can control the amount of detail you want as you become more comfortable and knowledgeable about display calibration. The Design mode is especially cool, more about that later.

To get started with CalMAN, you can download an evaluation copy from the SpectraCal website. This version offers full functionality with two important exceptions: you can only use a simulated meter and there is no control of pattern sources. You can experiment with all the modes, Basic, Intermediate, Advanced, and Design. When



you press a function key to take a reading or series of readings, CalMAN inputs values into the charts as if an actual meter were connected. Once you have simulated data in place, you can look at the various charts and read all the associated help files. You can even create layouts in the Design mode. Once you've decided to purchase the software, there are a range of prices depending on bundled hardware and which version of CalMAN you'd like to use.

SpectraCal offers a wide variety of color analysis tools with their software. The lowest-priced package starts at $299 and includes the X-Rite EyeOne Display 2. It was this meter that I used for my testing. The software supports a huge list of instruments right up to the uber-expensive spectroradiometers from Minolta and Photo Research.

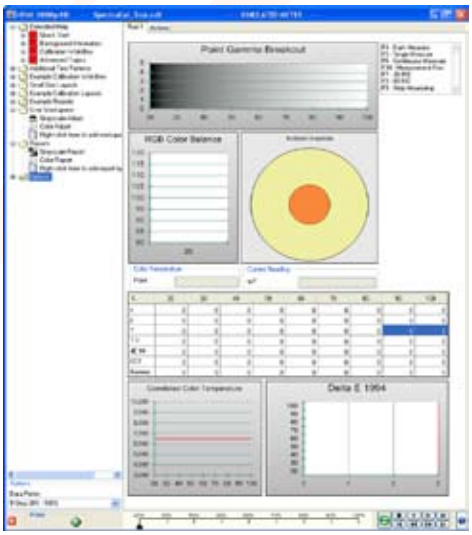
The other major area of hardware support is pattern generation. There are two ways to send the necessary test patterns to your display, a dedicated signal generator or DVD/Blu-ray based patterns. The Professional and Enthusiast versions of CalMAN include a slick system for integrating disc-based patterns into the calibration process. By turning on the Pattern Auto Sense option you can have your meter automatically take a reading when changing patterns on your player. Alternatively, you can plug in a USB to IR device that CalMAN controls. That way your player will change patterns via commands from CalMAN. It is then possible to do an entire series of measurements with a single button press. CalMAN is the only software out there that automates disc-based pattern generation. This is a real plus as very few hobbyist calibrators can justify purchasing a signal generator. These devices are typically $1500 or more. SpectraCal does offer a generator for $699 that includes most of the functionality of more expensive gear like the Accupel or Sencore units. This generator (the DPG-1000) is purely digital so it will only work with HDMI or DVI connections. It can be controlled by CalMAN through the USB-UIRT attachment which sends IR commands from your laptop's USB port.

One of my favorite features in CalMAN is the Design mode. It's easy to create custom layouts that fit my particular workflow and style. Some very nice sample layouts are included with the package for grayscale and color adjustments. You can change these to your hearts content or make your own from scratch. There are many different charts to choose from and you can mix them any way you like. You can also swap layouts with other users at the CalMAN forums. Below are a couple of layouts I created to adjust color management and grayscale.

CALIBRATING YOUR DISPLAY

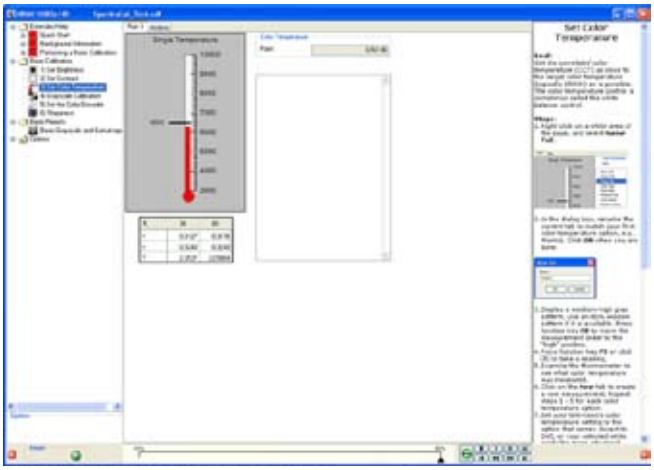
The process of calibrating a display with CalMAN could not be easier. The preset workflow lays everything out and guides you with easy to understand instructions. Once you've started up the program an intro screen takes you through the process of selecting your meter and method of pattern generation. The main calibration screen is divided into three parts. On the left side is the workflow tree. This gives you access to all the help topics and the actual calibration steps. I advise anyone using this program for the first time to read through all the help topics before moving on. The articles appear in the large center section of the CalMAN screen. They are easy to read and well-illustrated. Though it's not necessary to have a degree in color science to calibrate your TV, the process is much easier if you understand the theory behind what you're doing.

The workflow is arranged in a tree configuration down the left-side pane. You simply click on each step. When you do either a help article or the appropriate charts appear. The help article will tell you which patterns to use to set a particular display parameter. If charts are on the screen the help for them is in the right-side pane. Not only are you guided through the pattern selection, the help also tells you what adjustments to make on your display to achieve the desired result. When you have completed the workflow, you can generate a report which shows all your results for color



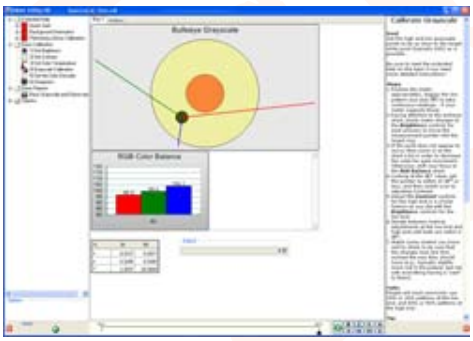
gamut and grayscale tracking. Clicking on individual charts in any screen brings up a help article that explains that chart and what it's showing you.

Although I use the Professional version of CalMAN to review displays, I tested the software with a Home license to evaluate its functionality for the do-it-yourselfer. I used the X-Rite EyeOne Display 2 meter to

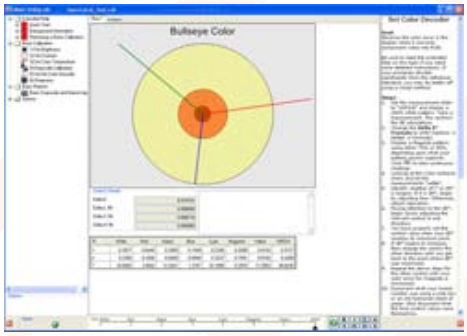


measure a Pioneer PRO-111FD plasma TV and a Panasonic AE2000U projector. The Display 2 is a tri-stimulus meter. It's a decent all-around tool that works on all display types. It's not as accurate as more expensive tools like the EyeOne Pro but as part of a $299 package, it performs reasonably well. To measure a plasma or any direct-view TV, you simply attach the meter to the center of the screen with its integrated suction cups. It's very light and includes a counterweight to hang over the back of your screen in case it comes loose. A cable connects it to your laptop's USB port.

After starting up CalMAN, the introductory screens automatically find the attached meter and allow you to select your pattern source. Once this is done, you select a list of inputs on your TV and initialize the meter with a dark measurement. This is very important as it affects the accuracy of the readings you take. You must cover the meter's sensors completely. I use a thick piece of cloth so no light gets in. With meters like the Display 2 you need to redo this dark measurement every 15 minutes or so to maintain accuracy. CalMAN thoughtfully includes an on-screen timer to remind you. When you're in the calibration screen you can re-initialize the meter at any time by pressing F4.

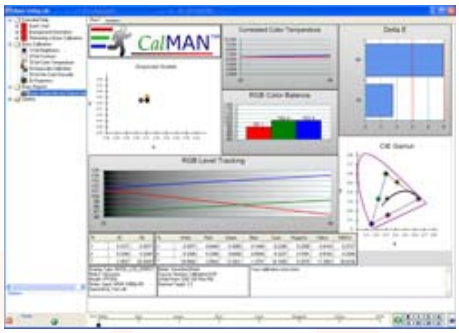


After setting brightness and contrast, you are presented with a screen that lets you measure the color temperature of your TVs different presets (first screen shot shown below). The help for this screen is on the right side. Here's where you can use the multi-tab system. CalMAN allows you to create multiple screens so you can easily compare measurements. For example, you can create a tab for each color temp preset on your TV then measure them. By looking at the data for all the presets, you can determine which one is closest to D65 or 6500k. This gives you the best starting point for calibrating grayscale.



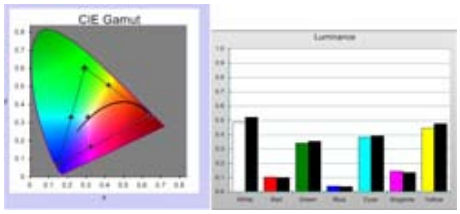
Next up is the actual grayscale calibration. This screen includes a bullseye and a color balance chart . It's quite easy and intuitive to use. You alternately display 30% and 80% window patterns and adjust the RGB High and Low controls until both patterns measure correct. The software can take continuous readings so you can make adjustments in real time. The goal is to have the point in the center of the bullseye. The color balance chart shows which colors are too high or too low as you make your adjustments. While it's rare to achieve a perfect chart, CalMAN makes it easy to maximize the potential of your particular display.

The next step is to adjust the color decoder (color and tint controls). CalMAN takes a novel approach to this. When you buy calibration discs like Avia or Digital Video Essentials, their method of decoder adjustment involves the use of color filters and a split color pattern. I can tell you from my own experience this almost never works. The only way the filter method can be accurate is if the display's primaries precisely



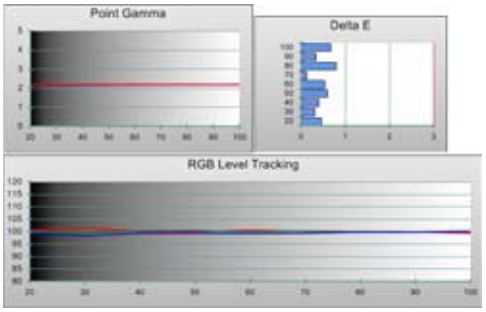
match the filters. If they don't match, you will not get correct results. The only other way to adjust color and tint without instruments is to selectively turn off the primaries. Some displays like Samsung LCD and plasmas or the DreamVision projector I recently reviewed feature a blue-only mode. This control shuts off the Red and Green primaries. Then you can very easily adjust color and tint by displaying a split color bar pattern.

Since very few displays have a way to turn off primaries, CalMAN includes a slick way to adjust color and tint using the meter. You start by measuring a 100% white pattern. Then you measure magenta and cyan patterns to achieve the lowest color error, expressed as Delta E*. There are other Delta values (Delta C* and Delta H*) that tell you whether to adjust the color or tint controls. Following



the steps in the right-side pane of this screen will make it easy to set your controls to their best positions. Using this method I was able to achieve excellent results in a short time.

I followed the same procedures as above to measure my Panasonic projector. Only the meter's setup was different. I attached the included diffuser to the Display 2 and set up the meter to read from the projector by attaching it to a tripod near the screen. You can measure light reflected off the screen without the diffuser if you wish but I found this more difficult as the meter has to be angled just right to allow light to hit the sensors. When I had finished, I generated

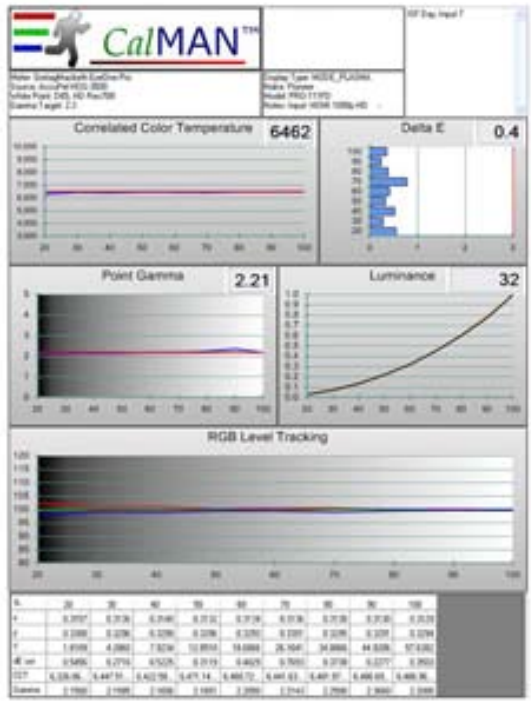


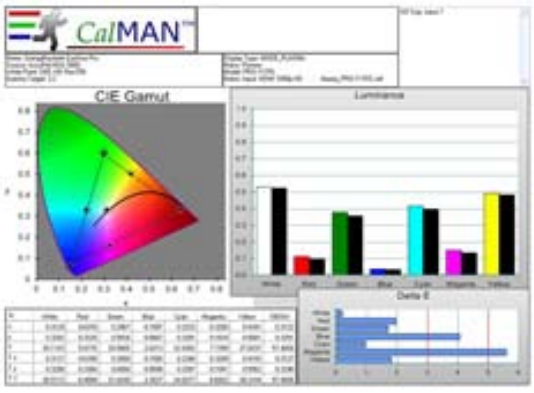
a concise report showing the results of my work (shown below).

CalMAN has over 50 charts available to measure every aspect of display performance. I wanted to show a few images of the more commonly-used ones along with sample data from my various experiments. The figure shown below illustrates the two most useful charts for measuring color performance. On the left is a CIE gamut chart. The squares show the reference color points for primaries and secondaries. The dots show the measurement. When a dot is fully inside a square, the Delta E* (color error) is under 3 which is invisible to the eye. The luminance chart shows the colors brightness compared to the reference which is calculated by CalMAN automatically. The goal is to have the colored bars even with the black ones. If your display has a color management system, you would adjust the lightness or brightness controls for each color.

Here are some of my favorite charts for measuring grayscale and gamma. The Delta E* bar graph shows the amount of deviation from 6500k at each stimulus level. Anything under 3 is invisible to the eye. A Delta E* of under 1 is superb performance. The Point Gamma chart shows the gamma at each stimulus level. This is much more useful than a single average gamma number because you can see potential problems at each point in the grayscale. Displays with customizable gamma curves can be adjusted to create the flat gamma chart you see here. The RGB Tracking chart shows the white balance at each stimulus level. Here again it is very easy to see where a color needs to be raised or lowered to achieve the correct color temperature.

"The wide range of hardware available means there is a complete package for every budget."





CALMAN PROFESSIONAL

Though this article is aimed at the do-it-yourself calibrator, I'd like to briefly describe the extra features available in the Professional version of CalMAN.

Firstly is CalMAN's signal generator integration. Pro calibrators always use a reference signal generator to calibrate a display. Test discs are used at the end of a session to verify results and make small adjustments for a particular source component. I use one of CalMAN's supported generators, the Accupel HDG-3000. I connect it to my laptop using a USB-Serial adapter to engage the Accupel's RS-232 interface. CalMAN has full control of the generator during the calibration session. I can select patterns from a drop-down list if I wish. I can also do an entire measurement run by simply pressing F10. CalMAN displays the appropriate pattern, takes a measurement, records it on the chart and moves automatically to the next pattern and measurement. By streamlining the process this way, it's super-easy to profile a display. I can use the multi-tab interface to compare different picture modes or color temp presets. By taking more readings and comparing them this way, I have more time to address all the adjustment options offered by a TV. The end result is a more thorough job where I've used every possible control to maximize a display's potential.

The other major feature available in CalMAN Professional is custom report design. Here you can literally create any set of charts you wish and arrange

them any way you like. I've created reports for grayscale and color data for example. In one layout I can see all parameters like gamma, Delta E* (color error), and grayscale tracking. You can resize the charts and zoom in on them if you want to change the scale or focus on specific areas. Besides charts, you can also have the raw data in your reports. I often like to see the specific numbers for a measurement. You can have spreadsheet-style tables that contain any datasets you feel are pertinent. The screen shots below show typical grayscale and color performance reports.

CalMAN Pro also includes a customer database which makes it easy to organize all your data and display information for each client. Any chart from any layout can be copied to the clipboard and pasted into other Windows applications. You can also save any screen to PDF format.

CalMAN's user options are quite extensive. You can define your own colorspace with the color target editor. This allows you for instance, to calculate the correct positions of the secondary colors relative a display's actual primaries rather than the reference ones. You can enable a low-light trigger to force your meter to take and average multiple readings for greater accuracy. You can also change the targets for parameters like colorspace, gamma, and Delta E*. It is also possible to create meter profiles. These enable you to "train" one meter to another. This is a great way to compensate for the inaccuracies in a less-expensive instrument by using a more accurate one as a references.

CONCLUSIONS

Whether you're a videophile looking to get the most performance from your new display or you're a pro calibrator looking for a more comprehensive and efficient package to service clients, CalMAN covers both ends of the spectrum. Its different operating modes and tremendous flexibility make it a professional-quality tool that is useable by the hobbyist. The wide range of hardware available means there is a complete package for every budget. The thorough and well-written documentation makes sense and logic out of previously mysterious topics. For anyone looking to learn about and calibrate their own display, CalMAN is highly recommended. I don't think there is a better or more complete product.

Specifications:

- Meters: Colorvision, DataColor, Extech, Klein, Konica Minolta, Lutron, Orb, PhotoResearch, Sencore, Sequel Imaging, TES; X-Rite
- Pattern Sources: Accupel, Avia, AVS, CalMAN, ColorFacts, Digital Video Essentials, DVDO, Extron, GetGray, Lumagen, Pixel Magic, Quantum Data, Sencore
- Operating Modes: Basic, Intermediate, Advanced, Design
- 64-bit Double Precision Calculation Accuracy
- Color Standard Support: Rec 709, D65 SMPTE-C, PAL/SECAM, D75, D93, Rec 601, E54, SRGB, Illuminant C, and dCinema
- Custom Color Target Editor
- Meter Profile Editor
- Professional Version Features: Customer Database, Custom Report Designer, Customer Fields in Layouts and Reports, Display Fields in Layouts and Reports, Setup Fields in Layouts and Reports
- MSRP: $299 for Basic Version with EyeOne Display2 Colorimeter; $14,995 for Professional Version with Photo Research PR-655 SpectraScan 3v171 Colorimeter; Many Other Versions in Between These Two Extremes
- SpectraCal

Secrets of Home Theater and High Fidelity