



House Calls

What you can expect when an ISF technician comes to calibrate your TV by John Sciacca

You finally made the plunge - you bought a new TV. After countless hours of research and comparing Model A to Model B, you're ready to get down to business. So you pop in a demo DVD, fire up the audio system, adjust the lighting, sit back in your favorite chair, and press play. But some-

thing isn't right. Everyone looks a little sunburned. And the "deep blacks" you read about in the magazine review of your TV don't look all that deep or black.

The owner's manual says you should "adjust the color and tint controls to achieve accurate flesh tones." So you start

punching buttons, trying to make the picture better but not getting anything that looks like any skin you've ever seen.

You go back to the original review to see if it said anything about having to adjust the set. And there, in a small box labeled "in the lab," you read, "Calibration needs

to be performed by a qualified technician with specialized equipment, so discuss it with your dealer before purchase, or contact the Imaging Science Foundation." Well, it might be too late to discuss it with your dealer, but it's never too late to consult a professional. Even an old set will perform better when it's properly adjusted.

The Psychology of Selling

I'm sure the idea that you can't just take a TV out of the box, plug it in, and get a good picture isn't sitting real well with you, especially after you just paid a grand or more for a new set. And you'd like to think you can do all the adjustments yourself - until you remember your dad's well-intended efforts to adjust the family TV, which made everybody look like Klingons. Well, there's probably nothing *wrong* with your set. It's almost certainly producing the picture the manufacturer set it to produce. But those settings aren't accurate.

TVs are adjusted at the factory to produce images that will make them stand out from the competition on harshly lit sales floors. It takes an awfully bright picture to overcome all that light. So when you place a brand-new TV in a properly dimmed environment like a home theater, the factory set picture is going to be off - way off.

To make them as bright as possible, most TVs come out of the box with the contrast (or "picture") control at its highest setting. Jacking up the contrast to maximum is like always driving your car revved near the red line. You can do it, but it's going to cut down on your engine's lifespan, and excessive contrast will reduce a picture tube's lifespan. It also distorts the picture geometry and causes "blooming," which E reduces resolution.

Most TVs are also preset for a high color temperature, which makes the picture look blue. Unless you're James Cameron shooting the finale of *Titanic*, you probably don't want that. To compensate, manufacturers sometimes design the set's color decoder with a red push, but that leads to the reds being overemphasized. This is most noticeable on faces.

Who Ya Gonna Call?

Founded in 1994, the Imaging Science

Foundation (ISF) is dedicated to improving the quality of electronic imaging. The ISF has raised public awareness of picture quality and helped reform how some manufacturers calibrate their TVs before they leave the factory. But the ISF's most successful "product" by far has been the calibrators (over 1,600 to date) it's certified as capable of coming into your home and adjusting your TV to perform at its peak. You can locate an ISF-certified technician by going to imaging-science.com and clicking on the "Trained Dealers" tab, or by calling 561-997-9073.

ISF technicians strive to bring your TV's performance as close to the NTSC television standard as it can get. Your TV is the final link in the video chain, so proper calibration is crucial to ensuring that the image you see from a DVD or broadcast program matches the producers' intentions.

When you contact an ISF technician, ask him what's included in his calibration services and what the rate will be. For adjustment of the front-panel (or user-menu) controls and calibration of the grayscale on either analog or digital models, the ISF suggests a fee of \$225 for direct-view TVs, \$275 for rear-projection TVs, and \$325 for front projectors. Things like multipoint convergence, adjustment of picture geometry and size, lens focus, and adjustment for multiple scan rates entail additional charges. A complete calibration of an elaborate high-end projection system can run upwards of \$1,000. Some technicians also charge for travel time if they have to go to a remote location.

Ask the calibrator if he has any experience with your brand and model of TV. If you're working with a smaller, specialty audio/video dealer rather than an electronics superstore or a faceless Internet site, your dealer might have a technician on staff. This would be the ideal arrangement since he would be most familiar with the product lines carried by that store.

Make sure you leave your TV on for at least 30 minutes before the technician arrives, since both the black level and grayscale will drift as it warms up. Also, projection systems won't hold their convergence until they are fully warmed up.

Bag of Tricks

In addition to the basics (screwdriver, tape measure, flashlight, and so on), the technician will arrive with some tools that are critical to properly adjusting your TV. The first will be something to generate test patterns. By far the two most popular tools for this are Ovation Software's *Avia Guide*

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to *Home Theater* and Joe Kane Productions' *Video Essentials*.

These two DVDs make a formidable arsenal for adjusting your video display and should be part of any videophile's home theater library. The recently released *Sound & Vision Home Theater Tune-up* DVD also includes the basic patterns for adjusting your set.

Some installers will also bring a video signal generator, which makes some adjustments easier to perform and is indispensable if there's no DVD player hooked up to the TV. And, since most signal generators can display high-definition signals in various formats, having one enables the technician to accurately adjust a high-definition TV (HDTV) or monitor.

Next up will be a tool for measuring and adjusting the TV's color temperature. This can range from an optical comparator (basically a box containing a fluorescent light bulb with a color temperature matching the NTSC standard) to a tristimulus color analyzer or a spectroradiometer. An optical comparator is the most difficult to use, often takes more time, and doesn't render as accurate a result since it relies on the technician's



After your TV has warmed up for a half hour, the technician enters special codes on the remote control and the TV's front-panel controls to access the set's service menu.

subjective judgment. However, with some color analyzers costing over \$10,000, they aren't a part of every toolbox. The technician will also bring some reference DVD movies for evaluating his finished work.

Picture Perfect

After taking some initial measurements, the technician will make his first adjustments via the user-accessible menus. If you own the *Sound & Vision*, *Avia*, or *Video Essentials* setup DVDs, these are all things you can do yourself to achieve a significantly better picture. But the technician's more experienced eye will always give you the best results.

Many new TVs have a picture preset labeled something like Film or Theater, or even NTSC, that automatically moves the picture away from the showroom - boosted settings and toward a more accurate image. Typically these presets lower contrast, disengage undesirable processing circuits like scan-velocity modulation (SVM), "auto color," or "flesh tone," and engage a lower (more accurate) color temperature. Simply selecting one of these presets will usually give you a much better picture. A good dealer will have pointed out this feature when you were considering the set.

From there, the technician will go on to fine-tune the big five: contrast, brightness, color, tint, and sharpness. Most technicians will make these adjustments within the set's service menu, not as user settings, ensuring that the calibrated profile can be easily recalled if power is lost or user settings are altered. The service menu is usually

accessed through a code supplied by the manufacturer - typically a combination of button pushes on the remote and on the TV's front-panel controls. Because service-menu adjustments can literally ruin your set, they should be made only by a trained professional.

Contrast and Brightness These parameters are so closely related that you usually can't adjust one without affecting the other. Contrast adjustments affect the peak white level of the picture, while brightness affects the black level. It is *crucial* that these adjustments be made under the same lighting conditions that you use when you watch TV. Brightness is adjusted using a PLUGE (picture line-up-generation equipment) pattern, with bars of varying black level demonstrating the true reference point of black. Various test patterns are useful for adjusting contrast, and the technician will look for a setting that achieves maximum white level without blooming or line distortion. He will go back and forth between these two adjustments until he finds the right settings for both.

Color and Tint These adjustments, also made together, use the SMPTE (Society of Motion Picture and Television Engineers) color bars and a special blue filter. Many recent THX-certified discs contain this test pattern under the THX Optimizer menu option. You can obtain your own blue filter from THX for a \$2 shipping charge at thx.com/consumer_products/optimizer, and a blue filter is included with the *Sound & Vision*, *Avia*, and *Video Essentials* DVDs.

Once color and tint adjustments have been made red and green filters (which are also included with *Avia* and *Video Essentials*) can be used to diagnose the accuracy of a set's color decoder. As discussed earlier, many TVs are designed with a red push, and sometimes it's necessary to sacrifice overall color saturation to achieve acceptable red levels.

Sharpness This adjustment was important on sets made in the early 1980s but doesn't have much impact on current TVs, so it should be put at the lowest acceptable setting. Set the sharpness control too high, and you'll get ringing or ghosting at certain video frequencies, seen as faint white lines next to objects. Set it too low, and the decreased resolution will make the picture soft or even fuzzy. The technician will use test patterns to find the best balance between ghosting and loss of resolution.

TV: Same as It Ever Was

Finally, we come to probably the best known part of calibration: grayscale adjustment. But to understand why it's so important, here's a quick history lesson.

The National Television System Committee, or NTSC, standards were devised in the 1950s to ease the transition to color TV by making sure that the new color signals would be compatible with existing black-and-white sets. To do this, the color information was essentially laid on top of the black-and-white signal. It was then up to your TV to separate these two signals (that's what a comb filter does) and properly decode them.

In the video world, gray is defined as equal amounts of red, green, and blue, with shades of gray produced by different levels of light intensity, from just barely lighter than black to peak white (peak white being gray at maximum intensity). As a result, you can't have an accurately reproduced color picture if the grayscale isn't set correctly.

A TV picture's light intensity is measured in IRE, a unit defined by the Institute of Radio Engineers. Black is 7.5 IRE, and peak white is 100 IRE. Transitions between 0 and 100 IRE are known as the grayscale. Video white is also measured in kelvins of color temperature, and it ranges from

2,800 K (the orangeish white of a 60-watt light bulb) to 10,000 K (a bluish-white found in some high-intensity lamps). In 1953, the NTSC decided that the correct shade of white for our video system is about 6,500 K, which most closely resembles midday sunlight on a clear day.

Why does this matter? Since the largest part of the video signal consists of black and-white information, any deviation from the white-level reference of 6,500 K will bias all pictures toward that color. More specifically, since the studio monitors used while creating the source material are calibrated to 6,500 K, your TV *must* be set to the same temperature to accurately recreate the colors.

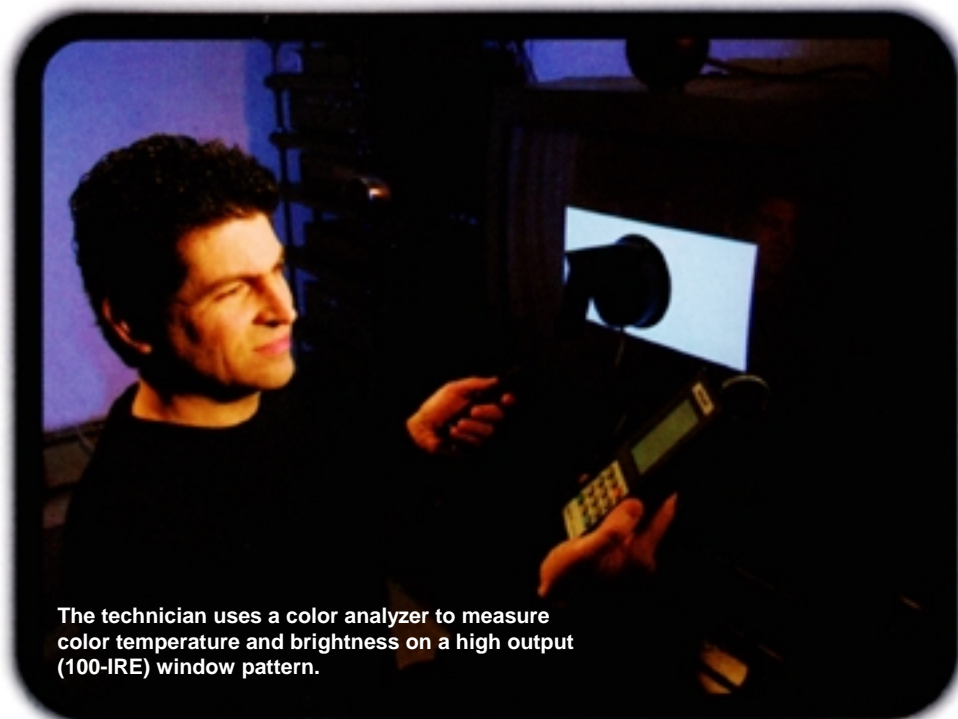
Tracking the Grayscale

Because you can't adjust the grayscale through the user-accessible controls, this is where the ISF technician really earns his keep. Using a test DVD or a signal generator, he will bring up a "window" pattern a gray rectangle in the center of the screen on a black background. There are two sets of adjustments available to calibrate color temperature, one for the low-IRE window and one for the high-IRE window.

The technician will make changes in the set's red, green, and blue levels until the gray rectangle in the windows matches the 6,500-K standard. Like a master chef, he'll add a pinch of this and a hint of that, going back and forth between the low and high windows until both measure the same.

While someone skilled with an optical comparator can do an acceptable job of grayscale adjustment, using a color analyzer provides more flexibility in adjustment and leaves no question about the accuracy of the result. The most common analyzers attach to the screen via a suction cup and provide readings of both color temperature in kelvins and light output in foot-lamberts, also plotting the precise points on the standard chart of color space. And unlike a comparator, an analyzer allows the calibrator to take readings at all points along the grayscale, not just the low and high windows. (For more about color temperature, grayscale, and how they relate to TV calibration, see "Behind the Numbers," page 86.)

Once the grayscale adjustments have been made, the technician will double check the color, tint, brightness, and contrast settings and make any necessary



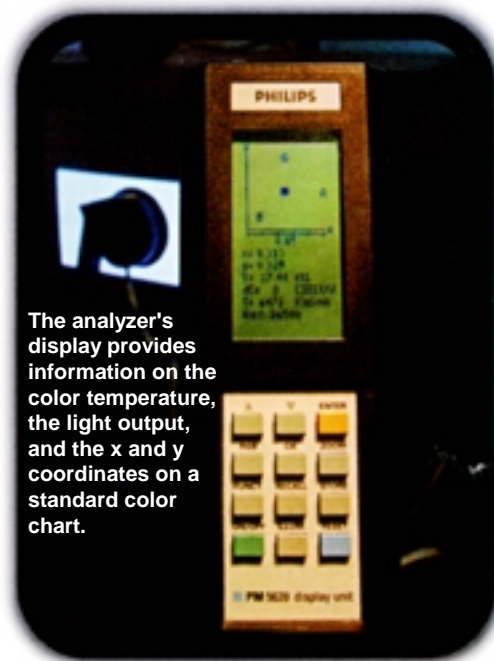
The technician uses a color analyzer to measure color temperature and brightness on a high output (100-IRE) window pattern.

changes. And that's it. All that's left is for the technician to give you a report on the pre- and post-calibration results for your set.

The most telling result is the colorimetry calibration, which is a graph of the color temperature in kelvins. Often, the "before" graph will resemble a roller-coaster year on the stock market, with temperatures ranging from 5,000 K to well over 10,000 K. The ideal post-calibration graph is a ruler-straight line holding 6,500 K at all points from 20 to 100 IRE. But most sets aren't able to track the grayscale that accurately throughout the entire range, so peaks and valleys of 200 to 300 K aren't uncommon - they won't be noticeable while you're watching DVDs or TV shows. Rear-projection TVs, for example, tend to exhibit a large dip (500 K or more) at the lowest end of the grayscale.

So how does it look? The most noticeable difference will be the set's overall light output - a properly calibrated set looks darker. That's because it's been adjusted for the best performance, within its capabilities, in a properly lit viewing environment. The image will look more natural, without artificially enhanced edges. Colors will look the way the content producer intended.

Even after watching for just a few moments, you'll be able to see the improvement by having the technician toggle between the calibrated setting and



The analyzer's display provides information on the color temperature, the light output, and the x and y coordinates on a standard color chart.

the Cool color-temperature preset. You won't believe the picture you'd been watching! More important, you'll know that your set is performing at its peak potential.

S&V

John Sciacca, the lead system designer for Custom Theater and Audio in Murrells Inlet, SC, recently completed an ISF certification course.