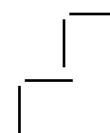
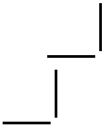


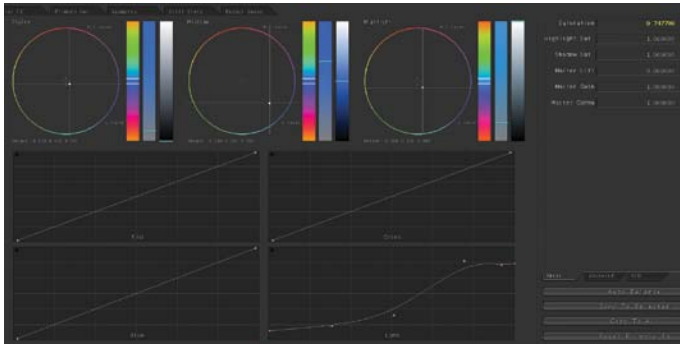
# Primary Color Correction for Video - Tonal Range and Color Correction

Application Note





## Application Note



**Figure 1.** This is the Primary color correction user interface for Apple Color.

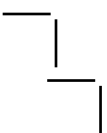
Primary color correction is the first step in a traditional color correction workflow which involves applying tonal range and color corrections to the entire raster or image (Figure 1).

Primary color corrections usually start with spreading out the tonal range to its fullest natural extent. Images that don't have this "spread" appear flat or washed out. To be able to do this



**Figure 2.** Tektronix WFM5200 is ideal for both color correction in a post production environment and for field production.

tonal spread well, you need to have waveform monitors and vectorscopes. Preferably external Waveform Monitors, like the Tektronix WFM5200 (Figure 2) where you can easily and quickly see the information you want at the touch of a button.





### Primary Color Correction for Video - Tonal Range and Color Correction

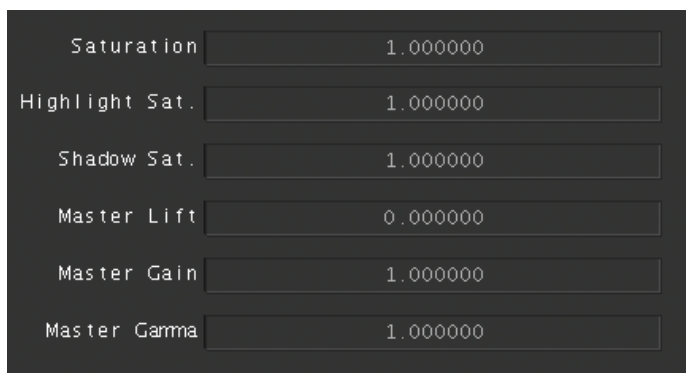


Figure 3. Master Lift, Master Gamma and Master Gain controls can be used to spread the tonal range of your picture to its fullest natural extent.



Figure 4. The Tektronix Waveform Monitor shows that the image doesn't take advantage of the full dynamic range. Blacks are lifted (above 0) and whites aren't at 100% (or 700 mv).

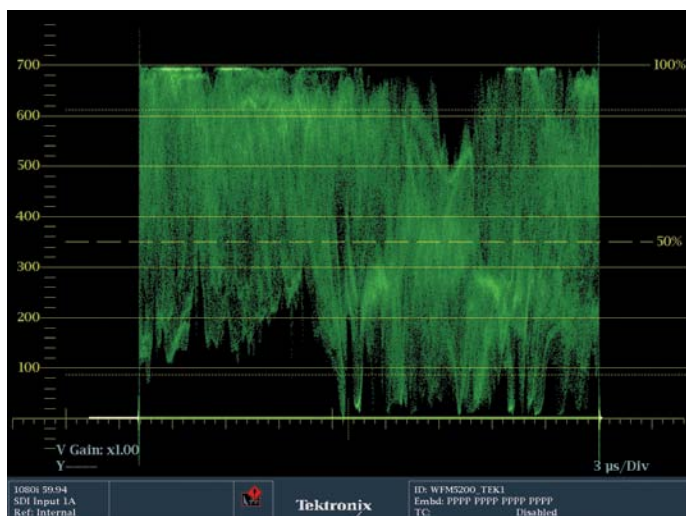


Figure 5. The Waveform Monitor shows the tonal range after spreading.

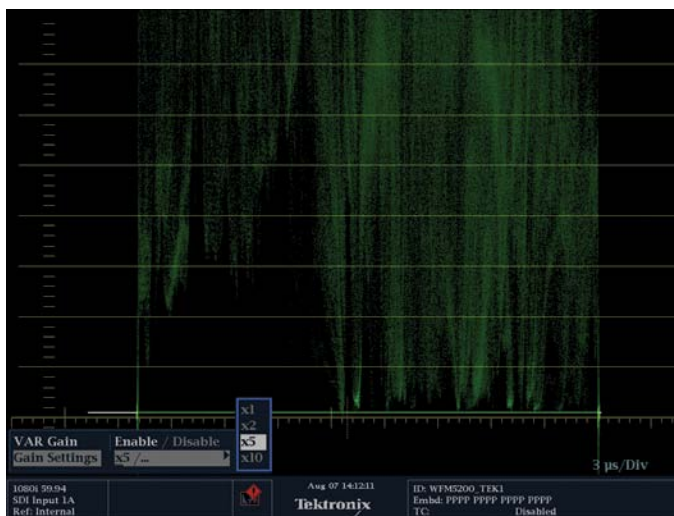
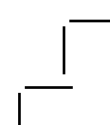
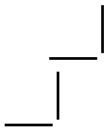


Figure 6. Tektronix waveform monitor zoomed to 5x and positioned to examine the black levels.

Refer to Figure 4 as the starting point for the correction. Note that blacks are not at 0 and whites are not at 700. Use the shadow, black or lift control to bring down your shadows to their lowest legal level (Figure 3). (Shadows, black and lift all mean the same thing. Each color correction application calls them something different.) For all forms of HD video and any form of video created digitally and viewed digitally, the level should be 0. Then bring your highlights up to 100 (refer to Figure 5). Some waveform monitors may have a scale from 0 to 700 millivolts as a form of measurement. On a Tektronix

Waveform Monitor it's easy to change the measurement to a simple scale of 100. Press the CONFIG button. Use the arrow keys to navigate to the Graticules and Readouts menu, then over to SDI Waveform Graticules and change from Normal to Percent. A quick glossary item: the graticule refers to the measurement lines and the trace is the squiggly stuff that represents the actual image. One of the advantages to good Waveform Monitors, like the WFM5200 is that you can zoom in to the blacks or the highlights to really see the fine detail. Refer to Figure 6.

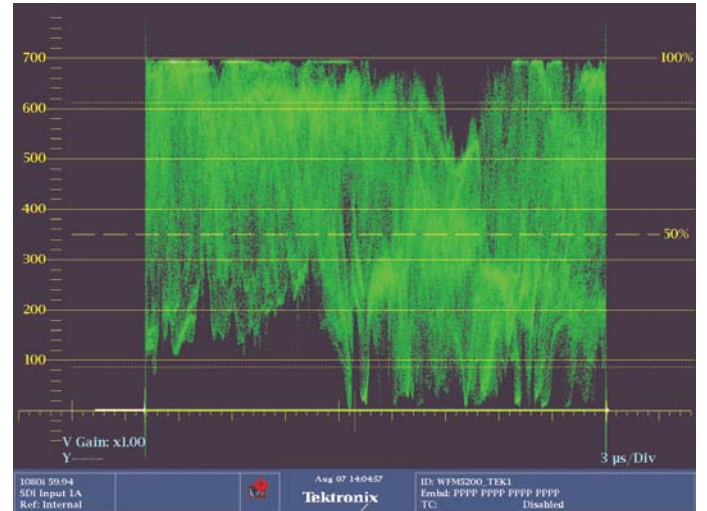




## Application Note



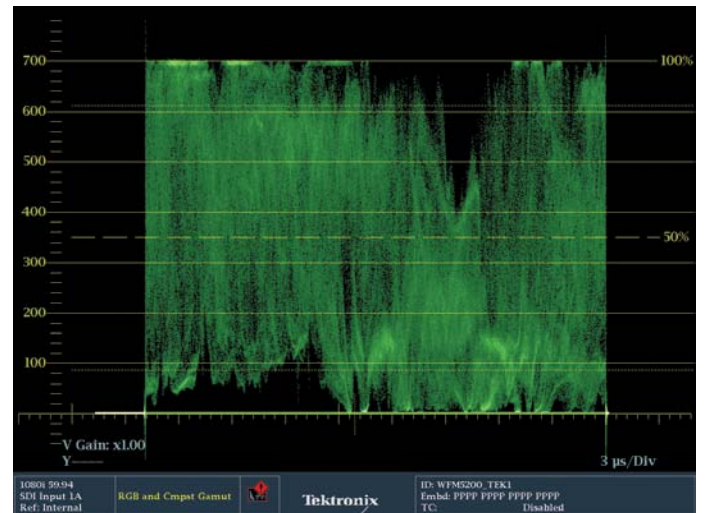
**Figure 7.** This is the image before the gamma adjustment.



**Figure 8.** This is the waveform monitor before the gamma adjustment.



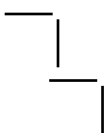
**Figure 9.** This is the image after the gamma adjustment. This can be done to taste. It would depend on the darkness of the shots around it or maybe even the sense of gravitas of the subject of the interview, in this case.



**Figure 10.** This is the waveform after the gamma adjustment.

Remember that not every image has something that “deserves” to be 0 black or 100 white. You need to look at the image and see if there’s something that should actually be deep black or bright white. If there is, then spread them out to 0 and 100. With the highlights and shadows adjusted to legal and appropriate levels, you may not be happy with the overall

brightness of the image. Use your gamma or midtone controls to affect the overall look. (Refer to Figures 7 and 8). Go back and look at your shadows and highlight again after doing this to ensure that they haven’t changed too much (Refer to Figures 9 and 10).







## Primary Color Correction for Video - Tonal Range and Color Correction



Figure 11. Neutral image



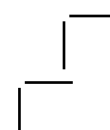
Figure 12. Warm, "golden hour" image.

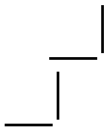


Figure 13. Cool, contrasty image.

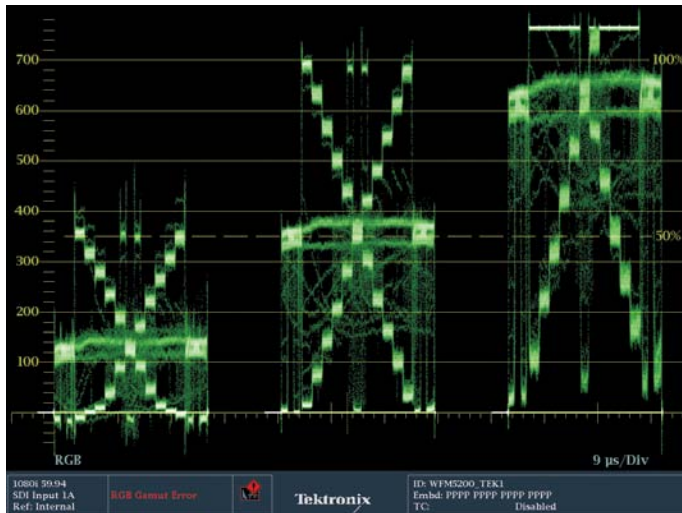
With the tonal ranges set, see if there's an overall color bias you want to get rid of – like a bad white balance. You may want to introduce a color bias to a neutral shot (Figure 11) – perhaps to make it look like "golden hour" (Figure 12). Or maybe you want to have the color correction tell part of the story of the shot, like making it cooler or warmer or show more contrast (Figure 13).

All of these corrections can be done by looking at the WFM5200, which has a group of useful displays, including some patented displays, that are exclusive to Tektronix.

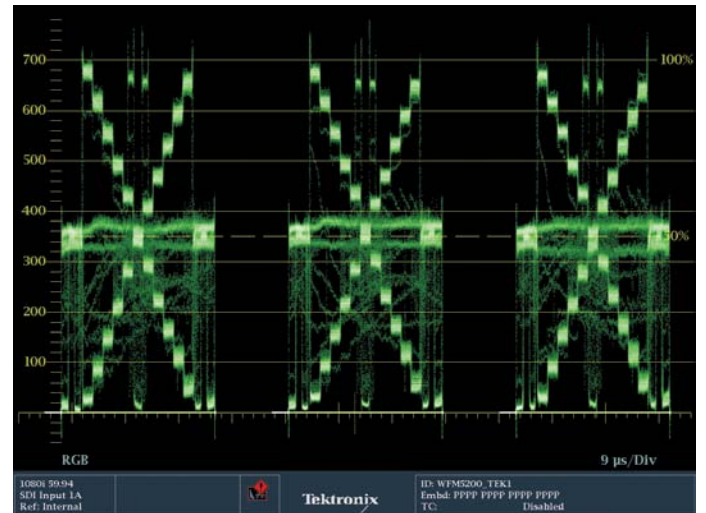




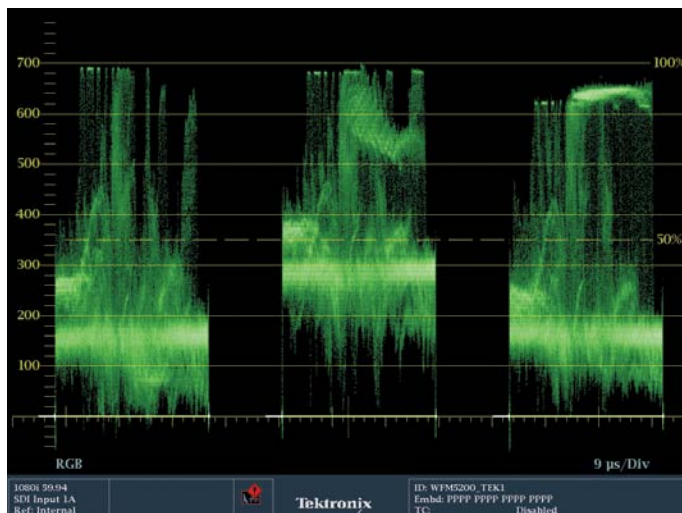
## Application Note



**Figure 14.** Misbalanced Chip Chart. Notice the clipping at the top of the blue (right) channel. And how the blacks and midtones are elevated compared to the same shapes in the trace of the Red (left) and Green (middle) channels.

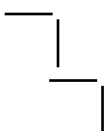


**Figure 15.** Balanced Chip Chart.



**Figure 16.** This is a fairly balanced image on an RGB Parade waveform monitor, but the image contains a lot of green grass, so the green channel appears to be elevated, but in the case of this particular image, is correct.

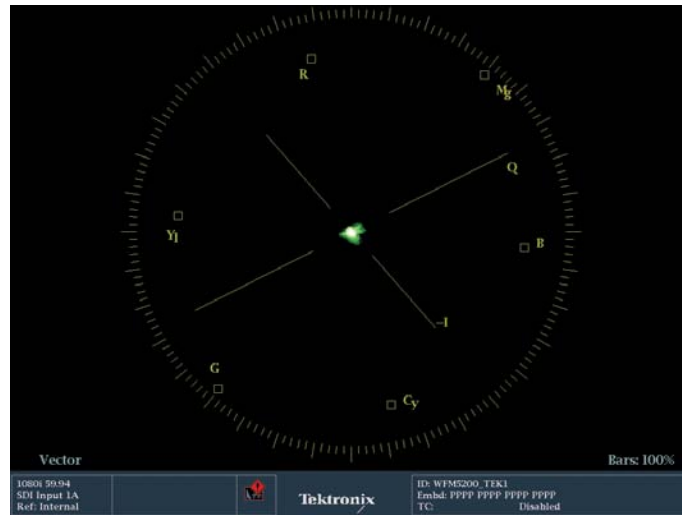
To understand how to use these Waveform Monitors, you have to know where the image is supposed to be in the first place. The RGB Waveform is probably the colorist's main Waveform Monitor of choice. The RGB Parade is like a regular waveform, but it shows the relative values of each of the red, green and blue channels. To form pure, balanced black, white or gray, you need to have equal amounts of each channel (Figure 15). In an RGB waveform, if the bottom of the blue channel is higher than the bottom of the other two, then you have blue in your blacks. If the red channel is a little higher at the top of the waveform than your blue or green channel, then your highlights are a little pink or red. For a lot of shots, all you have to do is line up the bottoms of each channel and the tops and you're balanced. There are exceptions, especially with shots with a lot of a specific color – like a huge swath of grass, for example (Figure 16). That shot will definitely have a stronger green channel. Also, shots with more clipping in one channel than another can be deceiving. You can see clipping as a flattening and brightening of the trace at the top or bottom of the waveform (Figure 14).



## Primary Color Correction for Video - Tonal Range and Color Correction



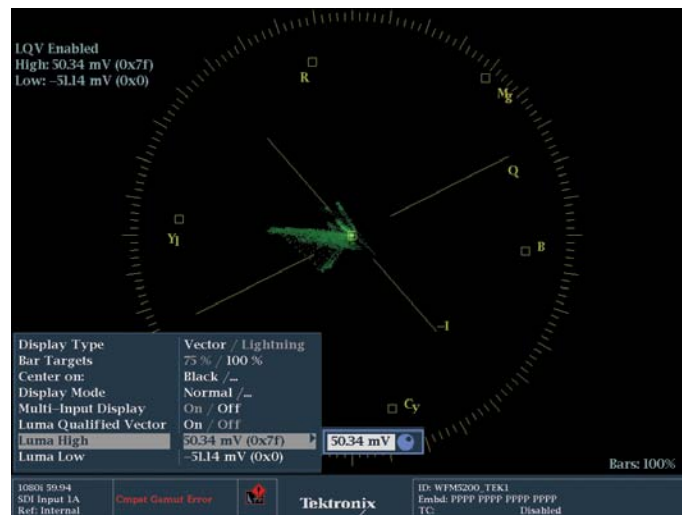
**Figure 17.** This Vectorscope is of a misbalanced Chip Chart. Because the Chip Chart is only made up of black, white and gray chips, the entire trace should be very close to the center. This image shows the trace skewed far off towards the blue vector, indicating a very blue image.



**Figure 18.** This Vectorscope is of a balanced Chip Chart. Note how close the entire trace is to the center of the vectorscope.



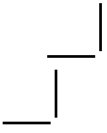
**Figure 19.** This is a Vectorscope of a typical image. An interview set in a backyard. The trace shows the red of the skin tones and the yellow/green of the grass and a bit of the blue sky.



**Figure 20.** Tektronix's Luma Qualified Vectorscopes are an exclusive feature that allow you to show a vectorscope image for a specific tonal range. In this case, only up to 50 mv. So this is showing the shadows or darkest parts of the image.

Another way to balance colors is to look at a vectorscope. On a vectorscope, pure black, white and gray – no matter how bright they are – all sit at the center of the vectorscope (Figure 18). Generally speaking, the further from the center, the more vivid the color appears due to either saturation or value (Figure 17). The hue is shown by the rotation around the circle. You don't want the entire trace in the middle – that would mean it's

just black and white – but as you manipulate the image while looking at the vectorscope you can see what parts need to sit closer to the center (Figure 19). An exclusive variation on the vectorscope is Tektronix's luma qualified vector, or LQV (Figure 20). This allows you to display just a specific part of the tonal range – like just the deep shadows or just the highlights – in the vectorscope, which I find really helps me to balance shots.



# Application Note

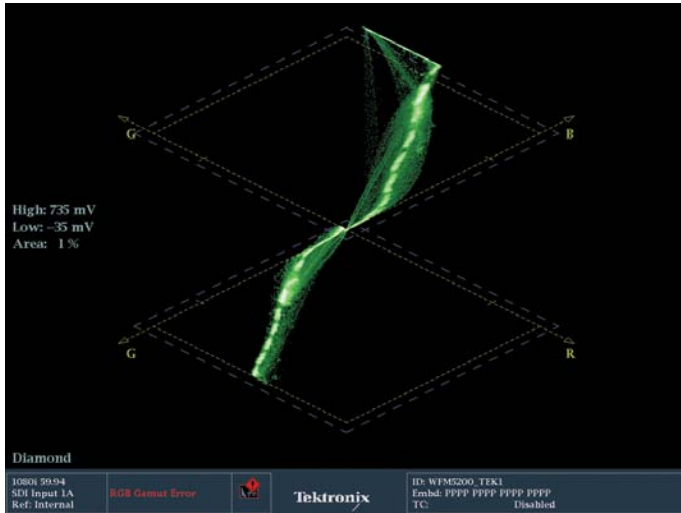


Figure 21. This is a Diamond display with a misbalanced chip chart with a blue cast to it.



Figure 22. This is a Diamond display with a balanced chip chart.

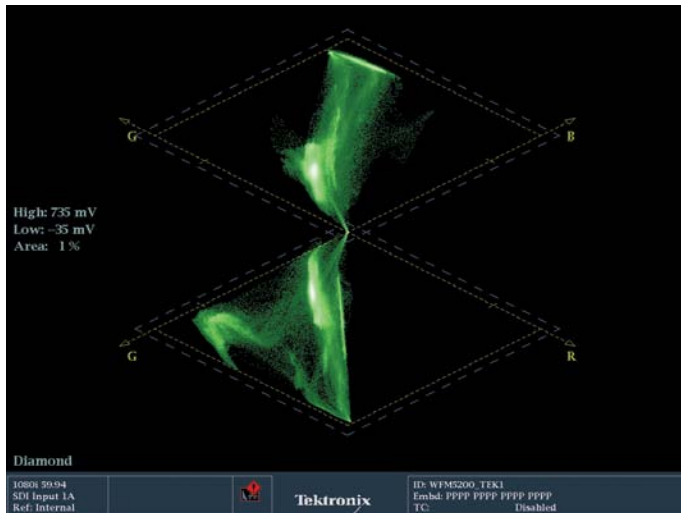
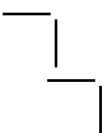


Figure 23. This image is fairly well balanced, but because of the large amount of grass in the image, the trace is quite off-center in the bottom diamond, indicating a large amount of green in the image.





## Primary Color Correction for Video - Tonal Range and Color Correction

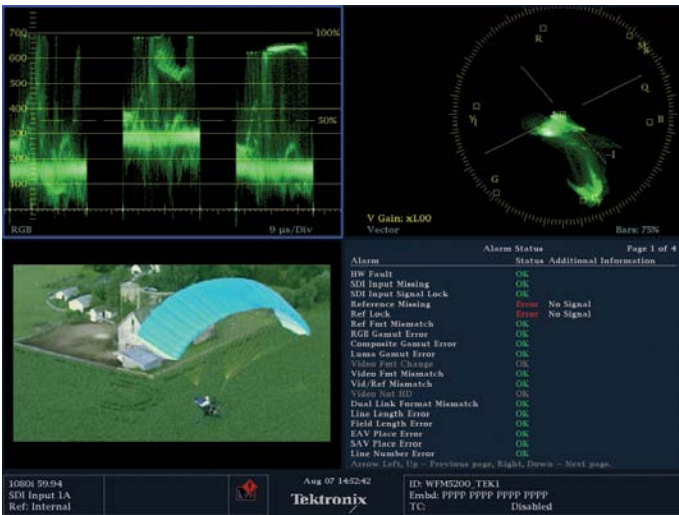


Figure 24. This is an RGB Waveform and Vectorscope of the same image with a lot of grass.

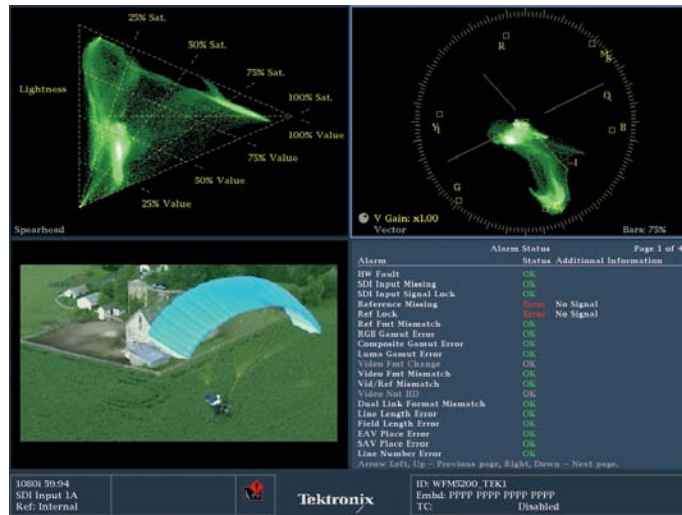
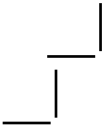


Figure 25. This is a Spearhead Display with a Vectorscope of the same image with a lot of grass.

Be sure to check out the on-line demo of the Tektronix WFM5200 and the rest of the videos on the Tektronix web site by visiting [www.tektronix.com/5200learn](http://www.tektronix.com/5200learn).



**Contact Tektronix:**

- ASEAN / Australasia (65) 6356 3900
- Austria\* 00800 2255 4835
- Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
- Belgium\* 00800 2255 4835
- Brazil +55 (11) 3759 7627
- Canada 1 (800) 833-9200
- Central East Europe and the Baltics +41 52 675 3777
- Central Europe & Greece +41 52 675 3777
- Denmark +45 80 88 1401
- Finland +41 52 675 3777
- France\* 00800 2255 4835
- Germany\* 00800 2255 4835
- Hong Kong 400-820-5835
- India 000-800-650-1835
- Italy\* 00800 2255 4835
- Japan 81 (3) 6714-3010
- Luxembourg +41 52 675 3777
- Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
- Middle East, Asia and North Africa +41 52 675 3777
- The Netherlands\* 00800 2255 4835
- Norway 800 16098
- People's Republic of China 400-820-5835
- Poland +41 52 675 3777
- Portugal 80 08 12370
- Republic of Korea 001-800-8255-2835
- Russia & CIS +7 (495) 7484900
- South Africa +27 11 206 8360
- Spain\* 00800 2255 4835
- Sweden\* 00800 2255 4835
- Switzerland\* 00800 2255 4835
- Taiwan 886 (2) 2722-9622
- United Kingdom & Ireland\* 00800 2255 4835
- USA 1 (800) 833-9200

\* If the European phone number above is not accessible, please call +41 52 675 3777

Contact List Updated 10 February 2011

**For Further Information**

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tektronix.com](http://www.tektronix.com)



Copyright © 2011, Tektronix. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks or registered trademarks of their respective companies.

10/11 EA/FCA-POD

2PW-27357-0

