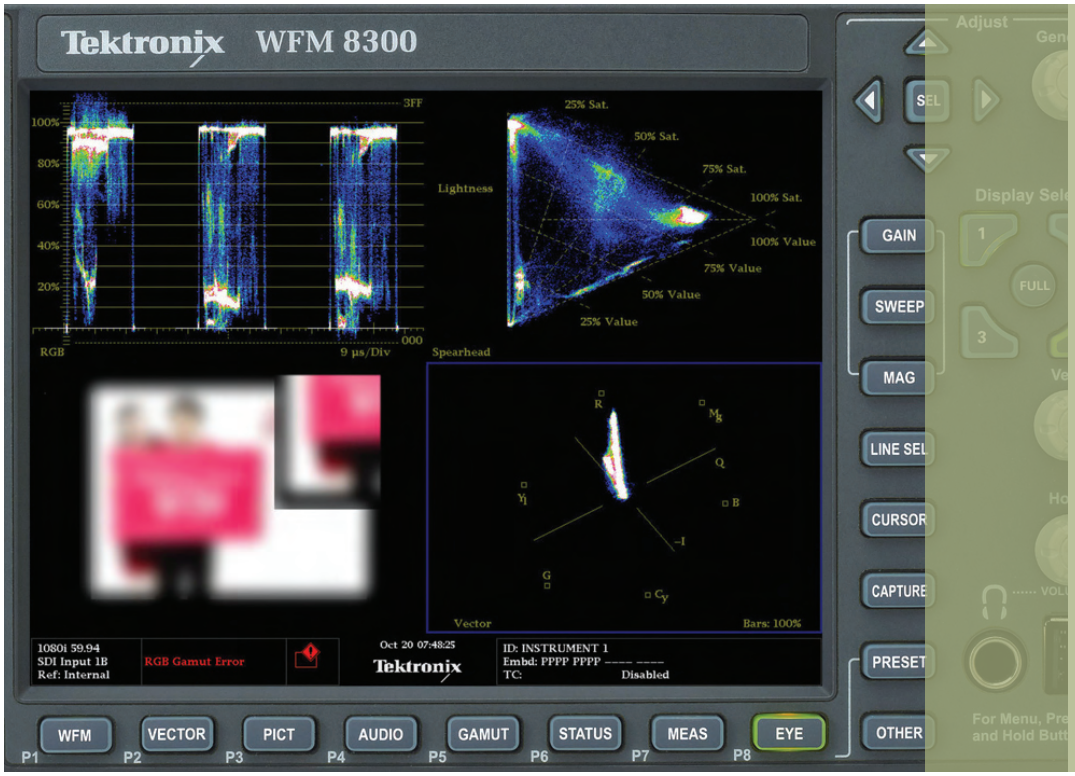

Spearhead Display

The Tektronix color tool set has always been about allowing the user to marry the Art & Science irrespective of the color space they are working in.

How To Guide

Tektronix®

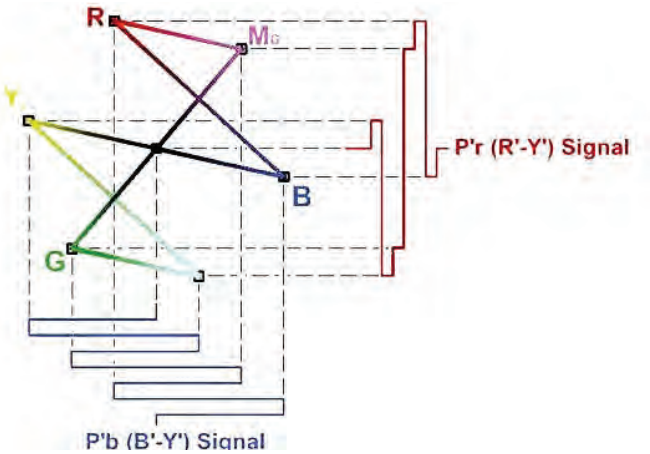

Figure 1. Vector Display.

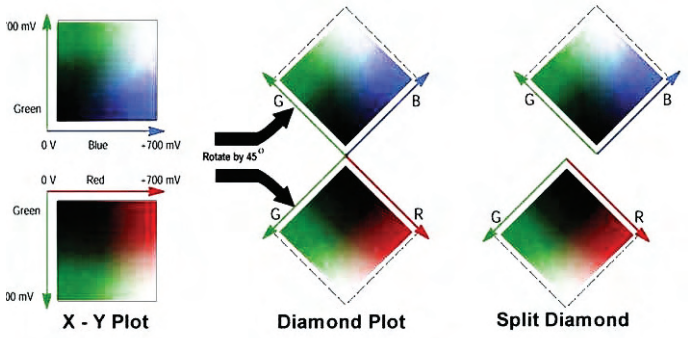

Figure 2. Diamond and Split Diamond Display.

Introduction

With the introduction of the WFM8300 Tektronix is also introducing two new displays known as the Spearhead (Luma, Saturation and Value) and the Luminance Qualified Vector (LQV) Display. These new displays do not replace existing displays, but rather complement the existing displays and are designed to enable even greater precision for high-end Post Production Colorist in the process of marrying the art and science of color grading.

This tutorial will describe the Spearhead Display and its application in the color grading process.

Note: There is a separate tutorial on using the Luminance Qualified Vector Display.

Why the need for a new display

It's been said that a good carpenter could build a house with nothing more than a hammer, but you might not want to live in it and it would probably not have the greatest esthetic appeal.Having the right tool for the job often makes the difference between a good result and a great result.

Colorists and Graphic Artists have long used Hue Saturation Value (HSL) as a creative tool to enhance photographic and graphic images. The Vectorscope or Vector display is a popular analysis tool for assessing the color of a video image. However, the Vector display does not allow the determination of color Saturation or color Value as is sometimes believed. In fact there is no known Waveform or Vector type XY display in any waveform monitor that directly indicates the color Saturation and Value of the signal. What is needed is a new display that clearly shows the artistic metrics of Saturation, Value and Lightness combined with RGB gamut limits allowing a colorist to adjust live signals back into gamut such that the desired image quality is maintained.

Vectorscope Characteristics

The Vectorscope is an XY plot of color (hue) as an angular component of a polar display much like some familiar color wheels used in color graphics with the signal amplitude represented by the distance from the center (black). It is ideal for monitoring both hue and amplitude of the chrominance signal.

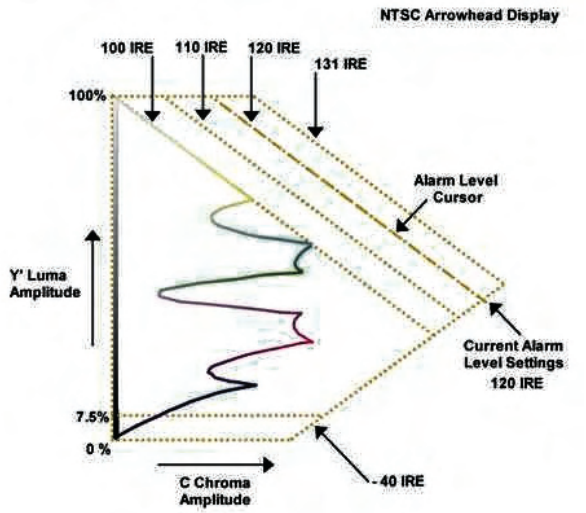

Figure 3. Arrowhead Display.

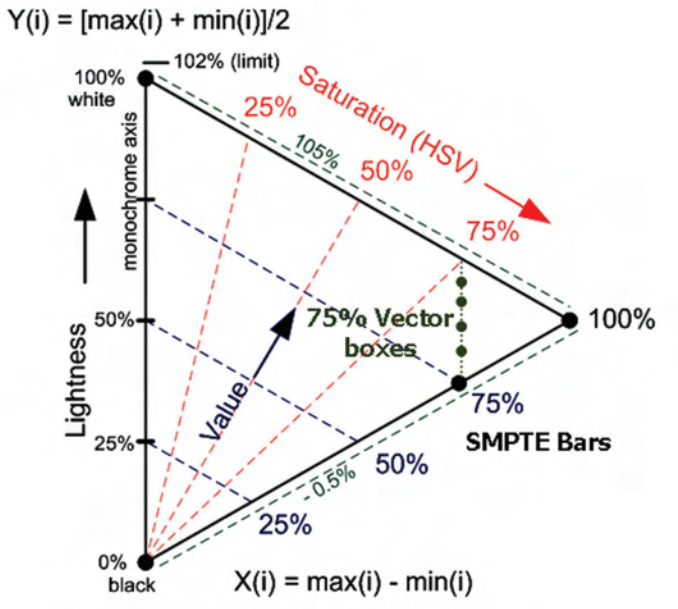

Figure 4. Spearhead Displays.

Diamond & Split Diamond Display Characteristics

Aside from making it easy to identify out of Gamut issues when working with RGB Signals one of the big advantages of the Diamond and Split Diamond display is that it allows the user to see which primaries are contributing to the out of gamut condition. Errors due to the Green channel will show up in both the Upper and Lower Diamond. Errors in the Red Channel will show up in the Lower Diamond and errors in the Blue Channel will show up in the Upper Channel.

Arrowhead Display

While the Diamond Display is great for keeping the signal content legal while working in RGB, there is a better then even chance that our content we worked so hard on will eventually be rendered as, or at the very least later converted to, Composite NTSC or PAL. The Arrowhead lets us view the converted Y, Pb, Pr information so that we can be sure that it will remain legal even when converted to a composite format. The result of this is that all the artistic efforts won't be wasted due to signal clipping if the signal is used on-air broadcast.

Spearhead Display characteristics

The Spearhead display plots Lightness (monochrome RGB) in the Vertical Axis on the left side of the triangle, Saturation (Red Dotted Lines) from left to right on the top upper diagonal of the triangle and Value (Blue Dotted Lines) on the lower diagonal of the triangle.

We describe this in more detail later, but for now just realize monochrome is on the left so a 50% Gray Signal would be a vertical straight line from 0% to 50%.

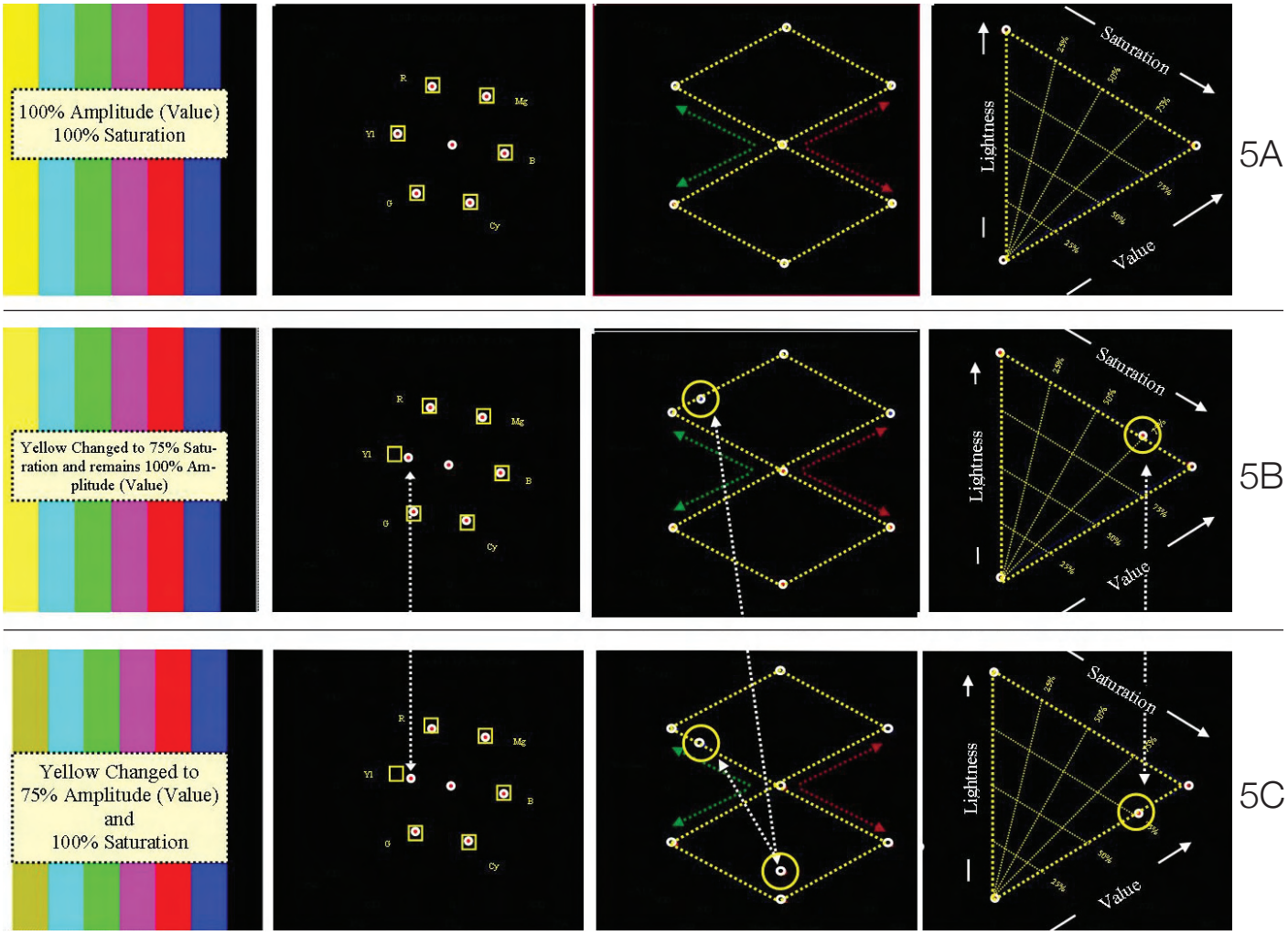

Figure 5. Vector, Diamond and Spearhead.

The Differences

Figure 5 allows us to quickly see just how the Spearhead enables us to work in an entirely new dimension by allowing us to see that effects of Saturation that simply were not available in the Vectorscope and Diamond Displays.

Notice in the 5B and 5C that the Yellow Dot appears in the same position for both 75% Saturation, 100% Amplitude and for 100% Saturation and 75% Amplitude. The Vectorscope tells us about the Color Hue (angular position) and amplitude of the chrominance signal (the combined effect of color and lightness but not the Saturation. The Diamond does just what it is supposed to do in telling us that we have not exceeded the legal RGB limits, but only the Spearhead display tells us which one is 100% Saturated (5C) and which one is 75% Saturated (5B).

Saturation is the purity or vividness of a color expressed as the absence of white. A color with 100% Saturation contains no white. Reducing Saturation drains the color away leaving just the gray-scale component.

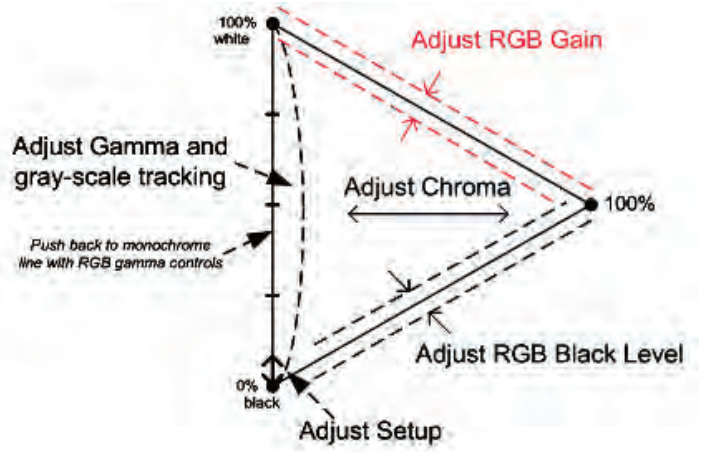

Figure 6. Color Corrector Adjustments with Spearhead Display.

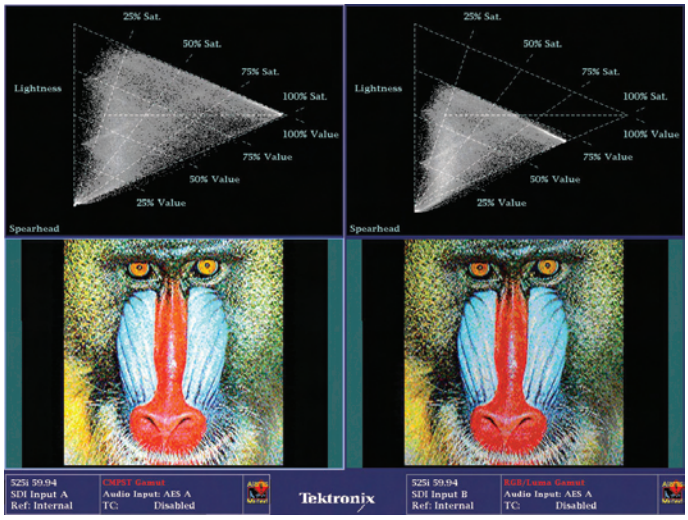

Figure 7. Spearhead Display & Image before (right side) and after (left side) Color Correction.

Spearhead for Color Correction

Figure 6 illustrates how to use the Spearhead display to quickly make color correction adjustments. As shown, the setup or black level is easily set by adjusting the image dot locations for alignment to the lower corner of the Spearhead triangle. The RGB White or Gain affects the image dot locations near the upper side of the triangle increasing or decreasing the color Value or intensity. The RGB black-level controls affect the image dot locations near the lower side of the Spearhead triangle increasing or decreasing color Saturation. A chroma level change stretches or compresses the image dot locations along the horizontal changing both Saturation and Value. Lastly, the gray-scale balance of the RGB gamma controls affects the alignment of the monochrome components of the image to the left side of the Spearhead. Almost anyone can tell if a video image is not properly gray-scale balanced so this is an important adjustment. For example, adjusting the red gamma control can stretch or compress the dark red components of the image. This will cause the gray parts of the image to pull away from the vertical or left side of the Spearhead and cause the image to have a reddish tint. Thereafter, the green and blue gamma controls can be optimally adjusted to push back the bowing to the left side thereby establishing gray-scale balance very quickly and returning the monochrome parts of the image to the displayed white point.

Color Corrector Adjustment with Spearhead

Figure 7 shows a practical example of using the Spearhead for color correction adjustment. The upper right tile shows the Spearhead display of the image just below it in Figure 7. Note that the image looks a little dark and has RGB gamut errors. For example, looking at the Spearhead display we can see the blacks near the bottom of the triangle are below the 100% Saturation line and exceed the valid RGB gamut space. Also note that there is a dot below the 0% point of the left side (Lightness axis) of the Spearhead triangle causing a luma gamut error. Both of these could have occurred due to the removal of setup at an earlier conversion stage. It is also clear that the image has been reduced to about 75% color Value not fully utilizing the full RGB gamut space.

Spearhead Display and Image after Color Correction

The left side of Figure 7 shows the image and Spearhead display after color correction. The color correction adjustments were made by looking only at the Spearhead display. The black level gamut error was corrected by increasing the RGB black-level adjustments whilst tweaking the three black-level controls to place the dot and the very bottom of the triangle without exceeding the boundaries. The interaction of the black level controls quickly converges to the location shown on the left Spearhead display. The Y gain and Chroma gain were adjusted to fill the valid gamut area by looking at the sections of the Spearhead triangle affected by each adjustment as illustrated in Figure 7. The result is a more vivid image with more detail in the blacks and the removal of both the Luma and RGB gamut errors without any changes in Hue. A Vector display could also be used to verify that color correction adjustments are not changing the Hue of higher Saturation and Value parts of the image. Finally, it is interesting to note that the bright red nose of the ape is visible as a higher intensity series of dots near the tip of the Spearhead and the nose is at full 100% Value and Saturation.

Figure 8. WFM8300 Front Panel.

How to set-up the Spearhead display in the WFM8300

Option PROD required

Note: For the purpose of this description I have used a 4-Tile screen setup but you could do this in the Full Screen Mode as well.

How to Configure Spearhead Display

1. Select one of the tiles (1,2,3 or 4) and press the **GAMUT** button.
2. Push and Hold the **GAMUT** button to enable the menu.
3. The menus should so the **Display Type** navigate using the up and down arrow keys or the general know to the Spearhead selection.

You can also save this as a Preset by Depressing the **PRESET** Button and then selecting the location you want to save it to. After saving the preset you can rename it as shown in this example.

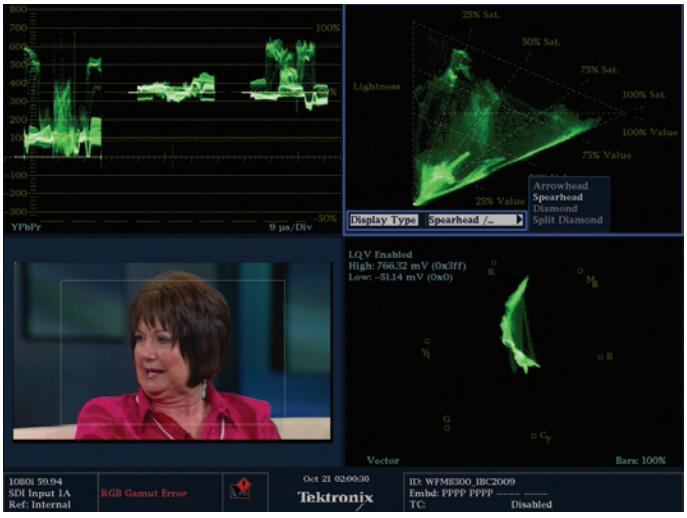

Figure 9. Configuration Screen for Spearhead Display.

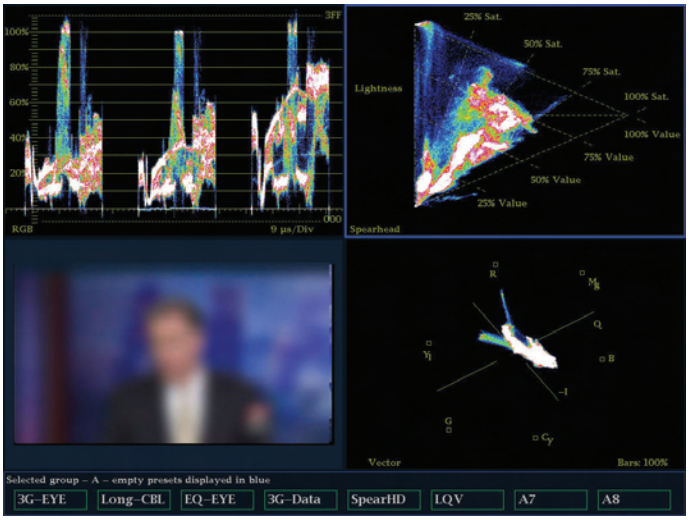

Figure 10. Spearhead Preset.

Waveform monitors have become more and more sophisticated in order to meet the monitoring and measurement demands placed on production, post-production and engineering staffs resulting from the need to work with a multitude of formats in a variety of ways. If you can remember the days when a typical waveform monitor had four or five push buttons and maybe three or four knobs you're probably thinking, "oh how simple it was then." I can relate to that, but today's challenges demand more sophisticated waveform monitors and, "sorry to say", that means the configuration and operation of these instruments has become more complicated.

Presets go a long way toward bringing back the simplicity:

Presets are a simple a way of saving a set of conditions that can easily be recalled later. You can give them real world names that eliminate the need to keep a list of 32 presets and what they were for.

If you have not tried the sample Top Ten Presets they are available at www.tektronix.com.

Summary

The Spearhead Display provides a simplified, 2D gamut ara of valid, real time RGB signals for content creation, color correction, color grading, format conversion and distribution.

This new display augments the current gamut displays of Diamond and Arrowhead for RGB adjustment and color correction.

Spearhead completes and complements the artistic use of Vector for color Hue by adding a measurable assessment of the artistic color metrics of the true Saturation, Value and Lightness not previously available in video signal monitoring/measurement equipment.

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Contact List Updated 09 December 2009

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**

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