AVI – Optimize your sensor suite

3-G SDI Quad Video Processor System Examples

Introduction

Applied Video Imaging's rugged Quad Video Processors allow system designers to create optimized video display applications for surveillance and mission systems using various video input and output standards. AVI's Quad Processors combine multiple independent video sources from sensors and other systems into a single image for display to the mission operator. This improves situational awareness, operator effectiveness, and mission execution while lowering weight and wiring complexity for both existing and new platform installations.

Fewer platform displays, improved surveillance and monitoring, decreased wiring, and improved operator performance are just some of the benefits realized when using AVI's Quad Video Processors.

This document introduces what quad processing is and describes various ways that AVI's Quad Video Processors can be used in creating more effective mission systems.

Concepts

General Concepts

In its fundamental form, a Quad Video Processor inputs four independent video sources, scales the inputs, then mixes them into a single image for output in real-time on a frame-by-frame basis. The resultant video stream can then be viewed on a single display as opposed to four separate displays. It also prevents having to switch each image individually in order to view it.

Figure 1. Typical Quad View

Only the image in the lower right quadrant of Figure 1 allows the operator to instantly determine that the truck is moving towards him and the car is moving away.

Hardware Concepts

AVI's Q000304 3-G SDI based Quad Video Processor, Figure 2, will be used to explain what a quad processor does and the signal paths through it.

In the block diagram in Figure 3, the four video inputs consist of SDI, HD SDI, or 3-G SDI signals provided by different sensors or systems on the platform. The input Digital Conversion block performs the following functions:

SDI is the digital transport of video signals over point-to-point serial links. SMPTE is the standards body that has developed both the technical requirements and standards.

- SDI receiver and equalizer
- SDI protocol/format decoding
- Digital conversion to board-level format

Figure 2. AVI's Q000304-00 Quad Processor

Once converted, each video frame is scaled to ¼ of the of the output frame's resolution and buffered.

When all Scalar buffers are full, the image engine writes (mixes) each buffer to the appropriate location in the output buffer. Overlay graphics are also mixed into the output buffer as required. In effect, the Image Engine just switches to the appropriate source buffer pixel based on the current output buffer's pixel location.

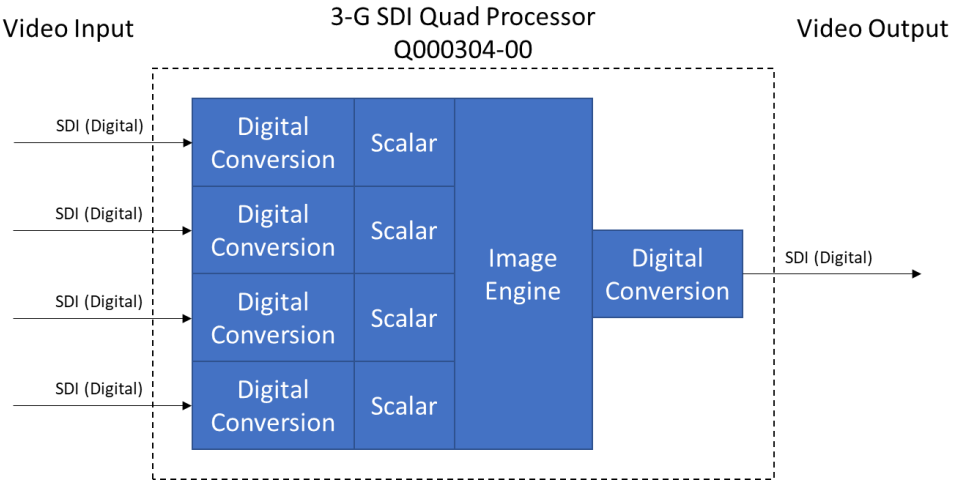

Figure 3. Simplified Functional Block Diagram

The video output, which is now a single frame of the combined inputs, will be output as a SDI, HD SDI, or 3-G SDI signal. Although simplified, the steps in this process of combining separate video sources into a single source for output is similar throughout industry. However, complexity increases based on input types and functionality requirements for how the output image is formatted.

Functional Concepts

AVI's "buttons" are actually PCAP touch modules (Projective CAPacitive). Each module contains six capacitive sensors with individual LED's. The module is placed behind cover glass and the icons are silkscreened onto the glass and can be customized.

If all the Quad Processor did was to format four video sources into a single image as in Figure 1, it would be quite beneficial, but not very flexible. By adding dynamic control to the Quad Processor, the unit not only becomes more flexible, but adds increased capability to the mission system and mission execution.

For example, AVI's quad processor can be controlled through AVI's multifunctional displays, remote controller, or control GUI over Ethernet. Figure 4 shows the front panel buttons in AVI'

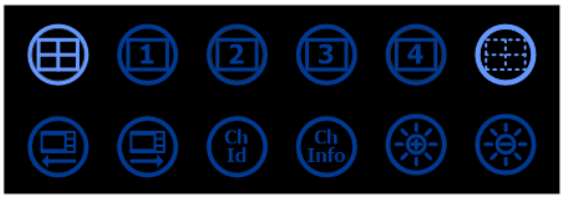

Figure 4. Quad Processor Remote Control Buttons

For AVI's Q000304 processor, functional control includes:

- Single image display of each input
- Quad image view
- Channel ID: on or off, text color, customizable name, and background color
- Signal Information: on or off, and background color

AVI's Q000304 provides up to 16 output image configurations shown below in Figure 5. Using AVI's controllers, multifunction displays, or interface GUI makes switching between image configurations fast and easy.

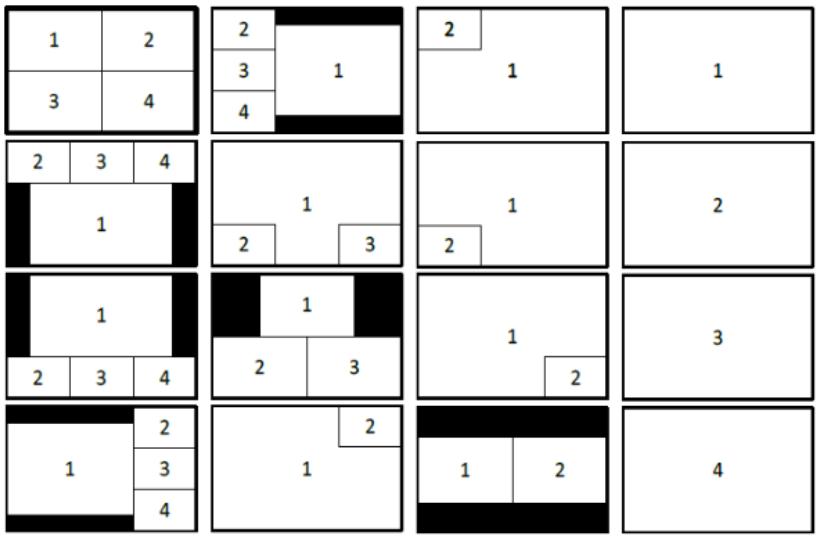

Figure 5. Available Image Configurations

System Concepts

So why not embed the quad functionality into the display or into a video switch? Some companies do, but here are the main reasons this is not a good idea:

- Only the display with the quad capability can use it.
- The additional complexity of the display design increases the cost and lowers the display MTBF.
- The quad processor can be placed near the sensor package and only a single cable needs to be run to the display.
- An existing display does not need to be replaced when using a separate quad processor, saving installation costs.
- The quad capability is a system functional element encapsulated in the quad processor. Changes to the sensor, display, or other system changes can be easily accommodated, including phased purchases and installations.
- Flexibility in mission systems design is increased when functional element encapsulation is adhered to.

SDI is a much more robust signal for video transport than analog NTSC/PAL or DVI/HDMI. It is highly immune to induced environmental noise.

The system examples that follow will help demonstrate this.

System Examples

System Example with AVI Q000304 Quad Processor and AVI Display

This system example shows a simple installation where all sensor video inputs are SDI. Control is coming directly from AVI's Display. Note the simplified wiring to the display.

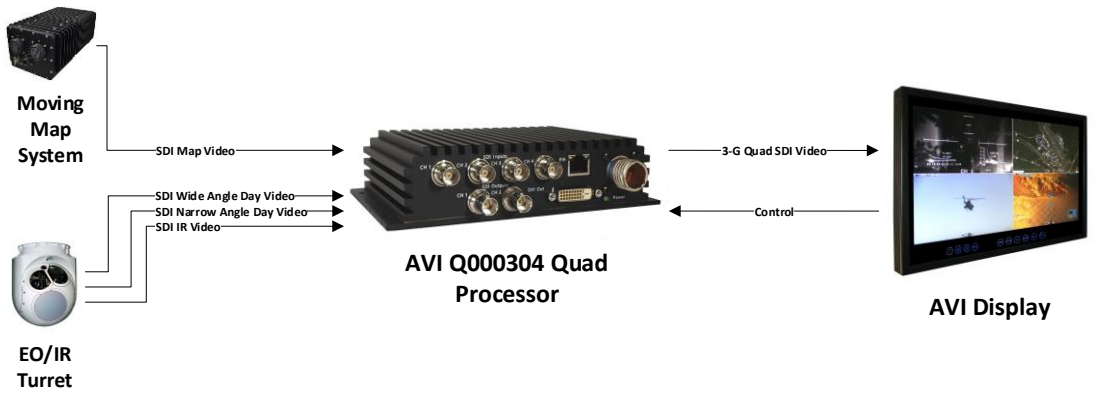

Figure 6. System Example 1

System Example with AVI's Q000304 Quad Processor and Different Company's Display

This system example also shows a simple installation where all sensor video inputs are SDI. In this case, the display already exists and control is provided by AVI's Remote Controller.

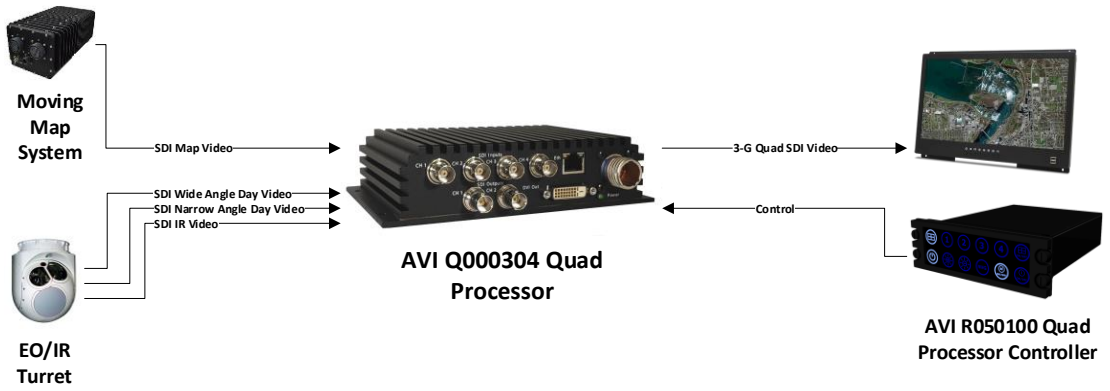

Figure 7. System Example 2

System Example with AVI Q000304 Quad Processor and Two AVI Displays

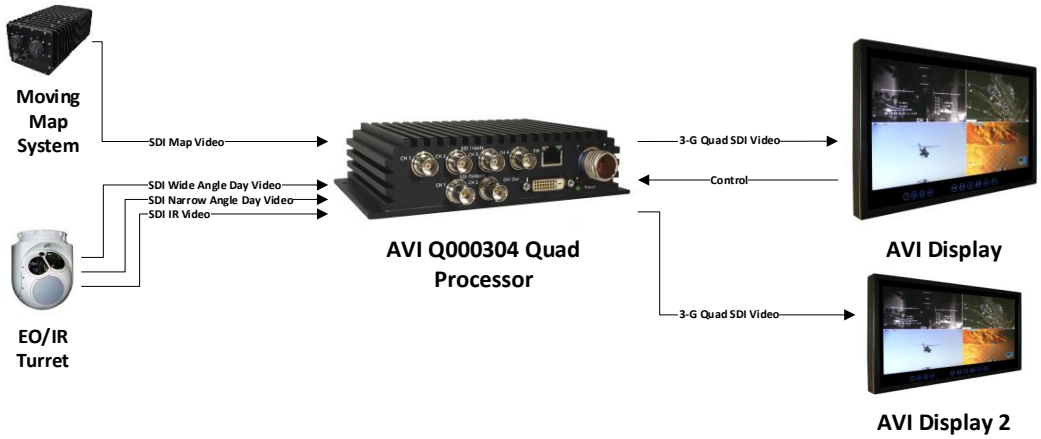

Figure 8. System Example 3

System Example with AVI Q000304 Quad Processor, AVI 8X8 SDI Video Switch, and Multiple AVI Displays

This system example shows a more complex design with seven sensor inputs into an AVI 8X8 SDI Video Switch. The quad processor output is one of the switches inputs. The quad processor's inputs are four of the switch's outputs.

VGA, Composite, and S-Video are considered "legacy" video signals. These are being replaced by newer digital forms. However, these signals are still pervasive in the industry.

Since the 8X8 switch is non-blocking, any input can go to any or all outputs. The quad processor's inputs can be any four of the switch's inputs. Any display can select any of the switch's outputs to the quad processor or to the display, including the quad image.

This concept could be expanded to include a larger switch (16X16), additional switches, additional quad processors, additional displays, and other system components.

System configuration and sensor selection is now a dynamic process with simplified wiring. Control of switch routing can be done directly through a display, a remote controller, or through a PC connected to the same network.

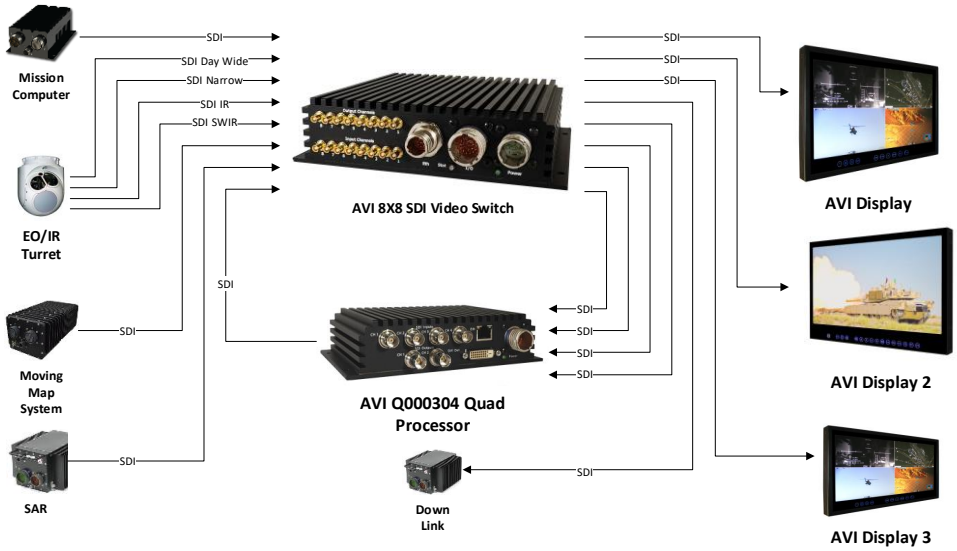

Figure 9. System Example 4

About Applied Video Imaging, LLC – Applied Video Imaging designs and manufactures advanced rugged video processing, distribution, recording, and display products for airborne, ground, and marine surveillance markets. AVI's products, services, and solutions optimize surveillance sensor suites, enhancing the platform and operator's mission effectiveness. For more information, or discuss your system requirements, visit www.appliedvi.com or call 434-974-6310, toll free 855-974-6310