



M2M



## Embedded Machine-to-Machine (M2M) Gateway: Trusted and Connected Intelligence

By Iain Davidson, Networking Marketing Manager, EMEA,  
Freescale Semiconductor, Inc.

This white paper makes the case for the M2M gateway and highlights its role in supporting connectivity, intelligence, scalability and security in M2M networks. Different M2M scenarios require different connectivity options, wired and wireless, broadband and slow serial data. The majority of M2M devices normally remain off to save power, meaning connectivity should be low cost and low energy, but this is not the hall-mark of cellular networks. The M2M gateway is key in this respect: for connecting those clusters of low-energy, low-cost M2M devices that will be deployed around buildings, campuses and city streets. Since M2M equipment will be on the Internet and will often be deployed in publicly accessible areas, security is required to help with both physical tampering and malicious network attacks. The Freescale QorIQ family of processors covers all these aspects.



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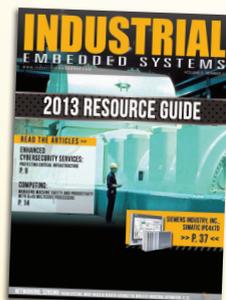
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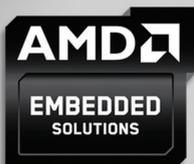
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# foreword >> thinking

By Rory Dear, Technical Contributor



## Retail expectations of industrial products

Embedded computing technology historically lags some years behind mainstream desktop computing. This is not something we take any shame in, actually quite the opposite.

The retail sector tends to release product as soon as the technology is saleable. Even before a new technology becomes mainstream, there are plenty with deep pockets willing to play guinea pig. The next stage is making that technology competitively priced, enabling the masses to climb aboard the next bandwagon. But at the same time we ask: Should our own industry hop on now?

No, of course not, is the answer. We simply can't afford to play guinea pig. Our industry is purposefully lagging behind in introducing new technologies. I wouldn't even consider availability to our client base until I could state, with absolute authority, that the technology has the stability required to be an industrial product.

By holding back, we allow the retail sector to become our beta testers – without any loss to our own reputation, or worse. And it's easy to understand why: If your new tablet fails, it can be returned and replaced in a matter of days with losses not stretching much further than one's own inconvenience. Now if the controller in charge of train signaling fails ... I'm sure you get the picture. Let's look at the danger of expectation from retail products in the industrial marketplace – focusing on display technology.

### Industrial versus consumer tech

Pushing proven stability aside momentarily, let's say a technology is natively so robust that the risk of avoiding a retail

“bedding in” period is perceived to be very low. Then does the embedded market really want the latest and greatest? More crucially, will the end user pay for it?

Since the release of a certain smartphone, the expectation of consumers as to the quality and usability of touch-screen devices has risen exponentially. When faced with any active display, the end user subconsciously compares it with that utilized in their pocket. This isn't necessarily a bad thing. You will never find me arguing against an increased pace of technology advancement, but just because it's the latest technology doesn't mean it's the most appropriate technology. There are two aspects in this example: display quality and the touch screens themselves.

### Display quality

The first aspect, the native resolution, is the simplest barometer of display quality. High-end smartphones use high-definition displays (the current guise boasting 1136 x 640 pixels) coupled with the tiny physical size of these displays; the image quality is superb and was historically unimaginable.

Conversely, a typical small panel PC sports an 8" SVGA display: 800 x 600 resolution. Immediately observable, the panel PC's display is quadruple the size, yet a lower resolution. Cries of “poor quality” are heard as groups debate amongst themselves how Neanderthal this product must indeed be.

At this point we should remind ourselves why the two products exist. A mobile phone is likely to be used in close proximity for a number of hours a day and is expected to capture HD photography and video with amazing clarity, unlike

the industrial panel PC. Typically, panel PC systems have a fraction of the daily viewing time and have never seen a high-resolution image.

So yes, of course it would be wonderful if every display, everywhere, offered HD resolution with eyewatering definition. But if that solution multiplies the price with little advantage to the end user, there's only going to be one loser: he who blindly insisted on it.

### Touch screens

The second aspect is touch screens, nicely in parallel with the display itself. The public is now long used to gesture-based control – fantastic on a mobile phone and increasingly expected by the end user. But in industrial, it's often the opposite. In industrial environments, workers often wear gloves to protect their hands, which previously had no impact on their ability to use touch-screen HMIs to increase efficiency. Unfortunately, Projective Capacitive (PCT) screen functions via electrical impulses through the fingertips. With most types of gloves, though “touch friendly” gloves are increasingly available, PCTs will be nonfunctional.

Additionally, how many existing industrial application GUIs would really benefit from pinch and grab, twist and turn, gesture control? An obvious advantage of a zoom mechanism on assembly lines would be to focus on particularly detailed assembly processes, but I've struggled to find many cases where a standard click to zoom wouldn't be sufficient. I suspect in 2-3 years' time, we might see the need. Until then, let us stick with stability and technology for purpose, not technology for technology's sake.

# The Interface

By Curt Schwaderer, Technology Editor



## HMIs: Write once, display anywhere

Players within the industrial control market have begun trying to take advantage of the mobility craze and Bring Your Own Device (BYOD) concepts. High mobility essentially boils down to using smartphones, tablets, or laptop equipment to make jobs easier and more efficient, drive down equipment cost, make replacement easier, and provide a more intuitive, familiar environment for end users.

Caught in the middle of this BYOD movement is the Human Machine Interface (HMI), creating the problem that HMI applications no longer know what display system they are operating on: perhaps it is a tablet, a desktop PC, or a smartphone, or maybe all three depending on the location in the plant! HMI applications do not live on a fixed device anymore, which presents challenges in designing HMI screens and interactions with the end user.

### Screen size and resolution challenges

The wide variety of smartphone, tablet, laptop, PC, and High-Definition (HD) displays available for HMI applications presents large logistical challenges during development. For example, even something as simple as widgets placed on a screen could be displayed incorrectly depending on the aspect ratio and other display properties. Writing an interactive app for a smartphone requires a very different layout and design interface than for a large HD panel, and the display capabilities of the devices vary too much in terms of space, resolution, and aspect ratios for the HMI to be displayed consistently.

Graphics and multimedia plug-ins like Silverlight, flash, and even Java can also create incompatibilities. There are Operating System (OS) platform considerations as well – developing for the Android OS is very different than for

Apple's iOS. Supporting both platforms requires two different development cycles, additional maintenance, and update considerations.

### Executing on write once, run anywhere

I recently had the opportunity to talk with Benson Houglund of Opto 22 ([www.opto22.com](http://www.opto22.com)) about the company's groov software that was developed with the notion of building HMI applications that look consistent across end-user devices. Houglund mentioned that an earlier HMI product from Opto 22 (called PAC Display) suffered from the resolution and interoperability issues described previously. They thought about moving the product to a browser or remote desktop environment and calling it a day, but unfortunately this approach did not solve the interoperability and varied display issues.

"We decided to start from scratch," Houglund said. "Some key technology advancements in modern web browsers like HTML5, CSS3, and scalable vector graphics, in addition to enhanced caching for performance, enabled our efforts." The result is groov, a new "write once, run anywhere" HMI product.

groov lets you build and run an HMI web app with only two simple things – a network connection and a modern web browser. Browser plug-ins are not used. When you open a browser and complete the authentication, groov starts running. You add screens, select widgets, and tie them to tags from industrial controllers. All these activities are saved on a server that automatically publishes the results. When the user surfs to a URL, the HMI you built is pulled into your browser, screens and all. Now when the end user navigates to various on-screen gauges or indicators, the browser pulls only new or

changed data from the server, which provides a dramatic increase in performance.

Security is also considered. The environment provides two network interfaces – one connected to the corporate network where groov connects to client devices, with the other connection to the control system network. The network interfaces are isolated from each other to ensure the corporate users do not interfere with the control network.

Opto 22 provides a couple of options – a standalone "groov Box" hardware appliance with wireless LAN that runs the groov server application, and a PC-based groov server for Windows. These two options provide an easy-to-use, efficient environment for developing and deploying groov apps.

### Standards involved

A recent standard called OPC-UA is an industrial protocol for interoperability between devices from different manufacturers. It is based on the paradigm for printers in PC OSs where the printer manufacturer provides the driver for the printer. This same concept applies to the HMI environment, as an industrial manufacturer would supply an OPC driver for a Programmable Logic Controller (PLC), for example, so there is no need to develop specialized back-end code to communicate with it. An application like groov then connects to that PLC with its IP address and tag list location.

Understanding display and mobile equipment complexities and the associated HMI interoperability and usability issues, it is now clear that write once, run anywhere HMI application environments, combined with advancing industrial control interoperability standards, will represent a significant leap forward for BYOD in the industrial space.

# Enhanced Cybersecurity Services: Protecting Critical Infrastructure

By Brandon Lewis, Associate Editor

*Comprehensive cybersecurity is an unfortunate necessity in the connected age, as malwares like Duqu, Flame, and Stuxnet have proven to be effective instruments of espionage and physical sabotage rather than vehicles of petty cybercrime. In an effort to mitigate the impact of such threats on United States Critical Infrastructure (CI), the Department of Homeland Security (DHS) developed the Enhanced Cybersecurity Services (ECS) program, a voluntary framework designed to augment the existing cyber defenses of CI entities. The following provides an overview of the ECS program architecture, technology, and entry qualifications as described in an “on background” interview with DHS officials.*

At some point in 2007, an operator at the Natanz uranium enrichment facility in Iran inserted a USB memory device infected with the Stuxnet malware into an Industrial Control System (ICS) running a Windows Operating System (OS). Over the next three years, the Stuxnet worm would propagate over the Natanz facility's internal network by exploiting zero-day vulnerabilities in a variety of Windows OSs, eventually gaining access to the Programmable Logic Controllers (PLCs) on a number of Process Control Systems (PCSs) for the facility's gas centrifuges. Stuxnet then injected malicious code to make the centrifuges spin at their maximum degradation point of 1410 Hz. One thousand of the 9,000 centrifuges at the Natanz facility were damaged beyond repair.



In February 2013, Executive Order (EO) 13,636 and Presidential Policy Directive (PPD)-21 ordered the DHS to develop a public-private partnership model to protect United States CI entities from cyber threats like Stuxnet. The result was an expansion of the Enhanced Cybersecurity Services (ECS) program from the Defense Industrial Base (DIB) to 16 critical infrastructure sectors (see Table 1, page 11).

## **Enhanced Cybersecurity Services framework**

At its core, the ECS program is a voluntary information-sharing framework that facilitates the dissemination of government-furnished cyber threat information to CI entities in both the public and private sectors. Through the

program, sensitive and classified cyber threat information is collected by agencies across the United States Government (USG) or EINSTEIN sensors<sup>1</sup> placed on Federal Civilian Executive Branch (FCEB) agency networks, and then analyzed by DHS to develop “threat indicators” (see Sidebar 1, page 11). DHS-developed threat indicators are then provided to Commercial Service Providers (CSPs)<sup>2</sup> that, after being vetted and entering a Memorandum of Agreement (MOA) with DHS, may commercially offer approved ECS services to entities that have been validated as part of United States CI. The ECS services can then be used to supplement existing cyber defenses operated by or available to CI entities and CSPs to prevent unauthorized access, exploitation, and data exfiltration.

1 EINSTEIN sensors provide an early warning system, improved situational awareness of intrusion threats to FCEB networks, near real-time identification of malicious cyber activity, and prevention of that malicious cyber activity to the federal government.

2 Threat indicators and ECS services are also available to Operational Implementers (OIs), or entities that have sufficient technical and security capabilities to implement ECS protections on their own networks and systems, but do not intend to offer those services as a CSP to other entities.

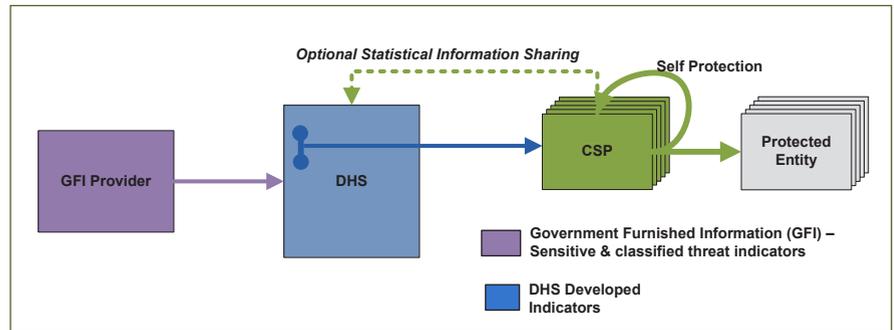
In addition, CSPs may also provide limited, anonymized, and aggregated cybersecurity metrics to the DHS Office of Cybersecurity & Communications (CS&C) with the permission of the participating CI entity. Called Optional Statistical Information Sharing, this practice aids in understanding the effectiveness of the ECS program and its threat indicators, and promotes coordinated protection, prevention, and responses to malicious cyber threats across federal and commercial domains. Figure 1 provides an overall outline of the ECS model.

### Enhanced Cybersecurity Services countermeasures

The initial implementation of ECS includes two countermeasures for combating cyber threats: Domain Name Service (DNS) sinkholing and e-mail filtering.

DNS sinkholing technology is particularly effective against malwares like Stuxnet that are equipped with distributed command and control network capabilities, which allows threats to open a connection back to a command and control server so that its creators can remotely access it, give it commands, and update it. The DNS sinkholing capability enables CSPs to prevent communication with known or suspected malicious Internet domains by redirecting the network connection away from those domains. Instead, CSPs direct network traffic to “safe servers” or “sinkhole servers,” both hindering the spread of the malware and preventing its communications with cyber attackers.

The e-mail filtering capability is effective in combating cyber threats like Duqu, for example, which spread to targets through contaminated Microsoft Word e-mail attachments (also known as phishing), then used a command and control network to exfiltrate data encrypted in image files back to its creators. The e-mail filtering capability enables CSPs to scan attachments, URLs, and other potential malware hidden in e-mail destined for an entity’s



**Figure 1 |** The ECS model gathers sensitive cyber threat information from across United States government agencies, and develops it into “threat indicators” that can be used to supplement CSP and CI entity cyber defenses.

networks and potentially quarantine it before delivery to end users.

### Accreditation and costs for Enhanced Cybersecurity Services

The CS&C is the DHS executive agent for the ECS program, and executes the CSP security accreditation process and MOAs, as well as validation of CI entities. Any CI entity from one of the 16 key infrastructure sectors can be evaluated for protection under the ECS program, including state, local, tribal, and territorial governments.

For CSPs to complete the security accreditation process, they must sign an MOA with the USG that defines ECS expectations and specific program activities. The MOA works to clarify the CSP’s ability to deliver ECS services commercially while adhering to the program’s security requirements, which include the ability to:

- Accept, handle, and safeguard all unclassified and classified indicators from DHS in a Sensitive Compartment Information Facility (SCIF)
- Retain employee(s) capable of holding classified security clearances for the purposes of handling classified information (clearance sponsorship is provided by DHS)
- Implement ECS services in accordance with security guidelines outlined in the network design provided on signing of the MOA

Although participation in the ECS program requires no up-front costs, CSPs

may encounter costs related to the requirements of the program. These requirements could include, but are not limited to, costs to adhere with the hardware, software, installation, and configuration requirements of ECS, as well as the construction of a SCIF. However, the DHS projects that these costs will be outweighed by the long-term benefits of the program.

### Privacy, confidentiality, and Enhanced Cybersecurity Services

In addition to not disclosing information on CI entities enrolled in the ECS program (including names), a fundamental tenet of the ECS program is that the government takes no part in securing voluntary networks, nor does it monitor private communications or communications content of CSPs or CI entities.

“ECS does not involve government monitoring of private communications or the sharing of communications content with the government by the CSPs,” a DHS official told *Industrial Embedded Systems*. “Although CSPs may voluntarily share limited aggregated and anonymized statistical information with the government under the ECS program, ECS related information is not directly shared between customers of the CSPs and the government.

“CS&C may share information received under the ECS program with other USG entities with cybersecurity responsibilities, so long as the practice of sharing information is consistent with its existing policies and procedures. DHS does not

## Enhanced Cybersecurity Services threat indicators

As mentioned, ECS threat indicators are the product of sensitive Government-Furnished Information (GFI) that is directly related to the high-level operations of threat actors. These indicators range in classification, and are provided as human-readable cyber data that identifies and describes specific characteristics of particular known or suspected cyber threats. Examples of the data provided in human-readable threat indicators are:

- › Internet Protocol addresses
- › Domain names
- › E-mail headers
- › Files
- › Strings

Once confirmed, the information from threat indicators is used to develop intrusion detection signatures, which are machine-readable software code that enable automated detection.

control what actions are taken to secure private networks or diminish the voluntary nature of this effort. Nor does DHS monitor actions between the CSPs and the CI entities to which they provide services. CI entities remain in full control of their data and the decisions about how to best secure it."

For more information on participating in the ECS program as either a validated CI entity or CSP, contact the ECS Program Management Office at ECS\_Program@HQ.DHS.gov. **IES**

### Reference:

- [1] Lee, Robert M. The History of Stuxnet: Key Takeaways for Cyber Decision Makers. Retrieved from [www.afcea.org/committees/cyber/documents/TheHistoryofStuxnet.pdf](http://www.afcea.org/committees/cyber/documents/TheHistoryofStuxnet.pdf). Access date: 10/08/2013.

**Sidebar 1** | The ECS program is based on the development of "indicators" to identify known or suspected cyber threats.

### The 16 Critical Infrastructure Sectors and Sector-specific Agencies

Sector	Governing Agency	2010 Sector-specific Plan
Chemical	Department of Homeland Security	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-chemical-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-chemical-2010.pdf</a>
Commercial Facilities	Department of Homeland Security	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-commercial-facilities-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-commercial-facilities-2010.pdf</a>
Communications	Department of Homeland Security	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-communications-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-communications-2010.pdf</a>
Critical Manufacturing	Department of Homeland Security	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-critical-manufacturing-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-critical-manufacturing-2010.pdf</a>
Dams	Department of Homeland Security	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-dams-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-dams-2010.pdf</a>
Defense Industrial Base	Department of Defense	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-defense-industrial-base-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-defense-industrial-base-2010.pdf</a>
Emergency	Department of Homeland Security	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-emergency-services.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-emergency-services.pdf</a>
Energy	Department of Energy	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-energy-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-energy-2010.pdf</a>
Financial Services	Department of the Treasury	<a href="http://www.dhs.gov/sites/default/files/publications/nipp-ssp-banking-and-finance-2010.pdf">www.dhs.gov/sites/default/files/publications/nipp-ssp-banking-and-finance-2010.pdf</a>
Food and Agriculture	U.S. Department of Agriculture and Department of Health and Human Services	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-food-ag-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-food-ag-2010.pdf</a>
Government Facilities	Department of Homeland Security and General Services Administration	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-national-monuments-icons.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-national-monuments-icons.pdf</a> (National Monuments and Icons) <a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-education-facilities-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-education-facilities-2010.pdf</a> (Education Facilities)
Healthcare and Public Health	Department of Health and Human Services	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-healthcare-and-public-health-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-healthcare-and-public-health-2010.pdf</a>
Information Technology	Department of Homeland Security	<a href="http://www.dhs.gov/publication/information-technology-sector-specific-plan">www.dhs.gov/publication/information-technology-sector-specific-plan</a>
Nuclear Reactors, Materials, and Waste	Department of Homeland Security	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-nuclear-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-nuclear-2010.pdf</a>
Transportation Systems	Department of Homeland Security and Department of Transportation	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-transportation-systems-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-transportation-systems-2010.pdf</a>
Water and Wastewater Systems	Environmental Protection Agency	<a href="http://www.dhs.gov/xlibrary/assets/nipp-ssp-water-2010.pdf">www.dhs.gov/xlibrary/assets/nipp-ssp-water-2010.pdf</a>

**Table 1** | In 2010, the Department of Homeland Security requested that key critical infrastructure sectors update their sector-specific plans to address cybersecurity shortcomings. Listed here are the 16 key critical infrastructure sectors, their governing agencies, and corresponding 2010 sector specific plans.

## Vision systems, image-based ID readers advance the world of industrial automation



Q&A with John Lewis, Market Development Manager at Cognex Corporation

*Vision System on a Chip (VSoC) technology and machine vision-based 3D laser profilers are stepping up to the plate and hitting a homerun when it comes to improving read rates in the factory, says Cognex Corporation's Market Development Manager John Lewis. But the bring-up of image-based ID readers and vision systems still presents some challenges in cost, ease of deployment, and electronics reliability.*

**Remind us briefly about Cognex – when started, number of employees, where located, technical focus, and markets served.**

**LEWIS:** Cognex Corporation, with a total worldwide headcount of about 1,000 employees, has shipped more than 850,000 systems, representing over \$3 billion in cumulative revenue, since the company's founding in 1981. Cognex provides vision systems, vision software, vision sensors, and surface inspection systems used in manufacturing automation. Cognex vision helps companies in virtually every industry improve product quality, eliminate production errors, lower manufacturing costs, and exceed consumer expectations for high-quality products at an affordable price. Typical applications for machine vision include detecting defects, monitoring production lines, guiding assembly robots, and tracking, sorting, and identifying parts. We also provide industrial ID readers.

**Describe a practical scenario where your VSoC image-based ID readers would be used and what they would accomplish.**

**LEWIS:** A snack food manufacturer with multiple brands ran into problems when they tried using a laser-based barcode scanner to direct boxes to different shipping areas. The height of the boxes (1.5 feet) made it necessary to position 3 feet above the conveyor line, and 3 feet away from the box, forcing the device to scan the barcode at a 45-degree angle, resulting in read rates

of only 20 percent to 30 percent. As a result, the manufacturer had to assign a full-time employee over three shifts to manually divert the boxes when barcodes weren't read by the existing laser scanner. The company also had to deal with the consequences of orders filled incorrectly, such as returned product that could not be resold.

To solve this problem, they switched to an image-based barcode reader, in this case a DataMan 500 from Cognex. These devices, which can read any label at any orientation within a 12-inch by 12-inch field of view, improved the read rate to 100 percent even though it reads from the same location as the previous laser-based scanner. This saved the company the cost of three full-time employees as well as the losses incurred by returned products, accounting for a total savings of approximately \$250,000 annually.

**How does VSoC technology work, technically speaking?**

**LEWIS:** Cognex considers VSoC technology proprietary, however, it's essentially a higher level of chip integration. The VSoC includes a three-quarter-inch XGA CMOS active pixel image sensor that can capture High Dynamic Range (HDR) images and a single instruction multiple data machine called a Linear Array Processor (LAP) optimized for real-time image analysis. An external DSP provides additional processing for data decoding, formatting, and communication.

**What are the benefits of VSoCs compared to laser scanners or area scan image-based readers?**

**LEWIS:** Decode speed – defined as the time required to capture an image and analyze it – is currently limited by the distance between the imager and the processor, the associated data transfer rates, and primarily the heavy analysis burden on the single DSP. Combining imager and processor on a single piece of silicon permits handling two tasks almost simultaneously, dramatically increasing decode speeds and overall frame rates.

Also, image-based ID readers provide a much higher level of reliability compared to traditional laser scanners. Traditional laser scanners are electro-mechanical devices that rely on an oscillating mirror to direct the laser beam across the barcode during operation. In contrast, image-based ID readers have a solid-state design with no moving parts that wear out and require repair or replacement.

**Would it be possible to get the same capabilities using an FPGA rather than VSoC technology?**

**LEWIS:** Probably. There's usually more than one solution to any engineering problem. We felt VSoC was the most efficient path for us to meet the design requirements at the time.

**Your company also recently announced a machine vision-based**

**calibrated 3D laser profiler for harsh factory environments. What industry challenges does it meet?**

**LEWIS:** The DS1100 is an industrial 3D sensor that uses laser triangulation to extract topographical information from the surface it's scanning. Each variation in height on the surface results in high contrast within the image. The height information provides accurate, repeatable measurements below 5 microns. Target applications include gap-tolerances measurement detecting very small surface defects, and volume measurement for portion control in the food industry. Other applications include plane fitting to detect if components are slightly higher or tilted, angled in one corner, or out of place.

**What are the three most significant technical challenges faced by developers of intelligent machine vision-based technology for manufacturing?**

**LEWIS:** 1. Bringing down the cost of vision systems and image-based ID readers: As the cost to deploy vision and image-based ID solutions decreases, the number of applications where it can be cost-justified naturally increases. Whenever possible, we leverage Commercial Off-the-Shelf (COTS) electronic components such as DSPs and imaging sensors to reduce the cost of our products without compromising performance.

2. Make machine vision and image-based ID readers easier to deploy: Even more important than price is ease of use. By decreasing the level of expertise required to deploy and maintain products, we can decrease technical hurdles and other objections to ownership to increase the number of potential applications. Whether you're connecting a vision system directly to a PLC or robot controller or managing multiple vision systems remotely from a networked PC or HMI, [there is a need] to provide tools that simplify integration and communications with other factory floor equipment.

3. Design and manufacture products that can perform reliably in harsh industrial

environments: Our In-Sight 5000 Series vision systems incorporate a die-cast aluminum housing and sealed industrial M12 connectors to deliver an extremely rugged, self-contained vision system that meets IEC specifications for shock and vibration and achieves an IP67 (NEMA 6) rating for dust and wash-down protection. **IES**

*John Lewis is Market Development Manager at Cognex. Formerly a technical editor for an engineering magazine, he has been writing about machine vision, factory automation, and other technology topics since 1996. He has published hundreds of articles in dozens of trade journals and holds a B.S. degree in Chemical Engineering from the University of Massachusetts, Lowell.*

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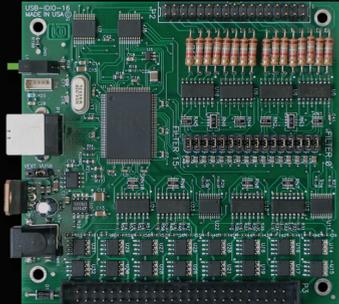
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Systems

# Managing machine safety and productivity with QorIQ multicore processors

By John Ralston

*Current legislation is now driving system feature requirements, specifically in the area of health and safety. This article focuses on the control subsystem (the programmable logic control function), and how multicore processors are helping to address safety requirements and provide additional functionality needed in industrial control.*

In North America and Europe, UL or CE marks are familiar sights in most households. Less widely known is what these marks stand for, and the stringent processes that manufacturers must follow to qualify for those marks. A key motivation behind these stringent processes is safety, which applies to equipment and machinery ranging from handheld power tools, elevators, railway systems, and robots on the factory floor to nuclear, oil, and gas installations. Safety is paramount in the latter group, but similar care and attention is also given to equipment that people use on a daily basis.

The objective behind what the industry calls “functional safety” is to limit the risk of physical injury or health impact on people operating or using equipment and machinery. Not only must equipment operate correctly in response to inputs, but it must also safely manage any operator errors, hardware failures, or environmental changes. While functional safety covers the end-to-end system, the control subsystem focuses on sensors, the programmable logic control function, and the actuation subsystems. The following covers the functional safety impact on the control subsystem architecture, and how a QorIQ multicore processing solution can address safety requirements more efficiently by improving machine productivity.



## **Making machines safe**

Standards covering functional safety are specified by governing bodies in each country. For countries in the European Union, the baseline is IEC 61508. In North America, the ISO 13849 specification is enforced. The process of achieving certification involves a number of steps that identify the required safety functions, potential hazards, and any risk-reduction required. This goes towards identifying the required Safety Integrity Level (SIL) for IEC 61508, or Performance Level (PL) in the case of ISO 13849. Other key factors in the process include the Hardware Fault Tolerance (HFT), or the number of faults equipment can tolerate, and the Safe Failure Fraction (SFF), which is the probability of the system failing in a safe state. Responsibility for these aspects lies with appropriately skilled engineers, who, like the standards, have to take a holistic system approach.

The HFT and SFF are significant in that they are a measure of the redundancy

and diagnostic capabilities of the subsystem. The HFT depends on the amount of redundancy and voting policy used in the system. The SFF is a measure of the fail-safe design and quality of built-in diagnostics.

Figure 1 shows a dual-redundant system with one of two voting architectures and diagnostics (1 out of 2 with Diagnostics, or 1oo2D). 1oo2D means two channels will process the same inputs and request a certain action. The voter will compare the request from both channels, but only use the data from the channel with good diagnostics. This implementation also provides for redundant fallback to 1oo1D.

The diagnostics will report on software or random failures, incorrect operator inputs, or common cause failures arising from environmental impact (a memory or data bus corruption caused by EMC, vibration, temperature, or pressure changes). In the case of the QorIQ

multicore processor, a channel can be implemented on a core utilizing local cache/memory. The basic hardware features that would be used here are Error-Correcting Code (ECC) and parity on the memories. Making systems safe requires additional processing performance to deliver real-time computation and diagnostics. Duplicating hardware resources provides the redundancy necessary to increase the probability of systems achieving a safe state in the event of a failure.

### Redundancy and real-time diagnostics

Herein lies the challenge for equipment or machine manufacturers: adding redundancy has a direct impact on hardware costs, as it traditionally involves replicating controller modules or processor components. This leads to two questions:

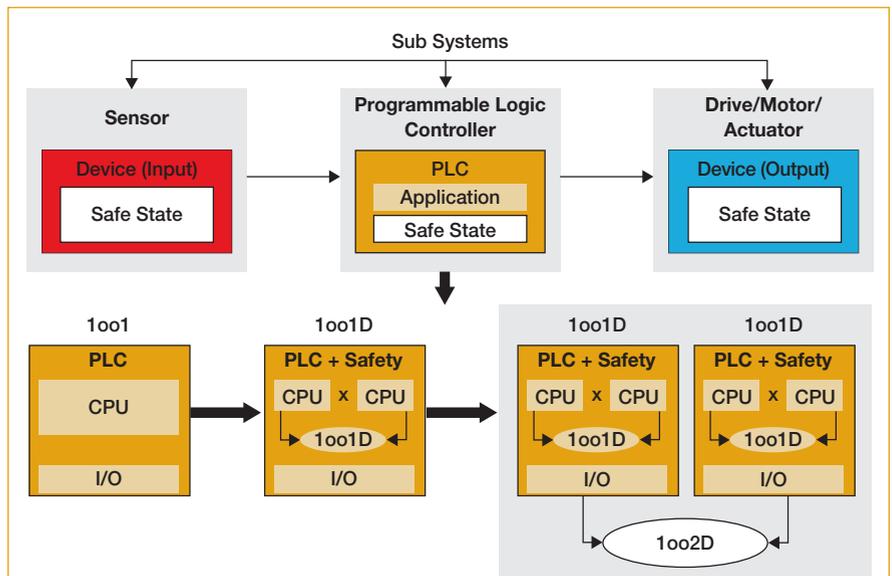
- Can functional safety be provided without the replication of hardware?
- Can smarter and more integrated diagnostics help manage functional safety and productivity at the same time?

To illustrate the second question a little more, consider a robot on an assembly line. The robot is protected by light curtains (Figure 2).

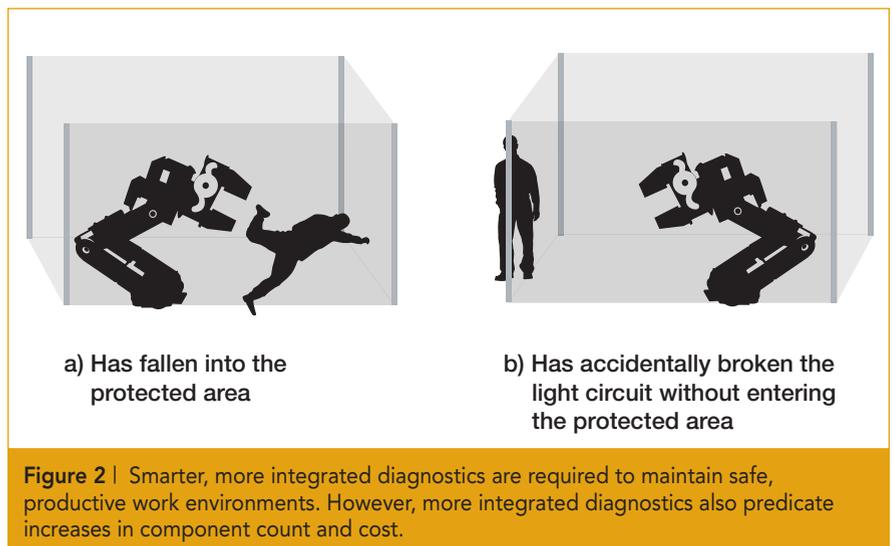
There is a clear difference between 2a and 2b. The first illustrates an incident where an operator is at risk of injury and the robot should de-energize or stop. This is not the case in the second illustration, where perhaps slowing the robot down would be sufficient. A system that can differentiate will improve productivity since it can maintain safety but also keep the production line going. In this situation, an additional light curtain could be used to designate a "buffer" zone and an "operational" zone, or a vision-based system might be the answer. In both cases, there are now additional sensor inputs to be considered by the controller and additional processing that must be performed in real time.

### Consider QorIQ multicore processors

Part of the solution to both questions lies with QorIQ multicore processors, a



**Figure 1 |** Making a system safe requires additional/duplicate hardware resources. Illustrated here is the 1oo2D architecture of a dual-redundant system. A 1oo2D architecture allows a voter to compare and select the best input data from either of two diagnostic channels.



**Figure 2 |** Smarter, more integrated diagnostics are required to maintain safe, productive work environments. However, more integrated diagnostics also predicate increases in component count and cost.

family of processing platforms ranging from single-, dual-, and quad-core to multicore, all based on 32- or 64-bit Power Architecture cores with integrated double precision floating point. Figure 3 (page 16) shows how programmable control and safety functions could co-exist on a single QorIQ multicore processor. The different functions can run on this architecture using shared or dedicated interconnects, memory, and I/O resources. Hardware enforcement allows the different functions to run without interference from other functions on other cores or on external hosts.

The main element in the safety application is the channel. Here, the hardware implementing a channel requires providing some form of isolation. In the QorIQ multicore processor, the channel would be built from a core complex that is physically instantiated on the device. The core complex has two layers of caching (Layer 1 (I\$/D\$) and Layer 2 (L2\$)), which used in a different mode allows local storage. This, combined with the individual cores' Memory Management Unit (MMU), hardware hypervisor and virtualization support, and the Peripheral Access Management Unit (PAMU) ensure that rights given to a software task are visible to the hardware, thereby allowing enforcement of the isolation.

### Hardware hypervisor and virtualization support isolates logical containers

PAMU isolates intelligent peripherals like Ethernet controllers, crypto acceleration, and others in the processor. This effectively allows the viewing of a QorIQ multicore processor as a group of independent CPUs with their own intelligent I/O and memory.

Like any CPU, the core is informed of hardware-detected exceptions in the core complex; for example, single or multiple ECC errors in the core timers or watchdog timers. The core is also made aware of device exceptions beyond the core complex, like ECC errors for internal and external memories or memory violations. All external memory-mapped access to the device is also monitored by the PAMU, which will block and flag unauthorized access attempts. The routing of an exception can be to any number of cores in the device and can be flagged externally. Hence, a channel utilizing a core complex can have exceptions associated with it routed to itself and/or another internal monitor (another

core), or an external monitor such as a master on the PCI Express (PCIe) or Serial RapidIO blocks.

In addition to the device detecting the standard hardware errors mentioned above, the QorIQ trust architecture provides the capability to establish a secure trusted node from power on, also known as an encrypted boot. This enables the hardware to validate memory code or static data blocks anywhere on the device to be changed during the normal runtime of the device, creating a hardware method complementary to one of the diagnostic routines typically run in software.

### Internal processor communications enable integrated diagnostics

In safety applications, communication between channels is likely to be implemented via a black channel, which in the case of a multicore platform, is internal to the processor. To help with communication inside a QorIQ multicore processor there are three independent communication paths between the cores:

- Shared memory protected by MMU/PAMU
- Hardware queuing system linking individual physical ports to each core complex
- Inter-core messaging registers\*

This multicore approach offers many advantages over discrete solutions, allowing for multiple safety channels and consolidation of components or modules. The integration enables improved diagnostic capabilities, which can in turn support better machine availability and productivity. **IES**

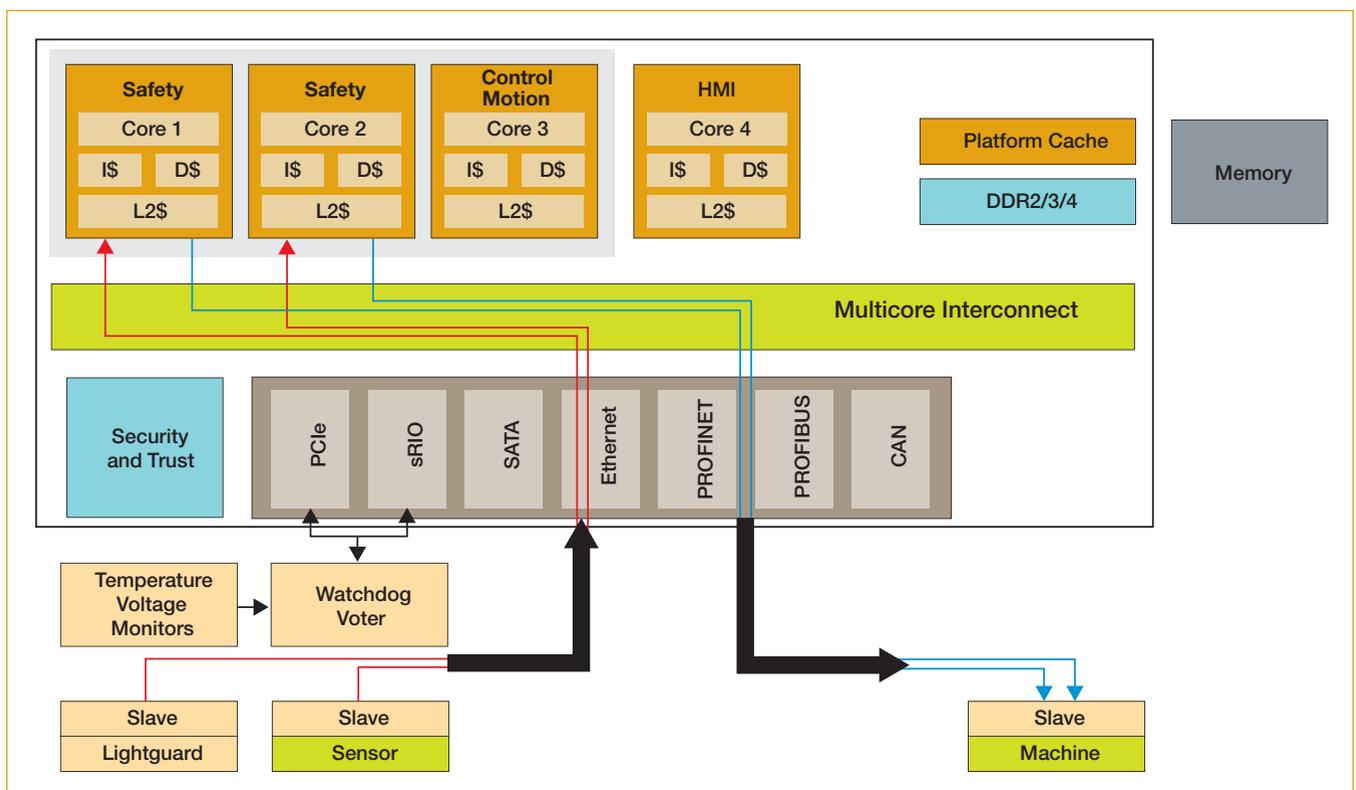


**John Ralston** is a Systems Architect at Freescale Semiconductor, Inc.

\*Note: 1 and 2 are available to external entities via PCIe and sRIO.

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**Figure 3** | Hardware enforcement on QorIQ multicore platforms allows programmable control functions and safety functions to exist on the same processor without interference.



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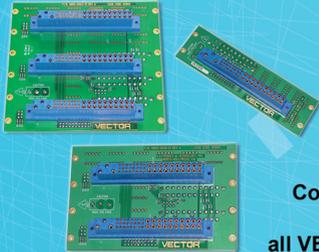
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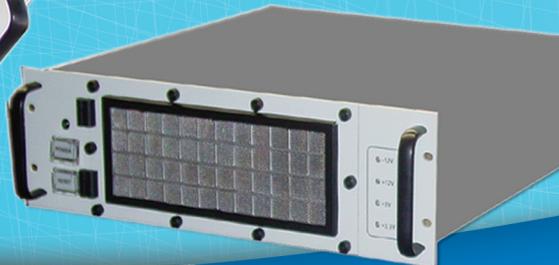
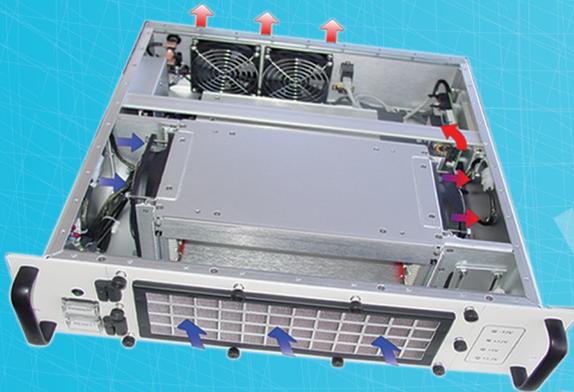
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# COMs tackle industrial automation systems' reliability, versatility challenges

Q&A with Dr. Ron Valli, Director of Engineering, Americas, congatec



*Industrial automation systems will continue to thrive in harsh environments – as long as their electronics can take the heat. Meeting the typically required -40 °C to +85 °C range is not a challenge for the faint of heart, but Dr. Ron Valli, Director of Engineering, Americas, at congatec explains why and how Computers-On-Module (COMs) are up to the task. He also notes the ways in which versatile COM form factors will need to continue evolving to keep up with the Internet of Things, and where COMs fit into the industry's need for lower power in a smaller form factor.*

## **Remind us briefly about congatec.**

**VALLI:** congatec was incorporated in December of 2004 and currently employs 142 people around the world. Corporate headquarters are located in Deggendorf, Germany. We have subsidiaries in the U.S., Taiwan, Czech Republic, Japan, and Australia, and sales offices in London, Paris, Stockholm, and Tel Aviv. We also have main design centers in Deggendorf, Germany; Plzen and Brno, Czech Republic; and Boca Raton, Florida.

congatec supplies industrial COMs using the standard form factors Qseven, COM Express, XTX, and ETX. Our products can be used in a variety of industries and applications, such as industrial automation, medical technology, military, aerospace, transportation, test and measurement, and communications. Core knowledge focuses on unique extended BIOS features as well as comprehensive driver and board support packages. Following the design-in phase, customers are given product lifecycle management support. Our 2012 corporate-wide revenue was \$80M.

## **Why did you choose to design COM-based products versus another small form factor architecture?**

**VALLI:** When compared to monolithic processor boards, COMs are the typical first choice when the platform requires special hardware functions. These functions can be dedicated interfaces and interface location, special power supplies, or simply a special mechanical

shape to properly fit the final system design. Special requirements like these can only be matched by creating a ground-up custom design or by utilizing a semi-custom design that includes a COM for the standard PC functions and a custom carrier board to address the special required functions. In most cases, a full custom design does not make sense when you take into account the time and money needed to complete it. A COM can reduce the amount of time from roughly 12 to 18 months down to 6 months. This obviously saves a lot of development dollars as well. That being said, there is a threshold where a custom design does not make sense. That threshold often tends to be around 50,000 units per year.

We focus on COM form factors because they lend themselves to becoming candidates in many more applications and opportunities than simpler, high-volume monolithic boards. There is more engineer-to-engineer interfacing happening overall when a COM is being deployed in an OEM product. This allows for a tighter partnership between supplier and customer and removes a certain degree of "commodity effect" from the product.

## **How do COMs match up to other form factors when it comes to achieving the reliability needed for industrial automation?**

**VALLI:** COMs are designed and tested for extreme environments.

Most Mini-ITX boards are designed for friendly environment office applications and are never tested for shock, vibration, or extended temperatures. Most motherboards are commodity-based solutions that do not emphasize lifecycle management and a focus on industrial computing. COM designs offer availability of a minimum of seven years. Component selection is focused on this as well as the industrial nature of the COM. The quality of the design is certainly more industrial. We test every new COM to temperature extremes, which are much broader than standard operating temperature ranges. We have a number of modules that operate in the -40 °C to +85 °C range, which makes them suitable candidates for the harshest of operating environments.

Ultimately, the best industrial automation system needs to be based on the best components utilized with the best practices. COMs are industry standards that are focused on industrial environments, long lifecycles, and minimal changes. All of these attributes contribute to reliability for the OEM.

## **How does congatec assure reliability for its industrial spec-rated COMs?**

**VALLI:** congatec leverages the claims and specifications from silicon providers as its starting point for rating the operating temperatures of its modules. When an extended-temperature-range silicon platform is offered by the likes of Intel, Freescale, AMD, etc., we take steps to

ensure that its COM offering operates in the same environment range.

A common definition of extended temperature range is -40 °C to +85 °C. When this is the case, we use a PCB that is designed for this range and all populated components are specified to meet or exceed that temperature range. Our design verification testing takes the operating temperatures beyond this range. The tests are performed at both tolerances of the specified supply voltages (this is 11.4 V and 12.6 V for COM Express modules) during a full functional test of all available interfaces.

In addition, we focus heavily on offering innovative cooling solutions for our COM products. One example is a patented heat-pipe cooling solution that utilizes flat, fluid-filled pipes within the cooling solution. This design significantly helps to improve the heat dissipation from the module and reduces the chance of any shutdowns or clockdowns in the silicon due to overheating. Lab tests comparing a classic cooling approach (phase change foil + copper block + gap filler + heat spreader) to the congatec patented heat-pipe based solution (phase change foil + copper block + flat heat pipe + heat spreader) showed a temperature improvement of 14 °C. Taking into account the 5 °C improved die temperature can double the MTBF of a silicon component. The change to heat-pipe based cooling can improve the MTBF – a measure of reliability – up to 8x.

#### **How have the technical demands increased for COMs used in industrial automation in the past five years?**

**VALLI:** There have been a number of distinct technical improvements that have occurred, or at least begun to be taken advantage of, in the past five years or so. For one, we now have multicore silicon found on the long-term embedded road maps from silicon providers. Many applications in the embedded space, including industrial automation, are taking advantage here and writing new code for optimization. AMD has been offering Accelerated Processing Units

(APUs) whereby designers can take the General-Purpose Graphics Processor Units (GPGPUs) and use them as a CPU. With the proper coding, this changes the game for what can be done with less, especially when you think of less as lower power, smaller size, and lower cost.

Industrial automation systems are more highly connected and more sophisticated than ever before. PLCs and HMIs have historically consisted of separate boxes, connected by a communication interface – typically Ethernet or a real-time capable implementation of Ethernet. With today's multicore technologies it's more common to use virtualization for industrial automation solutions. One set of hardware is enough. PLC and HMI systems are both operated by one CPU. Using real-time virtualization, one core of the chip is completely isolated to run the PLC based on a real-time operating system. Some of the other cores (typically two) are allocated for the Windows- or Linux-based HMI. The remaining fourth core from a quad-core CPU is used as a firewall to ensure data security. All of this does not require a rewrite to existing software because the use of multicore is controlled by the real-time hypervisor, which partitions the CPUs and also the attached I/Os to avoid conflicts between the different operating systems. Communication between the separated applications happens – as in the past – by virtual Ethernet ports.

#### **How will industrial COMs need to evolve in the coming five years?**

**VALLI:** A continued increase in connectivity is the first thing that comes to mind. Most of us have heard of the "Internet of Things" and "intelligent systems." This means that industrial automation systems will become more and more intelligent and capable. Just think of the trajectory that something like the connected home is on. That trajectory of the technology is evident in many vertical markets for embedded computers today. In order for COMs to keep up, they will need to evolve with the I/O and buses being developed and implemented by the silicon providers.

It is standard today to see 8 USB ports supported by COM Express modules. That is not something that was relevant 10 years ago. In addition, security features such as the Trusted Platform Module (TPM) will continue to be more important for COM users.

#### **What are the challenges your industrial automation customers are facing now? How are you meeting these challenges?**

**VALLI:** On the technical side it is often power draw and physical size. If you look today, one of the smallest proven COM form factors is Qseven. At 70 mm x 70 mm it is quite small. There was recently an update to the Qseven specification that calls out a version that is 40 mm x 70 mm. Today this form factor is small, but as silicon continues to get smaller and more integrated, we will continue to see a drive to make smaller COMs. This parallels what a number of industrial automation companies are experiencing. They want small form factors at the system level, that draw as low an amount of power as possible and are as inexpensive as possible.

For COMs suppliers the challenge is always to create the most power-efficient solution. This is not just selecting the best CPUs; it also requires a careful design of the required DC/DC converters. Saving power consumption lowers the cost of ownership for industrial machines by saving electricity. Even a few watts can make a difference in the long term to the overall cost of the system. Add in the fact that some devices are battery driven and the hairs are split even further. **IES**

*Dr. Ron Valli is congatec's Director of Engineering, Americas. Ron holds patents at IBM and Racal-Datacom. He received a BS and a Ph.D. in Electrical Engineering from the University of Pittsburgh, and an MS in Electrical Engineering from the University of Virginia.*

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# Rugged COM Express: Empowering high-performance automation for an increasingly connected world

By Vibhoosh Gupta

*Industrial automation systems are performing more tasks and doing so more quickly, more accurately, and in harsher environments than ever before. They are becoming connected tools with substantially more computing and communication capabilities, allowing them to interoperate with other devices. As they evolve and proliferate, these systems put new demands on their computing technology. Rugged COM Express modules not only meet the computing needs of today's rapidly changing industrial landscape, but also protect the investment to meet tomorrow's performance needs.*

At the dawn of the "Industrial Internet," the ante is being upped for modular embedded systems. More and more machines are being connected, many in remote and challenging environments such as oil and gas, locomotives, transportation, and ship-propulsion systems. To meet the demand for more data in less time, these systems must work faster and longer. Accelerating with the demand for data is the evolution of computer processors. But businesses can't afford the downtime required to replace processors, or the expense of replacing the carrier board when upgrading the processor. According to a 2006 Department of Energy study, idle industrial machinery can cost as much as \$800 per minute.

What's needed is a modular embedded computing architecture that addresses these cost and downtime issues. Perhaps the most compelling of the modular architectures available today is COM Express. COM Express provides the requisite computing power for today's



increasingly connected world while also extending the lifespan of the underlying system. As chip technology evolves, users can switch out the module without adverse effect on the underlying hardware and assets – saving time and money. The modularity, simplicity, and reliability of COM Express technology help businesses remain competitive, profitable, and flexible.

## Leveraging upgrades in processing power

COM Express-based technology was developed in 1994 by PICMG, a 250-company consortium that develops open specifications for high-performance computing applications. Today, the COM Express form factor comes in four sizes:

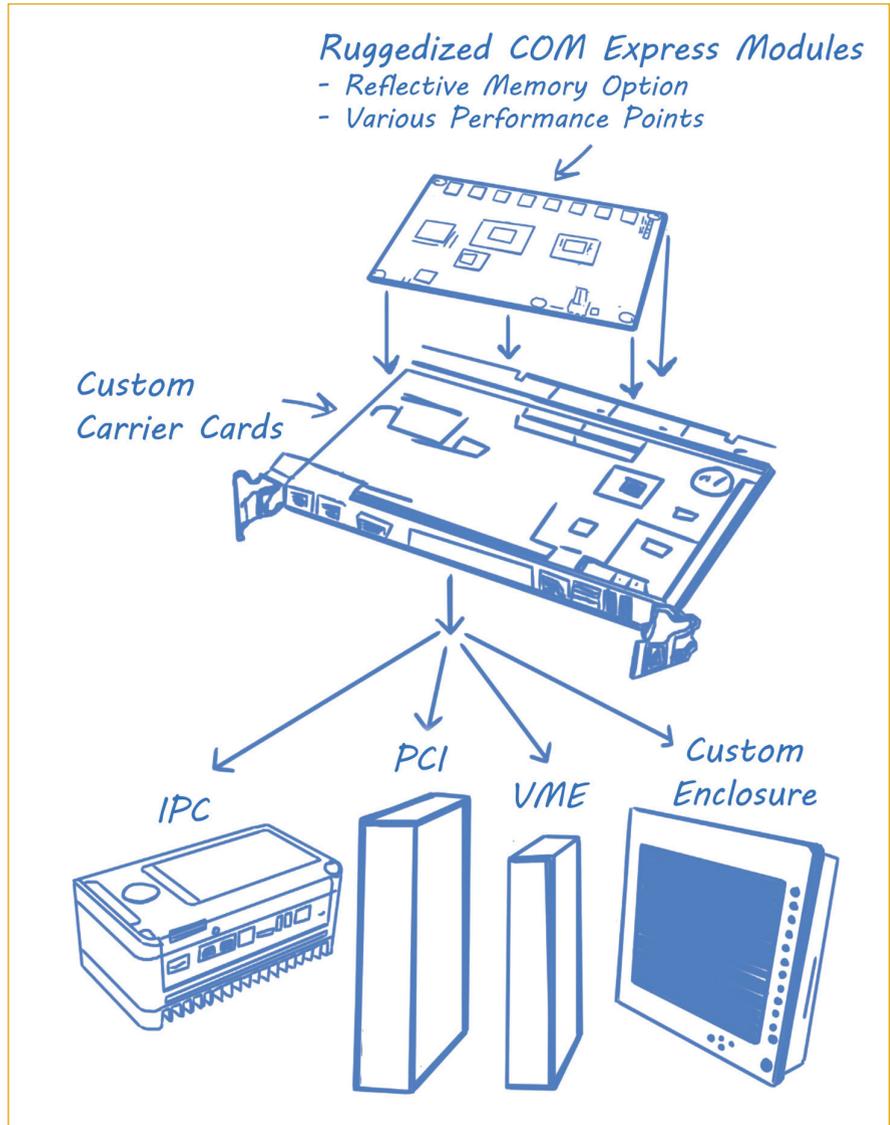
- › Mini: 55 x 84 mm
- › Compact: 95 x 95 mm
- › Basic: 95 x 125 mm
- › Extended: 110 x 155 mm

These different sizes of COM Express modules help businesses to remain competitive by maximizing the performance of critical infrastructure systems in an increasingly connected world in any conceivable industrial application.

The need for improved performance is evidenced by continuous new product introductions by processor manufacturers such as Intel, AMD, and others. Whether it is better threading, more cores, better graphics, lower power, or higher clock speeds, these companies continuously respond to demand for more and faster computing across the board – whether on the desktop or in embedded industrial systems. But replacing a complete subassembly or subsystem each time a compelling new generation of technology becomes available is time-consuming, expensive, and risky. And yet the need to leverage greater levels of processor power and performance is an imperative. Separating the processor module from the underlying carrier means that technology upgrade is painless and affordable.

Beyond this, the modular COM Express approach allows users the flexibility to deliver application-specific performance and power at an appropriate price level (Figure 1). For instance, a quad core i7-based processor module can be used on a specific carrier board for a high-value, high-criticality, high-performance application – while the same carrier board, with the same features and I/O functionality, can be deployed for a lower value, less critical, less demanding application with a lower-performance VIA Nano processor-based COM Express module; this results in lower development cost and faster time to market.

A modern locomotive is a perfect use case for this flexibility. There are nearly a dozen computer processors in today's locomotives. While the processing requirements for these computers are different, most of them have similar I/O requirements. Using the same or a similar carrier board with different



**Figure 1** | The flexibility of the COM Express architecture is illustrated by its utilization in industrial PCs, PCI, VME, and custom enclosures.

COM Express modules based upon the appropriate level of processor power for the application, depending on its profile, allows for price/performance balance.

The advantage of this level of modularity extends well beyond the initial deployment, however. In the longer term, upgrading the level of performance is simply a matter of replacing the processor module – not the entire subassembly. This saves money, and minimizes unforeseen impact on the way in which the module as a whole interacts with its surroundings.

In the locomotive example mentioned, the COM Express processor module

can be upgraded without affecting the connection to the engine I/O residing on the carrier board – reducing costly and time-consuming recertification and testing. The modularity of COM Express gives a whole new meaning to “technology insertion.”

Because of this modularity advantage, COM Express can substantially extend the useful life of key elements within critical infrastructures – a valuable benefit for industrial applications such as oil and gas, energy, and transportation. This is especially true when it comes to leveraging commercial technologies – often referred to as Commercial Off-the-Shelf (COTS).

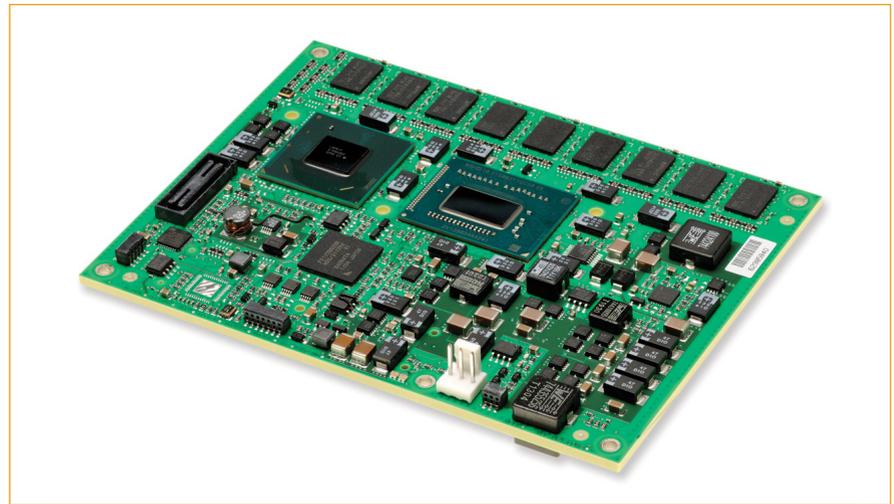
In the past, vendors often used special niche and proprietary components on their products. However, for many of these component vendors, the long-term commitment to ensuring the continuing competitiveness of these products – with its requirement for extensive investment in R&D – meant that such components often had relatively short useful lifetimes, and didn't benefit from the support of well-funded programs to minimize the impact of obsolescence.

Commercial products, however – such as those from Intel and AMD – could be expected to benefit from a development road map that would see successive generations of products emerge into the market, each compatible with its predecessor and each capable of delivering new levels of performance. This constant “upping the game” presents a real opportunity for users of COM Express technology – and it is an opportunity that modular architectures leverage to the maximum, enabling the Internet of Things (IoT) to become a practicable reality.

### Reliability for harsh environments

For COM Express to deliver real business benefit, it has to provide one other vital attribute: reliability. We are in the era of “always on” computing: The lights must never go out. And downtime means lost revenue. That's a challenge in the harsh, hostile environments in which many critical infrastructure systems operate. Today's connected world paradigm does not make a distinction between systems in stable environments such as offices and data centers, and systems deployed in harsh environments found in heavy industry, on factory floors, on drilling rigs, or on transportation systems.

These extreme industrial conditions require a ruggedized COM Express module (Figure 2). Specifically, they must operate in temperatures as low as -40 °C and as high as +85 °C – temperatures that are often found in oil and gas operations, for example. They must also withstand shock of up to 40g and extreme vibration from machinery or aircraft engines. Conformal coating is needed to



**Figure 2 |** The GE Intelligent Platforms bCOM6-L1400 rugged COM Express module provides the performance and ruggedness required for deployment in harsh environments.

resist the moisture, dust, and chemicals typical of industrial environments.

Designing, testing, qualifying, and manufacturing modular architectures for deployment in the hostile environments found in many critical infrastructure systems in industry is, therefore, a painstaking and rigorous process – but it is essential if maximum reliability and uptime are to be achieved. Modularity is helpful: By separating the processing module from the I/O carrier board, manufacturers can ensure that all the components on the processing module are specifically selected to meet application-specific extended temperature, shock, and vibration levels. It also becomes easier to test the module at maximum performance stress that can, for example, help the designers to reach an optimal heat sink solution with a uniform temperature profile early in the design cycle.

While considerable attention is paid to the design of processor modules as noted previously, the modularity of COM Express enables the development of carrier boards in parallel. Design and test engineers developing the processor module don't have to wait until the entire carrier board is developed to verify the processor module design. This parallel – and even geographically dispersed – development can lead to lower time and cost of development while still

providing a reliable solution for harsh industrial environments.

### Reliable performance for today and the future

The flexibility to choose myriad differing price, power, and performance points makes the fully rugged COM Express modular architecture an outstanding choice for high-performance industrial automation applications for today's connected world. Not only can rugged COM Express substantially lower lifetime total cost of ownership and extend the lifecycle of automation applications, they afford businesses the opportunity to harness the power and opportunity of the Industrial Internet while providing outstanding reliability. **IES**



**Vibhoosh Gupta** is Product Management Leader at GE Intelligent Platforms. He has more than 14 years of product

management, product marketing, and engineering experience, with a passion to conceive new ideas and grow businesses.

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## HIGH-PERFORMANCE IMPLEMENTATIONS FOR ARM 64-BIT CORTEX-A57/A53 PROCESSORS



PRESENTED BY: ARM

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Mobile and server markets present unique challenges for the implementation of ARM 64-bit Cortex-A57 and Cortex-A53 processors. This E-cast will discuss techniques to achieve high-performance and power-optimized implementations, and how to leverage ARM POP IP core-hardening acceleration technology to achieve faster time to market with less risk.

## POWER INTEGRITY ANALYSIS OF AN ARM CORTEX-A15 QUAD CORE HARD MACRO



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The Seahawk hard macro is a quad-core Cortex-A15 implemented in the TSMC 28 hpm process designed to operate at frequencies close to 2 GHz and has DVFS and retention capabilities built in. This presentation describes the power integrity checks that were performed on the design to ensure proper functioning and reliability.

## A BETTER WAY TO CLOUD: WHY DSPS ARE OPTIMAL FOR HIGH-PERFORMANCE COMPUTING



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TEXAS INSTRUMENTS

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Cloud app designers have specialized processing needs best addressed with targeted processors and server elements. TI's multicore SoCs based on its KeyStone architecture featuring high-performance ARM Cortex-A15 MPCore processors, TI's latest DSP cores, and built-in Ethernet switching can enable more efficient servers for a wide variety of industries.

## READ THE EMBEDDED COMPUTING DESIGN OCTOBER ARM ISSUE!



### IN THIS ISSUE:

- ❖ Q&A with ARM VP of Embedded Processors Keith Clarke about how 64-bit ARMv8 architecture provides smooth migration for 32-bit OSs and apps
- ❖ AMD's ARM and x86 "ambidextrous" strategy highlights in the wake of AMD's September announcement
- ❖ Featured ARM products and a ARM TechCon company guide



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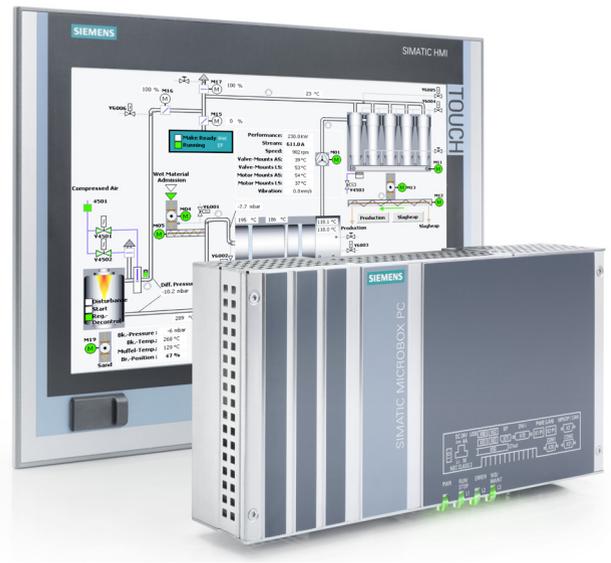


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## 2013 Resource Guide

Industrial computing has evolved through the years to encompass issues and technologies that transcend traditional process and control systems. Aside from technical coverage on the latest advances in cybersecurity, machine vision, and Human-Machine Interfaces (HMIs), the 2013 *Industrial Embedded Systems* Resource Guide offers developers a compilation of the latest off-the-shelf computing, networking, sensing, and storage solutions, among others. The staff at *Industrial Embedded Systems* hopes that what follows helps cut cost, improve time-to-market, and increase Return-On-Investment (ROI) for your future designs, whatever they may be.



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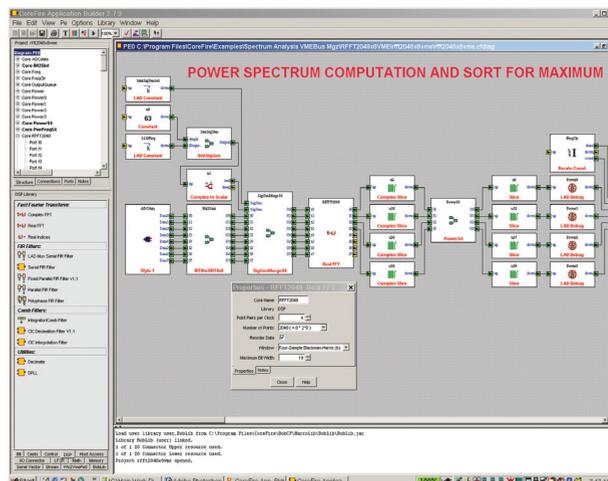
## CoreFire

Develop your application very quickly and easily with our **CoreFire™ FPGA Application Builder**, which transforms the FPGA development process, making it possible for theoreticians to easily and quickly build and test their algorithms on the real hardware that will be used in the field.

Use CoreFire's graphical interface to drag and drop library elements onto the design window. Modify your input and output types, numbers of bits, and other core variables by changing module parameters with pull-down menus. The modules automatically provide correct timing and clock control. Insert debug modules to report actual hardware values for hardware-in-the-loop debugging. Hit the Build button to check for errors and as-built core sizes and to build an encrypted EDIF file. Use the Xilinx ISE tool to place and route each FPGA design. Modify and use the jar file or the C program created by the CoreFire Build to load your new file into your WILDSTAR and I/O card hardware. Use the CoreFire Debugger to view and modify register and memory contents in the FPGA and to step through the dataflow of your design running in the real physical hardware.

Our extensive IP and board support libraries contain more than 1,000 proven, reusable, high-performance cores, including FIR and CIC filters, a channelizer, and the world's fastest FFT. We support conversion between data types: bit, signed and unsigned integers, single precision floating point, integer and floating point complex, and arrays. A few of the newly added array cores include array composition and decomposition; slice, parallelize, serialize, repack, split, merge, reorder, rotate, and concatenate transformations; matrix math, sliding windows, and convolutions.

The combination of our COTS hardware and CoreFire enables our customers to make massive improvements in processing speed while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



## FEATURES

- › Dataflow-based – automatically generates intermodule control fabric
- › Drag-and-drop graphical interface
- › Work at high conceptual level – concentrate on solving algorithmic problems
- › Hardware-in-the-loop debugging
- › More than 1,000 modules incorporate years of application experience
- › Reduce risk with COTS boards and software
- › Save time to market
- › Save development dollars
- › Easily port completed applications to new technology chips and boards
- › Training and custom application development available
- › Achieve world-class performance; WILD solutions outperform the competition
- › Annual node locked or networked license; includes customer support and updates

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### Four Channel Clock Synchronization Board

The **Four Channel Clock Synchronization Board** distributes a common clock and synchronized control signal triggers to multiple cards in the system. This 6U VME64x/VXS board provides four high-speed, ultra-low jitter, ultra-low skew differential bulkhead mounted clock outputs, two ultra-low skew differential vertical SMA on-board clock outputs, and four ultra-low skew and clock synchronized single-ended bulkhead mounted control signal triggers.

A jumper set at board installation time or via optional P2 Serial Port determines which one of the two installed clock sources is active. Manufacturing options for Clock Source 0 are Single Ended or Differential External Clock, a PLL ranging from 700 MHz to 3 GHz with an On-Board Reference Oscillator, or a PLL ranging from 700 MHz to 3 GHz with a 10 MHz External Reference. Manufacturing options for Clock Source 1 are a PLL ranging from 700 MHz to 3 GHz with an On-board Reference Oscillator, a PLL ranging from 700 MHz to 3 GHz with a 10 MHz External Reference or an On-Board Low Frequency Oscillator ranging up to 800 MHz.

The four control trigger outputs can originate from a high-precision external source via front panel SMA, from a manual pushbutton on the front panel, or from software via an optional Backplane P2 Connector Serial Port. These trigger outputs are synchronized to the distributed clock to provide precise output timing relationships.

Annapolis Micro Systems is a world leader in high-performance, COTS FPGA-based boards and processing for RADAR, SONAR, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.



### FEATURES

- › Four Synchronized Differential Front Panel Clock Outputs up to 3 GHz with Typical Skew of 5 ps
- › Ultra-low Clock Jitter and Phase Noise – 275 Fs with 1,280 MHz PLL and external 10 MHz Reference
- › On-board PLLs Manufacturing Options provide Fixed Frequencies of 700 MHz to 3 GHz, Locked to Internal or External Reference
- › On-board Low Frequency Oscillator provides Fixed Frequencies up to approximately 800 MHz
- › Four Synchronized Trigger Outputs, always Synchronized with the Output Clock, with Typical Skew of 5 ps
- › Jumper Selectable Trigger Output Levels of 3.3 V PECL, 2.5 V PECL, or 1.65 V PECL
- › Source Trigger from Front Panel SMA, Pushbutton, or Optional P2 Serial Port
- › Cascade boards to provide up to 16 sets of outputs
- › Compatible with standard VME64x and VXS 6U backplanes
- › Universal clock input supports wide range of signal options, including signal generator sine wave
- › Differential clock input permits multiple standards including: LVDS, 3.3 V PECL, 2.5 V PECL, and 1.65 V PECL
- › Clock and Trigger Outputs Compatible with all Annapolis Micro Systems, Inc. WILDSTAR™ 2 PRO I/O Cards and WILDSTAR™ 4/5 Mezzanine Cards

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**WILD OpenVPX Four Slot Mesh Chassis**

Annapolis enters the OpenVPX market with **WILDSTAR 6 Xilinx Virtex-6** and **WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards**, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Slot Chassis.

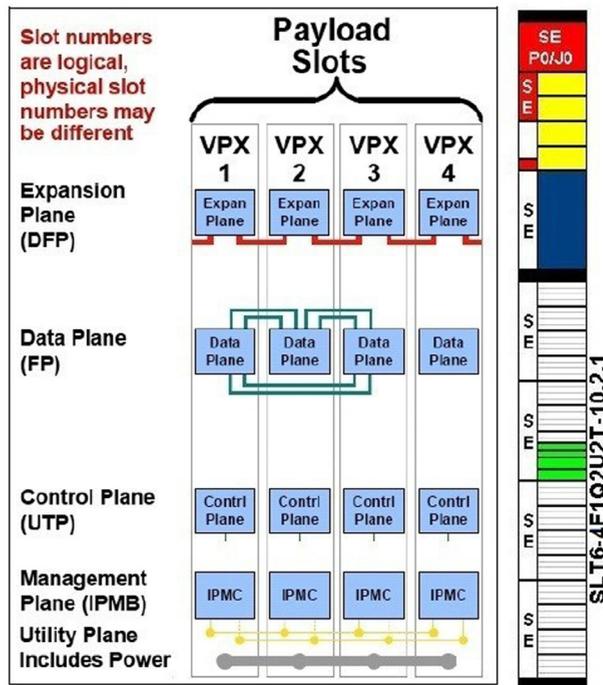
The **Four Slot Mesh Chassis** has a particularly powerful Backplane Configuration, as shown in the diagram.

The chassis could, for example, be filled with two of the 8 TB WILD Storage Cards, one WILDSTAR A5 Stratix V FPGA Processing Board, and a Single Board Computer.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OS 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for OpenVPX, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



**FEATURES**

- > 4U High 19" Rack Mount Chassis with Front Mounted Horizontal OpenVPX Card Cage with Four Slots
- > 4 Slot OpenVPX High Speed Mesh Backplane with Rear Transition Module Support
- > 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAUI or SDR, DDR and QDR 4x InfiniBand
- > 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- > 1000Base-X on Control Plane
- > Large Power Supply
- > Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- > High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- > Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
- > Electromagnetic Shielding
- > Includes one year hardware warranty

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Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.



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## WILD OpenVPX Storage Board

Annapolis leads the **OpenVPX** market with the 8 Terabyte per slot WILD Storage Solution with 4GBps Write and 8GBps Read Bandwidth. The **Storage Board** has a Hot Swappable Canister containing up to 16 Pluggable 1.8" SSD SATA 3.x Drives, with 2, 4 or 8 Terabytes per Board.

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## FEATURES

- › 4 GBps Write and 8 GBps Read Bandwidth
- › Up to 40Gb Ethernet or QDR InfiniBand on each of Four Fat Pipes on P1 for a total of 20GBps on P1
- › PCI Express 8x Gen 1, Gen 2 or Gen 3 on P2 and P5 of the OpenVPX Backplane
- › 2, 4 or 8 Terabytes per OpenVPX Slot
- › Hot Swappable Canister
- › Up to 16 Pluggable 1.8" SSD SATA 3.x
- › API for Command and Control of the Storage Process
- › Includes one year hardware warranty

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## WILD OpenVPX Switch Board

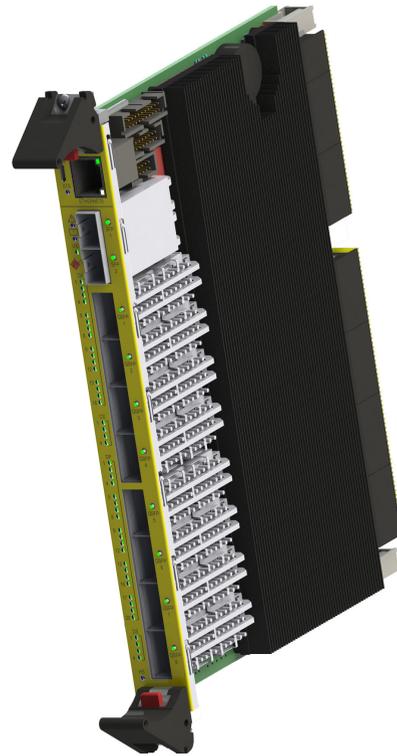
Annapolis leads the OpenVPX market with the **WILD 6U OpenVPX** (VITA 65.0 Compliant) **Switch Board**, with up to 4 Tbps non-blocking switching capacity with up to 8 switch partitions.

Supports OpenVPX Switch Profiles: SLT6-SWH-20U19F-12.4.1: 20 Control Plane and 19 Data Plane Backplane Ports; SLT6-SWH-16U20F-12.4.2: 16 Control Plane and 20 Data Plane Backplane Ports; SLT6-SWH-24F-12.4.3: = 24 Data Plane Backplane Ports.

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## FEATURES

- > 6U OpenVPX Board
- > Up to 4Tbps Non-Blocking Switching Capacity with up to 8 Switch Partitions
- > Multiprotocol Switch – SDR/DDR/QDR/FDR InfiniBand and 1/10/20/40 Gb Ethernet
- > Each Backplane and Front Panel Port can be Configured for either InfiniBand or Ethernet
- > Front Panel: Up to 8 QSFP+, Up to 2 SFP+, RJ45 Management Port, USB USART, LED Status
- > Supports OpenVPX Switch Profiles
- > InfiniBand and IP Routing
- > Ethernet Gateways
- > ChMc Management Plane Support
- > Includes one year hardware warranty

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### WILD OpenVPX Twelve Plus 3 Slot Switched Chassis

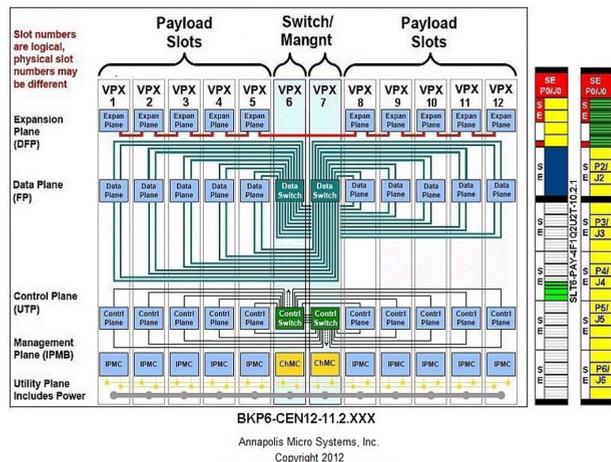
Annapolis enters the OpenVPX market with WILDSTAR 6 Xilinx Virtex-6 and WILDSTAR A5 Altera Stratix 5 FPGA Processing Boards, an 8 TB per slot WILD Storage Solution, a WILD Switch, a Four Slot and a Twelve Plus Three Slot Chassis.

With Ten Payload Slots and Two Switch Slots, and an option for Three VME/VPX Slots, the **Twelve OpenVPX Plus 3 Chassis** has a particularly powerful Backplane Configuration, as shown in the diagram.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. Annapolis provides I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores.

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### FEATURES

- > 19" Rack Mount Chassis with Front Mounted OpenVPX Card Cage
- > Primary Twelve Slot 6U OpenVPX High Speed Switched Backplane with Rear Transition Module Support
- > 10+GBps on Data Plane for 10GBase-KR Ethernet, 40GBase-KR4 Ethernet, 10GBase-KX4 XAUI or SDR, DDR and QDR 4x InfiniBand
- > 8x PCIe Gen 1, 2 or 3 on Expansion Plane
- > 1000Base-X on Control Plane
- > Secondary Three Slot VME/VPX Backplane for Power Only Payload Cards
- > Very Large Power Supply
- > Chassis Management, including Voltage, Temperature and Fan Monitoring and Control and a Front of Chassis Display Panel
- > High Performance Convection Cooling with Replaceable and Cleanable Fan Tray and Filter
- > Front Panel Power Switch, System Rest Switch and Maskable Reset Switch, all with Safety Covers
- > Electromagnetic Shielding
- > Includes one year hardware warranty

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Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

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## WILDSTAR A5 for OpenVPX

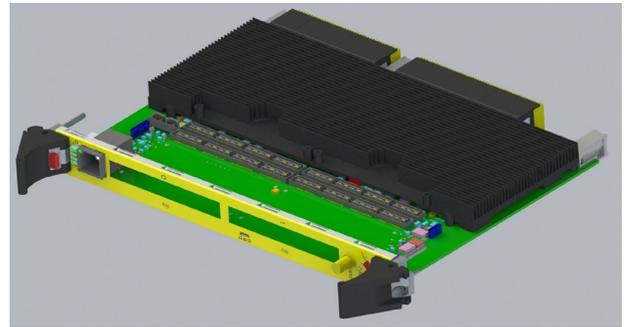
Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections.

**WILDSTAR A5 for OpenVPX** uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is one of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts up to four I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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## FEATURES

- › Supports up to Twenty-four 14G InfiniBand, Six 40Gb Ethernet, or Twenty-four 10G Ethernet Connections
- › Up to Three Altera Stratix V FPGA Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- › Up to 8 GBytes DDR3 DRAM in 4 Memory Banks and Up to 80 MBytes QDRII + SRAM in 5 Memory Banks per WILDSTAR A5 for OpenVPX Board
- › Programmable FLASH for each FPGA to Store FPGA Images
- › APM86290 PowerPC on Board Host
- › PCI Express Bus Gen 1, Gen 2, or Gen 3 to P2 Expansion Plane through On Board PCIe Switch
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope Access
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- › Includes one year hardware warranty, software updates, and customer support
- › Training available

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional support.

Save time and effort and reduce risk with COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.

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## WILDSTAR A5 for PCI Express

Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections.

**WILDSTAR A5 for PCI Express** uses Altera's newest Stratix V FPGAs for state-of-the-art performance. This is the first of a series of Altera Based FPGA Processing Boards from Annapolis.

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. It accepts one or two I/O mezzanine cards, including Single 1.5 GHz 8 Bit ADC, Quad 250 MHz 12 Bit ADC, Single 2.5 GHz 8 Bit ADC, Quad 130 MHz 16 Bit ADC, Dual 2.3/1.5 GSps 12 Bit DAC, Quad 600 MSps 16 Bit DAC, Universal 3Gbit Serial I/O (RocketIO, 10 Gb Ethernet, InfiniBand), and Tri XFP (OC 192, 10G Fibre Channel, 10 Gb Ethernet). Our boards work on a number of operating systems, including Windows and Linux. We support our board products with a standardized set of drivers, APIs and VHDL simulation models.

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Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules. WILDSTAR A5 for PCI Express, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.



## FEATURES

- › Supports up to Three 56G FDR InfiniBand, Three 40Gb Ethernet, or Twelve 10Gb Ethernet Connections
- › Up to Three Altera Stratix V FPGA Processing Elements – GSD4, GSD5, GSD6, GSD8, GXA3, GXA4, GXA5, GXA7, GXA9, GXAB
- › Up to 4 GBytes DDR3 DRAM in 2 Memory Banks and Up to 192 MBytes QDRII + SRAM in 12 Memory Banks per WILDSTAR A5 for PCI Express Board
- › Programmable FLASH for each FPGA to Store FPGA Images
- › 16X PCI Express Bus Gen 1, Gen 2, or Gen 3 to Host PC through On Board PCIe Switch
- › Supports PCI Express Standard External Power Connector
- › Multi Channel High Speed DMA
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope Access
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- › Includes one year hardware warranty, software updates, and customer support
- › Training available

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## WILDSTAR 5 for IBM Blade

Perfect Blend of Processors and Xilinx Virtex-5 FPGAs. Eleventh Annapolis Generation.

**Direct Seamless Connections** – No data reduction between: external sensors and FPGAs, FPGAs and processors over 10 Gb Ethernet backplane, FPGAs and standard output modules.

**Ultimate Modularity** – From zero to six Virtex-5 processing FPGA/memory modules, and two Virtex-5 I/O FPGAs. Accepts one or two standard Annapolis WILDSTAR 4/5 I/O mezzanines: Quad 130 MSps through Quad 500 MSps A/D, 1.5 GSps through 2.2 GSps A/D, Quad 600 MSps DAC, InfiniBand, 10 Gb Ethernet, SFPDP.

**Fully Integrated into the IBM Blade Management System** – Abundant power and cooling for maximum performance.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

Develop your application very quickly with our CoreFire™ FPGA Application Builder, which transforms the FPGA development process, making it possible for theoreticians to easily build and test their algorithms on the real hardware that will be used in the field. CoreFire, based on dataflow, automatically generates distributed control fabric between cores. Our extensive IP and board support libraries contain more than 1,000 cores, including floating point and the world's fastest FFT. A graphical user interface for design entry supports hardware-in-the-loop debugging, and provides proven, reusable, high-performance IP modules.

WILDSTAR 5 for IBM Blade, with its associated I/O cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Achieve world-class performance; WILDSTAR solutions outperform the competition.



## FEATURES

- › From two to eight Virtex-5 FPGA processing elements – LX110T, LX220T, LX330T, FX100T, FX130T, or FX200T; six are pluggable with power module and memory
- › Up to 10.7 GB DDR2 DRAM per WILDSTAR 5 for IBM Blade Board
- › 144 x 144 crossbar; 3.2 Gb per line; two external PPC 440s – 1 per each I/O FPGA
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope access
- › Available in both commercial and industrial temperature grades
- › Proactive thermal management system – board-level current measurement and FPGA temperature monitor, accessible through host API
- › Includes one-year hardware warranty, software updates, and customer support
- › Blade management controller; USB, RS-485, Ethernet, KVM, 16 RIO, Switch to 1 GbE over backplane
- › Save time and effort; reduce risk with COTS boards and software
- › We offer training and exceptional special application development support, as well as more conventional support
- › Famous for the high quality of our products and our unparalleled dedication to ensuring that the customer's applications succeed

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## WILDSTAR 6 for AMCs

Annapolis Micro Systems, Inc. is a world leader in high-performance, COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, DSP, FFTs, communications, Software-Defined Radio, encryption, image processing, prototyping, text processing, and other processing-intensive applications. Our fourteenth generation WILDSTAR 6 for AMC uses Xilinx's newest Virtex-6 FPGAs for state-of-the-art performance. It accepts one FMC I/O Card. Our boards work on a number of operating systems, including Windows, Linux, Solaris, IRIX, ALTIX, and VxWorks. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models.

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Our extensive IP and board support libraries contain more than 1000 cores, including floating point and the world's fastest FFT. CoreFire uses a graphical user interface for design entry, supports hardware-in-the-loop debugging, and also provides proven, reusable, high-performance IP modules. WILDSTAR 6 for AMC, with its associated I/O Cards, provides extremely high overall throughput and processing performance. The combination of our COTS hardware and CoreFire allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

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Save time and effort and reduce risk with our COTS boards and software. Achieve world-class performance – WILD solutions outperform the competition.



## FEATURES

- › One Xilinx Virtex-6 FPGA I/O Processing Elements – LX240T, LX365T, LX550T, SX315T or SX475T
- › On board Host Freescale P1020 or P2020 PowerPC
- › Up to 2.5 GBytes DDR2 DRAM in 5 memory banks or
- › Up to 80 MB DDRII or QDRII DRAM in 5 memory banks
- › Programmable FLASH to store FPGA image
- › 4X PCI Express Bus Gen 2 between PPC and FPGA
- › Supports VITA 57 FMC I/O Cards
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope access
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – current, voltage, and temperature monitoring sensors via Host API
- › Includes one year hardware warranty, software updates, and customer support. Training available.

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## WILDSTAR 6 for OpenVPX

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## FEATURES

- › Up to three Virtex-6 FPGA processing elements – XC6LX240T, XC6LX365T, XC6LX550T, XC6SX315, or XC6SX475
- › Up to 7 GB DDR2 DRAM in 14 banks or up to 448 MB DDRII or QDRII SRAM
- › OpenVPX backplane
- › 80 x 80 crossbar connecting FPGAs and VPX backplane
- › 1 GHz 460EX PowerPC onboard host
- › 4X PCIe controller
- › Programmable Flash to store FPGA images and for PCI controller
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope Access
- › Host software: Windows, Linux, VxWorks, etc.
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – Board level current measurement and FPGA temperature monitor, accessible through host API
- › Save time and effort and reduce risk with COTS boards and software; achieve world-class performance – WILD solutions outperform the competition
- › Includes one-year hardware warranty, software updates, and customer support; training available

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## WILDSTAR 6 PCIe

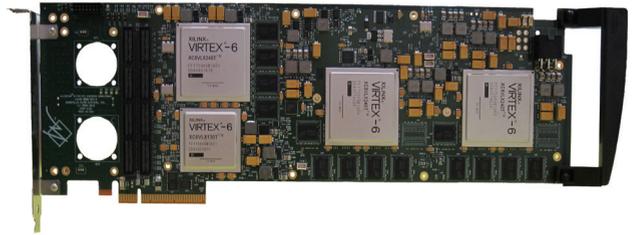
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## FEATURES

- › Up to three Xilinx Virtex-6 FPGA I/O processing elements – LX240T, LX365T, LX550T, SX315T, or SX475T
- › Up to 8 GBytes DDR2 DRAM or DDR3 DRAM in 14 memory banks per WILDSTAR 6 for PCI Express board or up to 480 MBytes DDRII+/QDRII DRAM in 15 memory banks
- › Programmable FLASH for each FPGA to store FPGA images
- › 8X PCI Express Bus Gen 1 or Gen 2
- › Supports PCI Express standard external power connector
- › High-speed DMA Multi-Channel PCI controller
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for hardware interfaces and ChipScope access
- › Available in both commercial and industrial temperature grades
- › Proactive Thermal Management System – Board Level current measurement and FPGA temperature monitor, accessible through Host API
- › Includes one year hardware warranty, software updates, and customer support. Training available.

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**Contact:** wfinfo@annapmicro.com

# SIEMENS

usa.siemens.com/pcba

## SIMATIC IPC 427D / 477D

The **SIMATIC IPC 427D/477D** Industrial PCs are both equipped with the latest 3rd generation Intel i7 processors and offer the highest performance – without a fan. With these computers you can implement complex, demanding and maintenance-free automation solutions, such as measuring, operating, controlling, handling, or monitoring. Both form factors, box and panel IPC, rely on the same hardware platform. This reduces your evaluation effort because common drivers, uniform engineering, and simple single parts management can be used. Moreover, training efforts for employees are reduced. The common platform is also equipped with the latest hardware features, such as USB 3.0, Display Port, and CFast, a fast, externally accessible mass storage. In addition, due to support by the Intel Core i7 processors, SIMATIC IPCs can use Intel AMT which allows remote controlling and remote maintenance of IPCs.

The Microbox 427D is highly efficient and highly flexible, even in ambient temperatures of up to 55 °C. The box PC can be configured with one or two additional PCI-e extension slots, Profinet or Profibus onboard. The panel PC 477D is available as touch or touch/key version, with display sizes ranging from 12-22". All panel computers are equipped with industrial-suited, widescreen front panels which rely on the established Siemens front concept. They feature brilliant imaging, due to high resolution and a high viewing angle; high energy efficiency, due to LED backlighting that is 100% dimmable; maximum ruggedness, due to fronts made of die-cast aluminum.



## FEATURES

- › **High performance, fanless:** Maximum performance in an embedded device
  - Intel Core-i7 processor (3rd gen.) with Turbo Boost
  - HD graphics with dyn. frequency integrated in the processor
  - 8 GB DDR3 RAM and ECC support
  - Fast, rugged bulk memories (SSD 160 GB, CFast 16 GB)
  - State-of-the-art interfaces (USB 3.0, DisplayPort)
  - Fanless operation up to ambient temperatures of 55 °C
- › **Flexibility and expandability:** Seamless system upgrades and expansion
  - Up to two PCIe expansion slots
  - Numerous interfaces onboard (4 x high-speed USB 3.0, COM, 2 x Gigabit Ethernet)
  - Multi-monitoring with DVI and DisplayPort interface for two monitors
- › **Ruggedness, minimal maintenance:** 24-hour continuous operation without maintenance
  - No rotating parts (fan, HDD)
  - Battery-free – (also applies to retentive memory option)
  - High temperature, vibration, shock and EMC resistance
  - Fanless operation up to ambient temperatures of 55 °C
- › **Easy integration:** Easy integration thanks to maximum application flexibility
  - Flexible installation positions with DIN rail, wall and portrait assembly (diagnostics LEDs always visible)
  - Interfaces on one side for easy wiring
  - Remote operation and maintenance via Intel AMT
  - Numerous certifications and approvals, e.g. shipbuilding, CE, UL, FM Class 1 DIV 2
- › **Rapid commissioning:** Unpack, Connect, Go!
  - Pre-installed and activated 32- or 64-bit Windows operating system
  - Turnkey bundles with pre-installed control software WinAC RTX (F) as well as pre-installed visualization software WinCC Advanced/Professional (in preparation)

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## Industrial Controllers

start at  
**\$199**  
qty 100

### Technologic Systems Industrial Controllers

Technologic Systems offers three powerful computers targeting industrial process control, TS-8820-BOX, TS-7558-BOX, and TS-7520-BOX. With Technologic Systems controllers, an intelligent automation system can be implemented at low cost with a minimal number of components.

#### The TS-7558-BOX

The TS-7558-BOX is a complete solution for extremely low cost industrial control applications. Designed around the mature Cavium 250MHz ARM9 architecture, the TS-7558-BOX is priced at \$199 (qty 100) including the plastic enclosure. Screw terminals bring out 8 I/O-isolated inputs, isolated outputs, and 4 ADC. TS-7520-BOX with 50 DIO and 8 ADC is also available.

#### The TS-7520-BOX

The TS-7520-BOX is a versatile solution with dense I/O available through 12 RS485 ports. This includes DAC, 8x 12-bit ADC channels, pulse counters, CAN, RS232, and 2 Modbus RJ45 ports. Priced at \$219 (qty 100) with a Cavium 250MHz ARM9 processor.

#### The TS-8820-BOX

The TS-8820-BOX is a powerful solution for a wide variety of industrial applications. This controller features an 800MHz CPU housed in a rugged extruded aluminum enclosure that exposes the I/O on screw terminals while protecting the more sensitive electronics. 120 screw terminals on the TS-8820-BOX bring out 16 I/O-ADC, DAC, optional H-bridges, relays, isolated CAN, isolated RS-232, and isolated RS-485. TS-8820-BOX is priced at \$588 (qty 100), including the enclosure.

#### Modbus Peripherals

Technologic Systems controllers feature a 2W-Modbus RS-485 port that allows power and data to be sent over a single CAT5 to communicate with multiple peripherals. Technologic Systems industrial controllers and peripherals support legacy modbus communication, as well as high speed communication up to 4096K baud.

#### FPGA Flexibility

Our industrial controller products feature FPGAs making them an ideal solution for applications requiring additional UARTs, non-standard bus interfaces, PWM outputs, quadrature decoding, CAN, pulse timing, digital counters, or other custom logic. Technologic Systems can integrate that functionality into a custom FPGA configuration for an elegant and cost effective solution. For our customers who prefer to do their own FPGA development, Technologic Systems has open-core Verilog projects for most controllers.

#### Fastboot Linux

Technologic Systems Industrial Controllers boot Linux in under 3 seconds, allowing your application to start working immediately. The Linux kernel can be loaded from a DoubleStore SD card or from an industrial SLC XNAND drive, for a guaranteed bootstrap. Full Debian Linux is also supported, allowing sophisticated software solutions such as database servers, web servers, and custom applications in Java, PHP, Python, Perl, or any language supported by Debian.



Picture of TS-8820-BOX

### FEATURES

- › ARM CPUs from 250MHz to 1066MHz
- › Fanless operation from -40°C to +85°C
- › Program in C/C++, or many other languages
- › 2W-Modbus RS485
- › Expandable Modbus Temperature Sensors, DIO, ADC
- › Rugged industrial screw-down connectors
- › Opto-isolated digital I/O
- › 16-bit or 12-bit ADC
- › Digital counters
- › PoE capable 10/100 Ethernet
- › USB Host ports
- › RS-232, RS-485, CAN
- › Industrial SLC XNAND drive
- › Industrial DoubleStore file storage
- › User-programmable OpenCore FPGA
- › DIN mount option



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product page

Technologic Systems | 480-837-5200

Contact: info@embeddedARM.com  
www.embeddedarm.com



www.vectorelect.com

### VECTORPAK™ "Slimline" CHASSIS – ITAR REGISTERED

19" rackmount, rugged aluminum construction with left to right airflow. Fans installed on left/right for maximum cooling of 6U x 160mm front cards and 6U x 80mm rear transition cards. 1U, 2U, 3U, 4U and 5U (2-10 backplane slots), IEEE 1101.1, .10 & .11 compliant.

#### Plug-in, hot-swap power supplies or embedded ATX:

- 200W plug-in power supply will provide 5V@25A; 3.3V@35A; +12V@8.0A and -12V@1.5A, AC/DC or DC/DC
- 250W high output plug-in power supply will provide 5V@40A; 3.3V@40A; +12V@5.5A and -12V@2.0A, AC/DC or DC/DC
- 300W embedded ATX-type power supply will provide 5V@30A; 3.3V@20A; +12V@16A and -12V@0.8A

#### Backplane options:

- cPCI 64-bit/66MHz PICMG 2.0, Rev 3
- cPCI H110
- VME64x with EBG (Electronic Bus-Grant)

Our units are made at our U.S. facility,  
and we offer short lead times and  
custom configurations upon request.

*Many color options are available.*

Please call us at 1-800-423-5659  
or e-mail us at  
inquire@vectorelect.com.



### FEATURES

- › CompactPCI or VMEbus
- › 1U, 2U, 3U, 4U and 5U 19" rackmount
- › Push-pull fans for maximum airflow
- › Dual-redundant hot-swappable power supplies
- › Wide choice of factory colors



www.accessio.com

### Multifunction DAQ-PACK Series (Up to 128 Channels)

The DAQ-PACK Series is a highly integrated multifunction data acquisition and control system. The system offers an ideal solution for adding portable, easy-to-install high-speed analog and digital I/O capabilities to any PC or embedded system with a USB port. It performs signal conditioning such as RC filtering, current inputs, RTD measurement, bridge completion, thermocouple break detection, voltage dividers, small signal inputs, and sensor excitation voltage supply.

The small, compact, multifunction I/O DAQ-PACK Series units provide the user with everything needed to start acquiring, measuring, analyzing, and monitoring in a variety of applications. These data acquisition and control devices can be used in many current real-world applications such as precision measurement, analysis, monitoring, and control in countless embedded applications.



### FEATURES

- > 32, 64, 96, or 128-channel single-ended or differential analog inputs
- > High-speed USB 2.0 multifunction DAQ
- > Sustained sampling speeds up to 500kHz
- > 12 or 16-bit resolution A/D converter
- > Flexible, software configured functionality
- > 18 input ranges, 9 unipolar and 9 bipolar, per 8-channel programmable
- > Wide range of flexible signal conditioning types
- > Autocalibration and oversampling for real-time accurate data
- > A/D starts via software, timer, or external trigger
- > Two 16-bit analog outputs and 16 high-current digital I/O lines
- > 16-bit programmable counter/timer

ACCES I/O Products, Inc. | 858-550-9559

Contact: [contactus@accessio.com](mailto:contactus@accessio.com)

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www.crystalrugged.com/products/embedded.aspx

### RE0412 Carbon Fiber Embedded Computer

The RE0412 has been designed and developed to support airborne and ground mobile applications where significant processing power is required while still being lightweight and rugged.

The system is designed around a DC power solution with an Intel mini-ITX board form factor using an air-over-components cooling approach. The system can accept a single PCIe X4 card in a X16 slot and up to two hard drives and 16GB RAM. The RE0412 is exceptionally rugged, powerful, and lightweight.



### FEATURES

- > Ultra-light carbon fiber chassis provides exceptional ruggedness
- > Unit weighs up to 4.25 lbs.
- > Extended temperature range -40C to +55C
- > Intel mini-ITX motherboard, LGA1155 socket, Lan, 2XUSB 3.0, 2XUSB 2.0, DVI-I, eSATA, HDMI, Audio, PCIe(X4 in X16 slot) provides exceptional performance in small package
- > Air cooled design limits weight
- > Two (2) 204 pin DDR-3 SDRAM sockets support 1066 MHz and 1333 MHz SO-DIMMs of 2GB to 8GB size i.e. up to 16GB capacity non-ECC memory
- > Intel H61 express chipset controller hub provides traffic management between memory, CPU, and I/O
- > Integrated graphics support within processor incorporates latest graphics technology
- > HDMI, DVI-I video options provide broad video support
- > Supports one (1) or two (2) 2.5" SATA hard drives (weight based on single drive)
- > One PCIe X4 electrical in a X16 slot via riser card supports LP expansion card
- > Power LED, power switch, and circular connector provide easy access and operation

Crystal Group, Inc. | 800-378-1636

Contact: [rfq@crystalrugged.com](mailto:rfq@crystalrugged.com)

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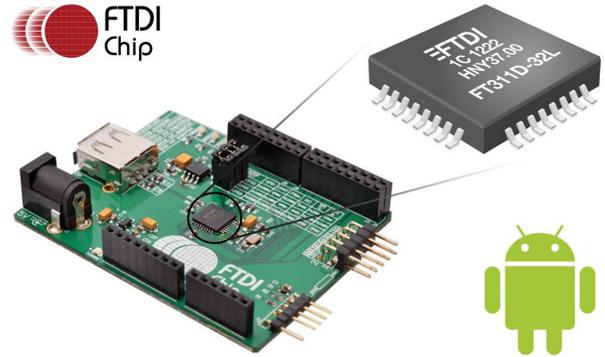
**FT311D****FT311D:**

A bridge, USB host integrated circuit that easily integrates into end systems through 6 interfaces and targets Android Open Accessory systems with USB slave, B port capability.

**UMFT311EV:**

Support includes evaluation module for fast and easy system development.

Twitter: @FTDICHIP



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**FEATURES****FT311D:**

- > Interfaces: UART, PWM, SPI master, SPI slave, I<sup>2</sup>C master, and GPIO
- > Interface configurable via 3 mode pins
- > Fixed functions include host stack, class driver, Open Accessory driver, and I/O bridging
- > 3.3V single supply, with 5V tolerant I/O
- > Extended temperature range: -40 to +85C
- > 32 pin LQFP/QFN

**FTDI Chip**

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www.innovative-dsp.com/products.php?product=ePC-K7

**ePC-K7**

The **ePC-K7** is a user-customizable, turnkey embedded instrument that includes a full Windows/Linux PC and supports a wide assortment of ultimate-performance FMC modules. With its modular I/O, scalable performance, and easy to use PC architecture, the ePC-K7 reduces time-to-market while providing the performance you need.

- Distributed data acquisition
- Uniquely customizable
- Remote or local operation
- Continuous data streaming
- Rugged – SSD boot drive support in a compact, rugged 8 x 11" footprint
- Download data sheets and pricing now!



**ePC-K7**

**FEATURES**

- > Combines an industry-standard COM Express CPU module with dual FMC I/O modules in a compact, stand-alone design
- > Programmable Kintex-7 325/410 and Spartan-6 FPGAs
- > Small form factor: 5" H x 8" W x 11" D
- > Conduction cooled design: Fins or cold-plate
- > Stand-alone operation: Able to operate headless, booting from SSD
- > Windows, Linux OS support
- > Dual VITA 57 FMC I/O module sites. Add anything from RF receivers to industrial control modules.

**Innovative Integration | 805-578-4260**

Contact: sales@innovative-dsp.com

# SENSORAY

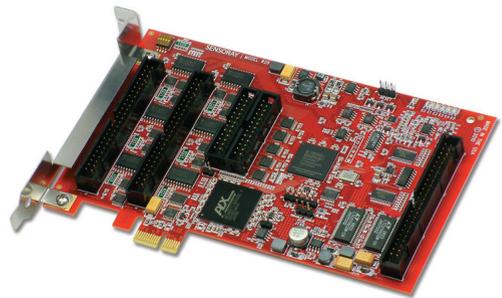
## embedded electronics

www.sensoray.com/IN10/826

### Sensoray Model 826, PCI Express Analog and Digital I/O

Sensoray's Model 826 is a versatile analog and digital I/O system on a PCI Express board. It has six encoder/timer/counter interfaces, sixteen differential analog inputs (16-bit, 300 kS/s), eight analog outputs (16-bit, 900 kS/s), and 48 bi-directional digital I/Os with edge capture. The board's 3-stage watchdog timer and output fail-safe controller work together to automatically assert fail-safe output levels in response to faults or external triggers. It is well-suited for a wide range of measurement and control applications, such as beverage and food processing, amusement park rides, and laser cutting systems.

Its six 32-bit counters can operate as conventional timer/counters or in any of several special modes, directly supporting incremental quadrature encoders, PWM and pulse generation, frequency measurement, period measurement, and pulse width measurement.



### FEATURES

- > (6) Versatile 32-bit counters
- > (16) 16-bit analog inputs
- > (8) 16-bit analog outputs
- > 48 Digital I/Os with edge capture
- > Multilevel watchdog timer
- > Directly supports incremental encoders, pwm/pulse generation, frequency/pulse/period measurement
- > Compatible with standard solid state relay racks, Windows, Linux, LabVIEW

Sensoray Co., Inc. | 503-684-8005

Contact: sales@sensoray.com

LinkedIn: www.linkedin.com/company/sensoray • Twitter: twitter.com/Sensoray

# Small PC .com

www.smallpc.com

### iBrick Rugged Computer

The **SC215ML iBrick** is a high performance rugged computer in a compact chassis. The system has been designed and tested to survive the extremes of rugged computing in wet, dirty, hot and cold environments. The chassis and connectors are sealed to dirt, dust and water.

Standard configurations include Intel's® 3rd generation mobile i-series processors, 64G SSD, HDMI Video Port, Gigabit Ethernet Port & 3 USB 2.0 Ports. A waterproof cable set is also included.

The iBrick is completely sealed in a rugged aluminum chassis that is only 8" x 5" x 2.7". All of our sealed systems use a unique and specialized heat pipe design providing fanless cooling. A wide variety of configurations and I/O options are available.



### FEATURES

- > Rugged Waterproof Aluminum Chassis
- > High Performance CPU and Graphics Engine
- > 3rd Generation i3 or i5 Dual Core Processor
- > Supports Intel® 64 architecture
- > 3MB Smart cache
- > 64GB Solid State Drive
- > Passive heat sink cooling
- > No Moving Parts/Silent Operation
- > Low Power Consumption
- > Waterproof cable set
- > HDMI Port/3 USB 2.0 ports
- > Memory to 16GB

### OPTIONS

- > Up to 16GB Memory
- > Solid State Flash Drive to 512G
- > Dual HDMI ports/HD Audio
- > 2/4 Video Capture Channels
- > Intelligent Vehicle/Marine Power
- > Thunderbolt Port, 10Gbs Bidirectional
- > USB 3.0 ports/Gigabit LAN Ports
- > Wireless n/g/b LAN, Bluetooth, GPS
- > Dual ended Waterproof Cable Set
- > USB Imaging Flash Drive Kit
- > Multiple RS232/RS422/RS485 ports
- > 24V DC or DC Voltage Range (6-32V)

SmallPC.com | 877-505-5022

Contact: salesinfo@smallpc.com



## Freescale's QorIQ Processors – Connecting your Industrial Network

Freescale's control and network processor solutions, based on Power Architecture® technology, are engineered to meet the challenging safety, security and connectivity requirements of industrial automation applications.

### MULTICORE FOR SAFETY

QorIQ multicore processors offer many advantages over discrete solutions allowing for multiple safety channels and consolidation of components or modules. The use of multicore processors enable functional safety, motion control and networking to co-exist in a single QorIQ processor through the use of a hard partitioning of resources and data flows, ensuring autonomous operations. This approach also helps improve system intelligence and speed of thought. The close integration of functions combined with the expansive use of ECC and parity protection on memory arrays can be linked into the diagnostics. The approach can provide early warnings and graceful degradation, which can in turn support better machine availability and productivity.

### CONNECTING THE FACTORY FLOOR

Freescale has been accelerating communication protocols both in data and control planes for more than 20 years, starting with our CPM then migrating to the more powerful QUICC Engine technology which is used for industrial protocol offload. These hardware-based accelerators enable real-time control functions while ensuring stream-lined communications for connected factories. As time has progressed, technologies and data rates have increased and so has the acceleration provided by Freescale processors. The latest acceleration engine, Data Path Acceleration Architecture (DPAA), provides packet routing, security, quality of service and deep packet inspection. The DPAA is a set of hardware components available on most QorIQ P and T series processors. This architecture provides the infrastructure to support simplified sharing of network interfaces and accelerators by multiple CPU cores. At the same time the QUICC Engine has been enhanced to provide acceleration/off load for UART and TDM based protocols like PROFIBUS and HDLC.

For example, Freescale's QorIQ T1040 processor combines DPAA and integrated 8-port gigabit ethernet switch for wire-rate Ethernet switching and routing. Industrial Ethernet protocols like PROFINET, EtherNET/IP and EtherCAT® can be supported. The QUICC Engine can accelerate serial protocols like PROFIBUS, HDLC and more.

### PROTECTING YOUR INVESTMENT

Freescale continues to develop more intelligent and cost-effective solutions. Our safe and secure systems can withstand hacking, cloning, tampering and soft errors in the harsh environments typical of manufacturing and process applications. An integrated security engine allows offload of services, while secure boot prevents unauthorized code from being loaded to end equipments.

Freescale recognizes that industrial applications ship for many years after launch, and need long-term product support. Our Product Longevity program supports device availability for a minimum of 10 years from the time of launch. [www.freescale.com/productlongevity](http://www.freescale.com/productlongevity).



## FEATURES

- > **Scalable system performance:** 1,000 to 129,000 Dhrystone MIPS
- > **Reduced system cost:** highly integrated processors starting at \$20
- > **Fan-less operations:** starts at <3W
- > **Rugged devices:** long life and reliability
- > **Industrial qualified:** -40° to 105°C
- > **Double precision floating point**
- > **Multiple 10/100/1000 Ethernet with IEEE® 1588 support**
- > **Serial interfaces:** FlexCAN®, UARTs, SPI, GPIO, I<sup>2</sup>C
- > **QUICC Engine for protocol offload:** eliminates need for FPGA or ASIC solutions
- > **Robust development environment:** SBCs, Linux SDK, Fieldbus and Ethernet protocol support, Real-time Operating Systems like QNX, Wind River and Green Hills
- > **Product longevity:** minimum 10 years

Visit: [www.freescale.com/qorIQ](http://www.freescale.com/qorIQ) for more information

**Freescale Semiconductor | 800-521-6274**  
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www.accessio.com

### USB-104-HUB – Rugged, Industrial Grade, 4-Port USB Hub

This small industrial/military grade hub features extended temperature operation (-40°C to 85°C), high retention USB connectors, and an industrial steel enclosure for shock and vibration mitigation. The OEM version (board only) is PC/104 sized and can easily be installed in new or existing PC/104-based systems as well. The USB-104-HUB now makes it easy to add additional USB-based I/O to your embedded system or to connect peripherals such as external hard drives, keyboards, GPS, wireless and more. Real-world markets include Industrial Automation, Embedded OEM, Laboratory, Kiosk, Transportation/Automotive, and Military/Government.

This versatile four port hub can be bus powered or self powered. You may choose from three power input connectors: DC power input jack, screw terminals, or 3.5" drive power connector (Berg). Mounting provisions include DIN rail, 3.5" front panel drive bay mounting, and various panel mounting plates.



### FEATURES

- › Rugged, industrialized, four-port USB hub
- › High-speed USB 2.0 device, USB 3.0 and 1.1 compatible
- › Extended temperature operation (-40°C to +85°C)
- › Data transfer rates up to 480 Mbps
- › Supports bus-powered and self-powered modes
- › Three power input connectors (power jack, screw terminals, or 3.5" drive Berg power connector)
- › LED status indicators for power and overcurrent fault conditions for each downstream port
- › USB/104 form factor for OEM embedded applications
- › OEM version (board only) features PC/104 module size and mounting
- › Includes micro-fit embedded USB header connectors in parallel with all standard USB connectors
- › Industrial grade USB connectors feature high-retention design
- › Small (4" x 4" x 1"), low profile, steel enclosure
- › 3.5" front panel drive bay mounting provision

ACCES I/O Products, Inc. | 858-550-9559

Contact: [contactus@accessio.com](mailto:contactus@accessio.com)

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**ADLINK**  
TECHNOLOGY INC.

www.adlinktech.com

### Express-HL COM Express® Type 6 Module

The **Express-HL COM Express® Type 6 module** adopts the 4th generation Intel® Core™ processor (formerly codenamed Haswell) and delivers enhanced CPU performance, stunning graphics, and improved security functions. Massive storage with high-speed data transfer interfaces, multiple display support, and enhanced graphics performance make the module well suited for intelligent systems innovations in retail, gaming, medical, transportation, defense, communications, and industrial automation applications.

The Express-HL supports up to three independent displays and provides rich image output options originating directly from the CPU for increased bandwidth and resolution over the previous generation Intel® Core™ processor. The Express-HL also supports up to 16GB dual channel DDR3L SDRAM at 1600 MHz system memory and offers significant performance gains for floating-point-intensive computations with the addition of new instructions to AVX, especially beneficial for digital signal and image processing applications, such as medical imaging or radar.



### FEATURES

- › 4th generation Intel® Core™ 2- and 4-core mobile processors (i7/i5) with the Mobile Intel® QM87 Express Chipset
- › Supports new mode known as stretching to enable virtual resolutions in three adjacent displays
- › Supports daisy chaining with HDMI to simplify cabling in multiple display solutions
- › Seven PCIe x1, one PCIe x16 (Gen3) for graphics (or general purpose x8/4/1)
- › Four SATA 6 Gb/s, Gigabit Ethernet, four USB 3.0, four USB 2.0
- › Extreme Rugged™ version with ECC DRAM; -40C to +85C temperature range
- › SEMA (Smart Embedded Management Agent) controller for monitoring of BIOS, power, temperature, watchdog, and board information

ADLINK Technology | 408-360-0200

Contact: [info@adlinktech.com](mailto:info@adlinktech.com)

[www.linkedin.com/company/adlink-technology](http://www.linkedin.com/company/adlink-technology)

# ELMA

Your Solution Partner  
www.elma.com

## SFF-IP68 Fanless Computer

Elma's **SFF-IP68** is a compact, fanless, rugged computer for demanding environmental conditions. Designed to meet IP68 protection from continuous water immersion and dust penetration, it also offers high shock and vibration resistance. Standard & custom versions are available.

*For full configuration details,  
go to [elma.com](http://elma.com)*



## FEATURES

- › Intel® Atom based single board computer, conformal coated
  - Up to 2 GB DDR2 SDRAM, 4 GB NAND flash
  - I/O ports: 4 PCI Express, 6 x USB, 2 x SATA, 2 x RS-232, 2 x RS-422/485, COM
  - Two Gigabit Ethernet ports
  - Compact flash socket
  - VGA, LVDS interfaces
- › Watertight, fanless box designed to protect to IP68/NEMA 6P
- › Temperature range from -40°C to +85°C and 0°C to +70°C
- › Conduction cooled
- › Customized versions available. It ships off the shelf with the above features. Tailored configurations can be easily accommodated.

Elma Electronic Inc. | 510-656-3400

Contact: [sales@elma.com](mailto:sales@elma.com)

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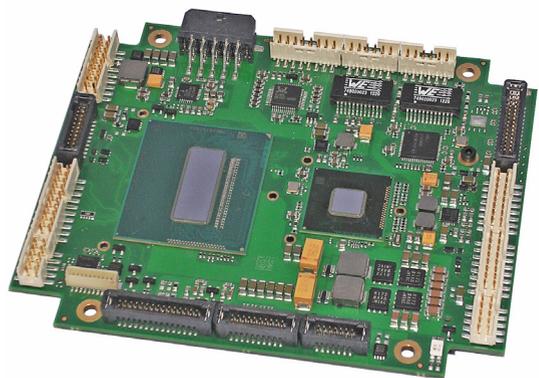


# Embedded Solutions™

www.adl-usa.com

## ADLQM87PC – Industry's Smallest 4th Gen. Intel Core i7 SBC

The **ADLQM87PC** delivers the industry's highest GIPS per in<sup>2</sup> and the most densely-packed comprehensive set of features. The ADLQM87PC's 17in<sup>2</sup> footprint features 4th generation Intel Core processors with Intel 8-series QM87 PCH chipset, on-board Mini PCIe/mSATA socket for on-board WiFi, GPS, bootable flash storage, a Trusted Platform Module (TPM v1.2), 2x USB 3.0, 8GB DDR3, 4x SATA 6 Gb/s, 2x GLAN, DisplayPort, HDMI/DVI, VGA, 8x USB 2.0, and more ... all with a smaller footprint and height than a basic COM Express module with greater temperature range and ruggedness.



## FEATURES

- › 4th Generation Intel® Core™ QUAD and DC Processors; PCIe/104; up to 8GB DDR3L
- › HD4600 GPU; Over 2x Performance Increase over 2nd Gen Intel Core i7 GPU
- › Onboard PCI-Express Mini Card Socket v1.2 Compatible with miniPCIe and mSATA Modules
- › Integrated Trusted Platform Module (TPM) v1.2
- › USB 3.0; 4x SATA 6Gb/s; DisplayPort, eDP, HDMI, VGA, 2x GbLAN, 2x COM, 16-bit GPIO
- › Mil-Std 810 Ruggedization and -40°C to +85°C Options Available

ADL Embedded Solutions | 858-490-0597

Contact: [sales@adl-usa.com](mailto:sales@adl-usa.com)



[www.innovative-dsp.com/products.php?product=FMC-310](http://www.innovative-dsp.com/products.php?product=FMC-310)

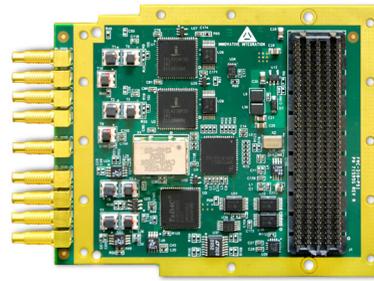
### FMC-310

The **FMC-310** is a high speed digitizing and signal generation FMC I/O module featuring four 310 MSPS A/D channels supported by sample clock and triggering features.

Analog I/O may be either AC or DC coupled. Receiver IF frequencies of up to 155 MHz are supported. The sample clock is from either an ultra-low-jitter PLL or external input. Multiple cards can be synchronized for sampling.

The FMC-310 power consumption is 6W for typical operation. The module may be conduction cooled using VITA20 standard and a heat spreading plate. Ruggedization levels for wide-temperature operation from -40 to +85°C operation and 0.1 g<sup>2</sup>/Hz vibration. Conformal coating is available.

Support logic in VHDL is provided for integration with FPGA carrier cards. Specific support for Innovative carrier cards includes integration with Framework Logic tools that support VHDL/Verilog and Matlab developers. The Matlab BSP supports real-time hardware-in-the-loop development using the graphical block diagram Simulink environment with Xilinx System Generator for the FMC integrated with the FPGA carrier card.



### FEATURES

- › Four A/D Inputs
  - 310 MSPS, 16-bit
  - AC or DC coupled
- › Sample clocks and timing and controls
  - External clock/reference input
  - Programmable PLL
  - 10 MHz, 0.5 ppm reference
  - Integrated with FMC triggers
- › FMC module, VITA 57.1
  - High Pin Count no SERDES required
  - Compatible with 1.2 to 3.3V VADJ
  - Power monitor and controls
- › 6W typical (AC-coupled inputs)
- › Conduction Cooling per VITA 20 subset
- › Environmental ratings for -40° to 85°C 9g RMS sine, 0.1g<sup>2</sup>/Hz random vibration

**Innovative Integration | 805-578-4260**

**Contact:** [sales@innovative-dsp.com](mailto:sales@innovative-dsp.com)



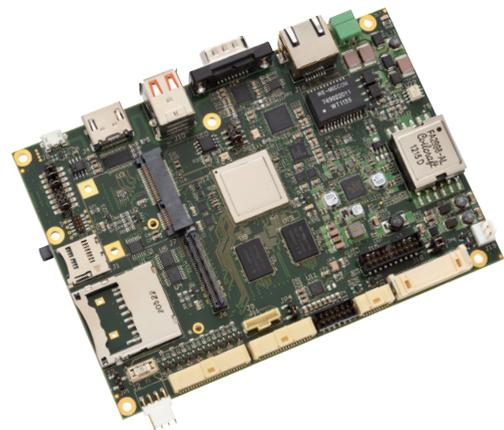
[www.WinSystems.com/SBC35-C398Q.cfm](http://www.WinSystems.com/SBC35-C398Q.cfm)

### -40° to +85°C Industrial ARM Single Board Computers

Designed for demanding industrial applications and long-term availability, WinSystems' SBC35-C398 SBCs feature Freescale i.MX 6 processors with options for expansion and customization. The combination of processing power and industrial I/O provides flexible solutions for security, industrial control, SCADA and other systems. The low-power design operates from -40° to +85°C without a fan or heatsink for improved reliability.

The IO60 connector supports I2C, SPI, TTL-UART, and PWM signals allowing stackable module expansion. When coupled with the Mini-PCIe socket, the 4 x 5.75 inch SBC35-C398s are among the most expandable ARM Single Board Computers currently on the market.

Linux and Android™ OS images and expert technical support are available to get your design started quickly.



### FEATURES

- › ARM Cortex™-A9 Processors: Quad, Dual, or Single Core
- › High-Performance Graphics with Multiple Video Interfaces
- › Powered by PoE or 10-50VDC Input
- › MIPI Capture and Display, with CMOS Camera Input
- › Gigabit Ethernet with IEEE-1588™
- › USB 2.0 and USB On-The-Go Ports
- › FlexCAN and RS-232/422/485 Serial Ports
- › 24 GPIO tolerant up to 30VDC
- › Mini-PCIe and IO60 (I2C, SPI, TTL, and PWM) Expansion

**WinSystems, Inc. | 817-274-7553**

**Contact:** [Info@WinSystems.com](mailto:Info@WinSystems.com)

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www.iar.com • www.iar.com/ew

## IAR Embedded Workbench

IAR Embedded Workbench is a high-performance C/C++ compiler and debugger tool suite for applications based on 8-, 16-, and 32-bit microcontrollers. It features comprehensive and capable tools that enable you to develop new competitive products. IAR Embedded Workbench incorporates a compiler, an assembler, a linker and a debugger into one integrated development environment (IDE). This gives you an uninterrupted workflow and a single toolbox in which all components integrate seamlessly. Outstanding speed optimizations enable IAR Embedded Workbench to generate very compact and fast-performing code. With the shortest possible execution times it is the ultimate choice for developing low-power applications. User-friendliness is improved with a new source browser and text editor. The world-leading C/C++ compiler and debugger tool suite, with the broadest MCU support, is now even more powerful.

Ready-made device configuration files, flash loaders and thousands of example projects are included. IAR Embedded Workbench is compatible with other ARM EABI compliant compilers and supports all ARM cores.

IAR Systems collaborates with all of the leading silicon vendors worldwide to ensure that our software supports more devices in more processor architectures than any other tool on the market.

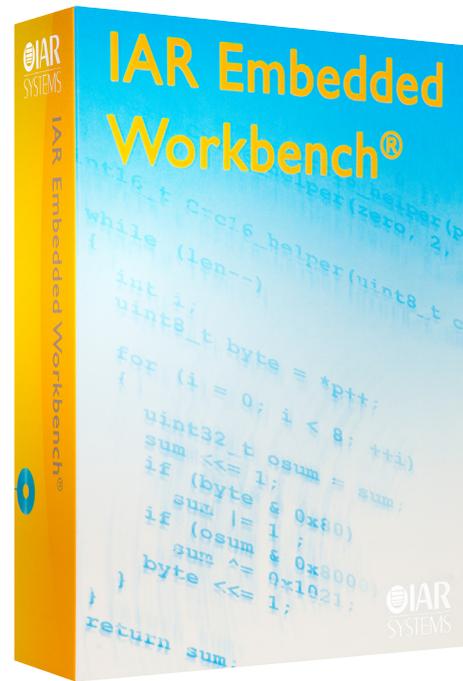
IAR Embedded Workbench is proven in use with over 100,000 licenses shipped to programmers worldwide. The knowledge and experience of its users and partners are incorporated in the design of new versions since nearly 30 years.

Many of the most renowned corporations that manufacture products with embedded systems, use IAR Embedded Workbench in safety critical applications, including the medical industry with its extensive testing. In addition, its quality is validated from independent test houses and commercial test suites.

The developers get access to excellent support via "My Pages" at [www.iar.com](http://www.iar.com), the software's help functions and our technical support teams from ten sales offices worldwide, in multiple languages and in local time. With a Support and Update Agreement you are guaranteed all software updates and support.

IAR Embedded Workbench is a reliable tool for demanding development projects.

Many global manufacturing companies have chosen to standardize their development of embedded systems on IAR Systems' technology. By standardizing on IAR Systems' toolchain, customers are able to vastly improve efficiency and time to market for new products. In one environment, they move freely between 8-, 16-, 32-bit microcontrollers from all major vendors in all relevant architectures, including all ARM cores. To standardize development on one toolchain provides freedom with regards to hardware and silicon vendors, enables reuse of code across projects, and reduces costs for training, maintenance, and managing of licenses.



## FEATURES

- › Integrated development environment with project management tools and editor
- › Highly optimizing C and C++ compiler for ARM
- › Automatic checking of MISRA C rules (MISRA C:2004)
- › ARM EABI and CMSIS compliance
- › Extensive HW target system support
- › Optional I-jet and JTAGjet-Trace in-circuit debugging probes
- › Power debugging to visualize power consumption in correlation with source code
- › Run-time libraries including source code
- › Relocating ARM assembler
- › Linker and librarian tools
- › C-SPY® debugger with ARM simulator, JTAG support and support for RTOS-aware debugging on hardware
- › RTOS plugins available from IAR Systems and RTOS vendors
- › Over 3100 sample projects for evaluation boards from many different manufacturers
- › User and reference guides in PDF format
- › Context-sensitive online help

**IAR Systems Software Inc. | 650 287-4250**

**Contact:** [info@iar.com](mailto:info@iar.com) • [sales.us@iar.com](mailto:sales.us@iar.com)

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www.WinSystems.com/PPM-C393-S.cfm

### Extended Temperature Intel® Atom™ PC/104-Plus SBC

WinSystems' PPM-C393, featuring high-integration with PC/104-Plus expansion, provides a flexible and cost-effective solution for demanding embedded applications. This combination provides designers access to the low-power performance of Intel Atom processors and to the thousands of PC/104, PC/104-Plus, and PCI-104 modules available worldwide.

The PPM-C393 is well suited for industrial applications requiring high reliability and long-term product availability in a small, rugged form factor proven in harsh environments. The extended temperature operation and low-power requirements make it an excellent solution for industrial control, security, data acquisition, and communications systems.

It supports Linux, Windows®, and other x86-compatible real-time operating systems.



### FEATURES

- › 1.66GHz N455 Intel® Atom™ CPU
- › Runs Linux, Windows® and other x86 operating systems
- › Up to 2GB of DDR3 SODIMM supported
- › Simultaneous LVDS and CRT video
- › Intel Gigabit Ethernet controller
- › SATA (2.0) channel and CompactFlash supported
- › Four serial COM ports (two RS-232, two RS-232/422/485)
- › Eight USB 2.0 ports with polyfuse protection
- › Watchdog timer adjustable from 1 sec. to 255 min.

WinSystems, Inc. | 817-274-7553

Contact: Info@WinSystems.com

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### Human Interface: Display

industrial-embedded.com/p9915825



**ADLINK**  
TECHNOLOGY INC.

www.adlinktech.com

### ADLINK BFS-15W02 15.6" Smart Touch Computer

The **BFS-15W02 Smart Touch Computer** embeds the low-power Intel® Atom™ processor D2550 with Intel® NM10 Express Chipset and allows fanless operation up to 50°C while also supporting solution longevity. The BFS-15W02 features a Color Active Matrix TFT flat panel display with LED backlight, 1366 x 768/18-bit resolution, 200 nits brightness (without touch screen attached), 400:1 typical contrast ratio, 5-wire resistive anti-glare touch screen, and bezel and chassis made of die-cast aluminum.

Unlike conventional panel PCs, this ultra-slim Smart Touch Computer also provides IP54 protection and outstanding reliability. Sleek full-flat touch screen, chemical resistance, and ease-of-maintenance and cleaning are just a few of its outstanding features. Arm-mount capability and an optional integrated desktop stand enable it fit anywhere – on a working bench, on the wall, on a swing arm – and still stay connected via built-in Wi-Fi or dual Gigabit Ethernet.



### FEATURES

- › Intel® Atom™ processor D2550 with Intel® NM10 Express Chipset
- › 15.6" 16:9 Color Active Matrix TFT flat panel display with LED backlight
- › Easy-to-clean, full-flat touch panel
- › Front panel complies with IP54 standard
- › Low power consumption and fanless design
- › VESA 75 mm/100 mm mounting holes for varied mounting demands
- › VGA output for 2nd monitor

ADLINK Technology | 408-360-0200

Contact: info@adlinktech.com

www.linkedin.com/company/adlink-technology



www.embeddedARM.com

## Industrial Touch Panel Computers

Technologic Systems offers three industrial TPCs (touch panel computers) powered by ARM CPUs with hardware video acceleration. They are ideal for applications requiring a touch screen human interface, such as industrial automation, home automation, self-service machines, and point-of-sale terminals. They offer an excellent value with a full range of features and industry standard connectors. Technologic Systems TPCs are powered by fanless, low power, high performance TS-SOCKET Computer-on-Modules that allow a simple migration path between power efficient and high performance modules.

### TS-TPC-8390: 7-inch 800x480 Open Frame Mount Panel

The TS-TPC-8390 is a panel mount computer that features 2 Ethernet ports, 1 PoE, 4 USB Host ports, 3 RS-232, up to 2 RS-485 ports, up to 2 CAN ports, DIO, I2C, built in speaker, RTC, and 6 channels of 16-bit A/D. Quantity 100 starts at \$415.

### TS-TPC-8380: 7-inch 800x480 Low Cost Fully Enclosed Panel

The TS-TPC-8380 is an ideal HMI solution for Modbus or gateway networks. It includes 1 Modbus RJ45, 2 Ethernet ports, 1 USB, built in speaker, RTC, XBee socket, and support for a Multitech Cellular modem or a built in wireless 802.11BGN adapter. This touch screen computer is fully enclosed in a low cost DIN mountable plastic enclosure. Quantity 100 starts at \$345.

### TS-TPC-8900: 10-inch 800x600 Open Frame Mount Panel

The TS-TPC-8900 is a panel mount computer that features 2 Ethernet ports, 1 PoE, 2 USB ports, 2 RS-232, up to 2 RS-485 ports, an XBee socket, DIO, I2C, built in speaker, and RTC. The TS-TPC-8900 also includes a 64-pin PC/104 bus that can be used to expand the functionality to many of Technologic Systems off-the-shelf PC/104 peripherals. Quantity 100 starts at \$599.

## High Performance ARM Computer-on-Modules

Our TPCs are powered by a selection of ARM COMs:

**TS-4600 – 450MHz ARM9 with 256MB RAM**

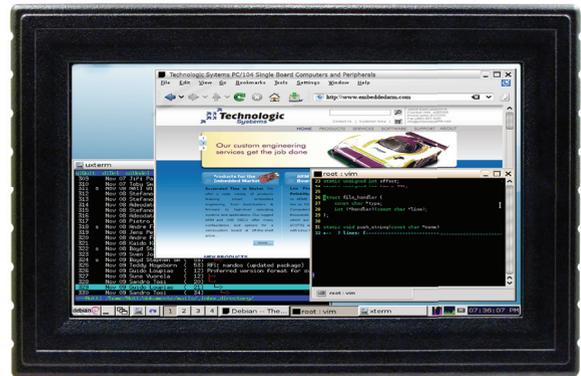
**TS-4700 – 800MHz ARM9 with 256MB RAM**

**TS-4710 – 1066MHz ARM9 with 512MB RAM**

**TS-4712 – Like TS-4710 with 2 Ethernets**

**TS-4800 – 800 MHz Cortex-A8 with 256MB RAM**

pricing starts at **\$389** qty 1 **\$349** qty 100



## FEATURES

- › Resistive touchscreen
- › LED backlit display
- › Gasketed construction
- › Tough powder coated finish
- › Fanless operation from -20 °C to +70 °C
- › ARM CPUs from 450MHz to 1GHz
- › Up to 512MB RAM
- › 256MB SLC XNAND or DoubleStore SD
- › MicroSD slot
- › Programmable FPGA
- › Fast Startup (under 3 seconds)
- › Debian Linux
- › Dual Ethernet
- › USB ports
- › CAN
- › RS-232 ports
- › RS-485
- › Mono speaker on PCB
- › Stereo Audio Output Jack
- › SPI
- › I2C
- › DIO



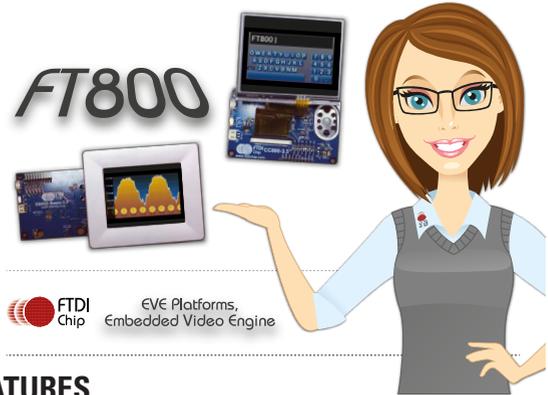
Scan to visit the product page



### FT800, Embedded Video Engine (EVE)

FTDI Chip is redefining the cost and quality paradigm for HMIs with the introduction of the FT800, Embedded Video Engine (EVE). With 3 in 1 functionality including display, audio, and touch operations, engineers now have an advanced solution to easily create and output state-of-the-art interactive display systems.

Twitter: @FTDICHIP



### FEATURES

- > QVGA and WQVGA resolution TFT displays with parallel RGB interface
- > Dithering provides 24-bit (true color) support on an 18-bit interface
- > Inbuilt controller supports 4-wire resistive touch panels
- > PWM output for programmable display brightness
- > Anti-aliasing support improves display perception
- > Low-power – 35mA typical in active mode
- > Widgets (innovation mechanisms) allow easy creation of complex objects
- > Integrated audio output-play beeps, tones or recorded audio
- > Space saving 48-pin QFN package
- > Wide range of low cost development systems and 3rd party support

### FTDI Chip

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Fax: +886-2-8751 9737  
E-Mail (Sales): tw.sales1@ftdichip.com  
E-Mail (Support): tw.support1@ftdichip.com



### SecureF1rst Security Gateway Solution

TeamF1's SecureF1rst Security Gateway Solution is a comprehensive turnkey software package combining a rich set of field-proven, standard components with an array of customizable options to provide OEMs/ODMs the ultimate in product flexibility. It enables OEMs to build fully integrated UTM devices allowing users to carve security zones and manage security policies in a centralized manner. A member of TeamF1's SecureF1rst line of innovative prepackaged solutions, SecureF1rst SGS allows OEMs/ODMs to deliver leading-edge VPN/firewall/IPS/Gateway AV devices to the small-to-medium businesses (SMB) market in record time at far less risk than traditional development approaches. Devices built around SecureF1rst SGS offer end-customers ironclad, advanced networking security; easy-to-use device management features; and multiple gateway options and can also be customized, or "branded" with unique graphical user interfaces (GUIs). With SecureF1rst SGS, OEMs can build gateways between multiple LAN, WAN, and DMZ interfaces – plus any other security zones – of several different types where WAN interfaces can be DSL, 3G/LTE, or Ethernet, among others.



### FEATURES

- > Less risk for OEMs through proven TeamF1 SecureF1rst software components and common framework's comprehensive set of features enabling full customization of devices
- > Extensive support for advanced 802.11 standards for security, QoS, mobility, and roaming
- > Advanced protocols such as IPsec, VPN, SSL (including OpenVPN compatible SSL), etc. provide ironclad networking security features
- > Branding options offer a cost-effective, customized look and feel
- > Advanced device management through SNMPv3, CLI, TR-069, and easy-to-use web interface, etc., with the ability to dynamically extend router functionality through TeamF1 and third-party extensions/plugin-ins

Team F1, Inc. | 510-505-9931

Contact: Sales@TeamF1.com  
LinkedIn: TeamF1



www.annapmicro.com

## 2.0 GSps 10-bit A/D

The **Annapolis Single Channel 2.0 GSps A/D I/O Card** provides one 2.0 GHz A/D input with a resolution of 10 bits. The board has one e2v AT84AS004 that is fed by an onboard analog input circuit, which converts the single-ended 50-ohm SMA input into differential signals for the ADC. There is a universal single-ended 50-ohm SMA clock input and a high-precision trigger input allowing multiple A/D I/O cards to be synchronized together. Synchronization of A/D I/O cards can be facilitated by the Annapolis 4 or 8 Channel Clock Distribution Boards.

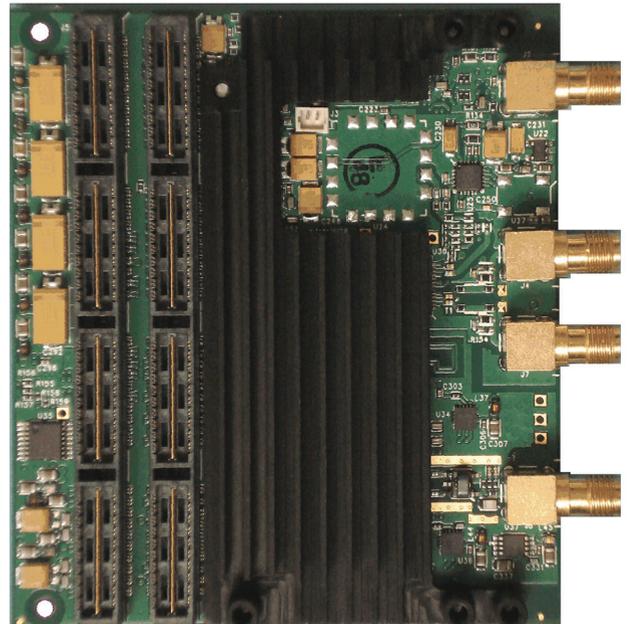
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time continuous sustained processing of the full data stream. Up to two A/D and up to two Serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D and up to one Serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

The combination of our COTS hardware and our CoreFire FPGA Application Development tool allows our customers to make massive improvements in processing speed while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed.



## FEATURES

- › One e2v AT84AS004 (2.0 GHz, 10-bit) A/D
- › Four SMA front panel connectors: one 50-ohm analog input, one single-ended 50-ohm clock input, or differential 1.65 V LVPECL clock input
- › One high-precision trigger input with Fs precision; high-precision trigger input – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- › Analog input bandwidth is 100 KHz-3.0 GHz
- › I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/IBM Blade main boards
- › JTAG, ChipScope, and Serial Port access
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for board-level interfaces
- › Proactive thermal management system
- › Includes one-year hardware warranty, software updates, and customer support
- › We offer training and exceptional special application development support, as well as more conventional customer support
- › **Designed and manufactured in the USA**

**Annapolis Micro Systems, Inc. | 410-841-2514**

**Contact:** wfinfo@annapmicro.com



www.annapmicro.com

## Dual 4.0 GSps DAC

The **Annapolis Micro Systems Dual Channel 4.0 GSps D/A I/O Card** provides one or two 12-bit digital output streams at up to 4.0 GSps. The board has one or two MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps.

The Dual Channel DAC board has five SMA front connectors: two single-ended DAC outputs, a high-precision trigger input with Fs precision, and a universal single- or double-ended 50 ohm clock input. It has excellent gain flatness in the first 3 Nyquist Zones, ultra-low skew and jitter saw-based clock distributions, and main board PCLK sourcing capability.

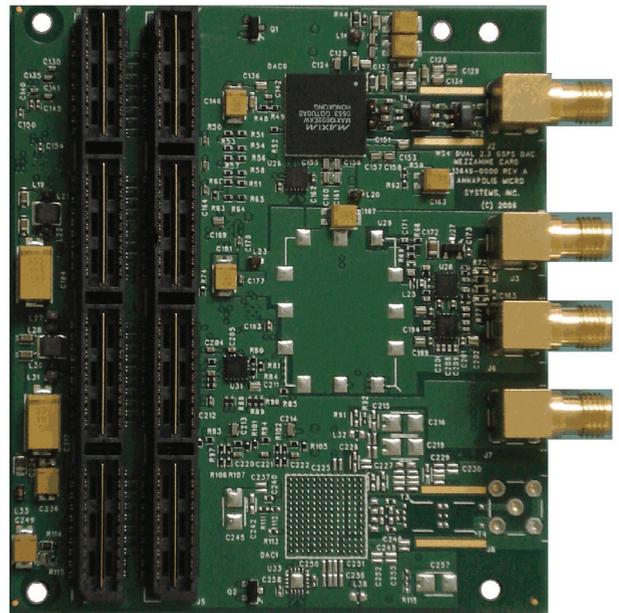
In concert with the WILDSTAR 4 or WILDSTAR 5 FPGA processing main boards, this mezzanine board supplies user-configurable real-time A to D conversion and digital output. Up to two A/D or D/A and up to two serial I/O cards can reside on each WILDSTAR 4 or WILDSTAR 5 VME/VXS or IBM Blade main board, or up to one A/D or D/A and up to one serial I/O card on each PCI-X or PCI Express main board.

Our boards run on many different operating systems. We support our board products with a standardized set of drivers, APIs, and VHDL simulation models. VHDL source is provided for the interfaces to A/Ds, D/As, DRAM/SRAM, LAD bus, I/O bus, and PPC Flash. CoreFire™ users will have the usual CoreFire Board Support Package.

The combination of our COTS hardware and our CoreFire FPGA Application Development tool allows our customers to make massive improvements in processing speed, while achieving significant savings in size, weight, power, person-hours, dollars, and calendar time to deployment.

Annapolis Micro Systems, Inc. is a world leader in high-performance COTS FPGA-based processing for radar, sonar, SIGINT, ELINT, Digital Signal Processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing, and other processing intensive applications.

Annapolis is famous for the high quality of our products and for our unparalleled dedication to ensuring that the customer's applications succeed. We offer training and exceptional special application development support, as well as more conventional customer support.



## FEATURES

- › One or two 12-bit Analog to Digital Converters: MAX 19693 for 4.0 GSps, MAX 19692 for 2.3 GSps, or MAX 5859 for 1.5 GSps
- › Five SMA front panel connectors: two single-ended DAC outputs, one high-precision trigger input with Fs precision
- › One universal single- or double-ended 50 ohm clock input
- › High-precision trigger input manufacturing options – 1.65 V LVPECL, 2.5 V LVPECL, 3.3 V LVPECL
- › I/O card plugs onto WILDSTAR 4 or 5 VME/VXS/PCI-X/PCI Express/IBM Blade main boards
- › JTAG, ChipScope, and Serial Port access
- › Full CoreFire Board Support Package for fast, easy application development
- › VHDL model, including source code for board-level interfaces
- › Proactive thermal management system
- › Industrial temperature range
- › Includes one-year hardware warranty, software updates, and customer support
- › **Designed and manufactured in the USA**

**Annapolis Micro Systems, Inc. | 410-841-2514**

Contact: wfinfo@annapmicro.com

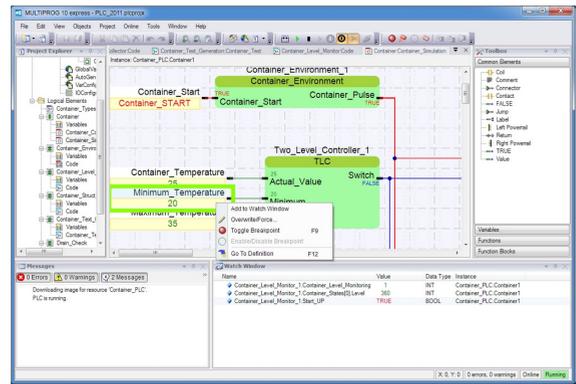


www.kw-software.com/en/iec-61131-control

## IEC 61131 Programming and Runtime Systems

**IEC 61131** is the international standard for PLCs. It standardizes programming languages, sets of instructions and structures for automation systems and enables easy porting and usage on different platforms. These support programmers in developing, testing, and commissioning their application. MULTIPROG takes care of the project management and helps with the management of fieldbuses, networks and peripheral components.

MULTIPROG is based on automation framework. This enables users to create automation tools in a modular way from a large number of components and combine the IEC 61131 programming system with other .NET-based tools at the same level. Automation Framework ensures consistent workflow and data exchange between modules. Embedded Common Language Runtime (eCLR) provides the functionality required to implement a complete IEC 61131 PLC for an embedded platform or standard PC. Our solutions support multitasking in the sub-millisecond range, jitter in the microsecond range, and extremely fast code execution in the sub-millisecond range.



## FEATURES

- › IEC 61131 runtime has real-time capability, high performance, and portability
- › IEC 61131 runtime is hardware and software platform independent
- › IEC 61131 solution provides full PLC functionality
- › Easy to use programming tool for projects of all sizes
- › Modular integrated platform for 61131 controls
- › .NET based IEC 61131 programming system
- › Fast and simple programming with high degree of integration
- › CIL code opens the control for C# programming with Visual Studio

**KW-Software | 734-205-5452**

**Contact:** marketing-usa@kw-software.com

**Twitter:** twitter.com/KWSoftwareUSA • **Facebook:** www.facebook.com/KWSoftwareUSA

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Storage: Storage hardware

industrial-embedded.com/p9911755

# swissbit®

www.swissbit.com

## Swissbit X-500 Series Industrial SATA II 2.5" SSD

The Swissbit X-500 Series Industrial SATA II SSD 2.5" storage solution is designed for demanding applications. The Solid State Drive is a rugged, high performance and extremely reliable storage solution. The data rate reaches up to 240 MB/sec and an impressive 14'500 IOPS with 4 KB random accesses. The high end architecture utilizes up to 8 channels with the most reliable SLC NAND Flash on the market. Special features such as ATA-8, NCQ and TRIM support enable higher IOPS (input/output per second) and sequential performance providing the best combination of performance and reliability for industrial applications. Additionally, the S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) protocol with extended lifetime monitoring tools and software development kit enables the application or designer to have the full control of mission critical data all the time. The BCH-ECC (error correction code) ensures data reliability with the power fail protected X-500 series.



## FEATURES

- › Power Fail Protection
- › High random IOPS & sequential performance
- › SLC NAND Flash for best reliability & durability
- › Ruggedized for "no-compromise" design
- › Self Monitoring Analysis and Reporting Technology (S.M.A.R.T.)
- › Life Time Monitoring Application & Software Development Kit (SDK/API)
- › Controlled BOM & PCN Process

**Swissbit | 914-935-1400 • +41 71 913 03 03**

**Contact:** sales@swissbit.com

# Apacer

Access the best

<http://us.apacer.com>

## SATA 3 Series

SATA interfaced SSDs have been the reliable partners for industrial and embedded computing systems in data cache, storage and system boot. Performance and I/O efficiency play extremely critical roles in industrial and embedded operations. Millions of daily data are processed and the host systems require storage media with even faster performance. Apacer has launched SATA 3 interfaced SSD series to break the performance bottleneck.



## FEATURES

- › SATA 3 (6Gb/s) interface
- › Global wear-leveling and block management
- › Built-in ATA secure erase and S.M.A.R.T. functions
- › TRIM command Support

Apacer Memory America, Inc. | 408-518-8699

Contact: [ssdsales@apacerus.com](mailto:ssdsales@apacerus.com)

## Test & Measurement: AXIe

industrial-embedded.com/p9915871

# ELMA

Your Solution Partner

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## AXIe Products and Systems

*Elma Joins AXIe Consortium to Help Grow Existing Ecosystem  
Elma's powerful development tools will quicken AXIe product time to market*

Elma Electronic Inc. has joined the AXIe Consortium to help promote and develop a robust ecosystem of AXIe products and systems for general purpose instrumentation and automated test equipment.

AXIe is an open system modular instrumentation standard based on AdvancedTCA that delivers high performance instrumentation for aerospace defense, high energy physics, semiconductor test and other industries.

AXIe uses the same PCIe fabric and programming as PXI while enabling horizontal configurations for minimal rack space and vertical layouts for large systems. In addition to easily integrating with PXI, LXI and IVI, AXIe is compatible with AdvancedTCA. It offers high speed trigger, timing and local bus parameters as well as accommodates larger boards for the highest rack and power densities per rack inch.



## FEATURES

- › Elma now offers AXIe products that bring robust management capabilities to AXIe system development.
  - An IPMI (Intelligent Platform Management Interface) shelf manager card offers a redundant IPMB (Intelligent Platform Management Bus) for chassis developers needing power management, cooling control, electronic keying and event sensor logging.
  - For module developers, a new IPMI controller mezzanine card fits a standard AXIe-based module and can quickly deploy the required IPMI functionality, so users can focus on the unique attributes of their designs and provide customers with more value.
  - A line of 19-inch rackmount chassis with AXIe backplanes.

Elma Electronic Inc. | 510-656-3400

Contact: [sales@elma.com](mailto:sales@elma.com)

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# Annapolis Micro Systems

The FPGA Systems Performance Leader

## WILDSTAR OpenVPX Ecosystem

### FPGA Processing Boards

1 to 3

Altera Stratix V or  
Xilinx Virtex 6 or 7  
FPGAs per Slot

### Input/Output Modules

Include:

Quad 130  
MSps  
thru

Quad 550  
MSps A/D

1.5 GSps thru

5.0 GSps A/D

Quad 600  
MSps D/A

Dual 1.5  
GSps  
thru

4.0 GSps D/A

1 to 40 Gbit

Ethernet

SDR to FDR

Infiniband

### Open VPX Storage

Up to 8 TBytes Per Slot

4 - 8 GBytes  
Per Second

GEOINT,  
Ground Stations,  
SDR, Radar,  
Sigint, COMINT,  
ELINT, DSP,  
Network  
Analysis,  
Encryption,  
Image  
Processing,  
Pattern Matching,  
Oil & Gas  
Exploration,  
Financial and  
Genomic  
Algorithms,

### Open VPX Switch

1 to 40 Gbit

Ethernet

SDR to FDR

Infiniband



### Chassis

4, 6 or 12 Slot

Up to 14G



**High Performance Signal and Data Processing  
in Scalable COTS FPGA Computing Fabric**

190 Admiral Cochrane Drive, Suite 130, Annapolis, Maryland USA 21401  
winfo@annapmicro.com USA (410) 841-2514 www.annapmicro.com



## INDUSTRIAL MEMORY SOLUTIONS

NAND FLASH PRODUCTS & DRAM MODULES

### SWISSBIT'S UNIQUE 360° CUSTOMER SERVICE

Swissbit is the largest independent DRAM module and Flash storage manufacturer in Europe. Established through a management buyout of the Siemens AG, Swissbit has more than 20 years of experience in memory technology.

The target markets for the high-end memory solutions are Industrial Electronics, Embedded Computing, Telecommunications & Networking, Aerospace, Defense, Medical, Automotive / Transportation and Infotainment.

Swissbit offers the complete range of DRAM modules starting from EDO to DDR3 technologies as well as NAND Flash modules like 2.5" Solid State Drives (SATA and PATA interfaces), m-SATA SSD (MO-300), slim-SATA SSD (MO-297), CFast, CFC, SD, µSD, MMC and USB. The DRAM memory solutions are available in various application specific form factors (VLP, UDIMM, RDIMM, SODIMM, miniDIMM, SORDIMM and SOCDIMM). All modules can be sealed with Conformal Coating, thus operating reliably 24/7, even in areas with high humidity.

For more information contact your Swissbit representative at [sales@swissbit.com](mailto:sales@swissbit.com)

#### AFTER-SALES

- Responsive Service
- Solution driven
- Failure Analysis (4D & 8D reports)
- Reliability Monitoring
- Legacy support & Longevity programs
- PCN process
- Firmware updates / upgrades

#### PRE-SALES

- Design In Support
- Joint qualification
- Qualification Reports
- Customizing
- Fast Prototyping
- Client specific testing
- Customer specific labeling
- Technology consulting and training
- Validation support (CMTL, USB-IF, JEDEC, SDA etc.)

### 360° Customer Service

#### SALES

- Global Key Account Management
- Worldwide Channel service
- Product Life Cycle Management
- Active sampling process
- Market information
- Worldwide logistics services
- Long Term and Service Contracts

