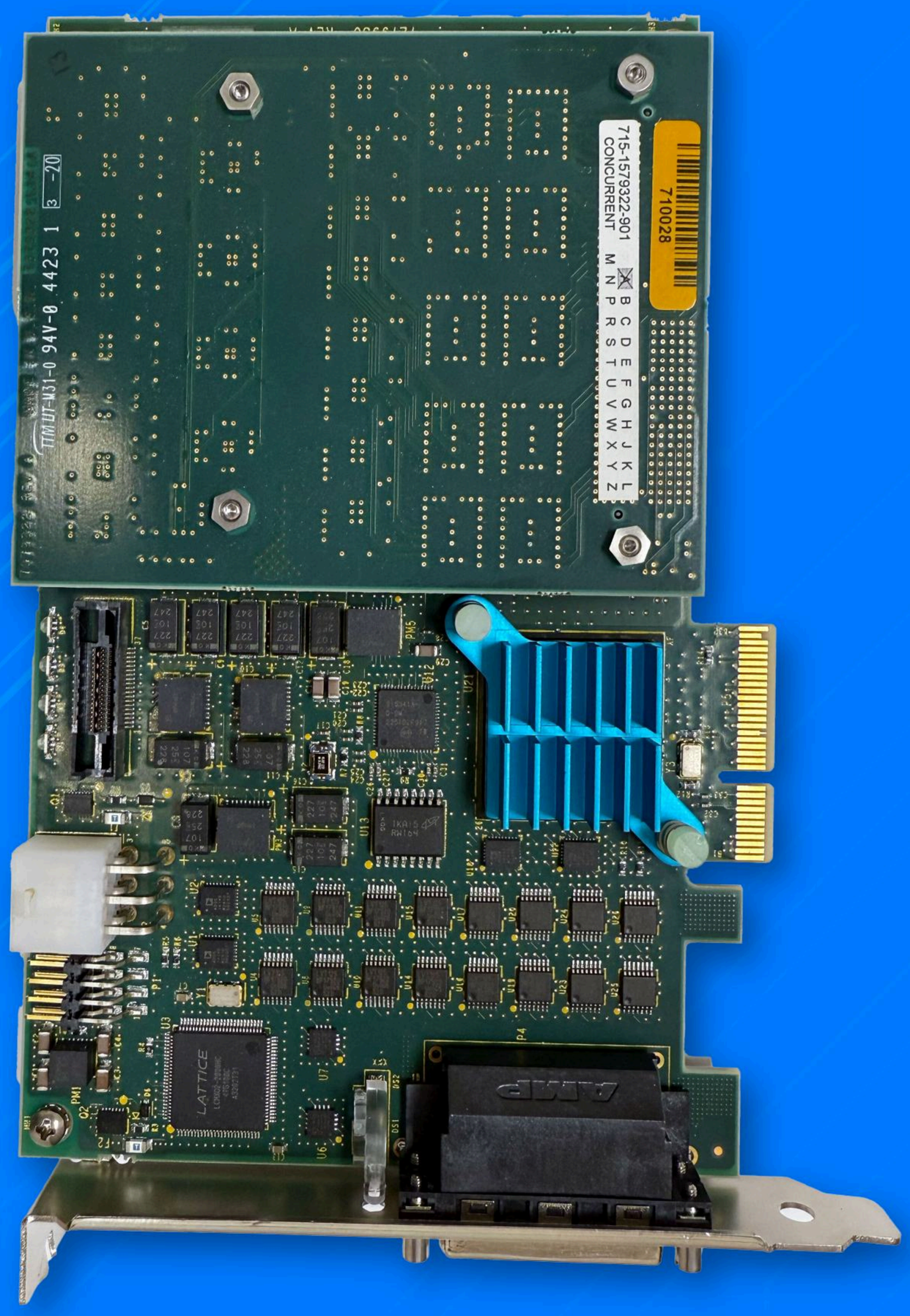
concurrent REAL-TIME

SignalHawk I/O

CP-FPGA-6 Programmable Card

Product Data Sheet



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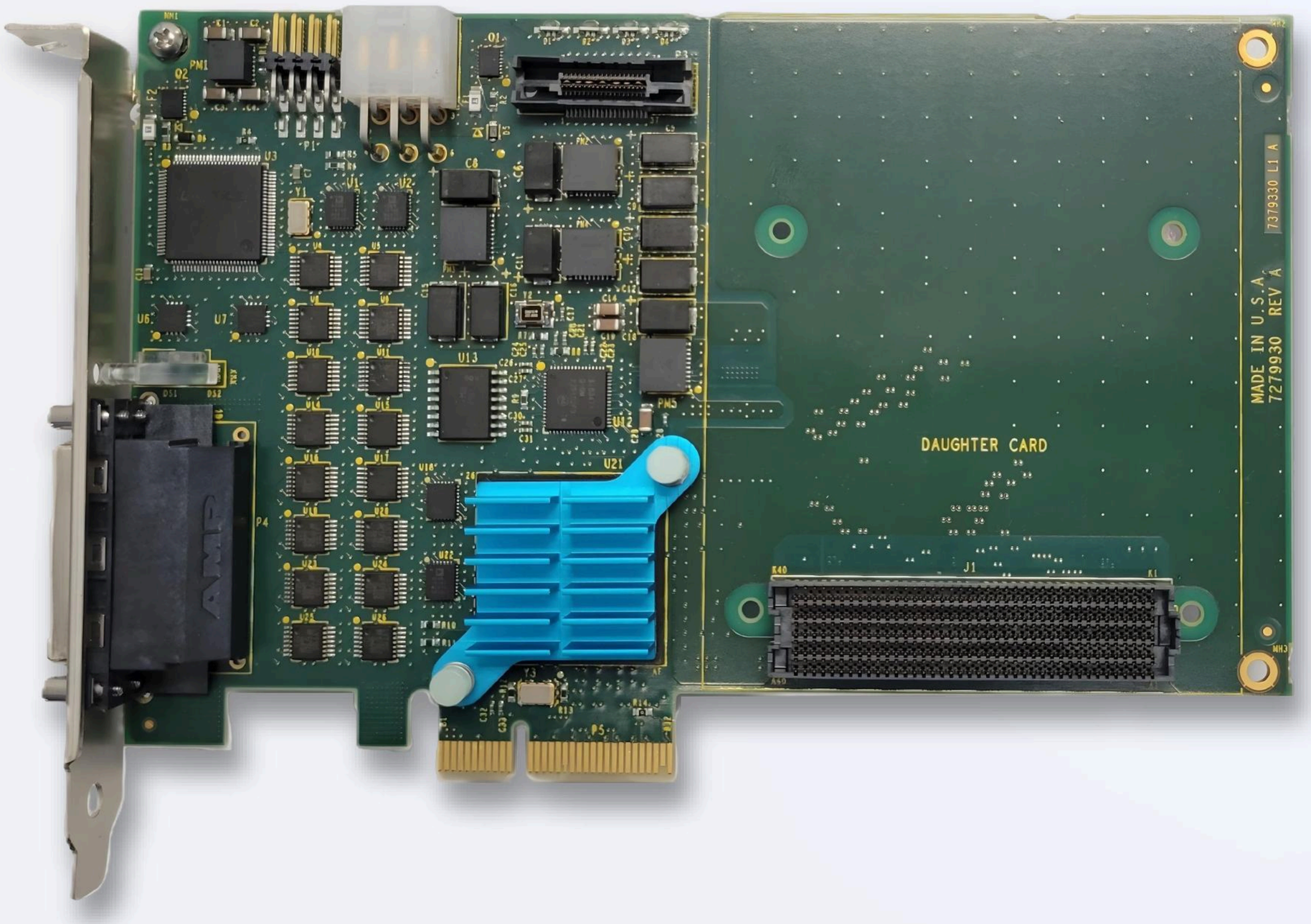

Overview

Concurrent Real-Time's SignalHawk I/O FPGA Card is an entry-level, high-performance programmable I/O solution designed for time-critical applications on Concurrent Real-Time's iHawk™ multiprocessing systems.

Built around the Altera Cyclone V FPGA with 301K logic elements, this card delivers flexible, low-latency digital I/O capabilities for simulation, data acquisition, and industrial control. The SignalHawk I/O FPGA Card integrates seamlessly with Concurrent Real-Time's RedHawk™ Linux real-time operating system, offering deterministic performance and scalability.

With a PCIe Gen 1 x4 interface, high-speed digital I/O, and a daughter card interface, it is ideal for single-system and multi-system real-time applications.

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High-Speed Digital I/O

The SignalHawk I/O FPGA Card features a 32-channel TTL-compatible digital I/O section, designed for robust, low-latency signal processing.
Each channel supports 3.3V or 5V TTL compatible signaling, with a high output source of 32 mA and a low output sink of 64 mA.
The I/O channels are highly configurable, offering per-bit output selection, input snapshot capabilities, and change-of-state sensing for real-time event detection.
Switchable 100-ohm termination ensures signal integrity in high-speed applications.
Output channel synchronization ensures precise timing across all channels, making the card ideal for applications requiring deterministic I/O operations, such as simulation and control systems.

- **Input/Output Configuration:**
  32 channels, individually configurable as input or output
- **Signal Compatibility:**
  3.3V/5V TTL Compatible, with per-bit output selection
- **Termination:**
  Switchable 100-ohm termination for signal integrity
- **Advanced Features:**
  Input snapshot, output synchronization, change-of-state sensing
- **Applications:**
  Real-time simulation, data acquisition, industrial automation

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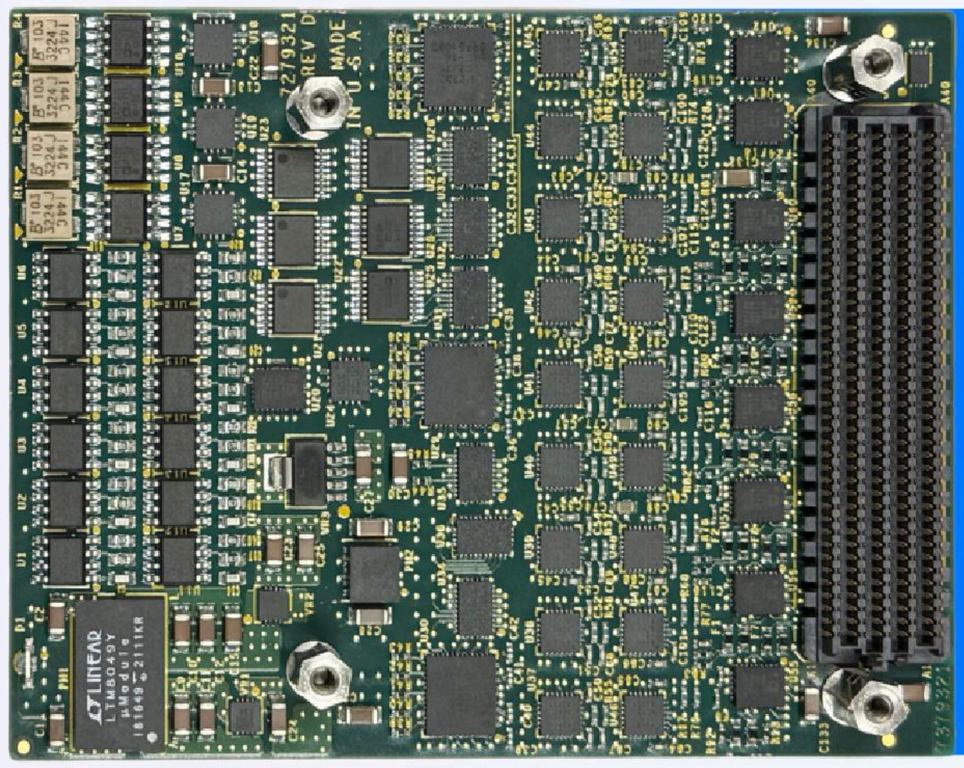
Daughter Card Interface

The SignalHawk I/O FPGA Card includes a single FMC-style daughter card interface (3” x 3.75”), enabling modular expansion for specialized I/O requirements.
The interface supports 1.8V LPC signaling, with HPC signals routed to I/O connectors for high-speed connectivity.

A four-lane DP transceiver provides high-bandwidth communication between the FPGA and daughter card, enabling integration with custom or third-party modules.
This flexibility makes the card adaptable to diverse applications, from signal processing to custom protocol implementation.

- **Form Factor:**
  FMC-style, 3” x 3.75” module
- **Signaling:**
  1.8V LPC, HPC for I/O
- **Transceiver:**
  Four-lane DP for high-speed data transfer
- **Applications:**
  Custom I/O, signal processing, protocol bridging



System Integration

The SignalHawk I/O FPGA Card is designed for seamless integration with Concurrent Real-Time’s iHawk systems.
The PCIe Gen 1 x4 interface ensures high-bandwidth communication, while six MSG DMA engines optimize data transfer efficiency.
The programmable clock generator, paired with a temperature-compensated oscillator (TCXO), provides precise timing for real-time applications.
In-system firmware updates simplify maintenance, ensuring long-term reliability.
The card’s industry-standard SCSI 68-pin connectors facilitate easy integration with existing systems.

- **PCIe Interface:**
  Gen 1 x4, with MSI interrupts for low-latency event handling
- **DMA Engines:**
  Six MSG DMA engines for efficient data movement
- **Clocking:**
  Programmable clock generator with TCXO for high accuracy
- **Firmware:**
  In-system updates for simplified upgrades

Software Support

Concurrent Real-Time's RedHawk Linux real-time operating system fully supports the Signal-Hawk I/O FPGA Card, providing developers with tools to leverage its programmable FPGA and I/O capabilities.
The Altera Cyclone V FPGA is programmed using Concurrent Real-Time's FPGA Workbench, a powerful development environment supporting Verilog and VHDL.
FPGA Workbench streamlines the design, simulation, and deployment of custom logic, optimizing performance for real-time applications.
Concurrent Real-Time's NightStar tools, including NightTrace and NightSim, enable precise event logging and frequency-based scheduling, synchronized with the card's clocking features.
The card's MSI interrupts and DMA engines are optimized for RedHawk's deterministic performance, ensuring low-latency response times.

- **Development Tools:** FPGA Workbench, RedHawk Linux, NightStar suite
- **Programming Languages:** Verilog, VHDL
- **Applications:** Event synchronization, real-time scheduling, performance analysis

Custom Engineering Support

Concurrent Real-Time's Special Systems group offers tailored solutions for customers requiring unique features or integration.
From custom daughter card designs to specialized firmware, Concurrent Real-Time engineers can deliver hardware and software solutions to meet exact specifications, ensuring compatibility with iHawk systems and third-party components.

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Specifications

FPGA

Type:	Altera Cyclone V
Logic Elements:	301K
Programming:	FPGA Workbench (Verilog/VHDL)

Digital I/O

Channels:	32 TTL-compatible
Signal Levels:	3.3V/5V
Output Source:	32 mA (high)
Output Sink:	64 mA (low)
Termination:	Switchable 100 ohm
Features:	Per-bit output selection, input snapshot, change-of-state sensing, output synchronization

Daughter Card Interface

Form Factor:	FMC-style (3” x 3.75”)
Signaling:	1.8V LPC, HPC for I/O
Transceiver:	Four-lane DP

System Interface

Bus:	PCIe Gen 1 x4
Interrupts:	MSI
DMA Engines:	Six MSG DMA
Connectors:	High-density SCSI 68-pin

Clocking

Type:	Programmable clock generator
Oscillator:	Temperature-compensated (TCXO)
Accuracy:	±2.5 PPM

Packaging

Form Factor: Half-length PCIe
Performance: PCIe x4
Maximum Cable Length: 100 ft. (SCSI connectors)

Environmental

Operating Temp: 10°C to 55°C
Storage Temp: -40°C to 70°C
Relative Humidity: 10 to 90% (non-condensing)
RoHS Compliant

Firmware

Updates: In-system programmable