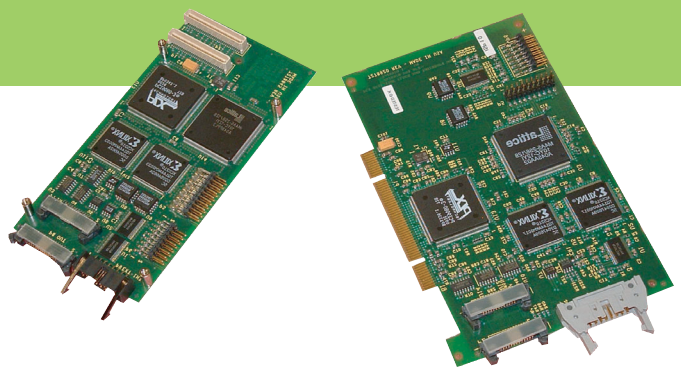
Real-Time Clock & Interrupt Module

Features

- Deterministic event synchronization among multiple CPUs and systems
- A synchronized clock readable by all application tasks
- Four interrupt-generating real-time clocks
- Edge-triggered external interrupt lines
  - Four input
  - Four output
- Inter-CPU interrupts generated by real-time clocks or software
- Standard PCI and PCI mezzanine card (PMC)
- Complete system software support
  - PowerMAX™ OS
  - RedHawk™ Linux®
  - NightStar™ tools
- Custom-engineered solutions



Overview

Concurrent's Real-Time Clock & Interrupt Module (RCIM) is a multifunction PMC and PCI card designed for time-critical applications that require rapid response to external events. Ideally suited for simulation, data acquisition and industrial control solutions, the RCIM includes a synchronized clock, four programmable real-time clocks, and four input and four output external interrupt lines. The RCIM mounts in a standard Concurrent Power Hawk™ PMC slot or an iHawk™ PCI slot. The RCIM is fully supported by Concurrent's PowerMAX real-time UNIX®-based operating system and RedHawk™ Linux® real-time operating system.

Processor Synchronization

The RCIM can provide fully deterministic event synchronization in multiple CPU applications, such as two or more networked iHawks or a closely-coupled Power Hawk system. The synchronized clock on each RCIM can be initialized by a designated master to ensure that all processes running on all CPUs can operate using a common time base. The RCIM is also very effective in single system applications where multiple external interrupts and clock support are needed.

With the RCIM, applications can direct both external and clock interrupts to other systems for fast inter-CPU event notification. Up to sixteen CPU boards or systems, in the same or different chassis, can be linked by the RCIM's synchronization cable. RCIM interrupts can be triggered by both hardware events and by user software.

Synchronized Clock

The RCIM's synchronized clock is a 64-bit, non-interrupting, free-running counter that uses the POSIX® 1003.1 format. The synchronized clock's high-order 32 bits are encoded in seconds, and the low-order 32 bits are encoded in nanoseconds. The clock ticks at 400 nanoseconds. Upon initialization of a system, a designated master RCIM clears the synchronized clock on all RCIMs and issues an enable signal that simultaneously starts each clock. Application programs on all CPUs are then able to read a common time value. Individual RCIMs can be programmed to ignore the master synchronization signal and use their own synchronized clocks independently.

Real-Time Clocks

The RCIM includes four independent, programmable, 32-bit real-time clocks, each with a minimum resolution of one microsecond. Unlike the synchronized clock, the real-time clocks cannot be synchronized among multiple RCIMs, however each clock is capable of sending an interrupt to other RCIMs as well as generating a local interrupt. This feature can be used to provide synchronized cyclic interrupts for frequency-based applications such as simulators and hardware-in-the-loop systems.

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Real-Time... Real Benefits

External Interrupts

Each RCIM includes four external edge-triggered interrupt inputs and four external interrupt outputs. Input interrupts are triggered by external, user-supplied sources. Output interrupts can be triggered by the RCIM's real-time clocks or by software. All interrupt lines have individual enable/disable, edge/level select, polarity select and arm/disarm controls.

Distributed Interrupts

Distributed interrupts are interrupt signals sent from one RCIM to another via the RCIM synchronization cable. Each RCIM has eight distributed interrupt inputs and eight distributed interrupt outputs. Distributed interrupts can be generated by an RCIM's real-time clocks, by its external edge-triggered input lines or by software. The latter feature allows an external event received by one CPU to be sent to one or more other CPUs.

Connectors and Cabling

The RCIM includes a Synchronization Cable for daisy-chaining a master RCIM to one or more slave RCIMs. A connector is mounted on each RCIM for connection to external interrupts. Customized connectors are configurable upon request.

Software Support

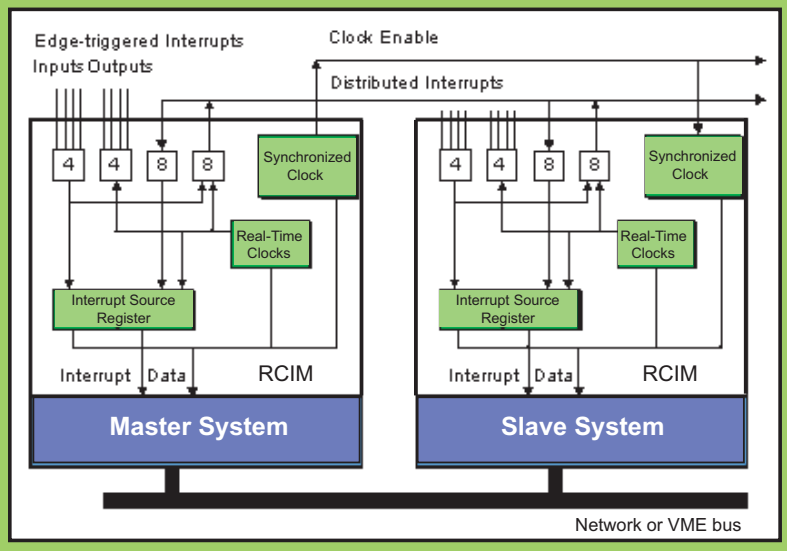
Concurrent's PowerMAX OS and RedHawk Linux allows application developers to take full advantage of RCIM features. Users can read the synchronized clock, disable and enable individual interrupt lines, send interrupts to external locations, and direct incoming interrupts to user-specified application code.

Concurrent's NightTrace™ analyzer tool utilizes the RCIM's synchronized clock to log system events using a single clock source. Concurrent's NightSim™ application scheduler can also make use of RCIM real-time clock interrupts to synchronize frequency-based scheduling among application modules running on multiple CPU boards and systems.

Custom Engineering From Concurrent

Concurrent's Professional Services group is available to design and deliver solutions for customers who require complete competitive solutions for demanding mission-critical applications. Concurrent engineers can develop special packaging including ruggedized and conduction-cooled enclosures, integrate third-party I/O cards, develop drivers, and provide hardware and software designed to exact customer specifications.

Processor Synchronization



Specifications

Synchronized Clock
- Length
  - 64 bits (two 32-bit words)
- Resolution
  - High-order 32 bits - 1 second
  - Low-order 32 bits - 400 nanoseconds

Real-Time Clocks
- Number - 4
- Length - 32 bits
- Resolution - 1 microsecond (programmable to larger values)

Local Interrupts
- 4 External Edge-Triggered input
- 4 External output

Distributed Interrupts
- 8 Input
- 8 Output

Interrupt Response Time
- Interrupt to user process < 8 microseconds

Packaging
- IEEE P1386.1 PMC or full-height short PCI form factor
- Maximum cable length - 16 ft.
- External Connectors - 16 position 0.1" Latching Header

Environmental
- Operating temperature: 10˚ C to 40˚ C (50˚ F to 104˚ F)
- Storage temperature: -40˚ C to 65˚ C (-40˚ F to 149˚ F)
- Relative humidity: 10% to 80%, non-condensing

Power Consumption
- ~ 5 watts

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