

Resistance Temperature Detector Input Module (RIM)

Fully Qualified Safety-Related Digital Platform

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About

Curtiss-Wright Nuclear has partnered with Radics, LLC to supply integrated FPGA-based instrumentation and control (I&C) systems for nuclear power plants and research reactors. RadICS is a digital I&C platform that is robust, flexible, and scalable. It provides state-of-the-art functions, services, and safeguards for safety applications in the nuclear industry. The RadICS product line consists of a Logic Module, basic input/output modules, and specialty modules all housed in a seismically qualified chassis.

The Resistance Temperature Detector (RTD) Input Module serves as a high density analog RTD sensor acquisition module. It provides 8 independent, highly reliable, and galvanically isolated inputs with built-in filtering, calibration and analog to digital conversion to be used by the Logic Module. The RTD Inputs Module also performs robust and continuous self-diagnostics to ensure the safety and integrity of each input and module function.

Resistance Temperature Detector Input Module (RIM)

- High density 8 channel analog RTD inputs with built-in hardware redundancy and self-diagnostics for highly reliable operation, filtering, calibration, and random hardware failure detection.
- Independent FPGA for analog input processing, self-diagnostics, and fail-safe functional behavior.
- Robust self-diagnostics ensure high reliability and early fault detection with safety-focused fault management.
- Segregation of input processing, self-diagnostics, and watchdog functions assure safety-critical functionality.
- Galvanic isolation for signal inputs with robust and dedicated communication links to Logic Module for secure data transfer.
- Inherent on-board diversity features eliminate common cause failure vulnerabilities.
- FPGA technology ensures resilience to I&C obsolescence.
- Support for 2, 3 and 4 wire configurations.
- Support for 100 Ohm, 200 Ohm and other input sensors.



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Resistance Temperature Detector Input Module Technical Specifications

Function	Specifications
Input Analog Signal Range	2 Ohms - 1500 Ohms (0-1600 Ohms over-range monitoring capabilities) 4 signal sub-ranges: 2 Ohms - 198 Ohms; 2 Ohms - 398 Ohms; 2 Ohms - 795 Ohms; 2 Ohms - 1500 Ohms
Supported Sensor Types	2-, 3- and 4-wire bridge extension installations supported Raw resistance (Ohms) measurement (to support any specific sensor type with external conversion into temperature performed in Logic Module) 5 pre-defined RTD sensor types support with adjustable R0 (up to 350 Ohms) and Temperature engineering units conversion performed by RIM prior to transfer to Logic Module Commonly supported RTD types: - Platinum ($\alpha=0.00385$ per °C) ($\alpha=0.00391$ per °C) - Copper ($\alpha=0.00428$ per °C) ($\alpha=0.00426$ per °C) - Nickel ($\alpha=0.00617$ per °C) ($\alpha=0.00618$ per °C) Supported RTD Conversions: - 200 Ohm Platinum - 100 Ohm Platinum - 120 Ohm Nickel - 100 Ohm Nickel - 10 Ohm Copper
A/D Conversion Resolution	18 bits / 400 kilo samples per second (kSPS)
Common Mode Rejection Ratio	> 86 dB
Overall Accuracy	0.1% of full scale (@ 25 °C)
Input Channel Isolation	All input channels are galvanic-isolated up to 250 V _{RMS} AC or 250 VDC field-to-Chassis and channel-to-channel
Overvoltage Protection	±60 VAC/VDC continuous (using external protection elements installed in Chassis)
Information Package Exchange Cycle	5 milliseconds
Diagnostic Data Exchange Cycle	5 milliseconds
LVDS Line Speed	100 megabit/second
LVDS Line Protocol	Proprietary protocol with integrity checking (CRC), galvanic-isolated Tx / Rx
Self-Diagnostic Functions	Diverse watchdog unit, checksum analysis, active diagnostics with internal fault detection, hardware error detection, functionally diverse continuous self-diagnostic tests, power supply fault detection
Power Supply / Consumption	2 independent inputs – 24 (18 – 36) VDC / 0.85 amp (± 0.15 amp)
Indications	2 status LED indicators (RUN/FAULT) 4-character dot matrix symbol-indicator for providing current operational mode, service information, and error codes
Operating Temperature	4.4 to 60 °C (40 to 140 °F)
Operating Humidity	10 to 90% relative humidity, non-condensing

CONTACT INFORMATION:

1350 Whitewater Dr., Idaho Falls, ID 83402 USA
Tel: +1.208.497.3535 | DSS-Sales@curtisswright.com