

# Thermocouple Input Module (TIM)

Fully Qualified Safety-Related Digital Platform

**CURTISS -  
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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 Thermocouple Input Module serves as a high-density analog thermocouple sensor acquisition module. It provides 32 independent, highly reliable, and galvanically isolated inputs with built-in filtering, calibration, and analog to digital conversion for use by the Logic Module. The Thermocouple Input Module also performs robust and continuous self-diagnostics to ensure the safety and integrity of each input and module function.

## Thermocouple Input Module (TIM)

- High density 32 channel analog inputs with built-in hardware redundancy and self-diagnostics for highly reliable operation, filtering, calibration, and random hardware failure detection.
- Independent FPGA for data communication, self-diagnostics, and fail-safe functional behavior.
- Robust self-diagnostics give early fault detection for safety-focused fault management.
- Segregation of communications processing, self-diagnostics, and watchdog functions assures safety critical functionality.
- Galvanic isolation for external communication lines 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 Type B, E, J, K, N, R, S, T thermocouples, with thermocouples being independently selectable per channel.



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## Thermocouple Input Module Technical Specifications

Function	Specifications
Supported Sensor Types	Type B, E, J, K, N, R, S, T with internal conversion mV→t °C Also supports raw millivolts (mV) acquisition (to support any other sensor type with external conversion into temperature performed in Logic Module)
A/D Conversion Resolution	19 bits delta-sigma analog-to-digital conversion
Response Time	300 milliseconds
Common Mode Rejection Ratio	> 86 dB
Overall Accuracy	Type B: 0.15% of full scale (@ 25 °C) Type R, S, T: 0.1% of full scale (@ 25 °C) Others - 0.04% of full scale (@ 25 °C)
Input Channel Isolation	All input channels are galvanic-isolated up to 250 V <sub>RMS</sub> 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 Package 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 / Maximum consumption: 0.4A (±0.15A) (32 inputs used in -35 +100mV mode; 100mV at each input)
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

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