

Digital Safety System

Fully Qualified Safety-Related Digital Platform



NRC-Approved Digital Safety System

RadICS Modular SIL-3 Platform

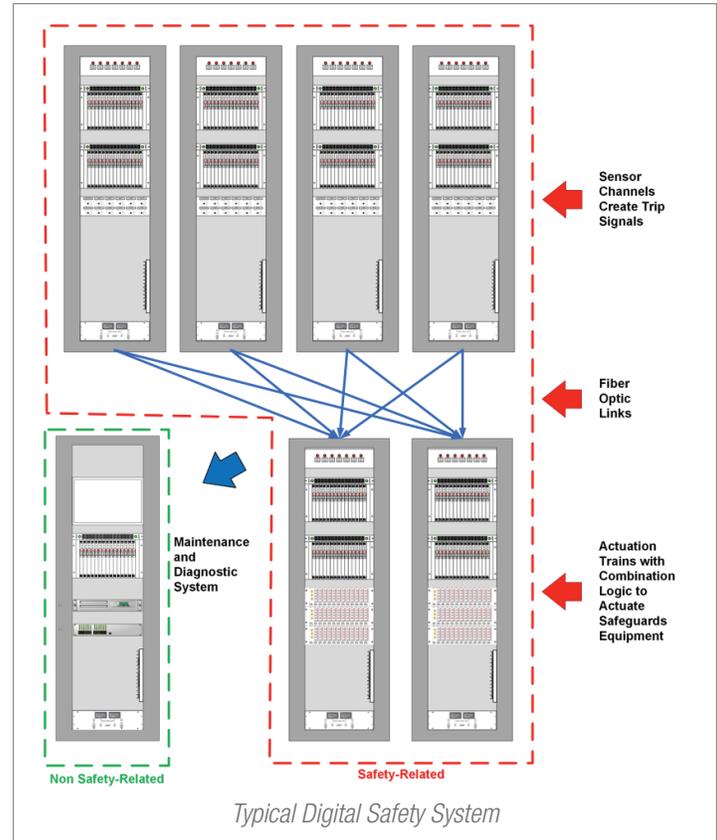
The core of the Curtiss-Wright Digital Safety System (DSS) is the NRC-approved RadICS platform. This modular SIL-3 platform is the foundation of the DSS that meets individual plant needs, as well as fulfilling all NRC requirements. The Field Programmable Gate Array (FPGA)-based architecture supports effective implementation of key nuclear safety design principles: redundancy; independence; predictability and repeatability; diversity and defense-in-depth.

Typically, a DSS consists of multiple Sensor Channels that monitor plant status using analog and digital input modules and a logic module to perform the functions formerly done in legacy analog modules. The RadICS chassis in the Sensor Channels communicate via unidirectional fiber optic communication links to RadICS chassis in Actuation Trains that trip the reactor and actuate safeguards equipment. Analog and digital output modules provide isolated signals for display, annunciation to the operators and other safety or non-safety systems.

FPGA AND CPLD TECHNOLOGY

RadICS uses both FPGA and Complex Programmable Logic Device (CPLD) technology to implement a functionally and technologically diverse platform that is immune to both cyber infiltration and common cause failure issues. The technology is proven in over 100 nuclear power safety and control applications worldwide and has achieved IEC 61508:2010 SIL 3 certification in a single chassis configuration. It is modular, scalable, and flexible to adapt to any system requirement large or small, simple or complex. The state-of-the-art FPGA design provides response times under 20 milliseconds.

The RadICS platform is housed in a single 6U 19" standard rack which contains the Logic module; redundant power supplies and up to 14 other modules; analog and digital input and output modules; and fiber communication modules. Adding cabinets, displays, power supplies, and other supporting hardware results in a fully functional Digital Safety System. The complete DSS solution is accomplished with a handful of standard I/O modules and a single programmable Logic module to execute the safety functions.



NRC SER approval was received in July 2019. The simple modular configuration, approved functional and technology diverse design, fully deterministic structure and immunity to cyber and common cause failure issues ensures that DSSs based on the RadICS platform will have a short, manageable and risk free licensing process.

System setpoints can be securely adjusted using the included tuning interface. The system footprint is typically one-half to two-thirds that of the current installation requirements. The modular nature of the platform means that a DSS can be installed in existing cabinets quickly and easily. Adapter cables and other installation support devices simplify and reduce installation costs, while the tuning interface reduces post-installation test time.

CHASSIS

The RadICS chassis is the common building block that is used for all safety configurations. Multiple chassis can be used to extend the input and output capacity by fiber optic connections between RadICS chassis, forming multi-chassis configurations of Sensor Channel or Actuation Channels.

The protection systems - Reactor Protection System (RPS) / Reactor Trip System (RTS) and the Engineered Safety Features Actuation System (ESFAS) - are the most critical safety systems in nuclear power plants. With an installed base of over 30 RPS/RTS and over 18 ESFAS systems, the RadICS platform has repeatedly demonstrated effective design processes,

quality manufacturing, secure software development, and successful system testing of these critical systems.

RPS/RTS systems are typically single level logic architecture configurations that continuously monitor various process variables and generate required reactor shutdown signals. The RadICS platform technology can be used for 3 or 4 redundant channel systems using 2oo3 or 2oo4 voting logic.

ESFAS systems are typically multi-leveled logic architectures that continuously monitor various process variables and generate required safety actuation signals. ESFAS applications combine protection functions with interlocks, as well as, allowing for manual system or component level control of actuators.

The flexibility and expandability of the RadICS platform allows for any size RPS/RTS or ESFAS system with any number of inputs. Further, the RadICS platform technology can be used to combine RPS/RTS and ESFAS functionality into a single integrated Digital Safety System, reducing maintenance, testing, and supply chain cost.

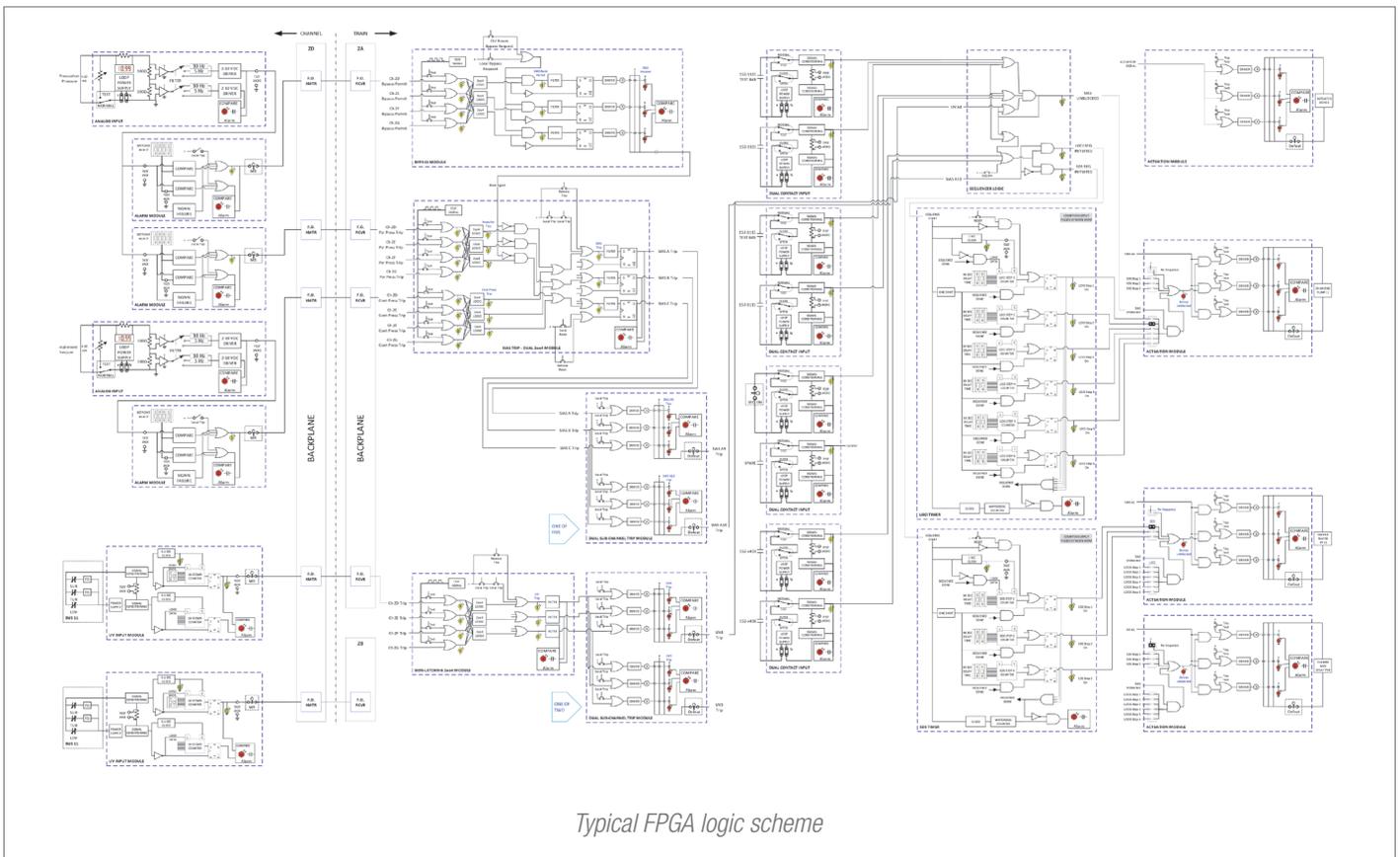
RadICS platform technology has also been used for systems that include manual actuation of shutdown logic from the Main Control Room or Remote Shutdown Station, and can easily be configured to perform equivalent functions in all the major reactor types (e.g., PWR, BWR, CANDUs, and SMRs). Replacing other I&C safety systems, such as Reactor

Vessel Level Instrumentation, Inadequate Core Cooling Monitoring, ATWS Mitigation, and Post Accident Monitoring are well within the RadICS platform capabilities.

DIAGNOSTIC SUBSYSTEM

The RadICS platform includes a self-diagnostic subsystem that provides troubleshooting assistance. It allows easy localization of faults with hot swap technology for ease of online repair. In case of critical failure detection (i.e., failure in a RadICS module), a system designed with RadICS platform technology can put the failed sub-system in a plant defined safe state and initiate appropriate Annunciation signals and maintenance alerts. Maintenance and operational bypasses can be built in to facilitate surveillance and maintenance functions.

The diagnostic subsystem displays, in real time, the system health status and can immediately direct maintenance personnel to any questionable platform component which will be replaced online without interruption of the DSS operation. Dynamic, real time, online monitoring can reduce Technical Specification requirements for surveillance testing, reducing costs and Delivering the Nuclear Promise. RadICS systems can be designed to detect and compensate for equipment failures, leading directly to increased system availability and system optimization without compromising safety.



Typical FPGA logic scheme

About Our Teaming Partner

Radics, LLC, an international nuclear engineering company, develops and supplies advanced customized instrument and Control solutions based on the innovative, highly-reliable SIL 3 and Nuclear Regulatory Commission approved RadICS FPGA platform. RadICS applications developed under NQA-1 compliant Quality Assurance Program can be used for digital safety and control systems for NPPs and other process industries with high level of safety requirements during modernization and new build projects.

Curtiss-Wright is the U.S. provider for RadICS-based digital instrumentation, including diverse (CCF free), cyber secure (FPGA & CPLD technology) Digital Safety Systems that are locally sourced and configured, and 100% compliant with current regulations defining safe and secure deterministic plant operation.

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