

Safety Control Solutions

The NuPAC Reactor Protection System provides safety-critical instrumentation and control applications – offering numerous nuclear power plant solutions.

The NuPAC (Nuclear Protection and Control) Reactor Protection System is implemented in Field Programmable Gate Arrays (FPGA) versus a microcontroller or microprocessor running software. The NuPAC system offers a unique design and simple configuration of inputs, outputs, communications and computations all residing on the same circuit card.

Simplicity at its Best. A platform of circuitry and infrastructure are configured into a card rack and backplane subsystem where several subsystems occupy a single cabinet. Depending on the application, a channel, division, or train of equipment may reside in a single cabinet—ideal for retrofitting existing facilities. Channels, divisions and trains may also be distributed across numerous cabinets, either in the same room, or isolated rooms complying with redundancy and diversity requirements, based on the RS485 communications capabilities of the architecture. Most importantly, the NuPAC system architecture offers detection and indication when and where a failure may occur in the system.

Protection & Safety When It Counts. The NuPAC system protects nuclear power plants by monitoring, calculating and actuating protective elements to ensure safety measures are operational when it counts.

Ensuring Logic and Safety. When integrated to form a protective system, one or more NuPAC system components monitor the status of the nuclear facility through signals received from peripheral input devices or sensors. The NuPAC system performs computations (in an assigned manner) in response to input signals, that generate appropriate output commands and actuates peripheral protective elements, protecting the nuclear facility.

NuPAC system components can be assembled in separate divisions with voting logic for specific plant safety requirements to implement plant systems such as:

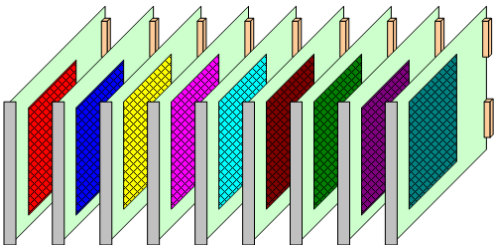
- Reactor trip systems
- Engineered safety features systems
- Safe shutdown systems
- Information systems important to safety
- Interlock systems important to safety
- Control systems
- Diverse instrumentation and control systems
- Data communication systems.



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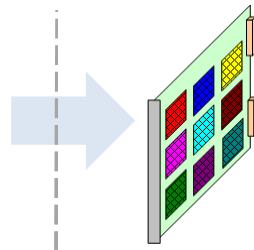
Traditional Programmable Logic Controller

Microprocessor and Software

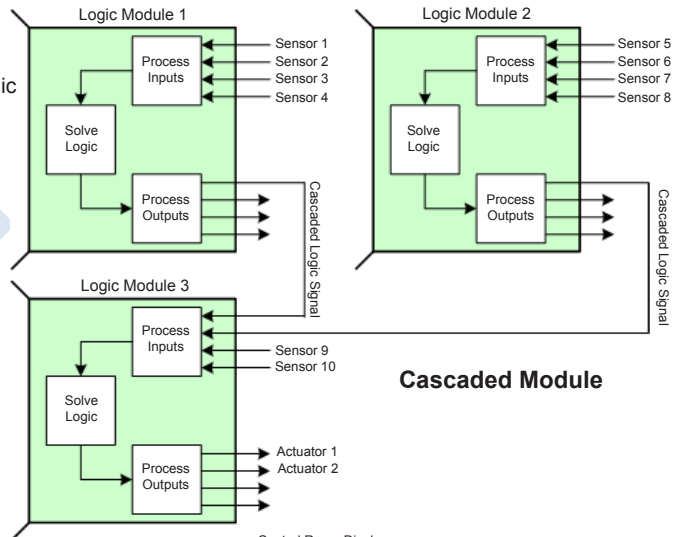


NuPAC System Module

FPGA and Programmable test box logic

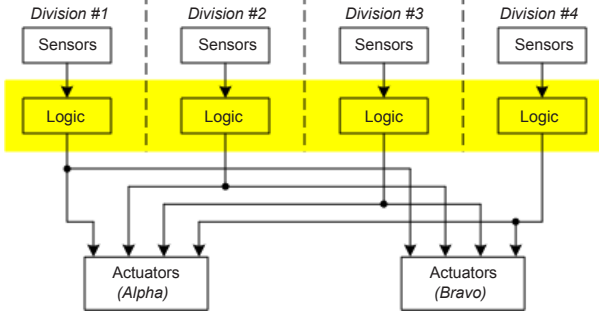


Functionality:	
Red	Controller
Blue	Analog Input
Yellow	RTD
Pink	Thermocouple
Cyan	Digital Input
Brown	Analog Output
Green	Digital Output
Purple	Relay
Dark Green	Serial Comm

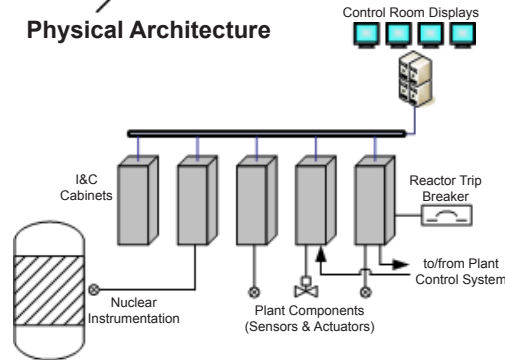


IMPLEMENTATION

Functional Architecture



Physical Architecture



Lockheed Martin NuPAC System Solution

Integrates all the functionality of a PLC on a single module

- User configurable I/O supports all standard types
- Provides an on-board FPGA-based logic solving capability

Provides scalability to cascade NuPAC system modules

- Supports eight different functional modules
- Supports partial system upgrades/retrofits and new construction

Maintains the design as SIMPLE as possible

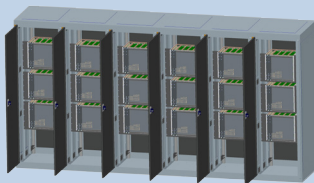
- Reduces system size, infrastructure and associated complexity
- Alternative to highly-integrated systems currently deployed

Supports functional partitioning

- Facilitates DIVERSITY, VERIFIABILITY and LICENSABILITY

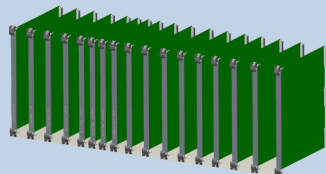
Benefits

- Digital technologies enhance safety, reliability and efficiency
- Designed, qualified and produced under a 10 CFR 50 Appendix B Quality Assurance Program
- Modular design for new and retrofit applications
- Significantly less complex than general purpose platforms (e.g. PLCs)
- Mitigates or even bypasses software common-cause failure
- Supports system diversity



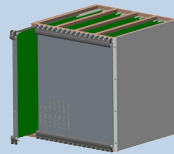
Cabinet Suite

Cabinets, Power Supplies, Media Converters, Cables, Component Interfaces Circuits



NuPAC Control System Platform

- Chassis Assemblies
- Logic Modules
- Programmable Logic
- I/O Cabling/Termination



- 21-slot 9U Chassis
- 16 General Purpose Slots
- Dual Redundant Communication Slots
- Mesh/Star Point-to-Point Serial Data Bus (Backplane)



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