Westinghouse Advanced Rod Control Hybrid (W-ARCH)

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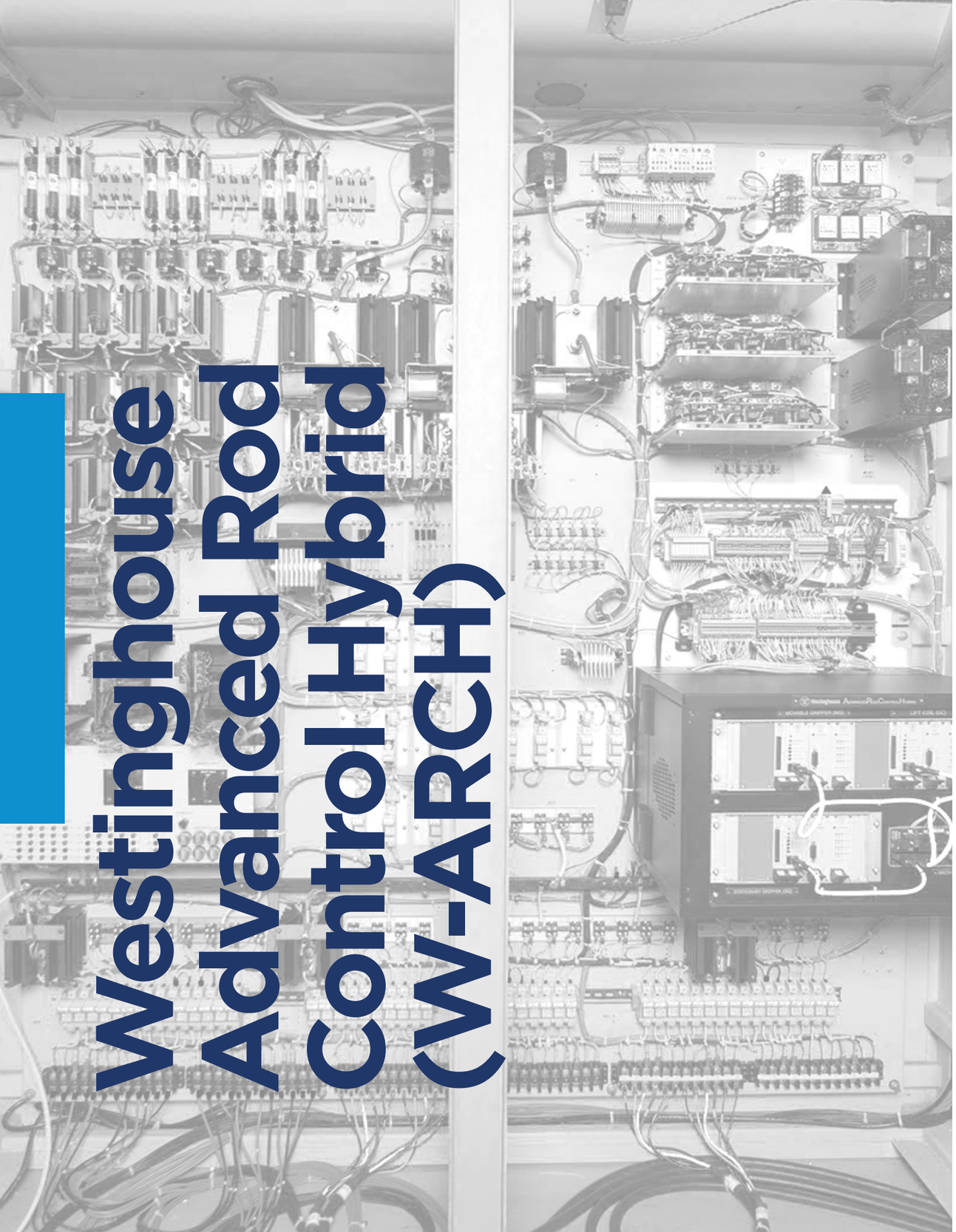

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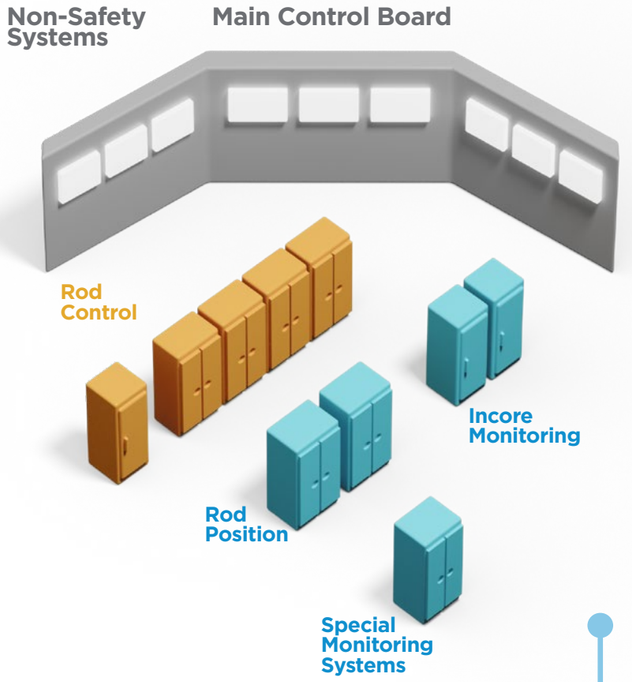
Background

The Westinghouse Advanced Rod Control Hybrid (W-ARCH) was developed to address obsolescence and maintenance challenges with legacy analog rod control systems in nuclear plants. W-ARCH provides a drop-in digital upgrade for existing Solid State Rod Control Systems (SSRCS), leveraging proven digital features while maintaining existing power electronics, and can be implemented as part of a plant's digital I&C modernization process. The upgrade aligns with NRC regulatory guidance for digital I&C systems, ensuring compliance with applicable standards and a streamlined path to enhanced reliability and diagnostics.



The Westinghouse Advanced Rod Control Hybrid (W-ARCH) introduces **True Double Hold** technology, **eliminating all single point vulnerabilities (SPVs)** in rod control operations. The system features hot-swappable industrial-grade cards, allowing rapid replacement and minimizing downtime in the event of a failure. W-ARCH also removes legacy hardware such as phase shift networks, mercury wetted relays, and DC hold cabinets, streamlining maintenance and improving reliability. This robust architecture ensures enhanced safety, operational efficiency, and future-proofing for nuclear plant rod control systems.

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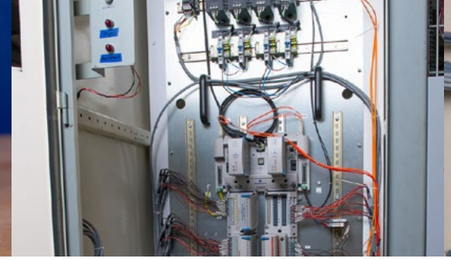

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Drop-in Solution retaining existing cabinet structures and field wiring installed in a normal refueling outage

Benefits

- Eliminates all single point vulnerabilities (SPVs) in rod control, dramatically reducing risk of dropped, slipped, or misaligned rods.
- “True Double Hold” technology ensures independent holding capability for each rod group of Movable and Stationary grippers.
- Redundant phase transformer circuits and control power supplies guarantee continuous operation.
- Replacement of legacy logic cabinet circuitry with Ovation™ redundant controllers and I/O eliminates SPVs in control logic and enables hot-swappable modules.
- Reduces annual surveillance and maintenance costs.
  - > 6hrs of critical path time
  - > 10hrs of non-critical path time
- Removes legacy hardware, simplifies architecture, and reduces spare parts inventory.
- Enhanced diagnostics and real-time coil current monitoring streamline troubleshooting and minimize downtime.
- Supports online repairs and rapid recovery, further reducing outage durations and maintenance costs.
- Improves reliability, safety, and regulatory compliance.

Cost Savings & Operational Efficiency:

- By eliminating SPVs, W-ARCH reduces the need for frequent surveillances and preventative maintenance inspections required by the legacy SSRCS. This can result in significant labor and outage cost savings.
- The upgrade removes legacy hardware such as phase shift networks, DC hold cabinets, and mercury wetted relays, simplifying system architecture and reducing spare parts inventory.
- Enhanced diagnostics and real-time coil current monitoring streamline troubleshooting, minimizing downtime and avoiding costly unplanned outages.
- The ability to hot-swap cards and modules allows for online repairs, further reducing outage durations and maintenance costs.

Additional Highlights:

- W-ARCH integrates seamlessly with digital I&C modernization processes and **Ovation™ plant systems.**
- Improved reliability and future-proofing through the use of industrial-grade, modern components.
- Enhanced safety and regulatory compliance by meeting modern digital I&C susceptibility requirements.

W-ARCH removes all SPVs associated with the legacy SSRCS rod control system

Scope

The Westinghouse Advanced Rod Control Hybrid (W-ARCH) upgrade provides a comprehensive, in-cabinet modernization of the existing SSRCS, integrating advanced digital control and diagnostics while retaining existing cabinet structures and field wiring. The upgrade is fully integrated with the Ovation™ Distributed Control System (DCS) platform, ensuring seamless operation, enhanced reliability, and future expandability.

W-ARCH Logic Cabinet Upgrade

- Replacement of all control electronics in the SSRCS Logic Cabinet with Ovation™ redundant controllers and I/O modules
- Retention of existing cabinet and field terminations

W-ARCH Power Cabinet Upgrade

- Replacement of control electronics and selected components in SSRCS Power Cabinets
- Installation of double hold-capable Movable Gripper bridges
- Redundant phase crossing transformers
- Updated fuses, sensing resistors, and removal of mercury wetted relays
- Modernized touch screen controls for the Main Control Room (MCR) (recommended)

Integration with Ovation™

- All new hardware and software fully integrated with the Ovation™ DCS platform for logic, control, and operator interface
- Ovation™ Application Software:
  - > Ovation™ Rod Control application software and displays
  - > Current Profile Viewer (CPV) for coil trace diagnostics
  - > Application server/datalink for communication between logic and power cabinets
  - > All software delivered with configuration and version documentation

Documentation

- Project Management Documentation:
  - > Project plan, schedule, and quality plan
- System Application Engineering Documentation:
  - > System architecture drawings
  - > Termination and configuration documents
  - > I/O database and system configuration files
  - > System test plans and procedures
  - > Factory and site acceptance test documentation
- Design Analysis and Test Reports:
  - > Failure Modes and Effects Analysis (FMEA)
  - > Software Failure Analysis
  - > Equipment Qualification Summary
- Manuals and Maintenance Documentation:
  - > O&M technical manual (preventative/corrective maintenance, troubleshooting, spares)
  - > Recommended spare parts list

Installation Support

- Detailed field service procedures for removal of legacy hardware, cabinet modifications, and installation of new equipment
- Pre-outage planning, readiness reviews, and mock-up training for installation crew
- On-site installation by trained Westinghouse personnel (20-person crew typical)
- Outage management, daily progress reporting, and post-outage critique
- Site acceptance testing and commissioning support

Value Added Services

Westinghouse offers a comprehensive suite of value-added services to support the successful implementation and long-term operation of the W-ARCH upgrade:

Product Support Services

- 24/7 technical support via the Westinghouse S3 Support Hub (phone, web, and email)
- Remote and on-site troubleshooting by experienced subject matter experts
- Access to software updates, firmware enhancements, and cybersecurity advisories
- Preventative and corrective maintenance recommendations
- Spare parts management and expedited replacement services
- Compliance documentation for digital upgrades, cybersecurity, and quality assurance

Training & Knowledge Transfer

- Comprehensive training programs for operations, maintenance, engineering, and system administration
- Hands-on training using Westinghouse-supplied Ovation™ training systems
- Customizable training modules for plant-specific needs

Applicable Codes & Standards

EQ Qualifications

- Environmental – IEEE 323-1983
- Seismic – IEEE 344-1987
- EMC/RFI – RG 1.180, Rev. 1
- EPRI TR-102323 Rev. 4

Industry Standards

- IEEE 1012-2004
- IEEE 802.3
- IPC-A-160

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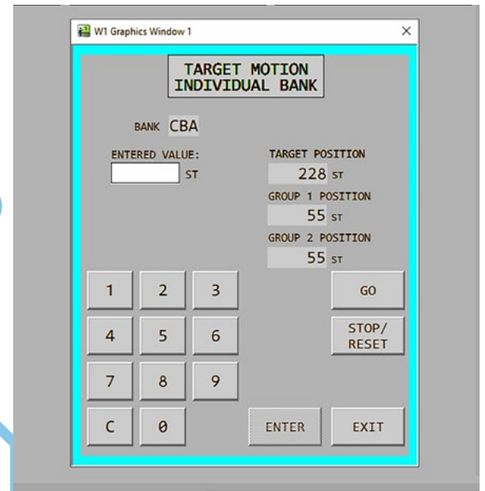
Advanced Diagnostics & Current Profile Capture

The W-ARCH system provides real-time coil current monitoring and captures current profiles for every rod movement, enabling predictive maintenance and rapid troubleshooting.

- Current Profile Viewer (CPV) for step-by-step coil trace analysis
- Coil traces are archived for future use
- Real-time status and detailed alarm information via Ovation™ displays
- Automated data archival for future analysis and trending
- Supports remote diagnostics and maintenance
- Reduces outage time and maintenance costs

Simplified operations through Target Motion & Fine Control



Target Motion

The Target Motion feature is an advanced, software-driven operational mode available as an option with the W-ARCH upgrade. Target Motion allows operators to select a desired rod position (in steps) for any bank or individual rod, and the system will automatically move the rods to the specified target position. This automation reduces operator workload, minimizes the risk of manual errors, and ensures precise, repeatable rod positioning for both routine and transient plant operations.

Automated Rod Movement
Operators can “dial in” a target position, and the system will execute all necessary steps to reach the desired rod height, pausing or aborting as required by interlocks or operator intervention.

Supports All Modes
Target Motion can be used in Individual Bank, Manual Sequential, or Single Rod Motion modes.

Enhanced Safety
The system continuously monitors for interlocks, alarms, and abnormal conditions, halting motion if required.

Improved Efficiency
Reduces operator workload and speeds up routine maneuvers, especially during startup, shutdown, or reactivity management.

Consistent, Repeatable Results
Minimizes the risk of overshoot or undershoot, ensuring rods are positioned exactly as required.

Integrated with Ovation™ HMI
Target Motion is fully integrated into the Ovation™ operator interface, with clear status displays and override capability.

Fine Control or Preset Control
Allows operators to enter demanded rod steps.

Soft Controls

Westinghouse recommends implementing Soft Controls via Ovation HMI screens.

- Simplifies Operator Actions
- Allows optional Target Motion and Fine Control features
- Elimination of hard control SPVs
- Fault Tolerance achieved via Ovation displays redundancy
- Provides greater amount of system health information and cabinet diagnostics

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Learn more about Westinghouse I&C products and services at

https://westinghousenuclear.com/operating-plants/instrumentation-controls-systems/