RODS CONTROL SYSTEM

PRODUCT HIGHLIGHTS

► FPGA-based

► Meets IEC 61513 requirements for Class 1 systems

► Proven in-use safety, reliability and maintainability

► Comprehensive, tried-and-tested range of I/Os

► Flexible redundancy management (1oo2, 2oo3, and coincidence logic)

► Comprehensive on-line diagnostics with fail-safe features

► Fast response time (less than 10 ms)

► Hot-swapping of modules

► Self-contained redundant power supply

► Licensing support for applicable local regulation

► Deterministic behavior, physical and functional separation

► Human-Machine Interface (HMI) can be customized in accordance with end user requirements

SYSTEM OVERVIEW

RCS equipment is designed and supplied in the form of a highly integrated unified system which can offer the implementation of all required functions. RCS in general consist of Rods Position Indication System (RPIS) and Rods Drives Control System (RDCS). RPIS indicate all reactor control and safety rods position operation parameters and real rods position in case of emergency TRIP (emergency shutdown) of the reactor. RDCS perform all Rod Drives control functions and include TRIP Portion (set of the Rod Drives power supply breakers).

RCS can have 2 or 3 redundant channels depending on the design basis of the nuclear reactor, and it can implement a voting logic of 1oo2 or 2oo3.

The configuration of the RCS consists of Rods Position Indication Cabinets (RPIC), Rod Drives Control Logic Cabinets (RD CLC), Rod Drives Power Supply Cabinets (RD PSC) with Rod Drives Control TRIP Portion breakers (Rod Drives Electric Power Supply Subsystem), software-based Workstation Cabinets (RCS WSC) for monitoring and data archiving functions and RCS Rods Position Indication Panels and Operators Workplaces. RCS offers the possibility of scaling and system extension, if required. It includes all necessary software and hardware changes, 50% FPGA redundancy for the whole system and also for functional modules.

Each of the Cabinets chassis contains one Logic Module (LM), one Diagnostic Module (DM) and can include up to 14 I/O modules of various types – Rod Position Indication Module (RPIM), Rod Drive Control Module (RDCM), Rod Drive Power Supply Module (RD PSM). LM collects data from input modules, executes user configured control logic, and updates the states of the output modules. DM collects diagnostic and performance information from all I/O Modules and the LM. The I/O modules provide interfaces with other devices (e.g., sensors, Rod Drives).

RCS has on-line monitoring and maintenance capabilities. It can correct its voting logic in case faults are detected, so that system availability is optimized without compromising safety. RCS has a self-diagnostic subsystem, which includes troubleshooting assistance functions for easy localization of faults. In case of failure, RCS puts itself in the safe state, signaling actuation for shutdown.

RCS support manual Rod Drivers deactivation (power-off mode) for the Reactor TRIP from the Main Control Room (MCR) or Emergency Control Room (ECR) using independent Rod Drivers power supply lines breakers. RCS also includes all necessary control panels, displays and rod position visualization in the MCR and in the ECR, with power supply for all these Human Machine Interface (HMI) components directly from RCS cabinets.