framatome

Wide Range Monitoring System

for Boiling Water Reactors

Framatome provides customers with neutron flux monitoring systems based on it's own digital instrumentation and control (I&C) platform, TELEPERM XS, and which meet the highest safety norms and standards of nuclear industry

Challenge

Old analog neutron flux monitoring systems for measuring the source and intermediate range in Boiling Water Reactors (BWRs) are becoming obsolete as safety requirements become more and more stringent. Furthermore, there has been an increase in both maintenance costs and lost time due to the obsolescence of both analog amplifiers and electronic modules in existing systems.

New solutions are required, based on digital I&C platforms which meet the highest safety norms and standards of the nuclear industry.

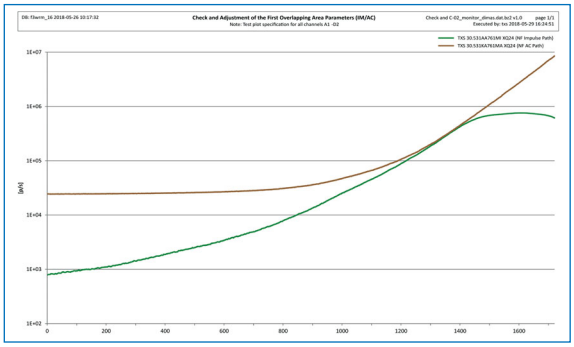
Solution

Existing fission chambers including cable connections to the current preamplifier may be reused for the new TELEPERM XS Neutron Flux Wide Range Monitoring (WRM) channels.

These detectors are capable of monitoring the neutron flux density in an extended range from shutdown condition up to approximately 40% of the rated reactor power. The Framatome WRM channels are designed to measure the neutron flux density up to 100% of the rated power and even beyond.

The detector signal is connected to a specific arrangement of TXS pre- and main amplifiers for initial signal conditioning before entering the TXS computer. Within the software, special patented and optimized digital algorithms ensure unique features of control functions.

Intensive verification and validation tests in the full scope simulator, plant and operation experience have shown the outstanding performance of Framatome's WRM algorithms with perfect adjustable overlapping areas for the detector signals between pulse and AC mode and AC to DC mode. This results in a smooth, stepless signal behavior and thus to an absolutely reliable wide range signal for the reactor operators.



Site acceptance test result: Special patented and optimized digital algorithms ensure absolutely reliable wide range signals for reactor operators.

Customer benefits

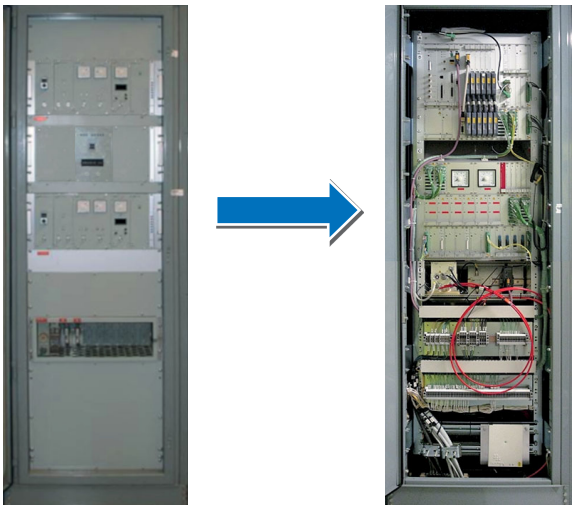
- Satisfies the highest safety norms and standards of nuclear industry
- Provides the highest safety and availability level due to deep self-monitoring of TELEPERM XS
- Patented and approved digital algorithms arrange simple and clear solutions for I&C functions
- Built-in hardware test signal generator and software simulation functions provide extensive support for periodic testing to the associated automation systems
- Drastic reduction of time for periodic testing thanks to a centralized graphical user interface
- Graphical user interface ships with API that allows the further development of highly dedicated add-ons to extend the customer's toolset

Your performance
is **our** everyday **commitment**

Key features

- High safety and availability
- Simple and compact structure
- Patented and approved digital overlapping algorithms
- Single stand-alone channel solution. Overall WRM structure and number of channels fully adaptable to present detector installation of the respective plant (usually 4 or 8 channel architecture)
- Cycle time of 15 to 25 ms
- Single failure tolerance
- High level of device qualification
- Modular hardware structure allowing easy installation of the WRM assemblies into existing cabinets
- Adaptable external power supply, depending on present operating environment (110V DC/230V AC). Channel is equipped with two redundant power supplies, each comprising two 230V AC (110V DC)/24V DC converters
- Electrical plant process interface realized in dedicated termination unit. Binary floating change over relay contacts and analog decoupled 0...20 mA current signals
- Built-in hardware test signal generator for testing the complete chain from raw detector signal input to system output to associated automation systems
- Built-in software simulation functions provide extensive support for periodic testing also to the associated automation systems
- Modern graphical operator Interface provides all kind of support for status overview, parametrization, periodic testing, recording and evaluation of I/V and discriminator curves or online presentation of logic functions. Highly customizable and expandable for customer needs.

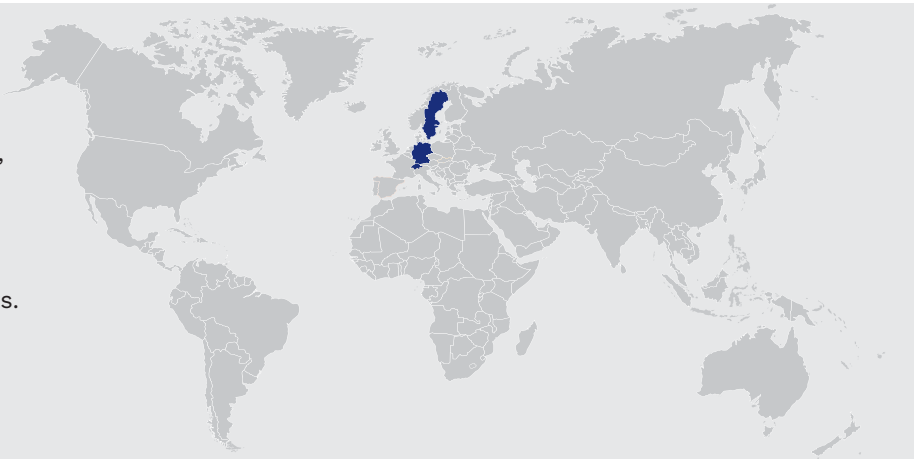
TELEPERM XS WRM channel designed and manufactured in modularized pre-assemblies allows short installation times during plant outages



Example: Replacement of obsolete equipment with TELEPERM XS WRM channel including installation in existing electronic cabinets

References

Numerous references for wide range, power range and core stability monitoring systems in German, Swedish and Swiss nuclear power plants confirm quality, functionality, safety and availability of our products.



Contact: ic@framatome.com
www.framatome.com