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TXS Compact

FPGA-based digital I&C platform for safety and standalone systems

TXS Compact provides greater safety and cybersecurity through advanced features like a wide range of function blocks, multiple interfaces, a high degree of standardization and modularity combined with long-term support.

Challenge

New nuclear plant designs require a safety-related instrumentation and control (I&C) application that offers high performance in a compact design and that also meets the latest regulatory requirements.

Existing plants need to address long-term operations and obsolescence of equipment and other systems aging issues. Operators must decide how to upgrade their I&C systems. Whether they choose partial or complete modernization, doing so can be costly and difficult, notably in terms of qualification. Oftentimes, the physical space and layout of the cabinets housing new system components create even more complexity.

Solution

Framatome's TXS Compact safety I&C platform is based on field programmable gate array (FPGA) technology. This innovative solution for decentralized Safety Class 1 systems is competitive, robust, compact and scalable. The simplicity of its design makes qualification easier for both new build projects and modernization projects at existing nuclear plants. Real-time self monitoring provides insight into the system health and helps guarantee a high level of reliability. It can also be used to build technologically diverse systems.

TXS Compact received a Safety Evaluation Report (SER) from the U.S. Nuclear Regulatory Commission. This comprehensive review of the platform's design, architecture, industrial chain and safety attributes confirms that it meets rigorous regulatory requirements for safety-related systems in U.S. nuclear plants.

The solution is developed 100% in-house so there is no external IP or black box. This ensures long-term product availability and ongoing support with licensing. The supply chain and production infrastructure for this product are mature, improving lead time and component availability.



Typical configuration of TXS Compact rack.
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Customer benefits

- Small 3U racks optimize footprint for standard or existing cabinets, with front access for easy maintenance.
- Scalability means greater flexibility thanks to support of remote I/O sub-racks and networking
- Codesigned with cybersecurity experts to have an unprecedented level of self-reliance against external attacks, lowering operational risk
- Clear network separation between safety and non-safety systems minimizes interference during operation and maintenance.
- Generic controller allows for configuration changes to the application alone; no impact on the prequalified product, eliminating relicensing
- Deterministic controller: no variability keeps static execution time of engineered I&C functions constant and allows advance calculations
- Simple to use, modern and convenient look and feel.

Technical Information

Systems built on the TXS Compact platform are easier to operate and maintain.

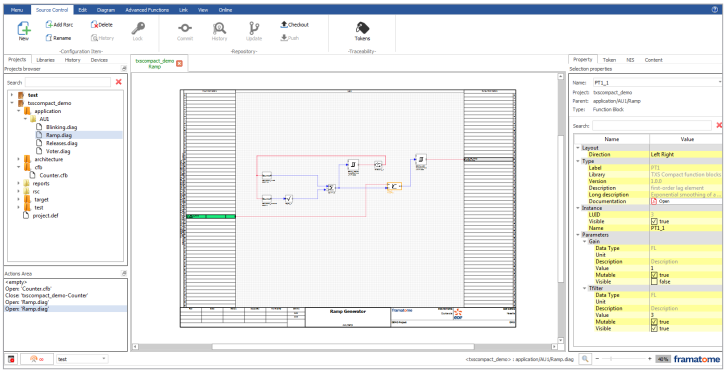
TXS Compact modules include Processing, Multi-Purpose IO Module, Service/Maintenance and Diagnosis Module, and a Gateway. All are plug-in modules intended for installation in a standard 3U/19" chassis which is equipped with a backplane for internal communication and front access to networks or field signals.

The TXS Compact platform was developed and qualified according to the guidelines from IEC 61513:2011, IEC 62566:2012, IEC 60987:2013, IEC/IEEE 60780-323:2016, IEC 60880:2006 and IEC 62138:2018 international standards and national regulations RCC-E:2019 and KTA:2015. The TXS Compact platform received its SER from the U.S. Nuclear Regulatory Commission, and TÜV SÜD certification to IEC 61513.

FPGA-based TXS Compact features high resistance to cybersecurity issues due to:

- Active and passive security included in the software tool chain for the design and testing phases of the I&C system
- Embedded active and passive security features in the automation platform that further increase the level of security on the test bay and on-site

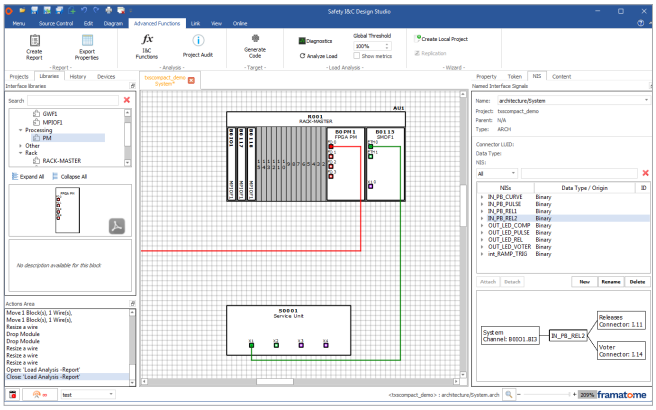
The application is programmed solely using function block diagram programming (from a library of more than 85 function blocks). It has a configurable cycle time from 4ms to 2s depending on the application. TXS Compact supports multiple configurations including remote I/O with up to three extension racks for a single automation unit with a total of 142 analog inputs, 142 analog outputs, 284 binary inputs, 284 binary outputs, and 71 TTL pulse inputs.



System architecture with TXS Compact Design Studio. © Framatome



TXS Compact assembled in cabinet. © Framatome



Function blocks diagram with TXS Compact Design Studio. © Framatome

Key Figures

TXS Compact is a diversified solution built on the proven platform of Teleperm XS which is installed in **90** units in more than **45** nuclear plants in **17** countries. Framatome employs **2,700** I&C professionals at **21** sites in **10** countries.

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