



OpreX™ Control and Safety System

Safety Instrumented System ProSafe-SLS

Proven Technology for Safety
Instrumented Systems



Powerful, state-of-the-art technology ...

... In ProSafe-SLS, solid-state elements process the functional logic, handling all typical safety tasks as well as related non-safety-critical functions.

Leading package...

ProSafe-SLS is inherently fail-safe: the self-testing nature of its basic circuitry mean it will invariably fail safely, without the need for additional test or diagnostic circuitry.

Success in critical applications...

... ProSafe-SLS is designed to deliver safety without compromise, demonstrating verifiable adherence to the highest Safety Integrity Levels.

Today, over one thousand ProSafe-SLS systems have been installed in the world protecting people, the environment, valuable assets and production installations.

The ProSafe range

Yokogawa covers the spectrum of requirements for today's safety systems with two product lines, ProSafe-SLS and ProSafe-RS, each geared to the needs of specific safety applications. For the highest- integrity, SIL 4-rated applications, ProSafe-SLS offers a superior solution - for the spectrum of applications in oil and gas, petrochemical and chemical, and conventional and nuclear power industries, including:

- Emergency-shut-down systems in safety-critical process units
- Environmental and asset protection systems
- Burner management systems for incinerators, furnaces and boilers
- Compressor protection systems for rotating and piston type compressors
- Process and emergency shutdown systems on offshore platforms and FPSO's
- High integrity protection systems for critical processes and pipeline protection
- Wellhead protection systems and sub-sea systems
- Liquefied natural gas (LNG) storage and loading installations
- High-integrity protection systems in chemical process plants as well as applications where previous-generation relay -based systems are to be upgraded.



When safety cannot be compromised, ProSafe-SLS is the solution

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ProSafe-SLS is a Safety Instrumented System specifically designed for applications which require the highest Safety Integrity Levels (SIL 3 and 4).

At the heart of ProSafe-SLS are solid-state elements which process the functional logic. This technology is capable of executing all typical safety tasks, as well as supplementary non-safety-critical functions such as interfacing with a Human Machine Interface, Process Control System, Sequence of Event Recording, (Event Loggers) or SCADA system, for example.

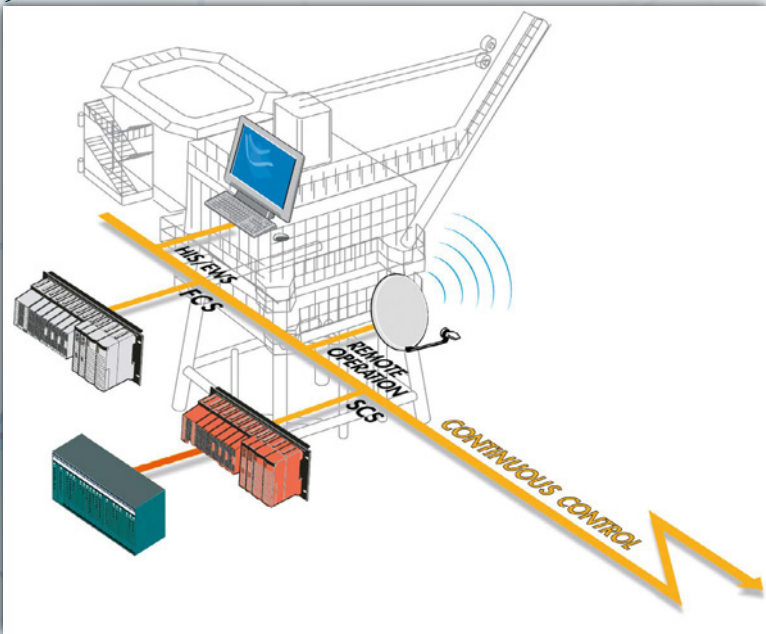
Sophisticated design and superior safety performance

have made ProSafe-SLS the reference standard for solid-state Safety Instrumented Systems. With ProSafe-SLS, there's no need for operating system and self-diagnostics software. Instead, it uses a unique inherently self-testing technology, for all safety-related functionality.

Modular design allows users to create fault-tolerant systems with very high availability, without compromising the superior safety performance. A 1 out of 2, or 2 out of 3 configuration, as defined by the IEC 61508/61511 and ISA 84.01

standards, allows redundant sensors and actuators to be connected in a very cost-effective way - enabling users to balance the availability of these field devices with the high system availability of the ProSafe-SLS system.

These redundant structures support on-line repair to restore the original fault-tolerant architecture, without the need to shut down the process, and without compromising safety.

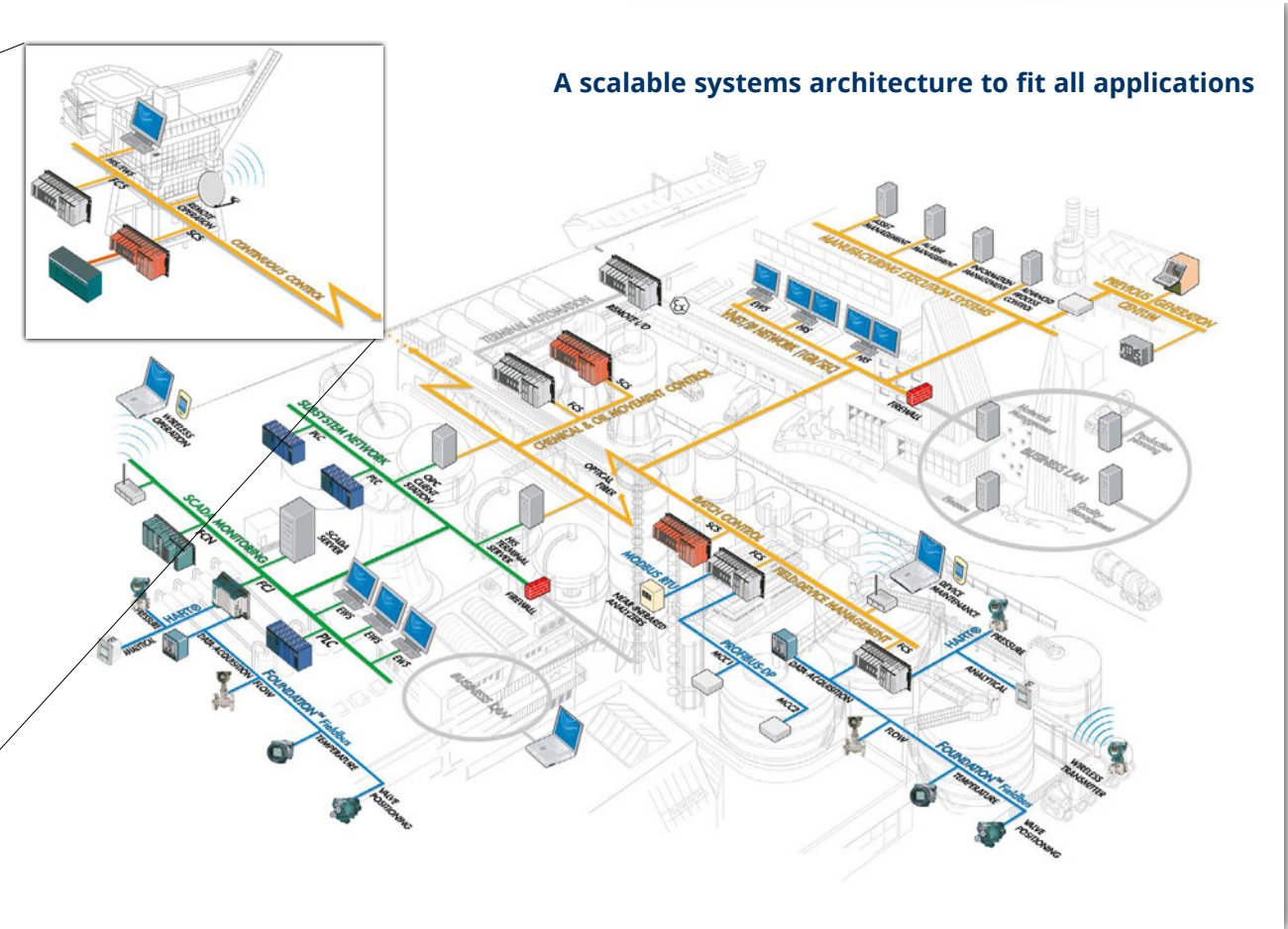


Total solution

Yokogawa delivers total automation and control solutions that comprise field instruments, control systems, safety and production management systems.

Depending on your requirements, the solution may vary from the supply of a single recorder to the execution of a complex project as your main automation contractor.

Whatever the size and complexity of your solution, our goal is "fit for purpose" and seamless integration of production processes and management systems.



The ProSafe-SLS System Concept

The SLS (Solid State Logic Solver) System was designed with the objective of establishing an uncompromising safeguarding system: one which would meet the highest Safety Integrity Levels, and whose performance could be verified.

The ProSafe-SLS concept has successfully eliminated all known sources of unsafe failures. Each logic processing unit performs inherent self-test, while working with the real functional logic of the application. Therefore, logic processing and self-test are carried out simultaneously, and by the same hardware components. During every scan, which takes just one millisecond, the system outputs are recalculated by executing the complete functional logic. So the safety critical parts do not require memory elements to store the results of the logic solver for longer than one millisecond.

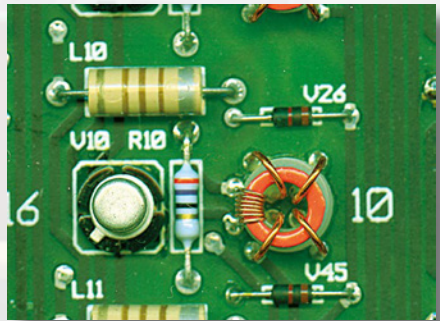
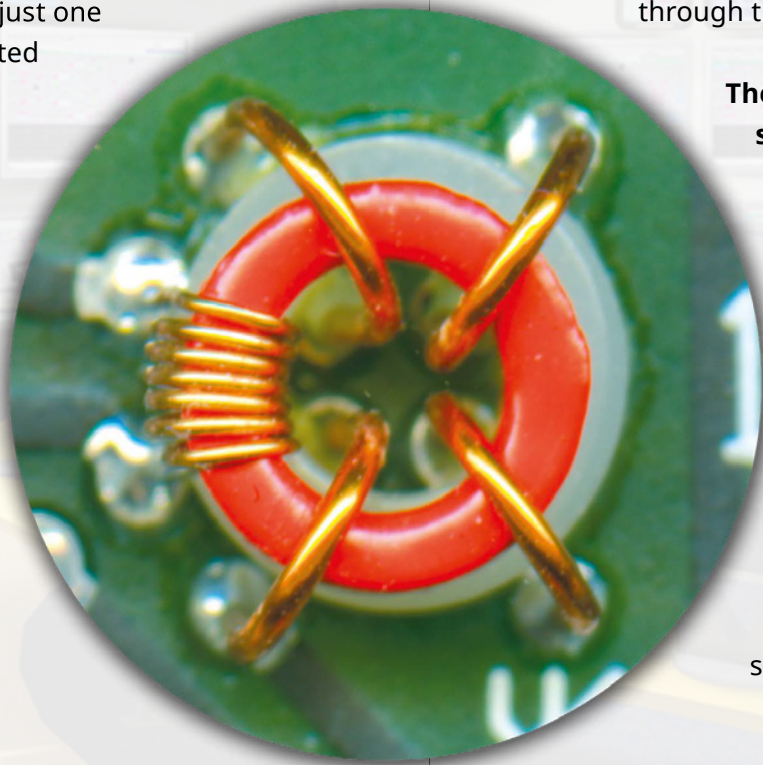
This unique intrinsic self-testing technology creates a robust safety environment where potential hazards are effectively eliminated

Non-safety-critical functions and computer interfaces are implemented using microprocessor technology.

The SLS magnetic core technology

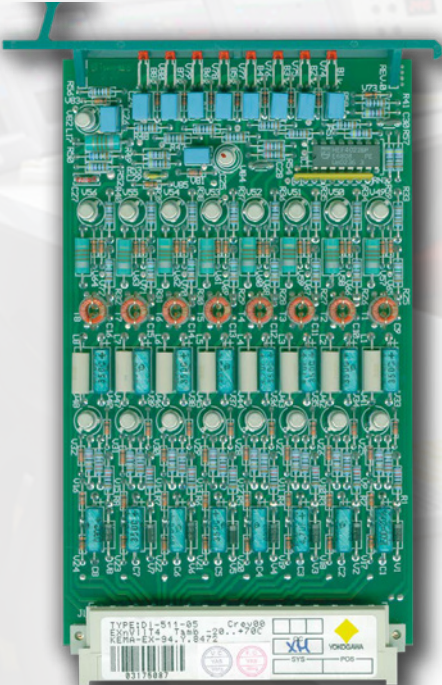
The effect of this unique technology is to render ProSafe-SLS inherently fail-safe - the self-testing nature of the basic circuit means it will always be fail safe, without the need for additional test or diagnostic circuits. The logical signal status, which reflects the 'safe' condition of critical process parameters, is represented by pulse-trains. In this way all the circuits remain dynamic continuously, during normal operation. Logic functions are processed by bi-stable magnetic core elements, which have inherent fail-safe characteristics. Amplifying transistors serve only to restore any energy lost by the pulse-trains as they pass through these magnetic logic elements.

The essence of the ProSafe-SLS, solid-state logic solver. The basic principle behind ProSafe-SLS is magnetic logic - or MagLog. Since its invention in 1965, it has proved its worth in numerous Safety Instrumented System (SIS) installations in the hydrocarbon, chemical and (nuclear) power industries. We've taken this technology, and upgraded it with up-to-date components and fabrication methods, while retaining its unique inherent safety characteristics. The simplicity of this underlying principle is a key strength of ProSafe-SLS: it supports any method of in-depth safety assessment and verification. And quantitative methods have shown that the SLS system scores highest on the scale of safety.



ProSafe-SLS Module

// SLS when Safety allows no compromise //



ProSafe-SLS Modular Card

// The SLS is inherently fail-safe //

The Communication interface ProSafe-COM

The functions of communication, sequence of event recording and remote input and output functions are handled by our ProSafe-COM system, supporting open communications with other systems

Non-safety-critical I/O

ProSafe-COM and additional modules handle non-safety-critical I/O - such as the control of annunciation matrices and mimic panels - highly cost-effectively. Features include:

- Bi-directional serial communication with other systems, operating as a master or as a slave, using the Modbus protocol
- Handling non-safety-critical functions
- Standard alarm sequences and first-up handling and other functions, which are readily available in the engineering tool
- Point-to point connections by dedicated modules

A unique - and deserved - reputation

ProSafe-SLS has earned its reputation through a number of factors, including:

- Superior fault-tolerance for unsafe errors, appropriate for SIL 4 safety categories
- Mean time between testing (according to IEC 61508 methodology) typically in excess of 10 years
- High availability (or low false trip rate) through low parts count and reliable design, with further improvements through redundancy of associated field devices
- A robust design, which can handle harsh environmental conditions such as extreme temperatures and. Electromagnetic Interference (EMI)
- No software required for safety functions (so no costly updates, maintenance, yearly license fees and bug fixing/service note implementations.))
- Fast response-time, independent of system size or I/O count

- Integrated computer interfaces and sequence of events recorder
- Provision of a PC-based engineering tool to keep documentation up-to-date
- Longevity (we still service systems we delivered in the early 1970s)
- Low power consumption
- Independently isolated inputs and outputs
- Many reference projects at leading companies on all continents including offshore projects

Standards compliance

- IEC standards 61508 & 61511
- ISA standard 84.01
- Standard engineering practices, as implemented by prominent operating companies

Applications

- Refinery
- Wellhead
- Furnace
- Nuclear
- Tank farm
- FPSO



Project organization

Yokogawa has engineering offices and production facilities for safety systems world-wide and operates via a network of Yokogawa sales and service subsidiaries.

Our project organization has a strong commitment to quality and is ISO 9001 certified. It operates on a world-wide basis, implementing turnkey projects, and providing after sales service and technical customer training. We provide advice on safety assessments and related issues via Yokogawa offices and regional subsidiaries.

Safety assessment

Safety Instrumented Systems play an increasingly crucial role in many process plants today. Safety standards such as IEC 61508/61511 and ISA 84.01 are now recognised worldwide, creating increasingly stringent safety requirements for process plants. Users in the process industry need system suppliers who understand the standards and can offer solutions to meet today's safety requirements. We have a department of specialists who will ensure adherence to the safety standards, and are able to provide Safety Assessment Certificates for individual applications.

Training

Yokogawa provides extensive training for all levels of plant personnel, to ensure that your enterprise gains the maximum benefit from its Yokogawa systems and integrated solutions. The training program includes product and system overviews, detailed system configuration, maintenance, operations, and fundamentals of safety and process control.

Customer support

Our customers can choose from a wide range of standard training courses, and customized courses are tailored to match the customer's specific needs. Project-specific courses can also be arranged. In all cases Yokogawa provides the training equipment.

The Yokogawa training center supports comprehensive training directly with customers worldwide. Training can be conducted in one of our Centers of Excellence, or any other Yokogawa facility or at the customer site.

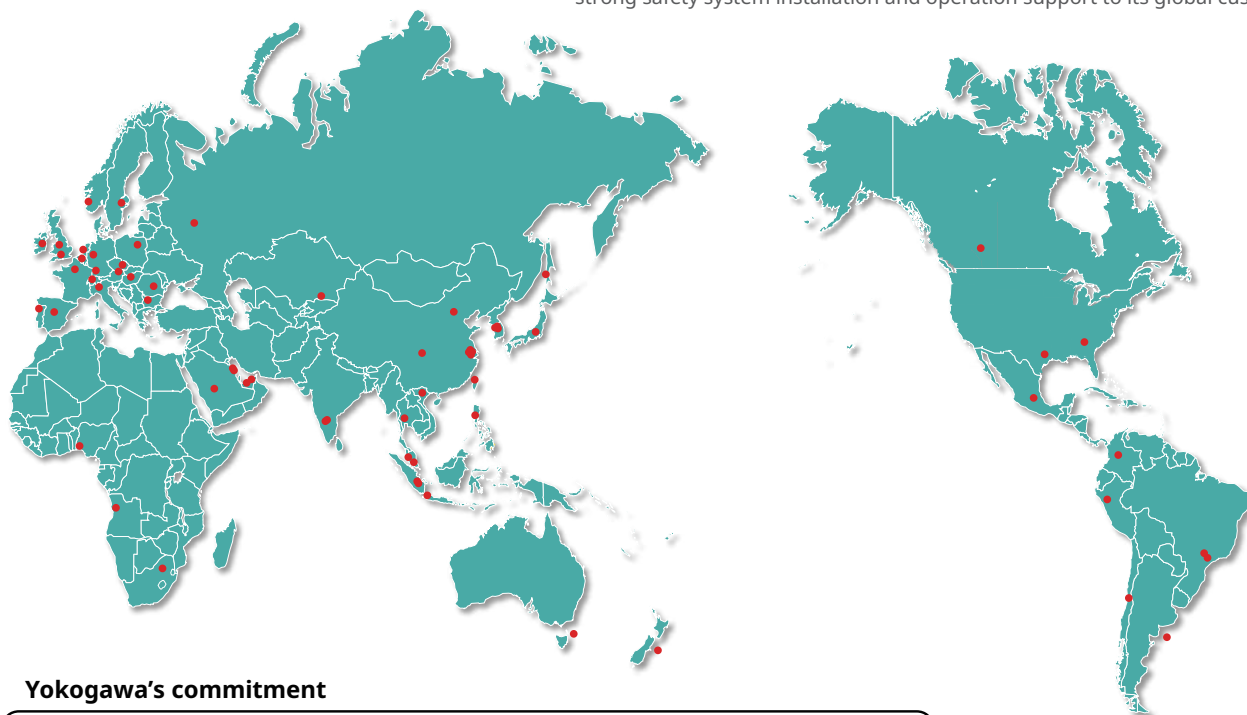
The Yokogawa training center is permanently staffed with highly qualified trainers and an administrative co-ordinator. Close co-operation with the System and Application Engineering team means that expertise is readily available for project specific training.

Specification highlights:

Principle of operation	Magnetic cores serve as logic processing elements; Inherent self-testing in Fail-safe Inputs & Outputs.
Special Features	Inherently fail-safe; No system software in Safety-Critical parts; Galvanic isolation of I/O and logic-solver.
Electromagnetic interference	High immunity to EMI, >30V/M.
Operating Temperature	-20° C to +70° C.
Number of Inputs & Outputs	Unlimited.
Input range	Discrete: 24 Vdc.; Analogue 0-20 mA, 0-10 V; Communication: Inputs via ModBus.
Output range	Fail-safe: 5 Watts & 20 Watts; 24 Vdc.; Relay: DC and AC; Communication: Outputs via ModBus.
Timer Range	500 millisecond to 70 hours.
Scan-time	1 millisecond for I/O scan and Safety logic processing; independent of number of I/O.
Auxiliary modules for	Line-fault detection. Microprocessors for non-critical functions such as: Annunciation, Communication & SER-Diagnostics.
Engineering tool	ProSafe-SLS SET logic symbols related to the SLS circuits.
Programming	Hardwired programming of the Safety Interlocks with protected (IP 20) cold crimp contacts.
Safety certification by TÜV:	SIL 1-4 based on IEC 61508

The Best Lifecycle Support

Not only have our products been certified according to international safety standards, they are backed by the safety expertise of Yokogawa Group engineers at certified offices and facilities worldwide. With this organization, Yokogawa provides strong safety system installation and operation support to its global customer base.



Yokogawa's commitment

Yokogawa's system platforms combined with proven execution experience provide the highest quality and innovative solutions for secure and optimized process automation and management. Yokogawa's global customer centric focus together with strong local support reduces users' business risks and provides the lowest total cost of ownership. With a long history of progressive compatibility, Yokogawa is your dependable automation partner.

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