

vigilantplant.®

Excellence in Safety & Availability



Free of bottlenecks

Optimum safety and maximum uptime



Fewer surprises

Integrated diagnostics and
asset management



Less blind spots

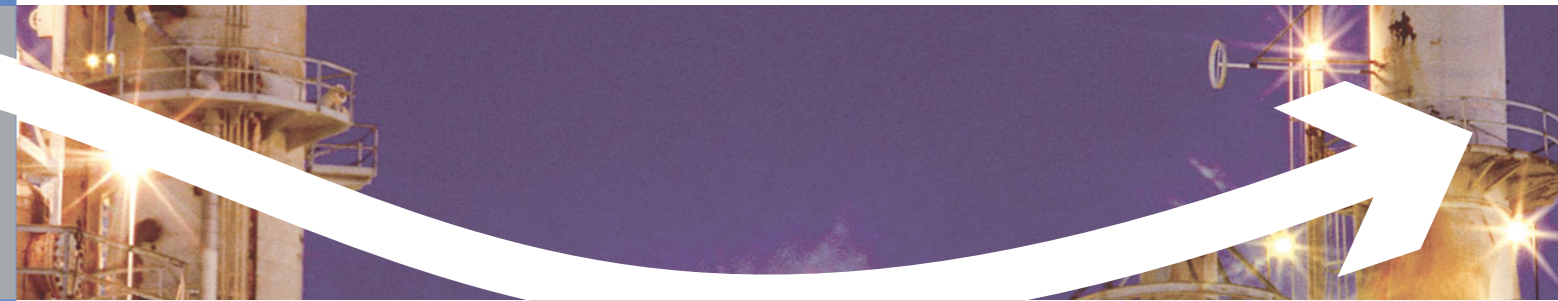
Unified operator interface to
control and safety

Bulletin 00A01A21-32E

vigilantplant.®
The clear path to operational excellence

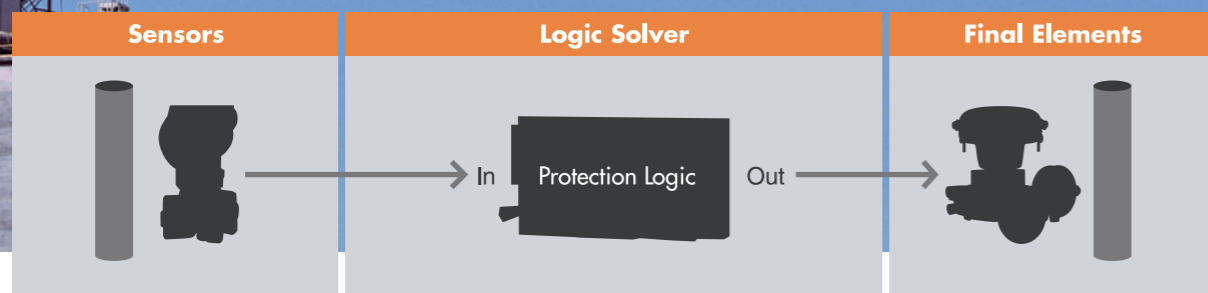
YOKOGAWA ◆

How to address the entire loop to maximize safety and availability.



What is safety?

Safety integrity means that an automatic protection system will work when needed. Higher safety integrity means that personnel, the environment and the business are less likely to be harmed, lower risk.



Pipe to Pipe

Protection is achieved not only by the logic solver but the entire loop including process sensors and final elements (motor controllers, remote actuated valves). The entire loop is designed to sense potential process hazards and take action to reduce risk. High integrity depends on correct functioning of all the parts. This entire loop is called a safety instrumented function (SIF).

No automatic protection system can have perfect integrity but it is clear that higher risk hazards must have higher integrity designs. According to international standards this integrity is defined by "Safety Integrity Levels" called SIL. Four levels are defined with level four indicating the highest integrity and level one indicating the lowest. With each SIL there are rules specified to reduce design error.

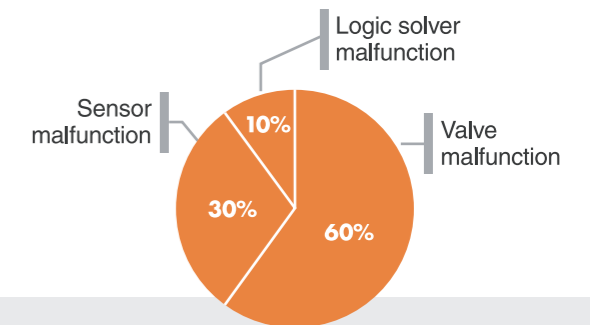
The rules for checking and testing get more stringent with higher integrity. With each SIL there is a maximum probability of hardware failure on demand (PFD). This probability of failure applies to the entire SIF - field equipment and logic solver.

The total PFD is calculated by combining the PFD sensor + PFD logic solver + PFD final element. A study done by exida, the safety consulting firm, has shown that on average a SIL certified logic solver contributes less than 10% of the PFD. The sensors contribute less than 30% and the final elements contribute over 60%.

That is why field instruments are now being designed to meet the tough requirements of IEC 61508. This helps field instruments achieve higher quality and integrity, like the IEC 61508 certified logic solvers.

How about availability?

In many industries it is just as important to avoid falsely stopping the process. A safety system must provide high safety integrity and high availability.



Primary cause of safety applications failure

In a good process design, hazards do not occur often. The safety valve may not move for a long time. Failure modes of the valve then include seat leakage, binding and breakage. Binding and breakage failures can prevent the valve from moving to a safe position. These failures can dominate the PFD of the SIF.

To improve safety and availability the valve must be checked periodically. This can be done with a full stroke test and leak test. Unless a special bypass valve has been installed, the process must be shut down. This testing can be costly.

Partial stroke testing (PST) is a technique that partially moves the valve. With pressure and position feedback sensors this technique can detect many of the actuator and valve failures.

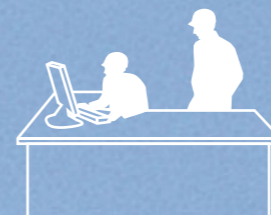
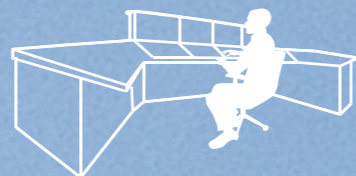
According to studies by exida, PST can detect 50% to 80% of the dangerous failures depending on valve type and shutoff requirements. Using PST on a remote actuated valve can substantially reduce PFD and will reduce false shutdown by diagnosing future failures. PST can be initiated by the independent PST device or by the other software like asset management.

Asset management software can also help improve the safety and availability of a SIF. Proof testing can be done with less cost and more accuracy. Additional diagnostic information is automatically collected. Proof test records are automatically generated and stored. Additional data can be collected via digital communication with the field devices to obtain all the benefits of asset management for the safety system as well as the DCS. Yokogawa offers PRM as it's asset management solution.

Safe & available...vigilant!

Why not have the best of both worlds? The vigilant approach delivers uptime and peace of mind.

Operators
now have an all-in-one interface to effectively handle both control and safety loops.



Asset Manager
can easily diagnose asset conditions, ensuring asset availability while optimizing maintenance.



DPharp EJX Digital Transmitter

EJX is the world's first and only fully digital pressure transmitter. EJX standard models are certified for use in SIL2/3 safety applications.

Key Features

- Certified IEC 61508 compliant by TÜV and Exida
 - Inherently fail-safe silicon resonant sensor and reverse calculation mechanism secure a safe failure function (SFF) of 93.2%
 - Industry-leading PFD avg = 1.49E-04/year
- Inherently fail-safe silicon resonant sensor



SIL2 certification pending for YTA temperature transmitter and DYF vortex flowmeter.



ProSafe-RS Integrated Safety System

ProSafe-RS is the world's first truly integrated safety controller. Its pair & spare architecture provides SIL3 protection in a simple configuration, while the unified human machine interface keeps your operators fully aware of safety system information.

Key Features

- TÜV certified SIL3 protection in single configuration
- Compact modules fitting small to large application
- Flexible versatile modular redundant (VMR) architecture
- Dual redundant configuration maximizes process availability
- SIL3 safety communication between safety controllers using a common network with the control system
- Inherits 99.99999 (seven 9's) pair & spare CPU technology of CENTUM DCS



SVI II Digital Positioner

The SVI II-ESD is a smart solenoid certified for use in SIL3 applications. Using the HART communications protocol, SVI II provides advanced diagnostics that monitor and predict equipment performance - including partial stroke testing for your safety valves.

Key Features

- Non-contact position sensor
- SIL3 rated when energized
- Analog and digital diagnostic feedback
- Multiple sensors for diagnostics
- User control of stroke testing
- Graphic representation of partial stroke
- Stroke test completely in concert with / or independent from safety systems



SVI II is a product of Dresser, Inc., a Yokogawa business partner



PRM Plant Resource Manager

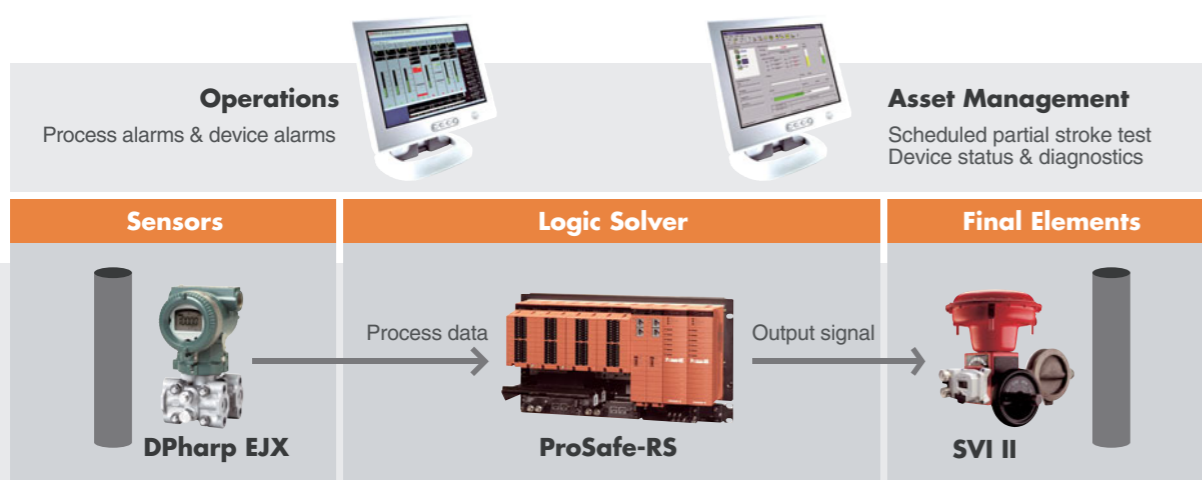
Plant Resource Manager (PRM) works as your integrated asset management platform. By keeping your operators and maintenance crew fully informed of the current performance and anticipated conditions of your plant assets, PRM maximizes your asset availability.

Key Features

- Intuitive visual interface to manage diagnostics information from intelligent devices
- Polls HART devices regularly to collect and distribute diagnostic information
- ValVue II plug-in application on PRM manages scheduled PST

A case in point.

The entire SIF must be designed correctly. An integrated solution helps assure a correct design. This means high safety integrity and availability.



A Yokogawa integrated safety solution ensures your process availability and safety. Functionality needed to properly integrate field devices is built-in.

For example, the 61508 certified EJX transmitter will indicate an internal problem including plugged impulse line by sending a 3.8 mA signal. ProSafe-RS recognizes this signal as a diagnostic and sends an alarm to the DCS alerting the operators to fix the problem. No shutdown is needed. To achieve this functionality in a non-integrated system, careful application level programming involving analog filtering and comparison is needed between the sensors and the logic solver, as well as complex engineering to send alarms from the logic solver to the control system.

Such collaborative functionalities ensure maximum process availability by avoiding unwanted shutdown.

The total impact.

The use of certified field devices with automatic diagnostics will have a major impact on the safety and availability of safety instrumented functions.

In a comparison study by exida the two designs show a significant difference in PFDavg, a measure of safety integrity and MTTFS, mean time to failure spurious (false trip). The ad hoc solution uses conventional design techniques including three transmitters, a SIL3 logic solver and remote actuated valve. The Yokogawa integrated solution utilizes a single EJX certified pressure transmitter, a ProSafe-RS SIL3 certified logic solver and a single remote actuated valve with the SVI II digital positioner configured for automatic partial valve stroke testing every week (168 hours).

As compared to the ad-hoc solution, the Yokogawa integrated solution doubles safety loop availability, triples safety and extends valve proof test interval by ten times. The results show significant differences. When one considers the lower capital cost of the integrated solution, the differences look even better. When life cycle cost is considered (more frequent proof testing), the integrated solution looks even more superior.



	Yokogawa integrated solution	Ad-hoc solution
Description	Single EJX pressure transmitter, ProSafe-RS SIL3 logic solver, single remote actuated ball valve with SVI II.	2oo3 Pressure transmitters, SIL3 logic solver, single remote actuated ball valve with 3 way solenoid.
MTTFS	39 years	20 years
PFDavg / RRF	8.98E-3 / 111	2.68E-2 / 37
Proof test interval (valve)	5 years	6 months
Capital cost	Lower	Higher
Lifecycle cost	Low	Very High

MTTFS : mean-time-to-failure spurious
 PFD : probability of failure on demand
 RRF : risk reduction factor

Making critical plant information fully visible is just the beginning of the vigilant cycle

Seeing clearly gives you the knowledge necessary to anticipate the changes required in your process.
Knowing in advance brings you the speed and flexibility to optimize your plant in real time.
And by acting with agility, you are able to adapt to the ups and downs of your business environment.



VigilantPlant excels at bringing out the best in your plant and your people - keeping them fully aware, well informed, and ready to face the next challenge.

vigilantplant.[®]

The clear path to operational excellence

SEE
CLEARLY

KNOW
IN ADVANCE

ACT
WITH AGILITY

VigilantPlant is Yokogawa's automation concept for safe, reliable, and profitable plant operations. VigilantPlant aims to enable an ongoing state of Operational Excellence where plant personnel are watchful and attentive, well-informed, and ready to take actions that optimize plant and business performance.

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