

FS FUNCTIONAL SAFETY SERIES

IEC 61508/61511
Solutions Line Card



Functional Safety Solutions

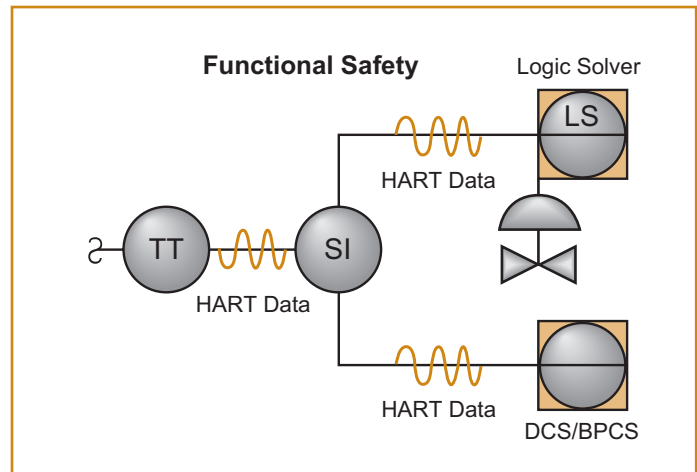
for Your Safety Instrumented System



Functional Safety Products Designed and Built for your Process

The Moore Industries **FS Functional Safety Series** instrumentation gives you layers of protection that reduce risk and deliver reliable performance when you need it most.

- Designed and built from the ground up for use with confidence in your Safety Instrumented System (SIS)
- Full third-party certification to IEC 61508 eases burden of proven in use on unapproved products
- SIL 2 and SIL 3 capable product family designed to meet your safety loop instrumentation needs
- Operating temperature range of -40 to 85°C for the most demanding environments



All FS Series Instruments Feature

Standard 20v/m RFI/EMI Protection:

Special circuit and enclosure designs protect against the harmful effects of radio frequency interference (RFI) and electromagnetic interference (EMI).

Rugged Housing:

All instruments are available in either a rugged and durable aluminum DIN-rail case or housed in a field mount explosion-proof or flameproof enclosure.

Certificates:

Exida certificates for Functional Safety Series products are available for download on our website (www.miinet.com) or exida's website (www.exida.com).

FMEDA reports are reviewed and endorsed by exida. Because each report is specific to hardware and firmware versions, all FMEDA reports are sent upon request so we can guarantee that you always have the latest version.



SSX/SST



Safety Signal Isolators and Splitters

STA



Safety Trip Alarm (Logic Solver)

STZ

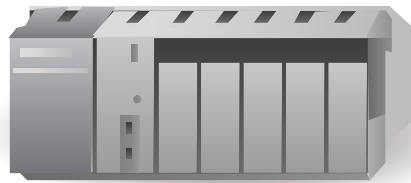


Safety Temperature Transmitters

4-20mA
4-20mA with HART

4-20mA
4-20mA with HART

Analog Output or Relay



Functional Safety PLC

Relay

SRM



Safety Relay Module/Repeater

4-20mA

4-20mA

SFY



Safety Frequency Transmitter

SLD



Safety Signal Monitor and Display

STA Functional Safety Trip Alarm

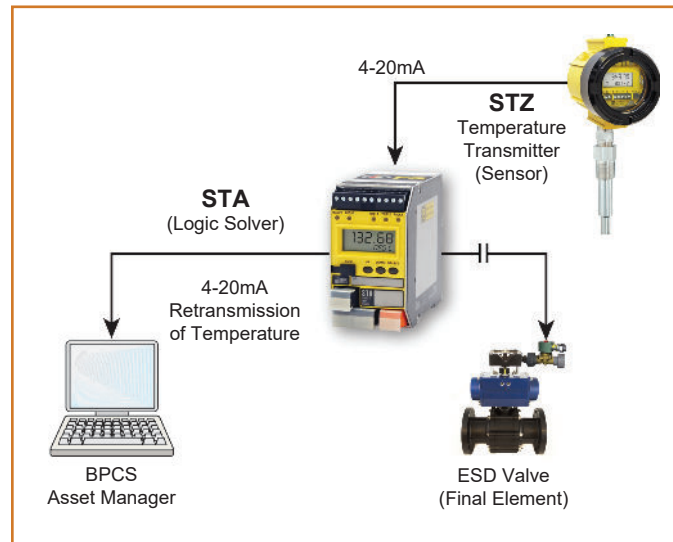


Description

The exida® certified SIL 2/3 capable STA Safety Trip Alarm performs as a logic solver and acts on potentially hazardous process conditions in your SIS. The STA models accept a signal input from transmitters, temperature sensors and a wide array of other monitoring and control instruments.

Features

- Dual process alarms, one fault alarm
- Site-programmable with password protection
- Combined alarm trip and transmitter
- Large 5-digit process and status readout



STZ Functional Safety Dual Input Smart HART® Temperature Transmitters



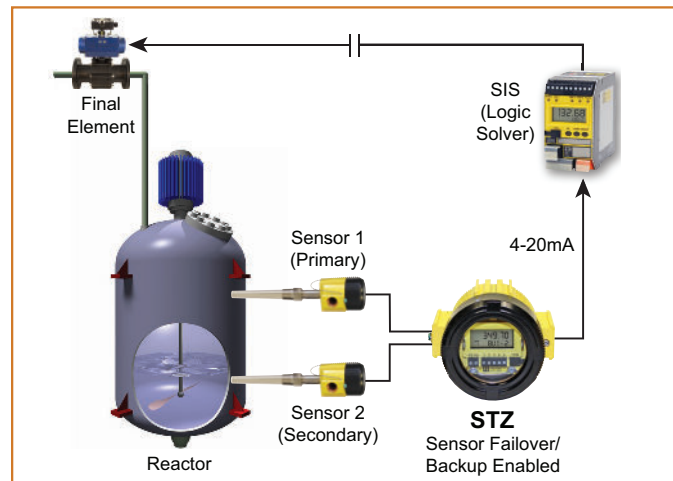
Description

The exida certified SIL 2/3 capable STZ Dual Input Smart HART® Temperature Transmitters were designed from the ground up for use in your SIS. The STZ configures quickly and easily to accept a single or dual input from a wide array of sensors and analog devices.

Features

Dual Sensor Input means expanded measurement capability, protection and diagnostics:

- Backup and fail-over protection
- Average and differential measurement
- High-select and low-select
- FDT/DTM or HART DD configurable
- HART configuration includes a read-only or disabled mode for added security



Advanced Diagnostics & Configuration

- Sensor drift and corrosion detection
- Smart range alarms
- High availability option

SSX and SST Functional Safety Isolators and Splitter



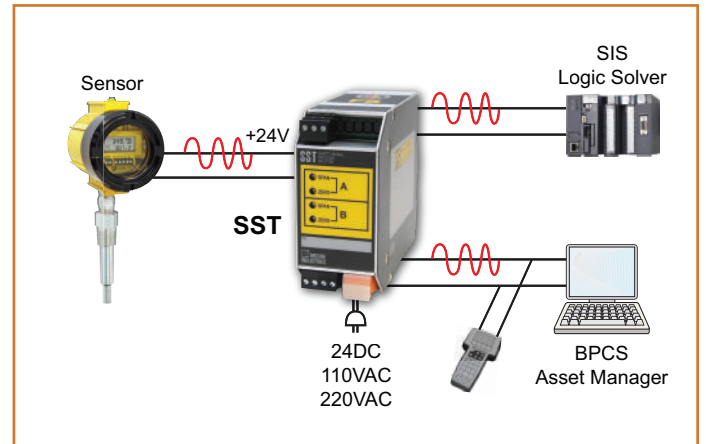
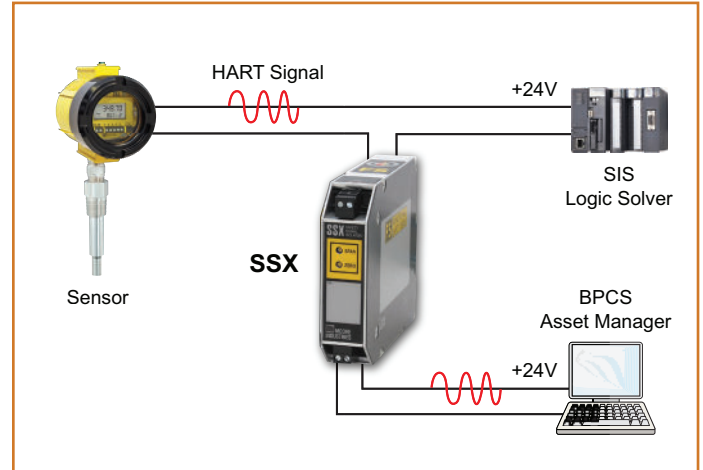
Description

These exida® certified SIL 2/3 capable 2-wire and 4-wire Isolators and Splitter provide isolation and signal splitting for your SIS needs.

These units protect and enhance loops and also pass valuable HART® data from the field transmitter to host systems and vice-versa. They isolate your SIS from your Basic Process Control System or monitoring system so disconnections or failures to these secondary systems don't affect your safety system.

Features

- 1500Vrms isolating capability
- Built-in HART pass-through technology
- SST Splitter provides two fully isolated outputs
- SST includes Transmitter Excitation



SRM Functional Safety Relay Module

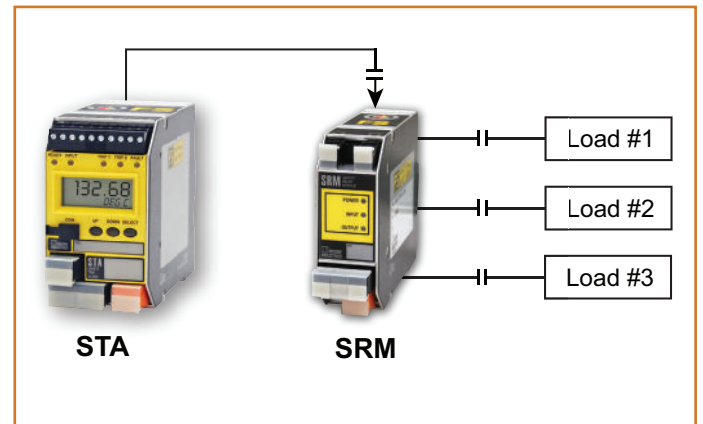


Description

The exida® certified SIL 2 capable SRM Safety Relay Module provides a high level of availability for safety-critical applications within your SIS. The SRM is a relay repeater that accepts a single contact closure input from a logic solver, such as the STA Safety Trip Alarm, and provides three relay outputs per alarm input. This allows you to simply and cost effectively add additional alarm contacts to your safety system.

Features

- Visual front panel diagnostic information
- Internal input snubbing diode
- Fuse protected input power and relays



SFY Functional Safety Frequency-to-DC Transmitter



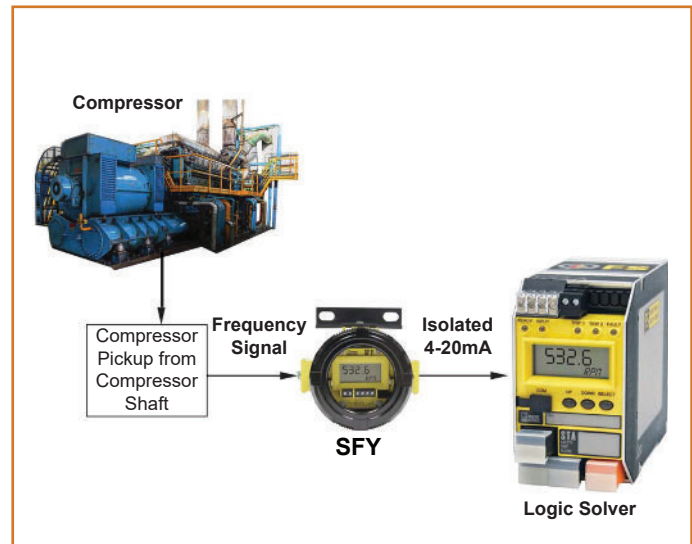
Description

The SFY Functional Safety SIL 3 capable Frequency-to-DC Transmitter with Display monitors frequency, period, high or low pulse width, and contact closure signals and converts the input signal to a proportional, input-to-output isolated 4-20mA output ready for direct interface with a Safety System, readout

instrument, recorder, PLC, DCS, SCADA system.

Features

- Versatile frequency range input choices
- Programmable moving average filter
- Quick and easy configuration from your PC



SLD Functional Safety Programmable Loop Display



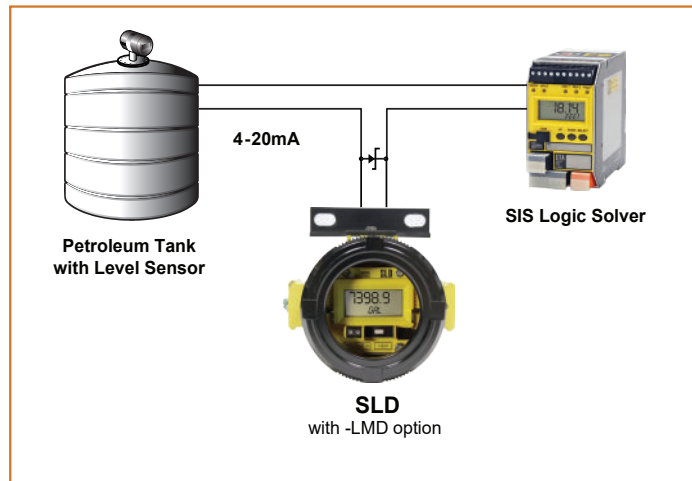
Description

The SIL 3 capable Moore Industries' SLD Safety Programmable Loop Display features a large integral display that shows real-time process status in mA, percent, or any designated 5-character Engineering Units (EGU). SLD is used in

a Safety Instrumented Function to display critical process data at eye level for plant personnel. The SLD is a non-interference device that can be taken out of the loop with the -LMD option (Loop Maintenance Diode) without affecting the integrity of the SIF loop.

Features

- Easy-to-read, customizable display
- 360°, flexible mounting at any angle in nearly any environment
- Low voltage drop allows the SLD to be installed on burdened loops
- Custom and square root curves
- Can be removed from the loop for maintenance without interrupting your safety function





Safety Instrumented Systems: The “Logic” of Single Loop Logic Solvers

As companies become more aware of the risks associated with their operations due to catastrophic events, they understand the importance of complying with national and worldwide safety standards such as ANSI/ISA 84 and IEC 61508/61511. A key element to compliance and safety are Single Loop Logic Solvers, which work within a Safety Instrument System to monitor variables such as temperature, pressure, level, flow, position or status. They can provide a warning, on/off control or emergency shutdown if readings exceed a specified level. This white paper highlights safety alarm trips from Moore Industries and how they can help provide your plant with a valuable asset in complying with important safety standards and preventing potential devastating accidents from occurring in case of an emergency.



Logic Solver for Tank Overfill Protection

When a storage facility’s tank level rises above safe limits, a logic solver that is part of a Safety Instrumented System (SIS) initiates final elements to restore the process to a safe state. This can include shutting off input feeds to the tank by isolating the pump and closing the input valve. This white paper explores the possibilities available to SIS designers of tank overfill protection systems when using a logic solver. It includes examples of system topographies and their associated Safety Integrity Level (SIL) calculations.



Logic Solver for Overpressure Protection

A high integrity pressure protection system (HIPPS) is a specific type of Safety Instrumented System (SIS) that acts as a barrier between high and low pressure parts of an installation without the need to release fluid into the environment or otherwise contaminate it. Within this SIS, the logic solver initiates the final elements that restore the process back to a safe state. This white paper explores the possibilities available to SIS designers of tank overpressure protection systems when using a logic solver. It includes examples of system topographies and their associated Safety Integrity Level (SIL) calculations.



Signal Isolators, Converters and Interfaces: The “Ins” and “Outs”

Signal isolators are useful process instruments that solve important ground loop and signal conversion problems. But they do much more than that. This white paper shows how signal isolators can be used to share, split, boost, protect, step down, linearize and even digitize process signals. It also gives a guide on what to look for when selecting a signal isolator.



Vetting Smart Instruments for the Nuclear Industry

Moore Industries’ early experience with the EMPHASIS assessment tool in the UK has helped shape our approach to building products designed for functional safety and use in the global and UK nuclear industry. This white paper examines the steps we took to ensure that specific products were designed following strict adherence to the IEC 61508 standard and how using the EMPHASIS process enabled us to further improve our design and development systems for products used in safety related applications throughout the nuclear industry.

Functional Safety - IEC 61508

Device Selection Process for Your SIF

To determine whether an approved device can meet the required SIL for use in a SIF, there are three factors which must be assessed to arrive at a final device SIL Capability:

- 1- Probability of Failure on Demand (SILpfd)
- 2- Architectural Constraint (SILac)
- 3- Systematic Capability (SILsc)

Information to determine these SIL capabilities can be found in the IEC 61508 approved device's safety certificate and FMEDA report.

Determining what SIL (Safety Integrity Level) each SIF (Safety Instrumented Function) Needs

Severity of Damage ↑ Extensive Minor	Extensive	SIL 3	SIL 3	SIL 4	SIL 4
		SIL 2	SIL 2	SIL 3	SIL 4
		SIL 1	SIL 2	SIL 2	SIL 3
	Minor	SIL 1	SIL 1	SIL 2	SIL 3
		Low → High Probability of Occurrence (Frequency)			

1 SILpfd - Probability of Failure on Demand

The PFD_{AVG} (or PFH for high demand applications) is calculated for each instrument (or set of instruments for redundant architectures) based on the architecture, dangerous failure rate and proof test interval. The sum of PFD_{AVG} (or PFH) for all instruments in the SIF limits the maximum capable SIL.

Safety Integrity	PFD/PFH Requirements for Safety Instrumented Functions			
	LOW DEMAND MODE		HIGH DEMAND MODE	
	Average Probability of Failure on Demand (PFD _{AVG})	Risk Reduction Factor (RRF)	Average Frequency of a Dangerous Failure per Hour (PFH)	Risk Reduction Factor (RRF)
SIL 1	0.1-0.01	10-100	0.00001-0.000001	100,000-1,000,000
SIL 2	0.01-0.001	100-1,000	0.000001-0.0000001	1,000,000-10,000,000
SIL 3	0.001-0.0001	1,000-10,000	0.0000001-0.00000001	10,000,000-100,000,000
SIL 4	0.0001-0.00001	10,000-100,000	0.00000001-0.000000001	100,000,000-1,000,000,000

2 SILac - Architectural Constraint

The capable SIL is limited by the instrument device type (A or B), Safe Failure Fraction (SFF) and Hardware Fault Tolerance (HFT) in the SIF.

3 SILsc - Systematic Capability

This is defined on the certificate as the Systematic Capability or Systematic Integrity level. This corresponds directly to the device's maximum SIL capability.

Device Selection via Proven In Use

When instruments do not have SIL capable certification the onus is on you, the end user, to justify the equipment for the SIF. You must assess the three SIL criteria covered here, and your device use justification needs to be made based on Proven In Use data and assessment of the device manufacturer's quality management and configuration management systems. You must also verify that the Proven In Use data is drawn from similar applications and environmental conditions.

Safe Failure Fraction (SFF)

The ratio of the average failure rates of safe plus dangerous detected failures and safe plus dangerous failures.

$$SFF = \frac{\lambda_s + \lambda_{DD}}{\lambda_s + \lambda_D}$$

Failure Types λ	Detected	Undetected
Safe λ_s	Safe Detected λ_{SD}	Safe Undetected λ_{SU}
Dangerous λ_D	Dangerous Detected λ_{DD}	Dangerous Undetected λ_{UD}

Per IEC 61508:2010, safe failures do not include "no part" or "no effect" failures.

Architectural Constraints: Safe Failure Fraction (SFF) & Hardware Fault Tolerance (HFT)

SFF	TYPE A (SIMPLE) DEVICE			TYPE B (COMPLEX) DEVICE		
	HFT			HFT		
	0	1	2	0	1	2
<60%	SIL 1	SIL 2	SIL 3	Not Allowed	SIL 1	SIL 2
60% < 90%	SIL 2	SIL 3	SIL 4	SIL 1	SIL 2	SIL 3
90% < 99%	SIL 3	SIL 4	SIL 4	SIL 2	SIL 3	SIL 4
≥99%	SIL 3	SIL 4	SIL 4	SIL 3	SIL 4	SIL 4

Note: Architectural Constraints may be reduced if good quality failure data (Proven In Use) is available. This is defined in IEC 61508 as Route 2_H (section 7.4.4) and as Prior Use in IEC 61511 (section 11.4.4).