MOORE INDUSTRIES WORLDWIDE

Demand Moore Reliability

FS FUNCTIONAL SAFETY SERIES

IEC 61508/61511
Solutions Line Card

Functional Safety Solutions

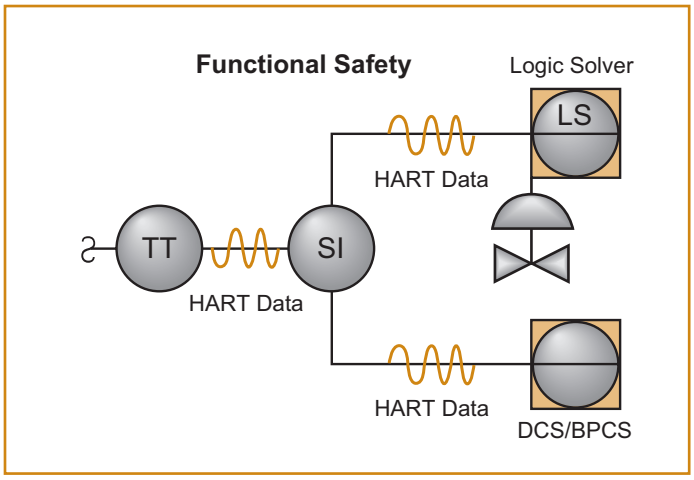
for Your **Safety Instrumented System**

www.miinet.com

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
Relay

Shutdown Device

Functional Safety PLC/Host

SFY

Safety Frequency Transmitter

4-20mA

4-20mA

Relay

SRM

Safety Relay Module/Repeater

MODBUS RTU
MODBUS/TCP
HTTP-Web Server

Analog
Discrete
Relay

SLD

Safety Loop Display

SLA

Safety Logic Alarm (Multiloop Logic Solver)

Analog Output or Discrete/Relay

Shutdown Device

SLA Functional Safety Logic Solver and Alarm

Part of the Moore Industries FS FUNCTIONAL SAFETY SERIES, the exida® certified SIL 2/3 capable SLA is a versatile multiloop and multifunctional Safety Logic Solver and Alarm that acts on hazardous process conditions; warns of unwanted process parameters; provides emergency shutdown; or provides on/off control in Safety Instrumented Systems (SIS) and traditional alarm trip applications.

The FDT/DTM programmable 4-wire (line/mains powered) SLA accepts up to four discrete and six analog inputs from a wide array of devices and sensors.

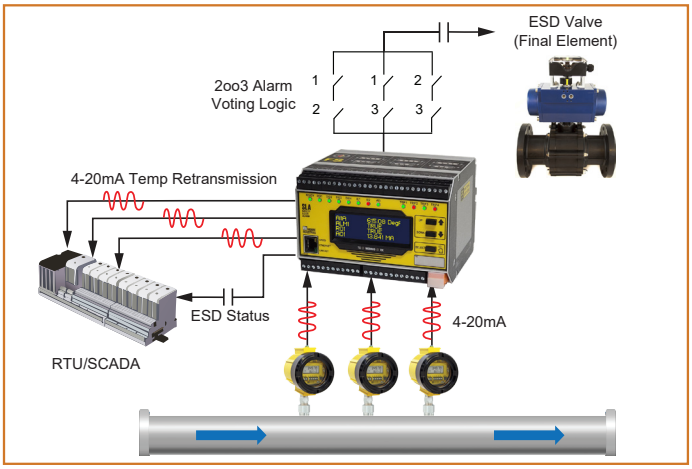
The SLA has four relay outputs and up to four discrete contact closure outputs that can be driven by any of the programmable 16 internal alarms. Individual or multiple alarms can be assigned to each relay or discrete output. Relay and discrete outputs can also be triggered by any input or internal diagnostic fault.

Three optional analog outputs allow retransmission of any input or internally calculated equation or variable.

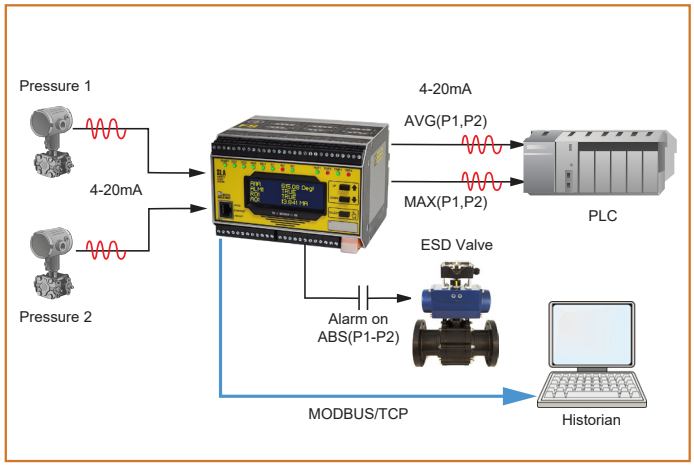
The SLA features a metal, RFI/EMI resistant housing with OLED display that snaps onto standard DIN-style rails.

Features

- Multiloop and Multifunctional Logic Solver
- FDT/DTM Programmable
- Dynamic Alarming Capability
- Secure Programming and Communication
- Intuitive Equation Editor for Math and Logic Functions
- HART Pass-through Capable
- Integrated Secure Web Server
- Embedded Event Logger



The SLA performs 2oo3 alarm logic voting in this low temperature gas pipeline application. Once any two temperatures fall below setpoint, SLA closes the emergency shutdown valve and informs RTU/SCADA. Analog and HART data from temperature transmitters are passed along to RTU/SCADA system.

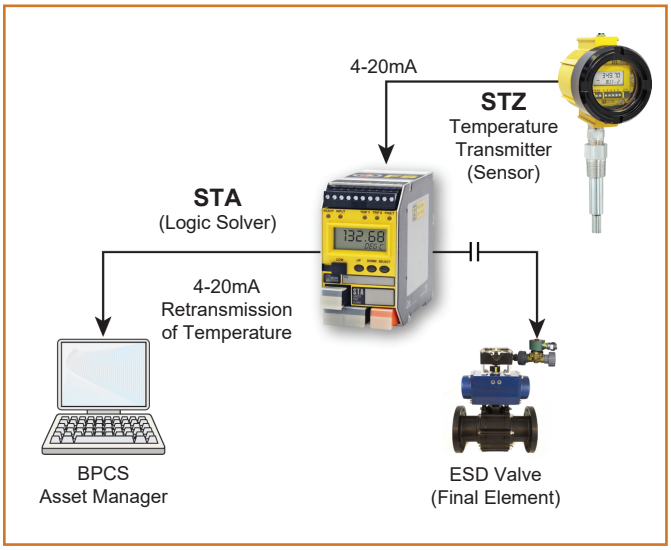


SLA monitors two critical vessel pressures and performs an internal differential calculation to alarm and shut down the process when the pressure differential breaches setpoint. The average and maximum pressure is also calculated and transmitted to a remote PLC for monitoring. All SLA and process parameters are also digitally sent over Ethernet to a historical archiving system via MODBUS/TCP.

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.



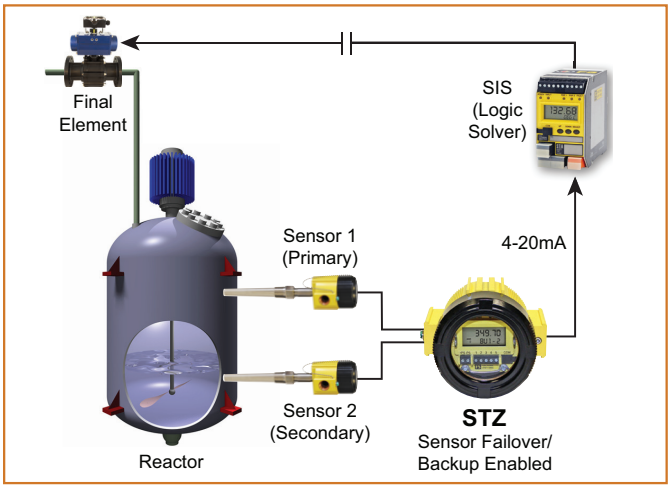
Features

- 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

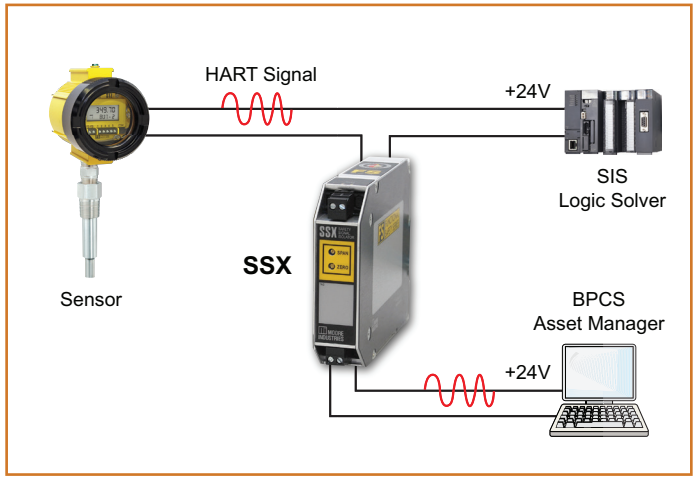
- Sensor Drift and Corrosion Detection
- Smart Range Alarms
- High Availability Option

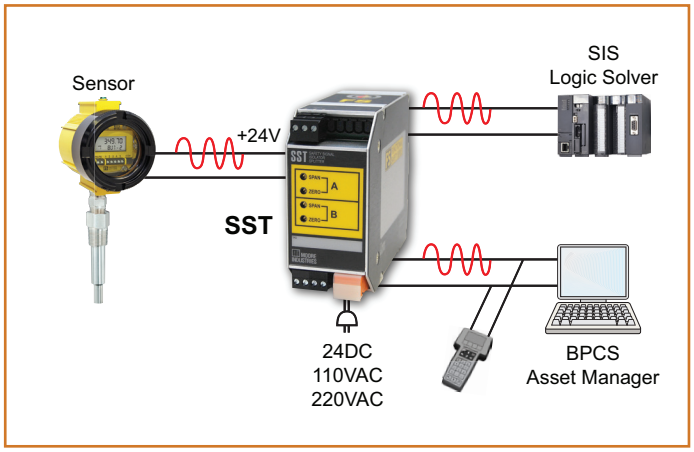
SSX and SST Functional Safety Isolators and Splitter

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.





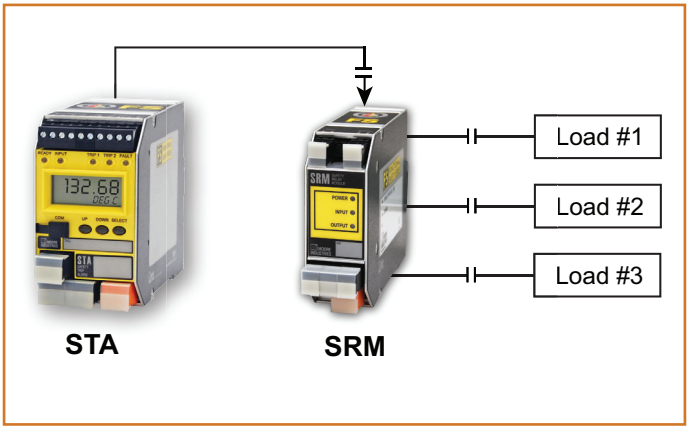
Features

- 1500Vrms Isolating Capability
- Built-in HART Pass-through Technology
- SST Splitter Provides Two Fully Isolated Outputs
- SST Includes Transmitter Excitation (24Vdc)

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 and provides three relay outputs per alarm input. This allows the simple addition of alarm contacts to your safety system.



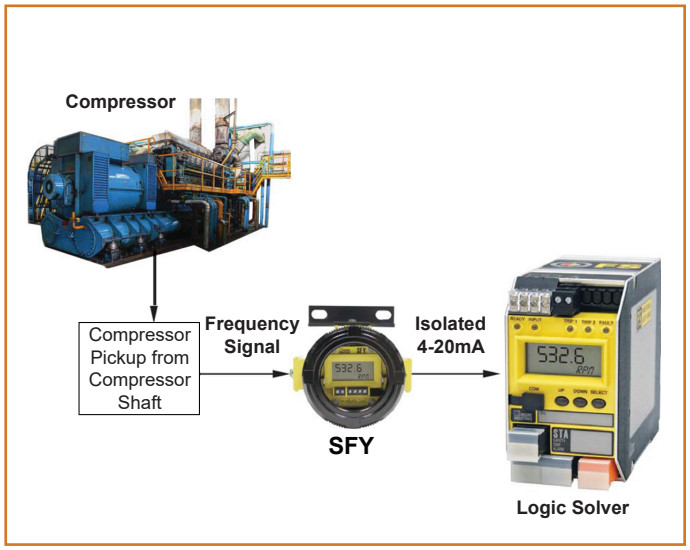
Features

- Visual Front Panel Diagnostic Information
- Internal Input Snubbing Diode
- Fuse Protected Input Power and Relays

SFY Functional Safety Frequency-to-DC Transmitter

Description

The exida® certified SIL 2/3 capable SFY Functional Safety 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.



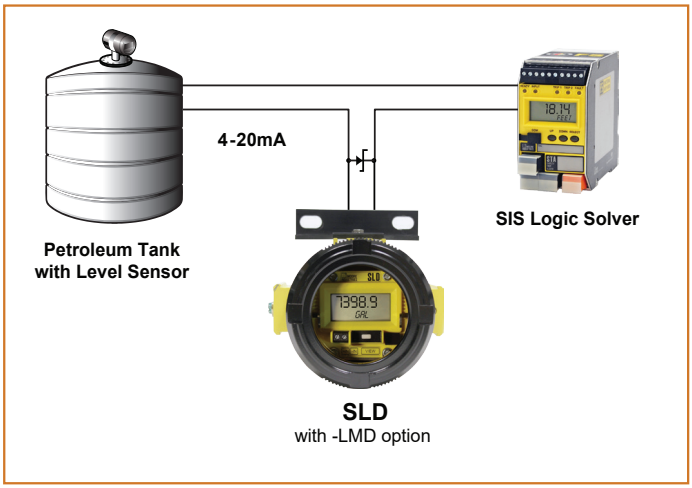
Features

- Versatile Frequency Range Input Choices
- Programmable Moving Average Filter
- Quick and Easy Configuration From Your PC

SLD Functional Safety Programmable Loop Display

Description

The 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

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	Probability of Occurrence (Frequency)			
	Low			High
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

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.

PFD/PFH Requirements for Safety Instrumented Functions

Safety Integrity	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 per Hour (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.

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)

	TYPE A (SIMPLE) DEVICE			TYPE B (COMPLEX) DEVICE		
	HFT			HFT		
SFF	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).

3 SILac - 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.

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