

ProTech[®]-SX Safety System

with Integrated Overspeed Protection (Safety Certified)

Description

The ProTech-SX ("ProTech Simplex") is a safety PLC (programmable logic controller) with integrated overspeed protection designed to safely shut down any plant process equipment, engine, or steam, gas, or hydro turbine upon sensing a safety event. This stand-alone safety system accepts two speed inputs and seven discrete/analog inputs, uses programmed logic to determine when a safety event has occurred, then issues system shutdown commands and alarms. The ProTech-SX uses five fast-acting, configurable relay outputs and a speed meter output to interface with/command the specific system or device being protected.

Designed to safely protect high-speed rotating equipment in system-critical applications, this safety PLC's total response time is less than 12 milliseconds.

Programmable inputs and outputs, a 4–20 mA speed readout, and Modbus[®] * communications make this device easy to integrate into any plant, engine, or turbine safety system.

The ProTech-SX is available in a flush-mount model designed to be installed within a panel or cabinet door located in a control room or on the turbine skid. Designed for harsh environments when installed within an enclosure, this device has an ingress protection rating of IP56 (protected against dust and completely protected against jets of water of similar force to heavy seas).

Depending on the model ordered, the ProTech-SX accepts either two high-voltage power inputs (90–240 Vac / 100–150 Vdc) or one high-voltage power input (90–240 Vac / 100–150 Vdc) and one low-voltage power input (18–32 Vdc). This design works on a high-signal-select basis, allowing the unit to fully operate with either or both power sources available.

*—Modbus is a trademark of Schneider Automation Inc.

Applications

The ProTech-SX safety system is designed to be applied as a safety system for small engines, steam, gas, or hydro turbines, or related plant systems. This safety PLC's fast (12 millisecond) response time, 0.5 to 32 000 rpm speed range, and integrated overspeed and acceleration detection/protection functionality, make it ideal for application on all types and sizes of turbines or engines.

Alternatively, this stand-alone safety device can be configured to protect any plant system or device, and report the system's/device's status to the plant DCS. The ProTech-SX's versatile inputs, outputs, programming environment, and communications make it ideal as a safety protection device for use in small applications that could possibly reach an unsafe state or condition and that must communicate directly to the plant DCS.

The ProTech-SX is designed for critical applications where both personnel safety and unit availability (operation run time) is a concern or necessity. Certified as an IEC61508 SIL-2 (Safety Integrity Level 2) safety device, the ProTech-SX can easily be applied as a stand-alone IEC61508-based device or within an IEC61511-based plant safety system. A thorough product manual is provided to instruct users on how to apply the ProTech-SX to meet IEC based requirements.

The ProTech-SX's high-end functionality, like first-out trip indication, alarm & trip logs, valve response monitoring, programmable auto-test routines, coupled with its cost-effective price, make it useful as a safety device, as a cost effective speed switch (four programmable relays), or as a valve health monitor.



- IEC61508 SIL-2 Certified
- API670 & API612 Compliant
- Overspeed protection
- Acceleration & deceleration protection
- 2 redundant speed inputs
 - ▶ HSS or LSS
- Programmable logic
 - ▶ 7 inputs
 - ▶ Discrete or Analog
 - ▶ Trip/alarm logic
 - ▶ Test logic
- Auto test routines
- Trip valve health monitoring
- Trip, Alarm & Test logs
- Modbus communications
- Password security protection
- 12 millisecond response time

Interface with related control systems or plant DCS's (Distributed Control Systems) can be performed via the ProTech-SX's hard-wired inputs and outputs or through its serial Modbus communication port. Optionally, an Ethernet gateway can be purchased to easily interface with a plant Ethernet network.

Functionality

Programming—The ProTech-SX functions as a safety PLC, as it accepts seven discrete or analog inputs, and allows users to create custom safety/protection programs to protect site personnel and equipment. Programmers are able to utilize typical logic and testing sequence routines to create their application-specific safety logic and tests.

On-Line Testing—The ProTech-SX can be tested manually from the module's front panel, Modbus communications port, or automatically via its auto-test routine function. The ProTech-SX allows users to configure overspeed or custom programmed tests to be performed manually or automatically.

Trip, Alarm, & Overspeed Logs—The ProTech-SX log function logs (saves to memory) all trips, alarms, trip valve response times, and overspeed events. The trip log function uses a scrolling buffer and records the last 50 sensed trip or alarm events and the last 20 overspeed events to memory, with associated times. Each log file can be viewed from the unit's front panel, or downloaded to a computer via the ProTech-SX service tool program. Each module utilizes non-volatile memory to ensure all logged events are saved, even on loss of power.

Trip Valve Health Monitoring—The ProTech-SX can be configured to test, log, and alarm on the response time of a turbine trip valve. Using the trooper's built-in valve response monitoring function, users can connect a valve position sensor (limit switch, pressure switch) to a ProTech-SX input and configure the ProTech-SX to monitor, log, and alarm the time period between when a trip command was sent and when a valve closed indication was received.

Real Time Clock—Each ProTech-SX utilizes a real-time clock to ensure accurate time logging. Alternatively, one of the ProTech-SX inputs can be configured to accept a discrete clock synchronization input signal from a plant DCS or other time synch device.

Features

High Resolution Displays—The ProTech-SX includes a high-resolution 107 mm (4.2") color display and keypad to allow users to locally monitor configuration settings, statuses, system inputs and outputs, and alarm, trip, and overspeed logs.

Acceleration/Deceleration Detection—Optionally, this safety system can be configured to protect a turbine from high acceleration/deceleration events. The derivative of the speed signal is used to detect turbine/engine acceleration/deceleration and issue an associated trip command.

MPU Detection—The ProTech-SX's speed-sensor input includes a special MPU open-wire detection circuit to validate that an MPU is properly connected before and during turbine operation. Note: Due to the difference in circuitry, this special, open-wire detection circuit is not available for use with active/proximity speed pickups.

Sulfur Contamination Resistant—The ProTech-SX utilizes a special conformal coating material that has demonstrated excellent long-term protection against H₂S and SO₂ gases at levels classified in international standard IEC 721-3-3 1994 - environment Class 3C2.

Configurability

The ProTech-SX is programmed through a software service tool, allowing users to customize the safety device's inputs, outputs, and operation to a specific application. Designed specifically as a safety PLC, the ProTech-SX includes safety-based logic, testing functions, testing sequences, and logging. Typical programmable logic functions (AND, NAND, OR, NOR, XOR, XNOR, NOT, analog comparators, timers, delays, etc) are available to create application-specific safety programs. Password protection is used to protect each module from accidental or malicious configuration changes.

This safety system can be programmed to accept simplex or dual-redundant speed signals, and simplex, dual redundant, or TMR discrete or analog signals. When configured to accept redundant inputs, system failures (switches, transducers, modules) are detected, annunciated, and allowed to be repaired or replaced while the monitored system continues to operate on-line.

Installation Information

- Approximate dimensions, including faceplate:
267 x 165 x 89 mm (10.5 x 6.5 x 3.5")
- Approximate mounting enclosure opening size:
241 x 140 mm (9.5 x 5.5")
- Designed to be flush-mounted vertically within a panel or cabinet
- Rated for IP56 (ingress protection level 5-6) based locations
- Operating / storage temperature range: -20 to +60 °C

Inputs Signals

Power Source (2 redundant)

- High-Voltage Power Supply (90–264 Vac/47–63 Hz. 100–150 Vdc) @ 30 W
- Low-Voltage Power Supply (18–32 Vdc) @ 30 W

Speed Signals (2 redundant)

Input #1 can be configured to accept signals from:

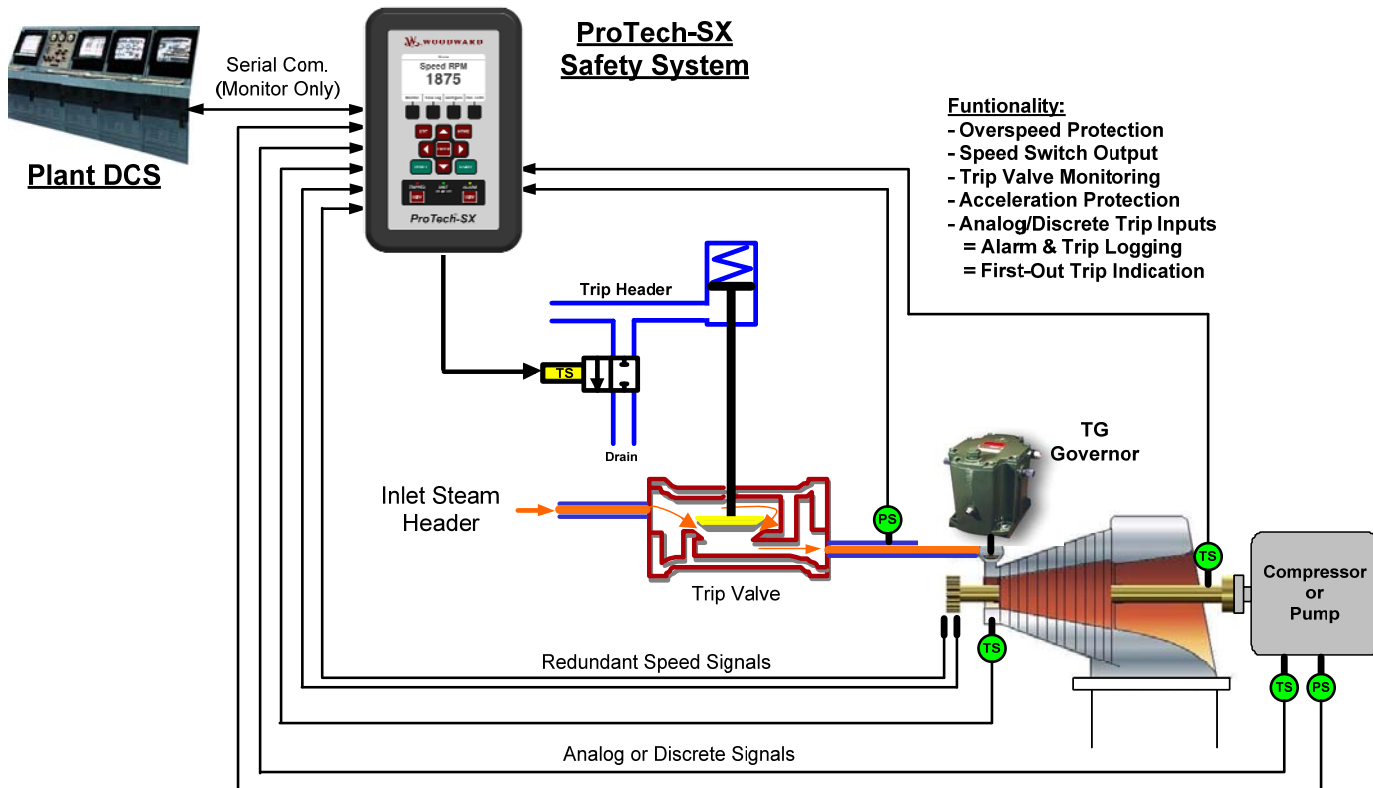
- MPUs (100–32 000 Hz) @ (1–35 Vrms)
- Proximity probes (0.5–25 000 Hz) @ 24 Vdc
- Gear Tooth Range (1–320 teeth)

Input #2 can be configured to accept signals from:

- MPUs (100–32 000 Hz) @ (1–35 Vrms), Gear Tooth Range (1–320 teeth)

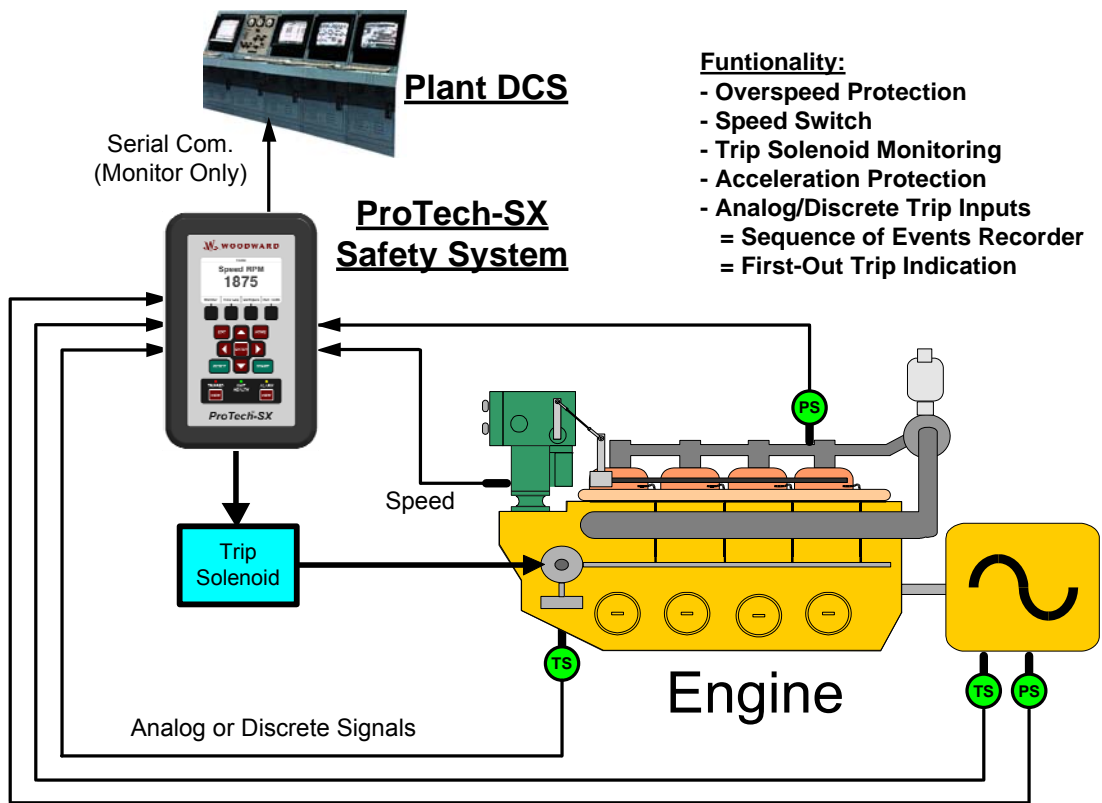
Analog/Discrete Inputs (10)

- Alarm/Trip Reset Command (Discrete Input)
- Start Command (Discrete Input)
- Failed Speed Signal Override Command (Discrete Input)
- Analog or Discrete Inputs—Configurable (7)



- Functionality:**
- Overspeed Protection
 - Speed Switch Output
 - Trip Valve Monitoring
 - Acceleration Protection
 - Analog/Discrete Trip Inputs = Alarm & Trip Logging
 - = First-Out Trip Indication

ProTech-SX Safety System Turbine Application Diagram



- Functionality:**
- Overspeed Protection
 - Speed Switch
 - Trip Solenoid Monitoring
 - Acceleration Protection
 - Analog/Discrete Trip Inputs = Sequence of Events Recorder
 - = First-Out Trip Indication

ProTech-SX Safety System Engine Application Diagram

Output Signals

Discrete Outputs (5 solid-state outputs)

- Shutdown relay outputs (2)—Rated for 1 A @ 24 Vdc
- Programmable solid-state relay outputs (3)
 - ▶ Rated for 1 A @ 24 Vdc
 - ▶ Functions—alarm, trip, speed switch, analog switch, test status, etc
 - ▶ 24 Vdc, 0.5 A auxiliary power available for interposing relay circuits

4–20 mA Analog Output (1)

- Dedicated to function as a speed meter readout

Communication Ports (1)

- Serial RS-232, RS-422, RS-485
- Modbus protocol

Regulatory Compliance

North American Compliance:

- **CSA:** CSA Certified for Class I, Division 2, Groups A, B, C, and D, T3 at 60 °C Ambient for use in Canada and the United States

European Compliance:

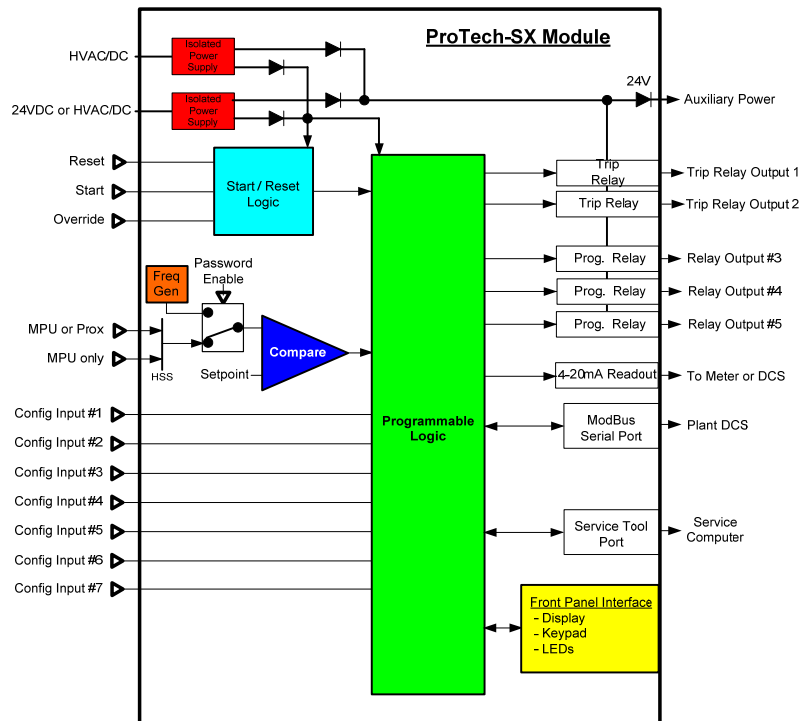
- **EMC Directive:** 2004/108/EC
- **ATEX Directive:** 94/9/EC Zone 2, Category 3, Group II G, Ex nA II T3

Other International Compliance:

- **TÜV:** TÜV certified for SIL-2 per IEC 61508 Parts 1-7, Function Safety of Electrical / Electronic / Programmable Electronic Safety Related Systems
- **C-Tick:** Declared to Australian Radiocommunications Act of 1992 and the New Zealand Radiocommunications Act of 1989.
- **GOST R:** Certified for use in explosive atmospheres within the Russian Federation per GOST R Certificate POCC US.ГБ04.В01594 with marking ExnAIICT4GcU

Other Compliance:

- **IEC60068-2-60:** 1995 Part 2.60 Methods 1 and 4 (conformal coating)
- **API670 & API612** compliant
- **RoHS Exempt** per Annex IA of Directive 2002/96/EC referring to "monitoring and control instruments" within the meaning of Category 9



ProTech-SX Functional Diagram



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