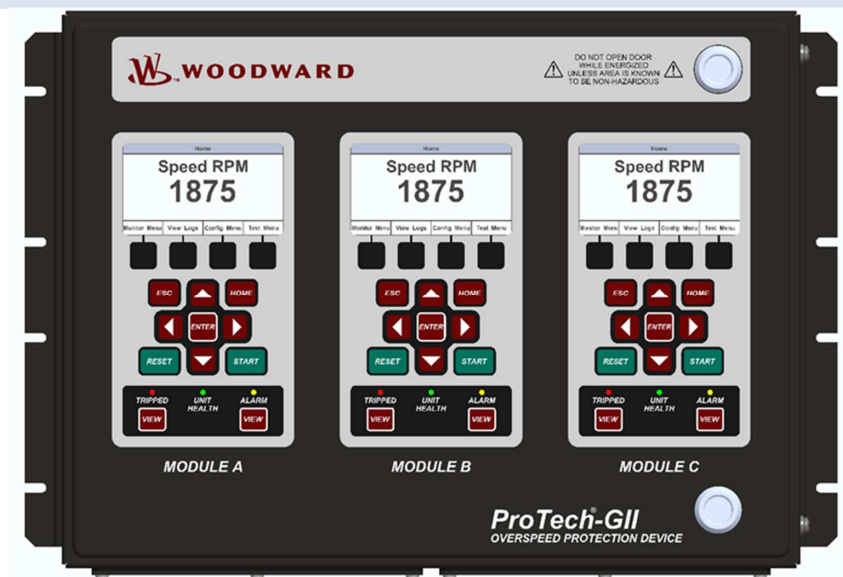


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**Product Manual 26545
(Revision G, 10/2020)
Original Instructions**



**Product Line
Overspeed Protection Device**

Installation and Operation Manual

Released**Manual 26545****ProTech-GII Overspeed Protection Device**

Chapter 1. General Information

Description

The ProTech-GII is a device designed to safely shutdown steam, gas and hydro turbines, as well as motors, compressors, reciprocating engines and other equipment, upon sensing an overspeed or over-acceleration event.

The ProTech-GII consists of three independent modules whose trip outputs are either independent or voted in a 2-out-of-3 configuration. The ProTech-GII includes Overspeed/Overacceleration, Alarm, and Trip log functions with time-stamping. Indication that a test was active at the time of the event is provided on all logs and first-out indications are provided for Trip logs.

The ProTech-GII provides various pre-defined test features including automated periodic tests.

There are several ways to interface with the ProTech-GII. The front panel allows the user to view current values, and to perform configuration and test functions. All of the features and most of the information available from the front panel are also accessible via the Modbus® * interface. Finally, the Programming and Configuration Tool (PCT) is software that is run on a PC to download log files and manage settings files.

*—Modbus is a trademark of Schneider Automation Inc.

This product is designed for critical applications and when installed correctly meets API-670, API-612, API-611, and IEC61508 (SIL-3) standards.

IMPORTANT

Note that the trip cycle time feature is not available on the ProTech-GII. If this function is desired, to determine the time between when a trip command is issued and the feedback from the system that the equipment has actually been tripped, a ProTechTPS or ProTech-SX must be purchased.

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The following table shows the various hardware configurations (mounting options, power supplies, and trip relay options) available:

Table 1-1. Available ProTech-GII Models

Part Number	Description
8237-1244	ProTech-GII - Bulkhead Mount, HV/LV, Independent Relay
8237-1367	ProTech-GII - Panel Mount, HV/LV, Independent Relay
8237-1245	ProTech-GII - Bulkhead Mount, HV/HV, Independent Relay
8237-1368	ProTech-GII - Panel Mount, HV/HV, Independent Relay
8237-1246	ProTech-GII - Bulkhead Mount, HV/LV, Voted Relays
8237-1369	ProTech-GII - Panel Mount, HV/LV, Voted Relays
8237-1247	ProTech-GII - Bulkhead Mount, HV/HV, Voted Relays
8237-1370	ProTech-GII - Panel Mount, HV/HV, Voted Relays
5437-1121	Spare Module for 8237-1244 Rev B or later, 8237-1367 Rev B or later
5437-1122	Spare Module for 8237-1245 Rev D or later, 8237-1368 Rev B or later
5437-1119	Spare Module for 8237-1246 Rev E or later, 8237-1369 Rev B or later
5437-1120	Spare Module for 8237-1247 Rev E or later, 8237-1370 Rev D or later
5437-1080	Spare Module for 8237-1244 Rev A or earlier -1367 Rev A or earlier
5437-1081	Spare Module for 8237-1245 Rev C or earlier -1368 Rev A or earlier
5437-1078	Spare Module for 8237-1246 Rev D or earlier, -1369 Rev A or earlier
5437-1079	Spare Module for 8237-1247 Rev D or earlier -1370 Rev C or earlier

Applications

The ProTech-GII is designed to be applied as an overspeed device for any size steam, gas, or hydro turbine, reciprocating engine, or plant process equipment. The device'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 critical low-speed or high-speed rotating motors, compressors, turbines or engines. This device accepts one speed (MPU or PROX) input per module (3 total). In addition to the trip relay outputs, each ProTech-GII module provides 1 relay output that is dedicated to an alarm function (3 total) and 1 analog speed output (3 total).

The ProTech-GII utilizes a triple modular redundant architecture and 2-out-of-3 voting logic to accurately determine unsafe conditions and ensure that no single-point failure will affect system reliability or availability. With this design, failures in overspeed system components (switches, transducers, modules) are detected, annunciated, and allowed to be repaired or replaced while the monitored system continues to operate on-line. The ProTech-GII is designed for critical applications where both personnel safety and unit availability (operation run time) is a concern or necessity.

The ProTech-GII is certified as an IEC61508 SIL-3 (Safety Integrity Level 3) safety device and can be applied as a stand-alone IEC61508-based device or within an IEC61511-based plant safety system.

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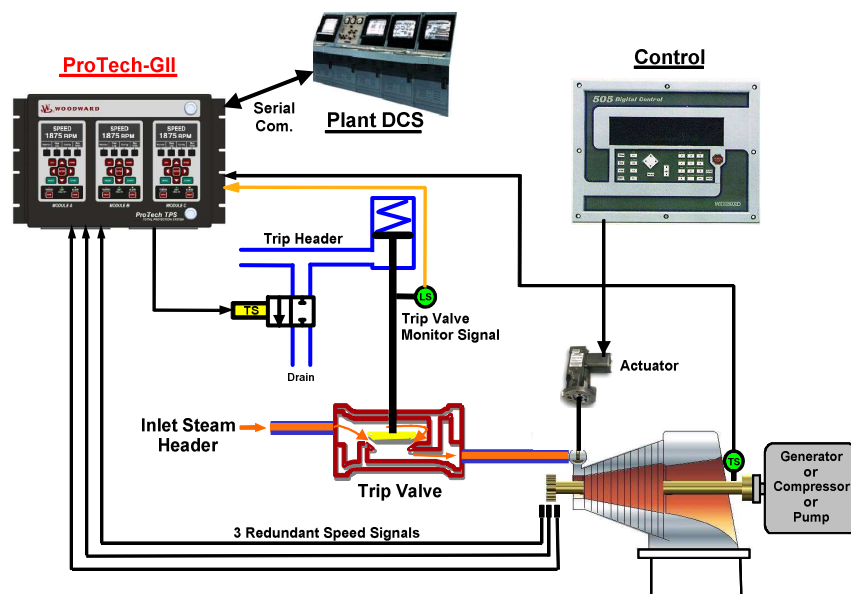


Figure 1-1. Typical ProTech-GII Application (Voted Trip Relay Models)

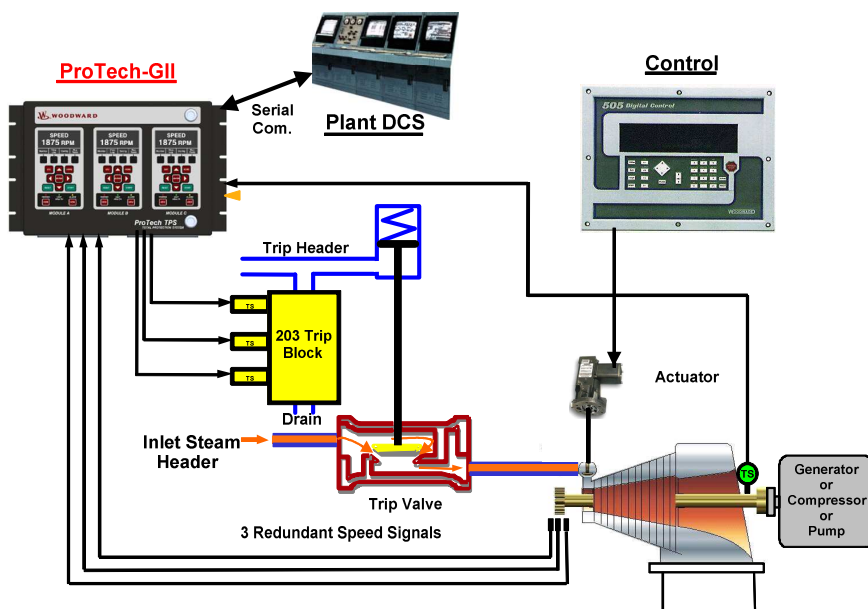


Figure 1-2. Typical ProTech-GII Application (Independent Trip Relay Models)

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Depending on the model purchased, the ProTech-GII has either a bulkhead-mounted or a panel-mounted enclosure package.

The bulkhead-mounted enclosure models are designed to be mounted on a wall or skid next to the turbine or equipment and are rated for IP56-based environments. With these models, field wiring access is through gland plates located on the bottom of the enclosure. Figures 2-1, 2-2, and 2-3 display the bulkhead-mounted ProTech-GII model's physical layout and mounting pattern.

The ProTech-GII panel-mounted enclosure models are designed for installation in a control room panel or cabinet and, by itself, cannot be bulkhead-mounted. Once installed within an IP56 rated panel or cabinet, the ProTech-GII panel-mounted models are rated for IP56-based environments. A gasket is attached to the rear side of the package's bezel to properly seal the ProTech-GII control's face-plate and around the mounting studs to a panel. With these models, field wiring access is located on the ProTech-GII control's back side, and a back cover is included to protect wiring terminals after installation. Figures 2-4 and 2-5 display the Panel-Mount ProTech-GII model's layout and mounting pattern.

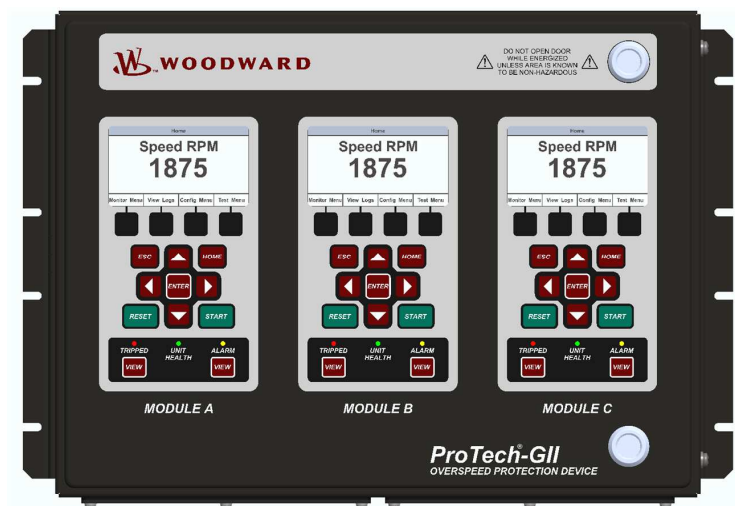
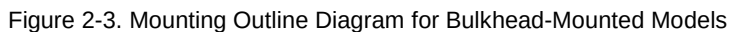


Figure 2-1. Typical ProTech-GII Bulkhead Package—Front View



Figure 2-2a. Typical ProTech-GII Bulkhead Package—Front Door Open

ProTech-GII Overspeed Protection Device



Note: The outline drawings for the TPS and GII are identical. The TPS is shown for reference.

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Table 2-1. Environmental Specifications

Operating Temperature:	–20 to +60 °C (–4 to +140 °F)
Storage Temperature (non operational):	–20 to +65 °C (–4 to +158 °F)
Relative Humidity:	Up to 95% (non-condensing)
Vibration:	0.04 G ² /Hz, 1.04 Grms, 10 to 500 Hz
Shock:	30 G, 11 ms half-sine pulse
Altitude:	Up to 3000 meters above sea level
Enclosure (Bulkhead Mount Version):	IP56 (per IEC 60529)
Enclosure (Panel Mount Version):	IP56, installed in IP56 enclosure/cabinet
Weight (Bulkhead Mount Version):	Approximately 26 lb (12 kg)
Weight (Panel Mount Version):	Approximately 22 lb (10 kg)
Pollution Degree:	2 (per IEC 60664-1)
Overvoltage Category:	II (per IEC 60664-1)
Electromagnetic Compatibility:	Emissions: EN61000-6-4 Immunity: EN61000-6-2

Power Supply Requirements

Each ProTech-GII system consists of three separate internal modules (A, B, C), and each of these three modules accept two input power sources. Depending on the ProTech-GII model purchased, the internal modules will accept either two high voltage (HV) input power sources or one HV input power source and one low voltage (LV) input power source. For reliability purposes, each ProTech-GII module will function normally with power sourced to either or both power supply inputs.

Power Supply Specifications

Table 2-2. Low Voltage Input Specifications

Number of Inputs	2. Input range depends on model (see following tables): • 2 High Voltage Inputs OR • 1 High Voltage and 1 Low Voltage
Wiring Constraints	Each power supply input must be provided with its own breaker. This is to facilitate both on-line-removal of a module, and also to protect other power supplies from tripping while connected to a common input power circuit.

High Voltage Input

Table 2-3. High Voltage Input Specifications

Voltage Input Range	90–264 Vac/47–63 Hz or 100–150 Vdc @ 30 W per module Nominal 115 Vac / 240 Vac / 125 Vdc
Current Input Max*	0.5 A @ 90 Vac 0.22 A @ 264 Vac 0.25 Arms @ 110 Vdc 0.18 Arms @ 150 Vdc
Inrush Current	10 A at 115 Vac, 20 A @ 220 Vac
Reverse Polarity Protection	Yes, for DC connection
Interrupt Time	45 ms, when operating on one power supply only

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Low Voltage Input

Table 2-4. Low Voltage Input Specifications

Voltage Input Range	18–32 Vdc @ 30 W per module Nominal 24 Vdc
Current Input Max*	1.5 A @ 18 Vdc 1 A @ 32 Vdc
Inrush Current	0.05 A ² sec
Reverse Polarity Protection	Yes
Interrupt Time	3 ms, when operating on one power supply only

NOTICE

*Note that the input current specifications are for one module, measured with the other power supply input disconnected. With both power supply inputs connected, input current will never exceed the maximum specification. However, the two power supplies do not load share internally.

Internally Generated Limited Power Supply

Table 2-5 Relay Output Power Supply Specifications

Relay Output Power Supply (24V_P)

Output Voltage	24 Vdc $\pm$ 10%
Current Limit	500 mA

Each ProTech-GII module will function normally with power sourced to both or either power supply input independently, however Woodward recommends that both input power sources be used to improve system availability. Please refer to Table 1-1 for available ProTech-GII models.

IMPORTANT

Since the ProTech-GII is designed to detect a failure of either power supply input, a continuous “Power Supply Fault Alarm” will be issued if power-sources are not connect for both power supply inputs.

Each ProTech-GII module requires a power source capable of a certain output voltage and current. In most cases, this power rating is stated in Volt-Amps (VA). The maximum VA of a source can be calculated by taking the rated output voltage times the maximum output current at that voltage. This value should be greater than or equal to the VA requirement listed.

WARNING

Each power source must be provided with an external disconnecting means that is identifiable to the specific power supply (A, B, or C).

NOTICE

A PE (Protective Earth) ground wire for each of the high voltage power supplies must be connected to PE ground. The PE ground connection wire must originate and be connected to PE at the power source. The PE ground wire must follow the power wires to the applicable power input connector PE Ground pin, so that each HV input has a PE ground. The PE ground wire gauge must be capable of handling the same current as the individual power wiring.

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NOTICE

A PE (Protective Earth) ground wire for the enclosure must be provided and connected to PE Ground. At least one of the enclosure's PE labeled connection points must have a wire going from the enclosure to a building PE ground point. This wire must be of sufficient gauge to handle the rated current of all the interposing relay wires or 1.5 mm² (16 AWG), whichever is larger.

Input/Output Specifications

Speed Input Specifications

Table 2-6. General I/O Specifications

Number of Inputs	1, selectable as passive or active probe by front panel configuration
Speed Sensing Accuracy	Accuracy: $\pm 0.04\%$ of current speed over -20 to $+60$ °C ambient temperature
Acceleration Sensing Accuracy and Range	Accuracy: $\pm 1\%$ of current speed Detectable over-acceleration range: 0 to 25000 rpm/s
Signal Cable Length	Must be limited to 1500 ft / 457 m (low capacitance 16 AWG / 1.3 mm ²)
Internal Test Frequency Generator	6 Hz to 32 kHz, selectable in different test modes, see Chapter 4, Configuration and Operation

Table 2-7. Passive Probe (MPU) Specifications

Input Frequency	Passive Probe (MPU): 100 Hz to 32 kHz
Input Amplitude	1 Vrms to 35 Vrms
Input Impedance	1.5 k Ω
Isolation	500 Vac from input to chassis and input to all other circuits
Open Wire Detection	MPU only > 7.5 k Ω

Table 2-8. Active Probe Specifications (Proximity, Eddy Current)

Input Frequency	Active Probe (Proximity, Eddy Current): 0.5 Hz to 25 kHz
Input Amplitude	Active Probe: 24 V probes
Probe Power	24 V $\pm 10\%$ @ 1 W, probe power switched on only in active probe mode.
Internal Pull-up Resistor	10 k Ω , input suitable for use with open collector probe outputs (see Note)
Input Threshold (Vlow)	< 2 V
Input Threshold (Vhigh)	> 4 V
Isolation	500 Vac from input to chassis and input to all other circuits



WARNING When Active Probes are used it is recommended to always enable (USED) the Speed Fail Trip function. Reference the Configuration Guidance section under the Troubleshooting Chapter for more detail.

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Dedicated Discrete Input Specifications

Table 2-12. Dedicated Discrete Input Specifications

Number of Channels	3, (Start, Reset, Speed Fail Override)
Input Thresholds	$\leq 8 \text{ Vdc} = \text{"OFF"}$ $\geq 16 \text{ Vdc} = \text{"ON"}$
Input Current	3 mA $\pm 5\%$ at 24 V (for externally power wiring, see, Chapter 2)
Wetting Current Supply	24 V at 2 W available (see installation diagrams, Chapter 2). This power supply is current limited.
Max Input Voltage	32 V (for externally power wiring, see, Chapter 2)
Isolation	500 Vac from output to chassis and output to all other circuits

Analog Output Specifications

Table 2-13. Analog Output Specifications

Number of Channels	1
Output Type	4–20 mA, isolated
Max Current Output	25 mA
Accuracy	$\pm 0.1\%$ at 25 °C, $\pm 0.5\%$ over temperature
Resolution	12 bit
Response Time	< 2 ms (2 to 20 mA)
Min Current Output	0 mA
Min Resistive	0 Ω
Max Resistive Load	500 Ω at 25 mA
Isolation	500 Vac from output to chassis and output to all other circuits
Signal Cable Length	Must be limited to 1000 ft / 305 m (low capacitance 16 AWG / 1.3 mm ²)

Serial Communication Port (RS-232/RS-485) Specifications

Table 2-14. Serial Port Specifications

Number of Ports	1
Comm Type	RS-232/RS-485, user selectable (2-Wire Only)
Termination Resistor	RS-485 on board, terminal block selectable
Isolation	500 Vac from output to chassis and output to all other circuits
Signal Cable Length	Must be limited to 1500 ft / 305 m (low capacitance 16 AWG / 1.3 mm ²)

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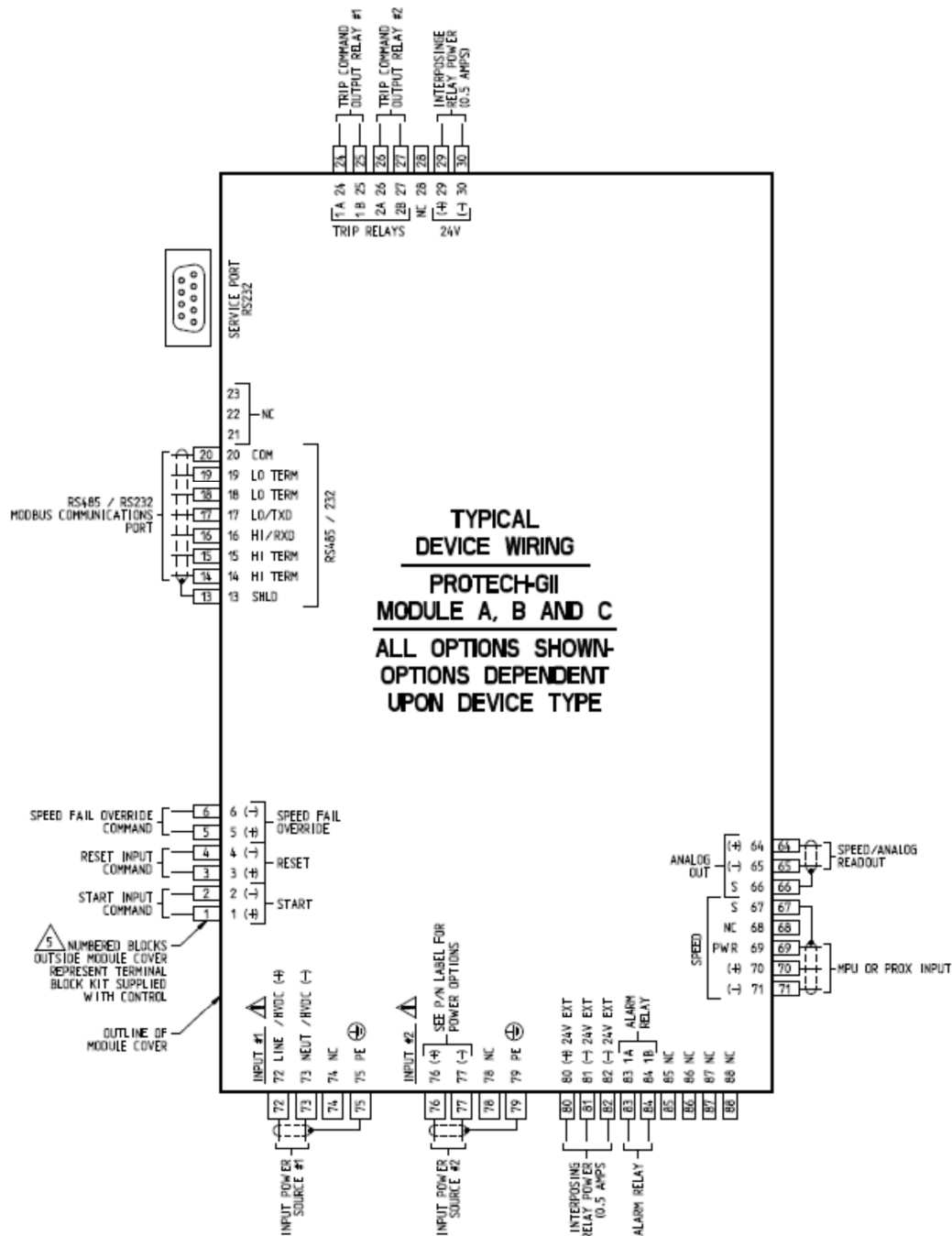


Figure 2-8. ProTech-GII Control Wiring Diagram

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Relay Outputs (Voted Trip Relay)

Each "Voted Trip Relay" ProTech-GII model has three independent modules (A, B, C), and each of these modules has three solid-state relay outputs. Each of the three solid-state relays have normally-open type contacts and are rated for 24 Vdc @ 1 A. Two of these relay outputs are dedicated as redundant trip signal outputs, and the output is the alarm relay. Note that, with the "Voted Trip Relay" ProTech-GII models, the two solid-state trip relays located on each module (A, B, C) are not available for use or connection. Each module's trip signal relays are connected internally to the ProTech-GII in a 2-o-o-3 voted fashion to drive two redundant Form-C trip relays. These two redundant have normally-open and normally closed output contacts rated for 220 Vac @ 8 A or 24 Vdc @ 8 A. Refer to Figure 2-14a for relay terminal location and Figure 2-14d for wiring information.

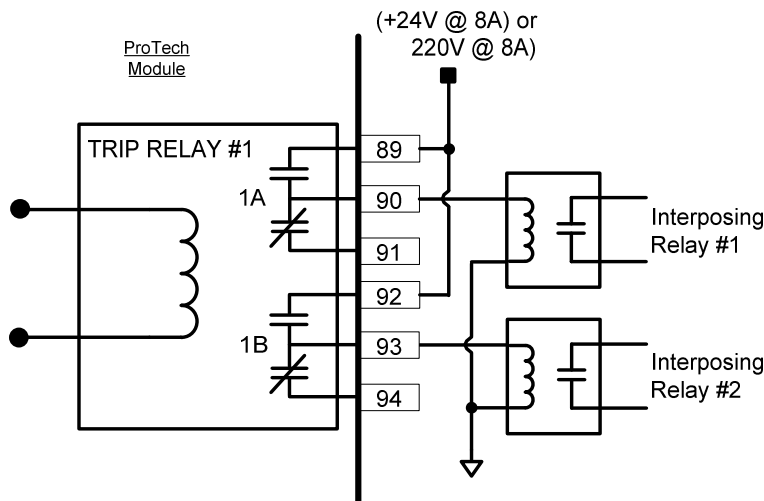


Figure 2-23. Example Trip Relay Wiring (Voted Trip Relay Models)

Alarm Relay Output

In both the Independent and Voted Trip Relay versions, each of the three modules (A, B, C) has an alarm output. The alarm relay output has normally-open type contacts and is rated for 24 Vdc @ 1 A. Refer to Figure 2-14e or 2-14f for wiring information.

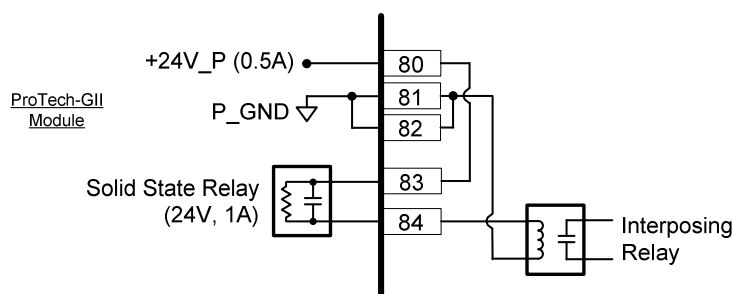


Figure 2-24. Example Alarm Relay Wiring (Internal Supply)

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ProTech with Voted Trip Relay Output

ProTech-GII "Voted Trip Relay" models consist of three independent modules that each accept one speed input whose trip output commands are then voted in a 2-out-of-3 (2oo3) fashion to create the 2oo3 trip output command. Two redundant "Form-C" 2oo3 voted relays are used in these models providing four isolated relay output signals with normally open and normally closed contacts.

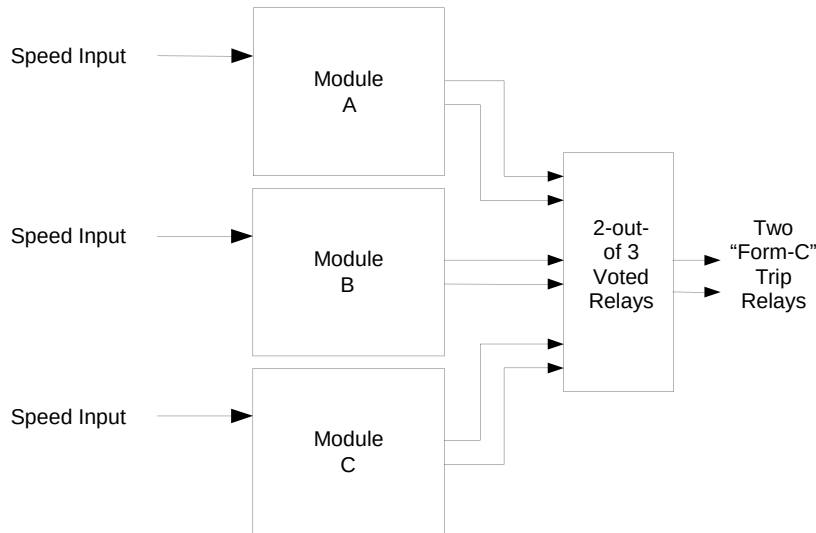


Figure 3-4. Basic Functional Overview of Voted Trip Relay Models

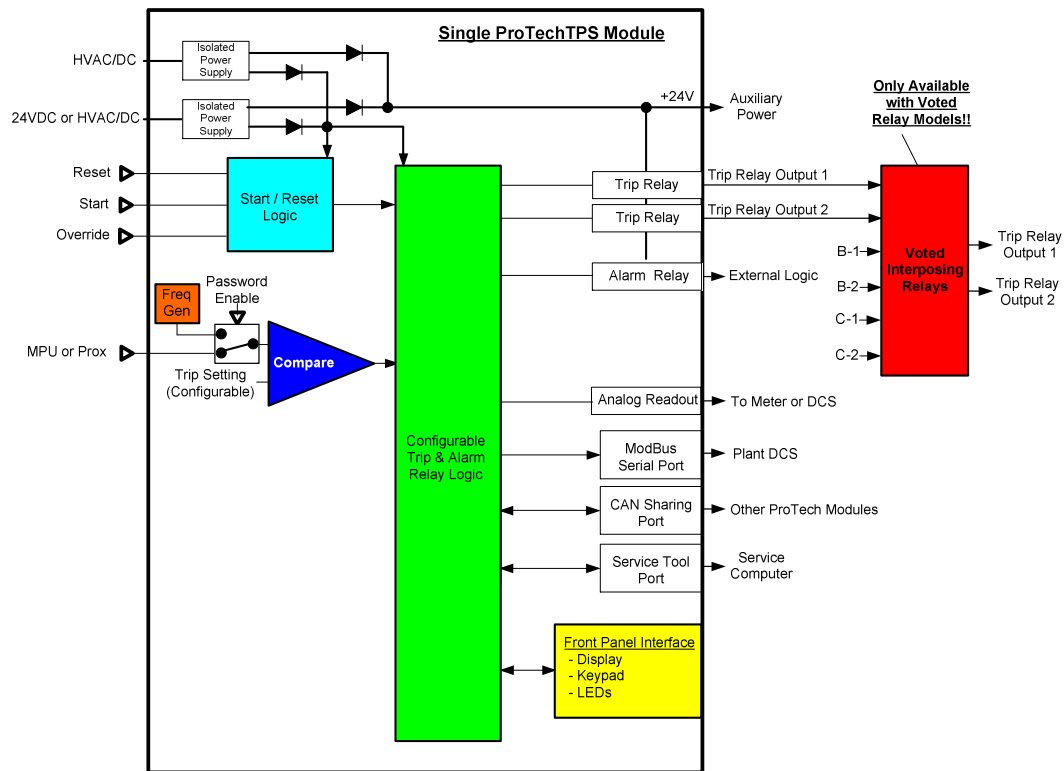


Figure 3-5. Functional Diagram of Single ProTech-GII Module with Voted Trip Relay Outputs

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I/O Troubleshooting

Table 5-1. I/O Troubleshooting

Problem or Diagnostic Indication	Possible Cause	Suggested Actions
Power Supply Inputs not working properly. Power supply input alarm present.	Wiring fault, terminal block loose.	Verify wiring and terminal block connections.
	Power source breaker or fuse open.	Verify breaker or fuse.
	Only one power supply is connected.	On the front panel, press the VIEW button under the ALARM LED and check for Power Supply 1 or 2 Fault.
	Power supply input out of range or insufficient rating.	Check input voltage level and verify it is within acceptable range per electrical specifications. Also check that power supply has appropriate rating to power the ProTech-GII.
Speed Input not working	Wiring fault, terminal block loose.	Verify wiring and terminal block connections.
	Configuration	On the front panel, check the Speed Input Configure Menu and verify that all proper configuration options are selected.
	Alarms and Faults	Verify that there are no alarms or faults that may indicate a setup problem (open wire trip, speed lost, speed fail, etc.)
	Signal level	Verify that the input signal levels are within the electrical specifications. Also verify shield connections.
	Active Probe Power	If using an active probe, verify probe power is correct by disconnecting the probe and measuring from terminals 69 to 71. The voltage should be 24 V $\pm$ 10%. Attach probe and measure again to verify that the probe is not overloading the voltage provided by the ProTech-GII.
Dedicated discrete input not working (Start, Reset or Speed Fail Override)	Wiring fault, terminal block loose.	Verify wiring and terminal block connections.
	Configuration	On the front panel, check the Dedicated Discrete Inputs Monitor Menu and verify logic state is correct.
	Signal source not working correctly or not within acceptable electrical specifications.	Check signal level and verify it is within acceptable range per electrical specifications.
	Internally supplied wetting voltage fault.	Measure voltage from terminal 1 to terminal 81 and verify it is 23 V $\pm$ 2 V. If out of range, return unit to Woodward.



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