



TPM

TPM LM500/2500/6000

Turbine Protection & Monitoring

Description

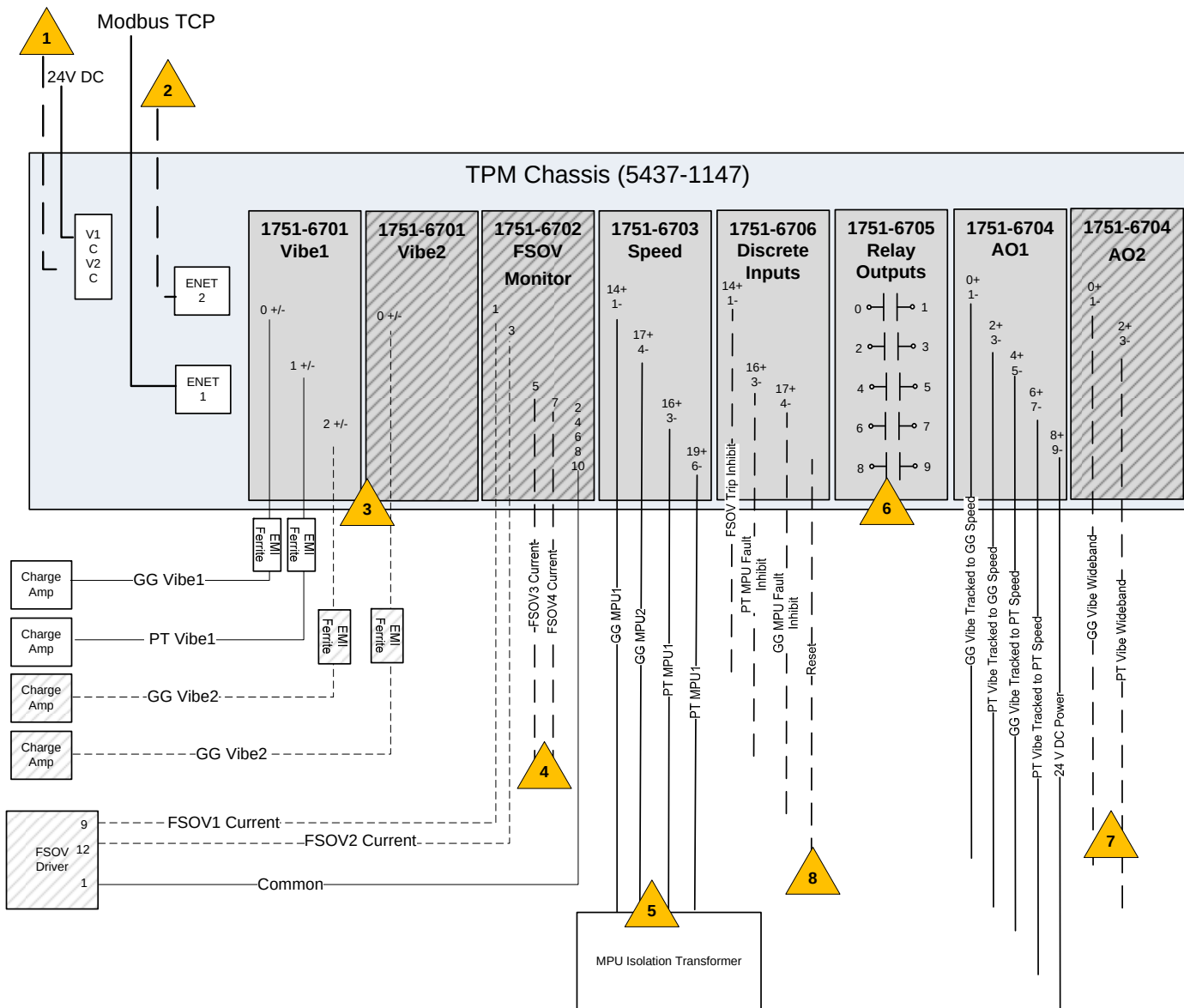
The Turbine Protection and Monitoring (TPM) system is a device that provides a compact, integrated solution for independent overspeed protection, fuel shut off valve (FSOV) solenoid monitoring, vibration signal conditioning for tracked and wideband measurements.

Based on the flexible and powerful National Instruments cRIO 9068 hardware platform, the TPM meets GE's specification requirements for these gas turbine protective functions for the LM500, LM2500, and LM6000 family of gas turbines and is designed to be used as a subcomponent of a complete LM gas turbine control system.

Features

- Overspeed protection for dual Gas Generator MPU's and dual Power Turbine MPU's
 - MPU fault detection with optional trip
 - FSOV monitoring for over current and under current conditions for up to 4 valves
 - Overspeed and FSOV trip response time of 5 milliseconds
 - Configurable FSOV delay time
 - Discrete input for FSOV trip inhibit
 - Optional redundant vibration signal conditioning
 - Selected vibration output in displacement or velocity
 - Measured vibration output via 4-20 mA analog outputs
 - o GG vibration tracked to GG speed
 - o GG vibration tracked to PT speed
 - o PT vibration tracked to GG speed
 - o PT vibration tracked to PT speed
 - o GG wideband vibration
 - o PT wideband vibration
 - Redundant Modbus TCP communications
 - Configuration using Woodward's Toolkit product
- Independent overspeed protection
 - Independent solenoid current monitoring with trip output
 - 5 millisecond trip times
 - Redundant vibration signal conditioning
 - Vibration tracked to rotational speed
 - Wideband vibration
 - Redundant Modbus TCP communications

Applications



1. Optional Redundant Power Supply
2. Optional Redundant Ethernet (Modbus TCP)
3. Optional Redundant vibration sensors. If redundant vibration sensors are not required, slot 2 must use a blank filler module.
4. The TPM can monitor current for up to 4 FSOV's, or be completely disabled if this features is not required. If this feature is not used, a blank filler module is required in slot 3.
5. An MPU transformer must be used with the 9221 speed module. The input voltage to the speed module MUST not exceed +/- 60 volts.
6. The TPM trips 5 relay outputs simultaneously. This may be wired to the trip string or discrete inputs of other devices. The current through each relay must not exceed 1.2 amps.
7. Optional wideband vibration outputs. If not enabled, slot 8 must use a blank filler module.
8. Discrete input reset is optional and must be enabled in the configuration.

Below are examples of hardware configurations for the TPM system.

Example 1:

Functionality

- Simplex Vibration with Tracking Filter
- FSOV Over/Undercurrent of 1-4 fuel valves
- Overspeed

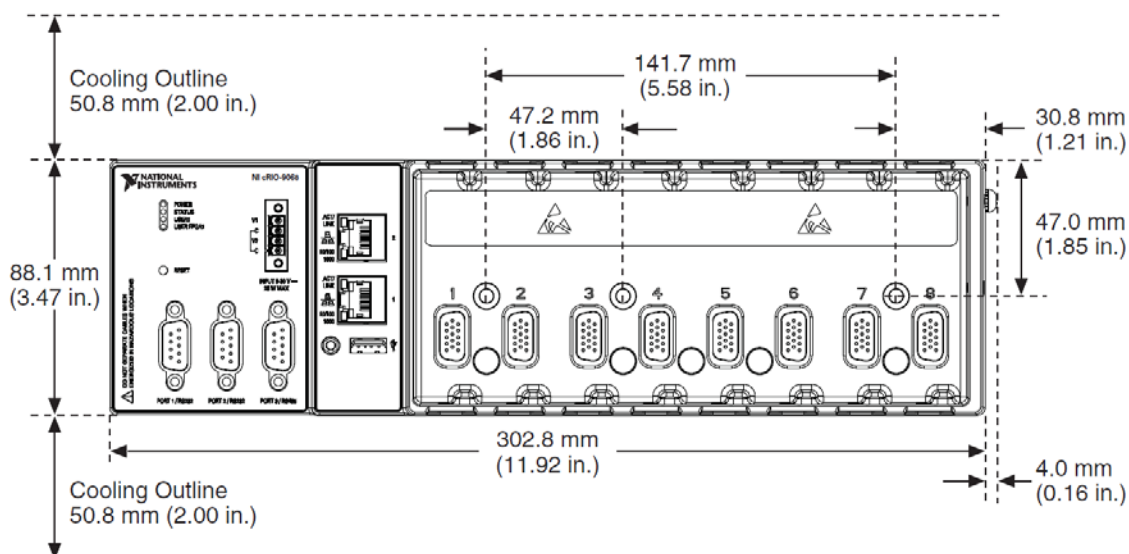
Module	Woodward Part Number	Location
Vibration	1751-6701	Slot 1
Blank Filler	1751-6707	Slot 2
FSOV Inputs	1751-6702	Slot 3
Speed	1751-6703	Slot 4
24V DI	1751-6706	Slot 5
Relay Outputs	1751-6705	Slot 6
4-20 mA AO	1751-6704	Slot 7
Blank Filler	1751-6707	Slot 8

Example 2:

Functionality

- Redundant Vibration with Tracking Filter and Wideband
- Overspeed

Module	Woodward Part Number	Location
Vibration	1751-6701	Slot 1
Vibration	1751-6701	Slot 2
Blank Filler	1751-6707	Slot 3
Speed	1751-6703	Slot 4
24V DI	1751-6706	Slot 5
Relay Outputs	1751-6705	Slot 6
4-20 mA AO	1751-6704	Slot 7
4-20 mA AO	1751-6704	Slot 8



Regulatory Compliance

The Woodward Turbine Protection Monitoring System does not have any certifications as a whole. However, the hardware components have the following listings. Please refer to the TPM manual for detailed information.

European Compliance for CE marking:

The cRIO-9068 Controller is CE marked for the following:

EMC Directive:	2004/108/EC
Low Voltage Directive:	2006/95/EC
ATEX Directive:	94/9/EC per Demko 12ATEX1202658X Zone 2, Category 3 Group II G, Ex nA IIC T4 Gc Special conditions for safe use below.
RoHS:	2001/65/EU

North American Compliance:

The cRIO units bearing the UL identification are listed per the following:

- UL Listed for Class I, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 in USA and Canada per UL E208190
- UL Listed as Measuring, Testing, and Signal-generation Equipment in USA and Canada per UL E183728

Other International Compliance:

Marked controller and modules are separately certified.

Korean EMC:	Registered with National Radio Research Agency under the Radio Waves Act. Each marked component type has its own KCC Registration Certificate.
IECEX:	Certified for use in explosive atmospheres per Certificate IECEX UL 14.0089X as Ex nA IIC T4 Gc. Special conditions for safe use below.

Conditions of Use for IECEX and ATEX:

- You must make sure that the transient disturbances do not exceed 140% of the rated voltage.
- The system shall be mounted in an IECEX certified enclosure with a minimum ingress protection rating of at least IP54 as defined in IEC 60079-15.
- The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC 60664-1.
- The enclosure must have a door or cover accessible only by the use of a tool.
- The devices shall be used with ATEX/IECEX certified Chassis for Group IIC and rated in accordance with the modules.

Marine Compliance:

Controller and modules only:

Lloyd's Register Type Approval Certificate LR 05/60002(E7) Expires 12-Feb-2020 – ENV1, ENV2, ENV3, ENV4

Conditions on Certificate:

To meet electromagnetic compatibility (EMC) requirements the product is to be installed in a shielded enclosure with shielded and/or filtered power and input/output ports. Power supply and module cables shall be separated on opposite sides of the enclosures, and enter/exit through opposing enclosure walls.

Environmental Specifications

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	–40 to 70 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	–40 to 85 °C
Operating humidity (IEC 60068-2-56)	10 to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	5 to 95% RH, noncondensing
Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine 50 g, 3 ms half sine, 18 shocks at 6 orientations

System Specifications and Performance

Voltage input range	9 to 30 V
Maximum power consumption	25 W
Network interface	10/100/1,000 Ethernet
Overspeed trip time	5 ms
FSOV over/under current trip time	5 ms
5 Hz bandwidth vibration tracking filter	100ms +/-20
Vibration input voltage	+/-30 V
Vibration minimum input frequency	15 Hz
FSOV input voltage	0-5 V
Speed input maximum frequency	10 kHz
Speed input voltage	+/-60 V
Discrete input voltage	24 VDC
Relay output maximum current	1.2 A



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