WOODWARD

Peak®200 Digital Control for Steam Turbines

Installation and Operation Manual

⚠ **General Precautions**	Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

⚠ **Revisions**	This publication may have been revised or updated since this copy was produced. The latest version of most publications is available on the Woodward website. **http://www.woodward.com** If your publication is not there, please contact your customer service representative to get the latest copy.

⚠ **Proper Use**	Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

⚠ **Translated Publications**	If the cover of this publication states "Translation of the Original Instructions" please note: The original source of this publication may have been updated since this translation was made. The latest version of most publications is available on the Woodward website. **www.woodward.com/publications** Always compare with the original for technical specifications and for proper and safe installation and operation procedures. If your publication is not on the Woodward website, please contact your customer service representative to get the latest copy.

Revisions— A bold, black line alongside the text identifies changes in this publication since the last revision.

Contents

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Important Definitions

⚠️ This is the safety alert symbol used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER** - Indicates a hazardous situation, which if not avoided, will result in death or serious injury.
- **WARNING** - Indicates a hazardous situation, which if not avoided, could result in death or serious injury.
- **CAUTION** - Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.
- **NOTICE** - Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT** - Designates an operating tip or maintenance suggestion.

⚠️**WARNING** **Lockout/Tagout**	**Ensure that personnel are fully trained on LOTO procedures prior to attempting to replace or service the PEAK200 on a "live" running turbine. All safety protective systems (overspeed, over temperature, overpressure, etc.) must be in proper operational condition prior to the start or operation of a running Turbine. Personnel should be equipped with appropriate personal protective equipment to minimize the potential for injury due to the release of hot gases or fluids, exposure to hot surfaces and/or moving parts, or any moving parts that may be activated and are located near the control area of the PEAK200.**

⚠️**WARNING** **Overspeed / Overtemperature / Overpressure**	**The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.** **The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.**

⚠️**WARNING** **Personal Protective Equipment**	**The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:** • **Eye Protection** • **Hearing Protection** • **Hard Hat** • **Gloves** • **Safety Boots** • **Respirator** **Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.**

⚠ **WARNING** **Start-up**	Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠ **WARNING** **IOLOCK**	**IOLOCK. When a CPU module fails, watchdog logic drives it into an IOLOCK condition where all output circuits and signals are driven to a known de-energized state as described below. The system MUST be designed such that IOLOCK and power OFF states will result in a SAFE condition of the controlled device.** • **Discrete outputs / relay drivers will be non-active and de-energized** • **Analog and Actuator outputs will be non-active and de-energized with zero voltage or zero current.** **The IOLOCK state is asserted under various conditions including:** • **CPU module watchdog failures** • **Power Up and Power Down conditions** • **System reset and hardware/software initialization** • **Entering configuration mode** **NOTE: Additional watchdog details and any exceptions to these failure states are specified in the related CPU or I/O section of the manual.**

⚠ **CAUTION** **Emergency Disconnecting Device**	An emergency switch or circuit breaker shall be included in the building installation that is near the equipment and within easy reach of the operator and that is clearly marked as the disconnecting device for the equipment. The switch or circuit breaker shall not interrupt the protective earth (PE) conductor.

⚠ **CAUTION** **Risks of Calibration and Checkout**	Only authorized personnel knowledgeable of the risks posed by live electrical equipment should perform the calibration and checkout procedure.

⚠ **CAUTION** **Fuse Power Supply Mains**	The power supply mains should be properly fused according to the National Electrical Code. The recommended fuse is a European Type T fuse.

Electrostatic Discharge Awareness

NOTICE **Electrostatic Precautions**	**Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:** • **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface, and maintain contact while handling the control).** • **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.** • **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.** **To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.**

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. After removing the old PCB from the control cabinet, immediately place it in the antistatic protective bag.

Regulatory Compliance

European Compliance for CE Marking:
These listings are limited only to those units bearing the CE Marking.

EMC Directive:	Declared to Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (EMC).
Low Voltage Directive:	Directive 2014/35/EU on the harmonisation of the laws of the Member States relating to making electrical equipment available on the market that is designed for use within certain voltage limits.
ATEX – Potentially Explosive Atmospheres:	Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

⟨Ex⟩ II 3 G Ex ic nA nC IIC T4 Gc

Other European and International Compliance:
Compliance with the following European Directives or standards does not qualify this product for application of the CE Marking:

RoHS Directive:	Restriction of Hazardous Substances 2011/65/EU: Woodward Turbomachinery Systems products are intended exclusively for sale and use only as a part of Large-Scale Fixed Installations per the meaning of Art.2.4(e) of directive 2011/65/EU. This fulfills the requirements stated in Art.2.4(c), and as such, the product is excluded from the scope of RoHS2.

United Kingdom Compliance for UKCA Marking:
These listings are limited only to those units bearing the UKCA Marking.
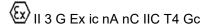
Units bearing the UKCA Mark in addition to the marking indicating Zone 2 are acceptable for use in UKEX Hazardous Locations.

EMC:	S.I. 2016 No. 1091: Electromagnetic Compatibility Regulations 2016
UKEX:	S.I. 2016 No.1107: Equipment and Protective Systems Intended for us in Potentially Explosive Atmospheres Regulations 2016

⟨Ex⟩ II 3 G Ex ic nA nC IIC T4 Gc

Other UKCA Compliance:
Compliance with the following UKCA regulations or standards does not qualify this product for application of the UKCA Marking:

LVD:	S.I. 2016 No. 1101: Electrical Equipment (Safety) Regulations 2016
RoHS Directive:	S.I. 2020 No. 1647: The Hazardous Substances and Packaging (Legislative Functions and Amendments) (EU Exit) Regulations 2020
	This product is intended to be sold and used only as equipment which is specifically designed, and is to be installed, as part of another type of equipment that is excluded or does not fall within the scope of this Regulation, which can fulfil its function only if it is part of that equipment, and which can be replaced only by the same specifically designed equipment and

therefore fulfills the requirements stated in Part 2 of Schedule1 clause 16 and as such is excluded from the scope of the Regulation.

This product is intended to be sold and used only as repair, updating or upgrading of EEE (as defined in part 3 of schedule 1) that either was excluded from the scope of the Directive at the time of placing on the market (as defined in Schedule 1, part 2) or which benefited from an exemption and which was placed on the market before that exemption expired (per schedule 1 part 3).

Other International Compliance:

IECEx: Certified for use in explosive atmospheres per Certificate:
IECEx CSA 17.0004X, Ex ic nA nC IIC T4 Gc

INMETRO Brazil: Declared to Ordinance No. 115:2022
NCC Certificate BRA 23.GE0016X
Ex ic nA nC IIC T4 Gc

North American Compliance:
These listings are limited only to those units bearing the CSA identification.
Units bearing only the CSA identification are restricted for use only in Ordinary Locations in North America.

Units bearing the CSA identification in addition to the marking indicating Class I, Div 2, Groups A, B, C, and D are acceptable for use in North American Hazardous Locations.

CSA: CSA Certified for Class I, Division 2, Groups A, B, C, & D, T4 at 65°C (Bulkhead version) 70 °C (Front Panel version) surrounding air temperature. For use in Canada and the United States.
CSA Certificate 70101251

Peak200 Front Panel Mount Version is certified as a component for use in other equipment. The final combination is subject to acceptance by the authority having jurisdiction or local inspection.

Special Conditions for Safe Use

A fixed wiring installation is required. Field wiring must be in accordance with North American Class I, Division 2 or European Zone 2, Category 3 wiring methods as applicable, and in accordance with the Local Inspection Authority having jurisdiction. On high voltage, AC and DC versions of the control the interior of the enclosure shall not be accessible in normal operation without the use of a tool.

A switch or circuit breaker shall be included in the building installation that is in close proximity to the equipment and within easy reach of the operator. The switch or circuit breaker shall be clearly marked as the disconnecting device for the equipment. The switch or circuit breaker shall not interrupt the Protective Earth (PE) conductor.

Hazardous Locations

The Peak200 Digital Control (Front Panel version) shall not be installed in areas exceeding Pollution Degree 2 as defined in IEC 60664-1.

Wiring must be in accordance with Zone 2 wiring methods and in accordance with the authority having final jurisdiction.

Field wiring must be suitable for the following temperatures:
- Power Input rated minimum of +95°C.
- All remaining connections; +10°C above highest ambient.

Protective Earth Grounding of the Peak200 Digital Control is required to be connected to the PE terminal.

The Real Time Clock Battery located on the CPU board is not to be recharged and is not user replaceable. Contact a Woodward Authorized Service Center if a replacement service is needed.

The CSA and/or CE marked High Voltage and Low Voltage ATEX Peak200 Digital Control is suitable for use in Class I, Div 2, Gas Groups A, B, C and D & European Zone 2, Group IIC environments.

For Zone 2 installations, the Peak200 must be installed in an area or enclosure providing adequate protection against high impact (7 Joules). The control is rated for 2 Joules impact.

For ATEX/IECEx the Peak200 Digital Control (Front Panel version) shall be installed in an enclosure that is coded Ex nA or Ex e, providing a minimum IP54 ingress protection in accordance with IEC 60079-15. The installer shall ensure that the maximum surrounding air temperature does not exceed the rated temperature of +70 °C at the final installation location.

For Zone 2 installations, transient protection for the Peak200 Digital Control is to be provided externally by the end user at the supply terminals of the control. The transient protection device is to be set at a level not exceeding 140% of the peak rated voltage (36Vdc for Low Voltage or 264 Vac for High Voltage Peak200 model).

The risk of electrostatic discharge is reduced by permanent installation of the Peak200 (Bulkhead version), proper connection of the equipment ground lugs, and care when cleaning. This device must not be cleaned or wiped off/against unless the area is known to be non-hazardous.

⚠ **WARNING** **Explosion Hazard**	**For ATEX/IECEx installation compliance, the input voltage shall be limited to 36 Vdc for Low Voltage or 264 Vac for High Voltage Peak200 model. When an external power supply is selected to supply the Control, it shall be ATEX/IECEx approved for Zone 2 Group IIC, Category 3G Applications.**

⚠ **WARNING** **Explosion Hazard**	Due to the Hazardous Location Listings associated with this product, proper wire type and wiring practices are critical to the operation.

⚠ **WARNING** **Explosion Hazard**	ENCLOSURE REQUIREMENT— ATEX/IECEx Zone 2, Category 3G applications require the final installation location provide a minimum IP-54 ingress protection enclosure against dust and water per IEC 60529. The enclosure must be coded Ex nA or Ex e.

⚠ **WARNING** **Explosion Hazard**	Do not remove covers or connect/disconnect electrical connectors unless power has been switched off and the area is known to be non-hazardous.

⚠ **WARNING** **Explosion Hazard**	Substitution of components may impair suitability for Class I, Division 2, or Zone 2.

⚠ **WARNING** **Explosion Hazard**	The external ground lugs shown on the installation drawing must be properly connected to ensure equipotential bonding. This will reduce the risk of electrostatic discharge in an explosive atmosphere. Cleaning by hand or water spray must be performed while the area is known to be non-hazardous to prevent an electrostatic discharge in an explosive atmosphere.

⚠ **WARNING** **Explosion Hazard**	MOUNTING The control must be mounted in a vertical position. The installer shall ensure the maximum surrounding air temperature of the control does not exceed +65 °C (Bulkhead version) or +70˚C (Front Panel version) at the final location.

⚠ **WARNING** **Explosion Hazard**	Class I, Div 2 Groups A, B, C, D and Zone 2, Group IIC applications require the input voltage to the relay contacts not exceed 32Vac rms or 32Vdc.

⚠ **AVERTISSEMENT** **Risque d'explosion**	Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous situez bien dans une zone non explosive.

⚠**AVERTISSEMENT**	La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2 et/ou Zone 2.
Risque d'explosion	

⚠**AVERTISSEMENT**	Ne pas utiliser les bornes d'essai du block d'alimentation ou des cartes de commande à moins de se trouver dans un emplacement non dangereux.
Risque d'explosion	

Safety Symbols

Symbol	Description
⎓	Direct current
∿	Alternating current
≂	Both alternating and direct current
⚡	Caution, risk of electrical shock
⚠	Caution, refer to accompanying documents
⏚	Protective conductor terminal
⏚	Frame or chassis terminal

Chapter 1.
General Information

Introduction

This manual describes the Woodward Peak200 digital control for single valve steam turbines used for pump and mechanical drive applications. The scope of this manual is to provide information on programming, operation and troubleshooting of the Peak200 control.
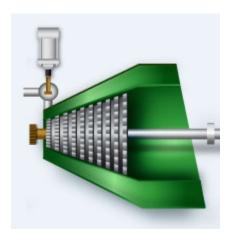
Figure 1-1. Single Inlet Valve Steam Turbine

Table 1-1. Part Number Options

Part Number	Mounting	Power
8200-1500	Bulkhead	LVDC (18–36 Vdc) Standard Compliance
8200-1501	Bulkhead	AC/DC (88–264 Vac/90–150 Vdc) Standard Compliance
8200-1502	Bulkhead	LVDC (18–36 Vdc) ATEX Compliance
8200-1506	Bulkhead	LVDC (18–36 Vdc) Inmetro Compliance
8200-1508	Bulkhead	AC/DC (88–264 Vac/90–150 Vdc) NA C1D2 Compliance
8200-1503	Door or Panel	LVDC (18–36 Vdc) Standard Compliance
8200-1504	Door or Panel	AC/DC (88–264 Vac/90–150 Vdc) Standard Compliance
8200-1505	Door or Panel	LVDC (18–36 Vdc) ATEX Compliance
8200-1507	Door or Panel	LVDC (18–36 Vdc) Inmetro Compliance
8200-1509	Door or Panel	AC/DC (88–264 Vac/90–150 Vdc) NA C1D2 Compliance

⚠ WARNING	**EXPLOSION HAZARD—Do not open the Peak200 control box when a hazardous atmosphere is present. Wiring connections, which could cause sparks, are exposed inside the cabinet.**

NOTICE	**Do NOT attempt to operate the turbine until properly configuring the Peak200 control. Doing so could cause equipment damage. As shipped from the factory the unit will not run a turbine.**

Controller Overview

The Peak200 is a field configurable control which allows a single design to be used in many different control applications and reduces both cost and delivery time. It uses a built in graphical user interface (GUI) with menu driven screens to instruct site engineers on configuring the control to a specific application. This control's intended use is on mechanical drive or pump control applications (generator drive units should use the Woodward 505 product). The Peak200 can be configured to operate as a stand-alone turbine control unit or can be interfaced via hardwire signals and/or a Modbus communication link to be operated from a plant's Distributed Control System.

The Peak200 control has four demand signals that can affect the controlled operation of the steam turbine: The Speed PID Controller, the HP Valve Limiter, the Manual HP valve demand (service only), and the Trip/Shutdown Command. The four demand signals connect to a Lowest Signal Select (LSS) bus that passes the lowest value to the output, which connects to the valve demand.

The Cascade PID controller is an additional (optional) control loop that allows the user to control some other process in their plant. The output of this control does not go to the LSS directly; instead, it controls the setpoint of the speed controller. In Woodward terminology, we call this a cascade control loop because its output drives another controller's setpoint rather than directly affecting the valve demand with its own output.

Functional Block Diagrams

A system overview in block form is in Figure 1-2 below.
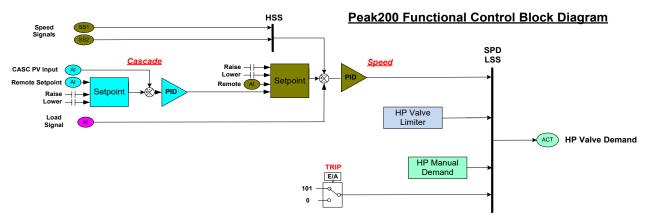
Figure 1-2. System Overview

Peak200 Keypad and Display

Graphical Display Key Inputs

The front panel display provides the user with multiple levels of access for configuring, calibrating, tuning, operating, and monitoring the turbine operation. No additional control panels are required to operate the turbine, with every turbine control function performed from the Peak200's front panel.

Figure 1-3. Peak200 Keypad and Display

A description of each key's function follows.

Hard Key Commands

NUMERIC KEYPAD

These are available for entering numeric values or text strings directly into the control when selecting a configurable or programmable edit field. The bottom row of keys has some special features.

Backspace and Delete Key (used when entering text)

In text mode, this functions as a Shift key. When making analog adjustments with the ADJUST key – pressing this key at the same time as the ADJUST will invoke a 'Fast' rate of adjustment

Brightness key – hold this down and then use the ADJUST key to increase/decrease the screen brightness

TRIP KEY

This will Trip the Turbine and remove all current from the Actuator outputs (zero current).

LED

Four LEDs located on the left side – a Summary Trip, Summary Alarm, IO Lock, and CPU Health. The GAP program controls the two Summary LEDs and relate to the status of the control. The IOLOCK and CPU LED's relate to the H/W status.

VIEW buttons will jump to the Trip or Alarm Summary screen to show these events in sequence with time stamp.

MODE button will jump to a Login screen that allows the user to view current permissions and allow access to changing the user login level

ESC Key – this will always step the user 'back' one page from the current page displayed

HOME Key
Brings the user to the Home menu for Run, Service, or Configure. Pressing the Home Key a second time will return to the Run (Operate) Menu Home Screen.

NAVIGATION CROSS KEYS
These are the primary keys for navigating from page to page, or for navigation of the FOCUS on any page.

Soft Key Commands – Dependent on the screen currently in view – the user must use the navigation cross keys to move the "Focus" to the desired component.

GREEN KEYS
Generally performs Operational Actions such as Enabling, Disabling, Starting, Stopping, Tuning, or Adjusting values.

MAROON KEYS
Generally performs Navigational actions that escort the user through the screen menus.

BLACK KEYS
Are soft-function keys that relate to the display indication displayed immediately above. They can be navigational or operational. These items do not require "Focus"; they are always available on that particular screen.

NOTICE	The Peak200 has a detailed tutorial that is always accessible through the Service Menu. It provides 'On-Screen' help on topics such as Navigation, User Levels, Operating Modes, how to adjust parameters, and more. The user should familiarize themselves with these screens
Screen Tutorial	

Peak200 Functional Inputs and Outputs

This section gives a quick overview reference of the functional I/O signals, which the Peak200 application software supports.

Magnetic Pickups
The Magnetic Pickups (MPUs) generate a speed signal used to provide speed feedback to the Peak200. The MPUs do this by generating voltage pulses as the gear teeth pass through the MPU's magnetic field. The Peak200 counts the number of pulses per second from the MPUs (frequency in HZ) and converts this frequency to turbine RPM.

Two MPUs (**MPU 1 and MPU 2**) may be used to provide redundant speed inputs, that is where one can fail and the remaining MPU keeps the turbine operating. The Peak200 determines which MPU is outputting the highest frequency and uses that frequency as the speed feedback to control the turbine.

When only one MPU is used, the user can disable the second MPU input.

The Peak200 converts the MPUs input frequency to RPMs by using the number of teeth programmed in the SPEED CONFIGURATION menu for TEETH SEEN BY MPU = xxxxx (Teeth) in the following formula:

$$RPM = (Hz \times 60) / Teeth$$

When the speed of the main turbine shaft is different from the speed of the MPU gear shaft, the value for MPU GEAR RATIO = x is programmed for the correct ratio. The above equation is multiplied by the RATIO so that the RPM seen by the Peak200 will be turbine RPM and not MPU gear shaft RPM. Gear Ratio equals the gear speed divided by the turbine speed.

$$RPM = ((Hz \times 60) / (Teeth \times Gear Ratio)$$

The physical MPU should be gapped so that a signal of at least 1.0 VRMS is seen at the control, when the speed is at the failed speed level (amplitude will increase as the speed increases). The Peak200 control will show the voltage of this signal on the speed signal.

Analog Input
The Peak200 has four analog inputs and the option for the customer to add a LinkNet distributed AI/AO module that would provide eight additional channels. All of these channels are configurable by the user. The following table is the list of analog input functions that the menus support, which assign functions to specific channels.

Table 1-2. Peak200 Analog Input Configuration Options

Remote Speed Setpoint	Bearing Temperature #1
Process/Cascade Input	Bearing Temperature #2
Remote Cascade Setpoint	Bearing Temperature #3
Vibration Input #1	Bearing Temperature #4
Vibration Input #2	Signal Monitoring #1
Vibration Input #3	Signal Monitoring #2
Vibration Input #4	Signal Monitoring #3
	HP Valve Feedback Position

Contact Inputs
The Peak200 has eight discrete contact inputs and the option for the customer to add a LinkNet distributed DI module that would provide 16 additional channels. Channel 3 is dedicated to "External Trip 1" (same as the previous Peak 150 product), but all other channels are configurable by the user. The following table is the list of discrete contact input functions that the menus support, which assign functions to specific channels.

Table 1-3. Peak200 Discrete Input Configuration Options

Lower Speed Command	External Trip 2
Raise Speed Command	External Trip 3
External Trip 1	External Trip 4
Start/External Run	External Trip 5
Reset Command	External Alarm 1
Idle/MinGov Command	External Alarm 2
Remote Speed Setpoint Enable	External Alarm 3
Select On-Line Dynamics	Valve Limiter Open
Overspeed Test	Valve Limiter Close
Raise Process/Casc Setpoint	Clock Sync Pulse
Lower Process/Casc Setpoint	Speed/Casc Raise Command
Process/Casc Control Enable	Speed/Casc Lower Command
Rmt Cascade Setpoint Enable	Start Permissive
	Normal Stop Command

Select these discrete inputs by connecting them to a 5–28 Vdc supply.

For an External Trip input, power is removed from the **TRIP** input. Therefore, before starting the turbine, close the external **TRIP** contact with a switch, a relay contact, or a jumper. The External Trips two, three, four, and five are also defaulted to be 'active low' so that a loss of signal initiates a Trip.

If the **IDLE / MIN GOV** input is configured for use, it is opened for IDLE speed and closed for MIN GOVERNOR Speed.

All other inputs close for the listed function.

Actuator Driver
The Actuator Driver output is dedicated to being the demand output for the main inlet steam valve (HP Valve) and supports two current ranges:
• 0-20 mA range
• 0-200 mA range

Analog Outputs
The Peak200 has three analog output and the option for the customer to add a LinkNet distributed AI/AO module that would provide two additional channels. All of these channels are configurable by the user. The following table is the list of analog output functions that the menus support, which assign functions to specific channels.

Table 1-4. Peak200 Analog Output Configuration Options

Not Used	HP Valve Demand
Actual Speed	Signal Monitoring #1
Speed Setpoint	Signal Monitoring #2
Remote Speed Setpoint	Signal Monitoring #3
Process/Cascade Input	
Process/Cascade Setpoint	
Remote Cascade Setpoint	
Valve Limiter Setpoint	

Relays
The Peak200 has four discrete outputs or relays. Default settings dedicate the first channel as the Trip Relay and the second relay as an Alarm Summary relay but can be re-assigned if needed.
• Relay #1 - TRIP RELAY (Configurable to either energize or de-energize for trip)
• Relay #2 - ALARM RELAY (Normally energized—de-energizes for alarm)

The Peak200 also has the option for the customer to add a LinkNet distributed DO module that would provide 16 additional channels.

All relays (other than channel 1) can be configured for the following functions or indications.

Table 1-5. Peak200 Discrete Output 'State' Configuration Options

Not Used	Process/Cascade Control Enabled
Shutdown Summary	Process/Cascade PID in Control
Alarm Summary	Process/Cascade PID Active
Reset Pulse (2 sec)	Remote Cascade Setpoint Enabled
Speed PID in Control	Remote Cascade Setpoint Active
Remote Speed Setpoint Enabled	Underspeed Switch
Remote Speed Setpoint Active	HP Valve Limiter in Control
Overspeed Trip	On-Line Speed PID Dynamics
Overspeed Test Enabled	Repeat of Trip Relay
Unit Started Pulse (2 sec)	Ready to Start Status

Table 1-6. Peak200 Discrete Output 'Level Switch' Configuration Options

Not Used	AI Signal Monitoring #1
Actual Speed	AI Signal Monitoring #2
Speed Setpoint	AI Signal Monitoring #3
Process/Cascade Input	
Process/Cascade Setpoint	
HP Valve Demand	

The four contact outputs on the Peak200 are Form C relays with both normally open and normally closed contacts available. The Linknet nodes provide only contact outputs, so interposing relays may be required.

Note: Refer to chapter 2 for specifications and ratings of the hardware.

Optional Distributed I/O

Additional I/O has been pre-programmed using Woodward's LinkNet HT distributed I/O nodes. If a feature pack is purchased to enable this feature (see Appendix I), these will be available via the Configuration Menu (under Woodward Links) and the user is free to select any or all nodes listed below. All distributed I/O channels have the same menu of functional choices as the lists above for the Peak200 hardware I/O.

Table 1-7. Available (Programmed) Distributed I/O Nodes

Node Device ID	Part Number	Description	I/O Type/Quantity
1	8200-1203	Analog 4-20 mA I/O	8 AI and 2 AO
2	Reserved	--	--
3	8200-1200	RTD Temperature Inputs	8 RTD
4	8200-1204	Discrete Input	16 DI
5	8200-1205	Discrete Output	16 DO
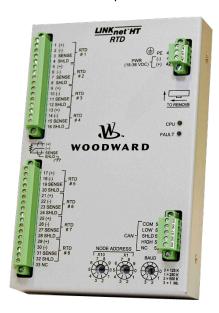
Figure 1-4. LinkNet HT Distributed I/O Node

By adding the AI/AO LinkNet Node, the Peak200 can support up to four Vibration monitoring input signals (4-20 mA inputs).
- Signals can be radial or axial – user can enter description in device TAG field to identify the sensor location
- Each channel has range fault detection and Alarm and Trip (or Second ALM) Level Settings
- There is a setting to Trip if too many Vibration sensors are failed (for example, if 4 sensors are brought into the Peak200 and 2 sensors minimum are required to run turbine)
- There will be a monitor page (as shown below) available from the Startup Curve page

By adding the RTD Input LinkNet Node, the Peak200 can support up to eight temperature monitoring input signals.
- Signals can be 100 or 200 ohm sensors
- Supports American or European curve
- Configurable to display degrees F or C
- Each channel has range fault detection and Alarm and Trip (or Second ALM) Level Settings

The following table is the menu list supported by RTD input functions that assign functions to specific channels.

Table 1-8. Menu Supported RTD Input Functions

Bearing Temperature #1	Temperature Monitoring #1
Bearing Temperature #2	Temperature Monitoring #2
Bearing Temperature #3	Temperature Monitoring #3
Bearing Temperature #4	Temperature Monitoring #4
Inlet Steam Temp	Lube Oil Temperature
Exhaust Steam Temp	
Turbine Casing Temp	

Communications (To Plant Controls)

The Peak200 control is capable of communicating to a plant computer using Modbus protocol over either serial or Ethernet communication links. All pertinent parameters are programmed to transfer through this link.

It is also possible for the control to communicate via Ethernet to a plant computer using Woodward's SOS (Servlink-to-OPC Server) program in a read-only mode. To use this function, reference the parameter block name from the Modbus address list information provide in chapter 6.

See Chapter 6 for complete details.

Chapter 2.
Hardware Specification

Peak200 Description and Features

The Peak200 controller is a significant upgrade to the existing Peak150 product line with enhanced CPU, Graphical display, communications, and I/O functions.

> **Note:** This controller supports expanded I/O options when using Woodward CAN distributed LinkNet I/O nodes.

Features
- 5" LCD Display (800x480) and Keypad
- (LV) input power: 18-36 Vdc input, isolated
- (HV) input power: 88-264 Vac / 90-150 Vdc, isolated
- Bulkhead version same mounting as current Peak150

Communications
- (2) Ethernet 10/100 communication ports, isolated
- (2) CAN communication ports (1 Mbit), isolated
- RS-232/RS-485 port, isolated

I/O Circuits
- GAP configurable update rates of 5 ms to 160 ms
- (2) Speed Sensor inputs (MPU 2K)
- (4) Analog input 4-20 mA channels (with Loop Power)
- (3) Analog output 4-20 mA channels
- Actuator output channel (configurable 4-20 mA/20-200 mA)
- (8) Discrete input channels (with Contact Power)
- (4) Relay outputs (form-c)
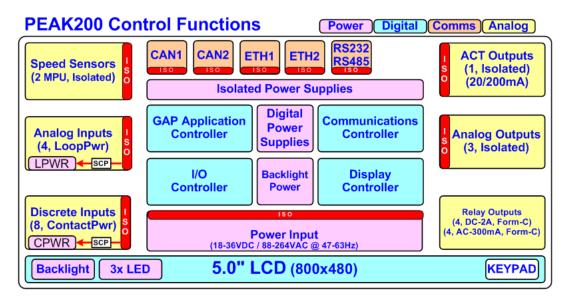
Figure 2-1. Functional Block Diagram (Peak200 Control)

Table 2-1. Environmental Specifications

Operating Temperature	Bulkhead mount: −20 °C to +65 °C Panel mount: −20 °C to +70 °C
Storage Temperature	−30 °C to +70 °C (recommended 10 °C to 40 °C)
Vibration	1.04 Grms, industrial skid mount, per Woodward RV5
Shock[1]	10 G, 3x each axis, per Woodward MS2 procedure
Humidity[2,3]	5 % to 95 %, non-condensing
Altitude	3000m (9842 ft.)
Installation Rating	Bulkhead mount: Pollution Degree 3, Overvoltage Category II Panel mount: Pollution Degree 2, Overvoltage Category II
Ingress Rating	Bulkhead mount: IP56(non ATEX/IECEx Applications) IP54 ATEX/IECEx Applications Panel mount: IP20 (As shipped) IP54 ATEX/IECEx Applications when installed in an enclosure coded Ex nA or Ex e and providing a minimum ingress protection rating of IP54 as defined in IEC60529 IP56 (Non ATEX/IECEx Applications) when installed in an appropriate IP56 or higher rated enclosure
Conformal coating	Polyacrylate, sulfur resistant (see AppNote #51530)
EMC Emissions	EN 61000-6-4 (Heavy Industrial)
EMC Immunity	EN 61000-6-2 (Heavy Industrial)

[1]Limited by internal relay specification
[2]Relative humidity levels of < 55% will prolong LCD life
[3]Cyclic condensing humidity supported with an appropriate enclosure for panel mount version

Maintenance Info and Recommendations

The Peak200 Control design allows for continuous operation in a typical industrial environment and includes no components that require periodic service. However, to take advantage of related product software and hardware improvements, we recommend sending your product to a Woodward Authorized Service Facility after every five years or 40k hours of continuous service for inspection and component upgrades.

Clock Battery
The Real Time Clock (RTC) battery design lasts approximately 10 years during normal turbine operation. When powered, the RTC automatically disables the battery usage to preserve it. During power-off, the battery maintains date and time functions only. For long-term storage, the battery specification is greater-than 5 years life.

The RTC battery is a replaceable lithium coin cell Woodward PN 1743-1017. Contact a Woodward Authorized Service Center if a replacement service is needed.

Calibration and Functional Verification
It is recommended that you verify calibration and functional operation every 24-36 months. This is essential for spare units that need to be ready for immediate use. Contact a Woodward authorized service center for assistance.

Aluminum Electrolytic Capacitors
It is recommended that you apply power to spare units every 24-36 months for 3 hours to reform the electrolytic capacitors used in the power module.

Display LCD with Backlight
The Peak200 uses a low power LED backlight display with a life expectancy of 70K hours to half brightness, at +25 °C operating temperature. If the display appears dim, use the "SCREEN SETTINGS" menu to verify the brightness setting and adjust as needed with the ADJ ARROW-BRIGHTNESS keypad combination. Contact a Woodward Authorize Service Center for a replacement display when display is damaged or if display quality is unacceptable.

Electromagnetic Compatibility (EMC)

The Peak200 product family complies with Heavy Industrial EMC requirements per EN 61000-6-4 & EN 61000-6-2 specifications.

Emissions EN 61000-6-4
- Radiated RF Emissions Limits 30 MHz to 6000 MHz (per IEC 61000-6-4)
- Power Line Conducted RF Emissions Limits 150 kHz to 30 MHz (per IEC 61000-6-4).

Immunity EN 61000-6-2
- Electrostatic Discharge (ESD) immunity to ±6 kV contact / ±8 kV air (per IEC 61000-4-2)
- Radiated RF Immunity to 10 V/m from 80 MHz to 2000 MHz,   1V/m from 2000 MHz to 2700MHz (per IEC 61000-4-3)
- Electrical Fast Transients (EFT) Immunity to ±2.0 kV Power Supply inputs and +/-1.0 kV on signal ports (per IEC 61000-4-4)
- Surge Immunity on DC Power Supply inputs to ±1.0 kV line to earth and ±0.5 kV line to line (per IEC 61000-4-5)
- Surge Immunity on AC Power Supply inputs to ±2.0 kV line to earth and ±1.0 kV line to line (per IEC 61000-4-5)
- Surge Immunity on I/O to ±1.0 kV line to earth (per IEC 61000-4-5)
- Conducted RF Immunity to 10 V (rms) from 150 kHz to 80 MHz (per IEC 61000-4-6)
- Voltage dips, short interruptions, and voltage variations immunity tests on AC power supply port (per EN61000-4-11)

Bulkhead Version Mounting Information

Packaging
Figure 2-2 is an outline drawing of the Peak200 control. All Peak200 control components are contained in a single, NEMA 4X corrosion restive enclosure. The enclosure can be mounted indoors or out. Access to internal components is through a left-hand-hinged door, which is securely closed by two latches. The approximate size of the enclosure is 19 x 12 x 6.1 inches (approximately 483 x 305 x 155 mm).
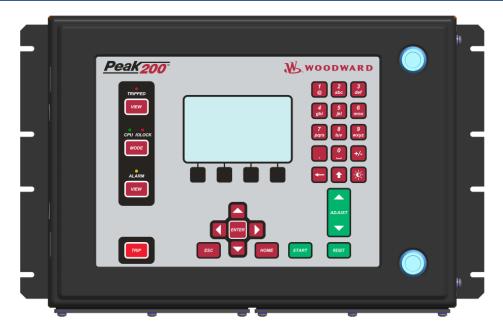
Figure 2-2. Peak200 Bulkhead Unit

NOTICE	**The enclosure has two gland plates in the bottom. It is up to end user to drill holes appropriate for conduit hubs for wiring access. Gland plates mounting screws are not tightened. Ensure all screws are tightened after control is mounted and all wiring finished. Recommended torque 31.7 inch-lbs. (3.5Nm)**

IMPORTANT	**If it is necessary to meet NEMA 4X requirements, you must use the appropriate conduit hubs and conduit when installing this control.**

IMPORTANT	**When using the stainless steel hubs to meet the NEMA 4X requirements, ensure the ground post on the conduit hubs is positioned down to allow the front door to fully and properly close.**

All internal components are industrial grade. The components include the CPU (central processing unit), its memory, the switching power supply, all relays, all input/output circuitry, and all communications circuitry for the front door display, touch keypad, remote RS-232, and RS-485 Modbus communications.

Mounting

The standard Peak200 control enclosure must be vertically mounted on a wall or 19" (483 mm) rack, allowing sufficient room for lid opening and wiring access. Two welded flanges, one on the right side and one on the left side, permit secure mounting.

NOTICE	**Peak200 unit has the identical mounting hole pattern as the Peak150, however power and I/O terminal block placement and size within the unit do not match Peak150 pattern. Check table below for details.**

NOTICE	**Peak200 unit does NOT feature RS-422 communication interface.**

Wiring Differences Between Peak150 and Peak200

Table 2-2. Peak200 and Peak150 Wiring Differences

Peak150	Peak200
Housing: *Dimensions:* 19" x 12" x 4" Opens from left to right Woodward provided bushings	**Housing:** *Dimensions:* 19" x 12" x 4" Opens from right to left Customer needs to mount bushings
Power input: *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins:* 3 pins, Ground, PS+, PS- *Length of cables inside housing*: ~6 – 14inch	**Power input:** *Wires gauge limits:* min 24 AWG max 12 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins:* 3 pins, Ground, PS+, PS- *Length of cables inside housing*: ~6 – 14inch
Discrete outputs: *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins:* 8 pins, 4 Relays. Use of NO or NC configurable with jumpers on PCBA. *Length of cables inside housing*: ~6 – 14inch	**Discrete outputs:** *Wires gauge limits:* min 28 AWG max 16 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins:* 12 pins, 4 Relays, NO, NC, COM terminals accessible for all relays *Length of cables inside housing*: ~6 – 14inch
Discrete inputs: *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins:* 9 pins, 8 inputs + 1 common return pin Length of cables inside housing: ~6 – 14inch *Electrical:* Internal jumper on PCB that polarizes input terminal when work with 28V power supply common with Analog Outputs.	**Discrete inputs:** *Wires gauge limits:* min 28 AWG max 16 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins:* 13 pins, 8 inputs, 1 common return, 3 pins with Contact Power Supply (24V) and 1 shield pin *Length of cables inside housing:* ~6 – 14inch *Electrical*: Return pin is connected to negative potential of isolated power supply. Work with external power supply is possible when common pin tied to external power supply negative.

Peak150	Peak200
RS-232: *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins: 5* pins, TX, RX, SIGGND, DTR (constantly tied to 9V), SHIELD, there is an access to +5VM communication power on external pin	**RS-232:** *Wires gauge limits:* min 28 AWG max 16 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins: 4* pins, TX, RX, COMGND, SHIELD
RS-422/RS-485: *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins: 8* pins, 422-TX+, 422-TX-, 485/422-RX+, 485/422-RX-, SIGGND, TERM+, TERM-, SHIELD, there is an access to +5VM communication power on external pin	**RS-485 (RS-422 not available):** *Wires gauge limits:* min 28 AWG max 16 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins: 8* pins, 232-TX, 232-RX-, 485+, 485-, SIGGND, TERM+, TERM-, SHIELD
Analog outputs (2 channels): *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins: 6* pins, AOUTx+, AOUTx-, 2x SHIELD pins *Electrical*: Analog output 1 and 2 can work as 4-20mA or 0-1mA output. Change of mode is through jumpers on PCBA. No current read backs.	**Analog outputs (3 channels):** *Wires gauge limits:* min 28 AWG max 16 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins: 10* pins, AOUTX+, AOUTX-, 3x SHIELD pins Electrical: All analog outputs work in 4-20mA industrial standard. Current read back is present.
Actuator output: *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins: 3* pins, ACT+, ACT-, SHIELD *Electrical*: Change of mode is through jumpers on PCBA. No current read backs.	**Actuator output:** *Wires gauge limits:* min 28 AWG max 16 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins: 3* pins, ACT+, ACT-, SHIELD Electrical: Change of mode is done inside software. Current read back is present.
Speed inputs (2 channels): *Wires gauge limits:* min 24 AWG max 10 AWG *Wire mount method:* screw connection with tension sleeve to PCB terminal block *Connector pins: 6* pins, SPEEDX+, SPEEDX-, 2x SHIELD pin	**Speed inputs (2 channels):** *Wires gauge limits:* min 28 AWG max 16 AWG *Wire mount method:* screw connection to pluggable connector *Connector pins: 6* pins, SPEEDX+, SPEEDX-, 2x SHIELD pin

Peak150	Peak200
Analog input (1 channel):	**Analog input (4 channels):**
Wires gauge limits: min 24 AWG max 10 AWG	*Wires gauge limits:* min 28 AWG max 16 AWG
Wire mount method: screw connection with tension sleeve to PCB terminal block	*Wire mount method:* screw connection to pluggable connector
Connector pins: 3 pins, AIN+, AIN-, SHIELD	*Connector pins: 10* pins, AINX+, AINX-, 4x SHIELD pin
Electrical: 4-20mA, 1 – 5V input. Internal 250ohm is connected or disconnected using jumpers on PCBA. No dedicated loop power supply.	Electrical: Only 4-20mA mode. Shunt resistance is 160ohm and input impedance around 200ohms.
Service port:	**Service port (debug port):**
Connection: DB-9 female socket	On Peak200, there is no port with the same functionality as service port on Peak150.
Purpose: Connection for Hand Held programmer tool. For modification of service parameters.	There is a service port to configure Peak200 VXWorks system for use.
	There are additional communication ports: CAN, Ethernet ports

The physical outline dimensions for the Peak200 control are shown below. See Woodward Reference drawing 9989-1335 for additional details if necessary.
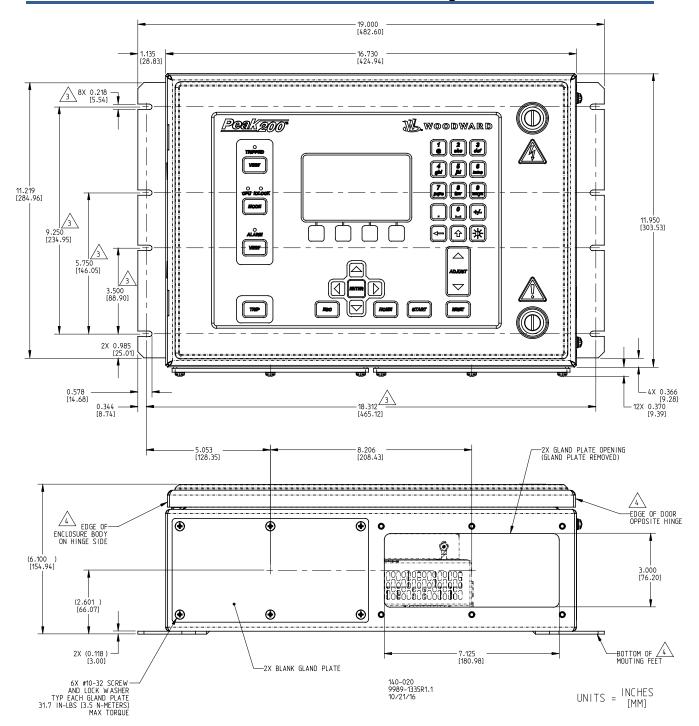
Figure 2-3. Peak200 Bulkhead Mount Version Outline Drawing

Panel Version Mounting Information

Figure 2-4. Peak200 Front Panel Mount Unit

- There are 8 x 10-32 UNF-2B tapped holes used to mount the Peak200.
- The holes are tapped to 0.312" min depth. Choose the proper length screw, which does not exceed this depth into the bezel.
- Use screw 1069-949 (.375 Long, 10-32) for panel thickness (including washers) .065" - .100"
- Use screw 1069-948 (.438 Long, 10-32) for panel thickness (including washers) .101"- .125"
- Use screw 1069-946 (.500 Long, 10-32) for panel thickness (including washers) .126" - .187"

See Woodward Reference drawing 9989-1337 for additional details if necessary.
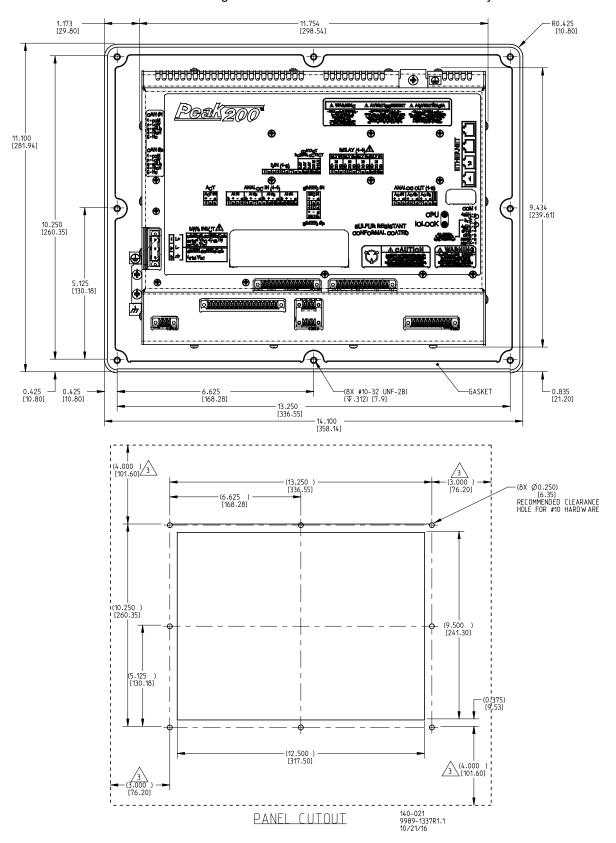
Figure 2-5. Peak200 Front Panel Mount Version Outline Drawing

Input Power Specification

Specifications (LV)

LV Input Voltage Range:	18-36 Vdc
Input Power (max):	< 45 W, 2.5A max
Output Voltage Holdup Time:	>14 ms with 24 Vdc input voltage
Isolation to Other Circuits:	> 500 Vrms to all other circuits
Isolation to EARTH:	> 500 Vrms to EARTH
Input Overvoltage Protection:	±60 Vdc @ 25 °C
Reverse Polarity Protection:	60 Vdc @ 25 °C
Input Undervoltage Shutdown:	~11 Vdc, non-latching

Note: Breaker or power-line fusing of 8 A min is recommended to protect the power-wiring network from possible wiring shorts.

Specifications (HV)

HV Input Voltage Range:	88-264 Vac / 90-150 Vdc
HV Input Frequency Range:	45-65 Hz
Input Power (AC max):	< 45 W, 0.7 Arms max
Input Power (DC max):	< 45 W, 0.5 A max
Output Voltage Holdup Time:	> 30 ms with 110 Vac input voltage
Output Voltage Holdup Time:	> 120 ms with 220 Vac input voltage
Isolation to Other Circuits:	> 3000 Vrms to all other circuits
Isolation to EARTH:	> 1500 Vrms to EARTH
Input Overvoltage Protection:	±375 Vdc @ 25 °C
Reverse Polarity Protection:	375 Vdc
Input Undervoltage Shutdown:	~65 Vdc, non-latching

Note: Breaker or power-line fusing of 3.5 A min is recommended to protect the power wiring network from possible wiring shorts.

Power Connector
Input Power is provided through a 3 position, latching terminal block with removable plug. Green connectors are used for low voltage DC units. Orange connectors are used for high voltage AC/DC units.

Table 2-3. Input Power Connector Pinout

Board Connection	PIN	Name	Description
	1	L+	Input Power (+)
	2	L-	Input Power (−)
	3	EARTH	Earth / shield connection

Plug Type: Side entry 7.62 mm, 12 A, pluggable with latching screw down

⚠ **WARNING** **Electric Shock**	**To reduce the risk of Electrical Shock the Protective Earth (PE) must** be connected to the PE ⏚ terminal on the enclosure. The conductor providing the connection must have a properly sized ring lug and wire gauge equal to or larger than 4mm² (12AWG).

Visual Indicators (LED's) & CPU Configuration

Visual indicators are located on the Front Panel keypad, the controller board, back cover, and related communications ports for diagnostic use.

CPU OK indicator (green/red)
This bi-color LED indicates the CPU status is operational (green) or faulty (red). The CPU will flash fault codes (red) if they exist. This LED exists on both the Front Panel and back cover.

IOLOCK indicator (red)
Indicate the controller is shutdown and held in an IOLOCK state. This LED exists on both the Front Panel and back cover.

ALARM indicator (yellow)
Viewable from the front panel and controlled by GAP software.

TRIPPED indicator (red)
Viewable from the front panel and controlled by GAP software.

Ethernet LED's
(green=link, yellow=traffic) on each RJ45 connector indicate port status and operation.

Communications (Ethernet)

There are (2) isolated RJ45 Ethernet Ports (10/100 Mbit/sec) available to the application software for system use. These ports are full duplex with auto crossover detection.

Features
- Interface standard: IEEE 802.3 (Ethernet)
- Port Isolation: 1500 Vrms to PS, EARTH, and all other circuits
- Control configuration using Woodward AppManager
- Control monitoring, trending, and Datalog collection
- Control configuration of Ethernet IP addresses
- General communications such as Modbus master/slave
- Manage Configuration data and tunables with Control Assistant
- Network time setup and control (SNTP)

Network Configuration
Ethernet ports (ETH1-2) can be configured for the customer network as desired. See the on-site Network Administrator to define an appropriate I/P address configuration.

IMPORTANT	**ETHERNET CABLES—Max cable length is 100 meters. To ensure signal integrity and robust operation, double shielded (SSTP) Cat5 Ethernet cables are required for customer installations. (Woodward PN 5417-394, 10 feet)**

IMPORTANT	**This module has been factory configured with fixed Ethernet IP addresses of** • Ethernet #1 (ETH1) = 172.16.100.15, Subnet Mask = 255.255.0.0 • Ethernet #2 (ETH2) = 192.168.128.20, Subnet Mask = 255.255.255.0

IMPORTANT	**Each of the ETHERNET ports is required to be configured for a unique subnet (domain) (view default settings as an example).**

Table 2-4. Ethernet Ports #1-2 (10/100)

Board Connection	Description
Note: Ports #3 and #4 are disabled and blanked off.	Pin 1 – TX+ Pin 2 – TX- Pin 3 – RX+ Pin 4 – not used Pin 5 – not used Pin 6 – RX- Pin 7 – not used Pin 8 – not used SHIELD = Chassis GND

Network Configuration Utility (AppManager)

Woodward's *AppManager*™ software can be used to configure network setting and load Control software (GAP), HMI display software (QT), and operating system service packs. The AppManager utility can be downloaded from www.woodward.com/software.

A PC connection must be made to Ethernet #1 (ETH1) using a RJ45 Ethernet cable.

> **Note:** AppManager can always be used to "discover/view" the current CPU IP Address. However, to modify settings or load applications, the PC running AppManager must be reconfigured to be on the same "network" as the CPU.

- Locate the ControlName on the module faceplate and highlight it in AppManager.
- To VIEW the IP address configuration, select menu option CONTROL - CONTROL INFORMATION. Look for the Ethernet adapter addresses under the Footprint Description.
- To CHANGE the IP address configuration, select menu option CONTROL - CHANGE NETWORK SETTINGS.

Communications (CAN)

Two (2) Isolated CAN ports are available for general communications as well as simplex or redundant distributed control. Compatible devices include Woodward LINKnet HT nodes, DVP valve products, and other third party devices. Removable latching connector plugs are provided for field wiring.

Network Termination: CAN networks must include a 120 Ω termination resistor at each end of the trunk line.

Network Topology: Daisy chain connections between multiple devices are recommended. Any drop cable connection of a device to the trunk line should be as short as possible and much less than six meters. It is recommended that the network trunk is designed to be less than 100 meters with a max cumulative drop length of less than 39 meters.

Important: For 1 Mbit/sec communication it is required that, each drop cable be less than one meter and as short as possible.

Table 2-5. CAN Specifications

Interface Standard	CAN 2.0B, CANopen
Network Connections	(2) CAN ports, separate connectors
Network Isolation	500 Vrms to EARTH, other CAN ports, all other I/O
Network Speed/Length	1 Mbit @ 30 m 500 Kbit @ 100 m 250 Kbit @ 250 m (thick cable only, otherwise limited to 100 m) 125 Kbit @ 500 m (thick cable only, otherwise limited to 100 m)
Network Termination	(120 ± 10) Ω is required at each end of the network trunk line. **The termination resistor is NOT built into the hardware.
CAN Address	Software configurable
CAN Baud Rate	Software configurable for 125 K, 500 K, 250 K, and 1 Mbit
Cable / Part Number	2008-1512 (120 Ω, 3-wire, shielded twisted pair) —Belden YR58684 or similar
Cable Drops (1 Mbit)	CAN Cable drops shall be < 1 m and as short as possible
Cable Drops (500K, etc)	CAN Cable drops shall be < 6 m and as short as possible

**If needed, an isolated CAN to USB converter is IXXAT, HW221245

Table 2-6. CAN Connector Pinout

Board Connection	PIN	Color	Description
	1	BLACK	CAN Signal Ground
	2	BLUE	CAN Low
	3	Shield	CAN Shield (30 Meg + AC coupled to EARTH)
	4	WHITE	CAN High
	5	n/a	Not used, no internal connection

Plug Type: Side entry 3.5 mm, 8 A, pluggable with latching screw down
Max wire size: 1.3 mm² / 16 AWG for single wires, 0.5 mm² / 20 AWG for two wires
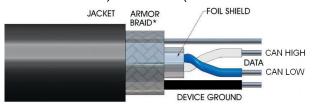
CAN Cable Specifications
Belden YR58684 (Woodward PN 2008-1512) communications / CAN cable is approved and recommended. This is a smaller and more flexible 0.3 mm² / 22 AWG, low capacitance cable suitable for tight routing in industrial environments.
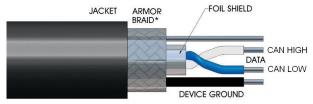
Table 2-7. CAN Cable Specifications

Belden YR58684, bulk cable (Woodward PN **2008-1512**)

Impedance:	120 Ω ±10 % at 1 MHz
DC Resistance:	17.5 Ω per 1000 ft
Cable Capacitance:	11 pF/ft at 1 kHz
Data Pair:	0.3 mm² / 22 AWG, 7 strands, individually tinned, FEP insulation (BLUE, WHITE twisted pair)
Ground:	0.3 mm² / 22 AWG, 7 strands, individually tinned, FEP insulation (BLACK)
Drain / Shield Wire:	0.3 mm² / 22 AWG, 7 strands, individually tinned
Shielding:	Foil 100 % with outer Braid 65 %
Jacket:	FEP Insulation, BLACK
Cable Type:	1.5 pair, twisted shielded
Outer Diameter:	0.244 inch
Bend Radius:	2.5 inches
Temperature:	−70 °C to +125 °C

Belden YR58684, bulk cable (Woodward PN **2008-1512**)

Impedance:	120 Ω ±10 % at 1 MHz
Similar Cable:	Belden 3106A (has different colors & lower temperature specs)

CAN Wiring / Shield Terminations & Limitations

For robust communications performance, the CAN cabling needs to minimize the exposed, non-shielded cable section that occurs at terminal blocks. The exposed length of CAN wiring must be limited to less than 3.8 cm / 1.5 inches from the end of the shield to the terminal block.

CAN shields are terminated to chassis (EARTH) through a capacitor-resistor network (designed into the Flex500 / Peak200 hardware products). However, the shield must also be directly terminated to chassis (Earth) at one point in the network. In the case of Woodward equipment, locate the direct ground at the master device end, as it exits the master device's enclosure.

> **IMPORTANT**   **Always use shielded cables for improved communications in industrial environments. Wire terminations should expose as little un-shielded cable as possible (less than 3.8 cm / 1.5 inches).**

Communications (RS-232/RS-485)

An isolated, configurable RS-232 / 485 serial port is available for customer use, as configured by the GAP software application. RS-422 communications are NOT supported.

Specifications
- Interface standard: RS-232C and RS-485
- Isolation: 500 Vrms to EARTH and all other I/O
- Baud Rates: 19.2K, 38.4K, 57.6K, and 115.2 K
- Max Distance (RS-232): 15 m (50 feet) max
- Max Distance (RS-485): 1220 m (4000 feet) max
- A shielded cable is required when using this port
- RS-485 networks require termination at both ends with approximately 90–120 Ω impedance that matches the characteristic impedance of the cable used.

   Cable Note: Woodward cable 2008-1512 (3-wire) is a shielded, low capacitance 120-ohm cable that is designed for communications. This cable is also used for CAN communications.

Table 2-8. COM1 Serial Port (RS-232/485)

Board Connection	Description
(8 pins)	Pin 1 – RS-232 Transmit Pin 2 – RS-232 Receive Pin 3 – Signal Common Pin 4 – Shield (AC) Pin 5 – RS-485 (+) Pin 6 – Termination Resistor (+) Pin 7 – Termination Resistor (-) Pin 8 – RS-485 (-)

Plug Type: Side entry 3.5 mm, 8 A, pluggable with latching screw down
Max wire size: 1.3 mm² / 16 AWG for single wires, 0.5 mm² / 20 AWG for two wires
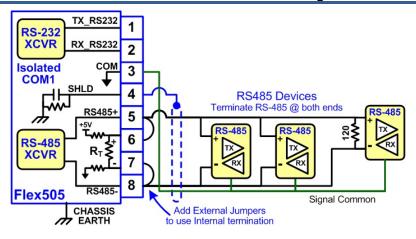
Figure 2-6. COM1 Example RS-485 Wiring

Hardware - Terminal Blocks & Wiring

Back cover view with wiring label.
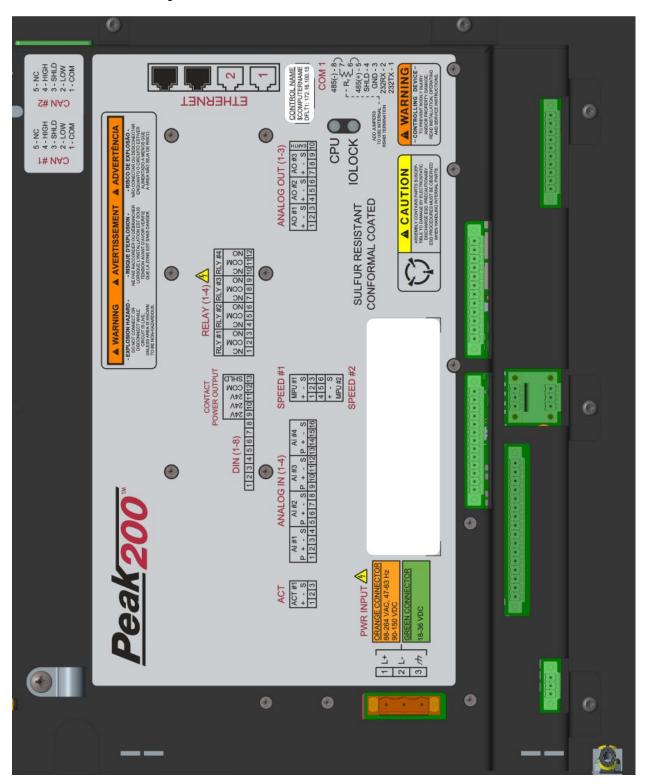
Figure 2-7. Peak200 Back Cover Label – Bulkhead
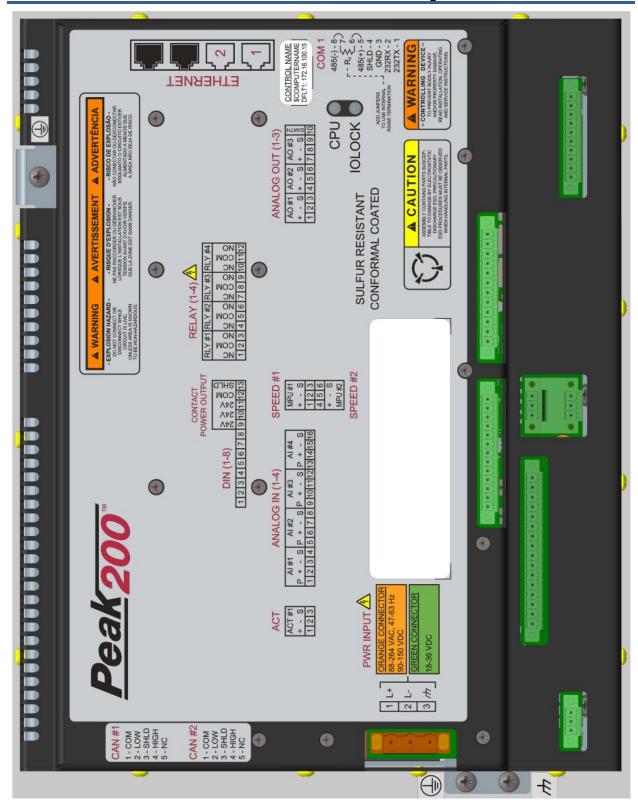
Figure 2-8. Peak200 Back Cover Label – Front Panel Mount
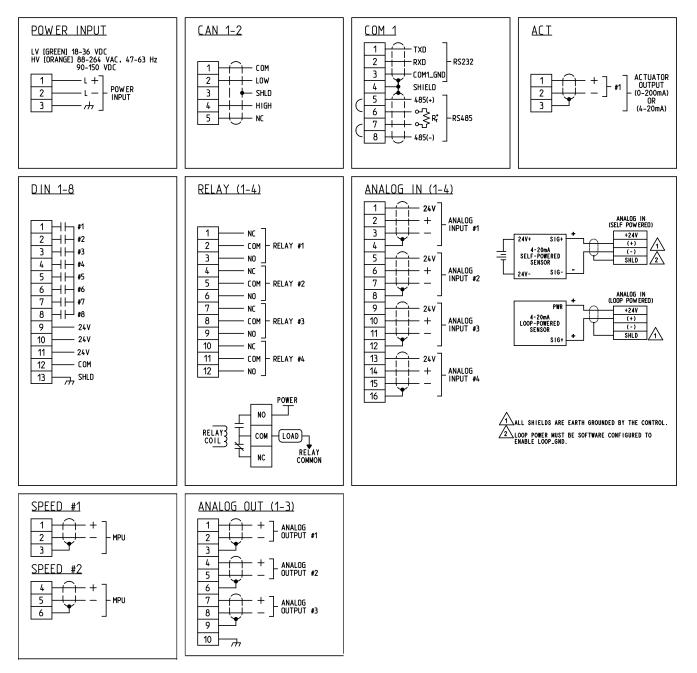
Figure 2-9. Terminal Block Connectors

I/O Signal Specifications and Wiring

Hardware - Speed Sensor Inputs
This controller includes two (2) Digital Speed Sensor circuits that are capable of interfacing to MPU speed probe sensors.

Features
- Two (2) Digital Speed Sensor circuits, isolated individually
- Woodward GAP block, diagnostics, and configuration support
- GAP configurable update rates of 5 ms to 160 ms

Table 2-9. Specifications (Speed)

MPU Input Voltage:	1 to 35 Vrms
MPU Input Frequency:	10 Hz to 35 KHz
MPU Input Impedance:	2000 Ω
MPU Input Isolation:	500 Vrms to EARTH and all other I/O 500 Vrms to other MPU channel

Max Speed Range:	Software Selectable from 5 kHz to 35 kHz
Accuracy (-20,70c):	< ±0.01% of full scale range selected
Resolution:	> 22 bits
Speed Filter (ms):	5-10,000 ms (2 poles)
Derivative Filter (ms):	5-10,000 ms (speed filter + 1 pole)
Derivative Accuracy:	0.1% of full scale range, over full temperature range
Acceleration Limit:	1-10,000 %/sec
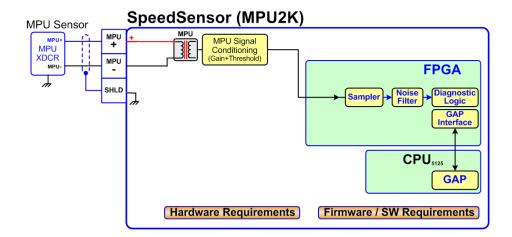
Figure 2-10. Speed Sensor Block Diagram

Hardware - Analog Inputs (4-20 mA)

AI Description and Features
The Peak200 includes four (4) 4–20 mA input channels for I/O monitoring and control. Each channel is differential (self-powered) but can be software configured for Loop Power mode. An Isolated Loop Power (+24 Vdc) is provided for analog input transducers and includes short-circuit/over-voltage protection. Note: Do not use the Loop Power output to power any other type devices.

Features
- Four (4) 4–20 mA Analog Input Channels, 16 bit resolution
- Differential inputs with high common-mode voltage capability
- Isolated Loop Power +24 V is provided with short-circuit protection
- Woodward GAP block, diagnostics, and configuration support
- GAP configurable update rates of 5 ms to 160 ms
- GAP configurable for Loop Power operation

Table 2-10. Specifications (AI)

Number of Channels	4
AI Input Range	0 to 24 mA
AI Input Isolation	0 V channel to channel 500 Vrms to EARTH and all other I/O (except USB)
AI Accuracy (@ 25 °C)	≤ 0.024 mA (0.1% of FS=24 mA)
AI Accuracy (–20, +70 °C)	≤ 0.06 mA (0.25% of FS=24 mA)
AI Resolution	~16 bits of full scale
AI Hardware Filter	2 poles @ ~10 ms
AI Input Impedance	200 ohms (Rsense = 162 ohms)
AI Loop Power Output	24 V ±14% (0-250 mA) short circuit & diode protected
AI Loop Power Isolation	500 Vrms to EARTH and all other I/O
AI CMRR Over Temp	> 70 dB @ 50/60 Hz (typical 86 db)
AI CMVR	> 200 V (dc) to EARTH
AI Overvoltage	±36 V (dc) continuous at room temperature
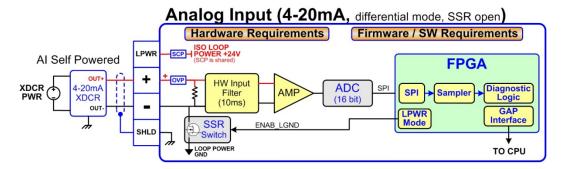
Figure 2-11. Analog Input – Self-Powered Block Diagram
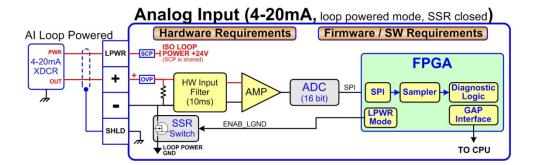
Figure 2-12. Analog Input – Loop-Powered Block Diagram

Hardware - Analog Outputs (4-20 mA)

This control provides an isolated group of (3) 4-20 mA outputs for customer use. Each output can drive up to 600-ohm loads and provides fault monitoring of individual source and return currents.

Features

- Three Analog Output channels (4-20 mA)
- Source and return current monitors
- Group isolated from other circuits
- Capable of driving higher impedance loads up to 600 ohms
- Woodward GAP block, diagnostics, and configuration support
- GAP configurable update rates of 5 ms to 160 ms

Table 2-11. Specifications (AO)

Number of Channels	3 (each with readback)
AO Output Range	0 to 24 mA, 0 mA during shutdown
AO Output Isolation	0 V channel to channel 500 Vrms to EARTH and all other I/O
AO Accuracy (@ 25 °C)	≤ 0.024 mA (0.1% of FS=24 mA)
AO Accuracy (−20, +70 °C)	≤ 0.120 mA (0.5% of FS=24 mA)
AO Resolution	~14 bits of full scale
AO Hardware Filter (max)	3 poles @ 250 µs
AO Load Capability	600 Ω at 20 mA
AO Output Readbacks	(0 to 24) mA, source and return
AO Readback Accuracy	< 1% at 25°C, < 3% over full temperature range
AO Readback HW Filter	~0.5 ms nominal
IOLOCK State	AO circuits are driven to 0 mA during power-up, power-down, core voltage failures, and watchdog failures
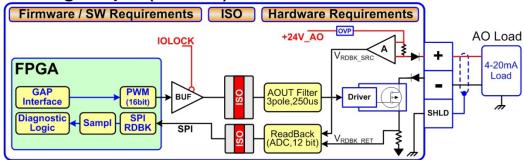
Figure 2-13. Analog Output Block Diagram

Hardware - Actuator Outputs

This control provides an isolated Actuator output for customer use. Actuator driver can be configured for low-range (20 mA) or high-range (200 mA) operation. Fault monitoring of individual source and return currents is included.

Features

- One (1) Actuator Output channel (4-20 mA, 20-200 mA)
- Source and return current monitoring
- Isolated from other circuits
- Capable of driving higher impedance loads
- Woodward GAP block, diagnostics, and configuration support
- GAP configurable update rates of 5 ms to 160 ms

Table 2-12. Specifications (ACT)

Number of Channels	(1) proportional driver with source & return readbacks	
ACT Output Range	Configurable for 24 mA or 200 mA range	
ACT Output Range (low)	0-24 mA, 0 mA during shutdown (FS = 24 mA)	
ACT Output Range (high)	0-200 mA, 0 mA during shutdown (FS = 210 mA)	
ACT Output Isolation	0 V channel to channel 500 Vrms to EARTH and all other I/O	
ACT Accuracy (25 °C)	Low Range ≤ 0.024 mA (0.1%)	High Range ≤ 0.21 mA (0.1%)
ACT Accuracy (−20, +70 °C)	Low Range ≤ 0.120 mA (0.5%)	High Range ≤ 1.00 mA (0.5%)
ACT Resolution	~14 bits of full scale	
ACT Hardware Filter (max)	3 poles @ 500 µs	
ACT Load Capability (low)	600 Ω at 20 mA	
ACT Load Capability (high)	65 Ω at 200 mA	
ACT Output Readbacks	(0 to 24) mA, source and return	
ACT Readback Accuracy	< 1% at 25°C, < 3% over full temperature range, (source & return)	
ACT Readback HW Filter	~0.5 ms nominal	
TRIP Action	Front panel TRIP button will shut down the actuator circuit, remove actuator power, and set an alarm in GAP software.	
IOLOCK Action	During IOLOCK, ACT power is shutdown and ACT circuits are driven to 0 mA during power-up, power-down, core voltage failures, and watchdog failures.	
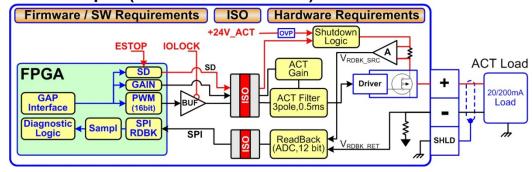
Figure 2-14. Actuator Output Block Diagram

Hardware - Discrete Inputs

This control provides an isolated group of (8) discrete input channels for use with +24 V (dc) signals. An isolated Contact Power voltage supply of +24 V (dc) is provided to use with the discrete inputs. This supply includes short-circuit and over-voltage protection.

> **Note:** Do not use the Contact Power output to power any other devices.

Features

- Eight Discrete Input Channels for +24 V (dc) signals
- +24 V Contact Power with short-circuit and diode protection
- Isolated power and discrete input group
- Woodward GAP block, diagnostics, and configuration support
- GAP configurable update rates of 5 ms to 160 ms
- Time-stamping capability (1 ms)

Table 2-13. Specifications (DI)

Number of Channels	8
DI Input Low State	(0 to 8) V (dc)
DI Input High State	(16 to 32) V (dc)
DI Input Current	< 5 mA per channel
DI Input Impedance	25K approximately
DI Hardware Filter	1.0 ms approximately at room temp
DI Channel Isolation	0 V channel to channel 500 Vrms to EARTH and all other I/O
DI Overvoltage	Overvoltage to 36 V (dc) for inputs
Contact Power Output	24 V ±14 %, 150 mA (max), short circuit & diode protected
Contact Power Isolation	500 Vrms to EARTH and all other I/O

Figure 2-15. Discrete Input Block Diagram

Note: Routing wetting voltage or common wires with signal wires and shielding of DI/DO field wires are recommended due to the possibility of large transients from load dump of high-current inductive loads and indirect lightning strike currents flowing in Protective Earth (PE) ground. If wires are routed separately from commons and are not shielded, transients that are large enough will be coupled into the input or output wiring and cause state changes to the signals for a short time.

Hardware - Relay Outputs
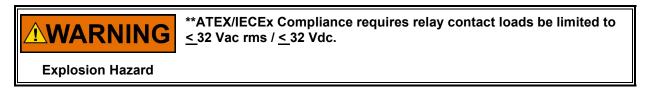
This control provides (4) Isolated, Form-C Relay outputs with NO, COM, NC contacts available at the terminal block.

Features

- Four Relay Output Channels
- Each Relay Output provides NO, COM, and NC contacts
- Each Relay Output channel provides a coil voltage readback fault
- Woodward GAP block, diagnostics, and configuration support
- Contact isolation maintained at terminal blocks
- ATEX approved version available using hermetically sealed relays
- GAP configurable update rates of 5 ms to 160 ms

Table 2-14. Specifications (Relay Outputs)

Number of Channels	(4) relays
Contact Type	Form-C with NO, COM, and NC terminals
STD Relay, Contacts (DC)	2 A, 5-30 Vdc (resistive)
STD Relay, Contacts (AC)	2 A, 115 Vac (resistive)
STD Relay, Operate Time	< 15 ms typical
RELAY Coil Readback	Coil voltage readback status is available
RELAY Coil Rdbk Filter	1 ms approximately at room temp
RELAY Output Isolation	500 Vrms minimum to EARTH and all other I/O
RELAY Contact Isolation	500 Vrms minimum between open contacts
RELAY to RELAY Isolation	500 Vrms minimum between relays
IOLOCK State	Relay outputs are de-energized during power-up, power-down, core voltage failures and watchdog failures
ATEX Version:	The ATEX approved control uses a Hermetically sealed relay
ATX Relay, Contacts (DC)	2 A, 5-28 Vdc (resistive), 0.75A @ 28V (inductive)
ATX Relay, Contacts (AC)**	0.3 A, 115 Vac (resistive)

> ⚠️ **WARNING**   ****ATEX/IECEx Compliance requires relay contact loads be limited to < 32 Vac rms / < 32 Vdc.**
>
> **Explosion Hazard**
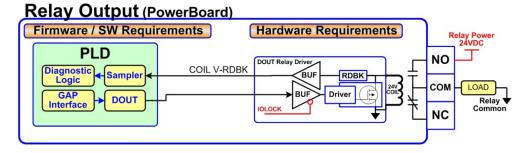
Figure 2-16. Relay Output Block Diagram

Troubleshooting Fault Codes

The CPU board runs diagnostics that display troubleshooting messages through the debug Service Port and AppManager. Additional information on diagnostics tests, subsequent LED flash codes, and serial port messages is contained in the VxWorks manual.

Table 2-15. CPU Fault LED Flash Codes

Failure	Flash Code
CPU not operational, IOLOCK state	Solid Red
RAM Test Failure	2, 1
FPGA Test Failure	2, 9
Watchdog not enabled	2, 10
RAM drive error	2, 11
Flash drive error	2, 12

Troubleshooting & Commissioning Checks

Power Checks
- Verify proper polarity on power connections
- Verify power source and wire size is sufficient for all loads
- Verify input power voltage is correct (i.e.: low voltage unit is 18 V to 36 Vdc)
- Verify PS(+) and PS(–) impedance to EARTH is > 10 MΩ

RS-232 Wiring Checks
- Verify the RS-232 wiring uses a high quality shielded communication cable. For example, Woodward 2008-1512 (Belden YR58684) or equivalent low capacitance, shielded communications wire.
- Verify the RS-232 wiring uses the signal common (COM1_GND)
- Verify RS-232 network length is within specifications (typically < 50 feet)
- Verify Signal wires (TX+,RX-) are not shorted to each other
- Verify Signal wires (TX+,RX-) are not shorted to COM1_GND
- Verify Signal wires (TX+,RX-) are not shorted to COM1_SHLD
- Verify Signal wires (TX+,RX-) are not connected to PS(+), PS(–), EARTH
- Verify COM1_GND is not connected to PS(+), PS(–), EARTH
- Verify the overall cable shield is terminated to EARTH at only (1) location.

RS-485 Wiring Checks
- Verify the RS-485 wiring uses a high quality shielded communication cable. For example, Woodward 2008-1512 (Belden YR58684) or equivalent low capacitance, shielded communications wire.
- Verify RS-485 network length is within spec for the baud-rate (typically < 4000 feet)
- Verify the network is terminated properly at both ends with approx. 90–120 Ω
- Verify the RS-485 wiring uses the signal common (COM1_GND)
- Verify Signal wires (RS-485+, RS-485–) are not shorted to each other
- Verify Signal wires (RS-485+, RS-485–) are not shorted to COM1_GND
- Verify Signal wires (RS-485+, RS-485–) are not shorted to COM1_SHLD
- Verify Signal wires (RS-485+, RS-485–) are not connected to PS(+), PS(–), EARTH
- Verify COM1_GND is not connected to PS(+), PS(–), EARTH
- Verify the overall cable shield is terminated to EARTH at only (1) location.

CAN Wiring Checks
- Verify the CAN wiring uses a high quality, 3-wire, shielded communication cable. For example, Woodward 2008-1512 (Belden YR58684) or equivalent low capacitance, shielded communications wire.
- Verify CAN network length is < max length spec for the baud rate being used
- Verify network is terminated properly at both ends with 120 Ω, ±10%
- Verify the CAN wiring uses the signal common (CAN_GND)
- Verify CAN drop cables to each device are as short as possible and meets spec.
- Verify CANH is not connected to PS(+), PS(–), EARTH
- Verify CANL is not connected to PS(+), PS(–), EARTH
- Verify CAN_COM is not connected to PS(+), PS(–), EARTH
- Verify CAN_SHLD shield wire is not shorted to PS(+), PS(–)
- Verify the CAN overall cable shield is terminated to EARTH at only (1) location for each network.
- For redundant CAN devices, verify CAN1 and CAN2 networks are not miswired and are connected.

AI (non-loop), Analog Input Wiring Checks
- Verify that external XDCR's are NOT used with these self-powered channels.
- Verify each AI(+,–) is not shorted to another input channel.
- Verify each AI(+) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each AI(–) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each AI shield wire is not shorted to PS(+), PS(–).
- Verify each AI shield wire is terminated at the node properly.
- Functionally verify the wiring for each AI channel using a simulator source.

AI (Loop power), Analog Input Wiring Checks
- Verify that external XDCR's are connected to these channels.
- Verify the LPWR voltage level (+24 V dc) is correct for the XDCR.
- Verify each LPWR(+) terminal is wired to the XDCR POWER(+).
- Verify each LPWR(+) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each AI(–) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each AI shield wire is not shorted to PS(+), PS(–).
- Verify each AI shield wire is terminated at the node properly.
- Verify that all XDCR's channels use less than 250 mA of LPWR.
- Functionally verify the wiring for each AI channel using a simulator source.

AO, Analog Output Wiring Checks
- Verify each AO(+,–) is not shorted to another output channel.
- Verify each AO(+,–) is not shorted to another Analog Input channel.
- Verify each AO(+) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each AO(–) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each AO shield wire is not shorted to PS(+), PS(–).
- Verify each AO shield wire is terminated at the node properly.
- Functionally verify the wiring for each AOUT by driving 4 mA and 20 mA to the load from the GAP application. Verify correct output current with a meter. Verify the correct SRC_RDBK & RET_RDBK values in GAP.

DI, Discrete Input Wiring Checks
- Verify each DI(+) is not shorted to another input.
- Verify each DI(+) is not shorted to CPWR(+), CPWR(–), PS(+), PS(–), EARTH.
- Verify each DI(+) wiring is functional by setting each input HIGH (>16 V DC) and then LOW (<8 V DC). Verify GAP software detects the state change.
- When possible, consider using a shielded DIN cable.

DI, Contact Power (CPWR) Wiring Checks
- CPWR(+) is an output voltage, it should never be connected to any other supply.
- To maintain node isolation, verify CPWR(–) is not shorted to PS(–).
- Using the internal isolated Contact Power output (CPWR,COM) is highly recommended to maintain discrete input isolation for other plant devices / controls
- Verify CPWR(+) is not connected to CPWR(–), PS(–), EARTH.
- Verify CPWR(–) is not connected to CPWR(+), PS(+), EARTH.
- Verify CPWR voltage meets spec at the terminal block (18 to 32 V dc).

DO Relays, Relay Wiring Checks
- Verify each Relay output (NO,C,NC) contact is connected to the load properly
- Verify each Relay output (NO,C,NC) is not shorted to another output channel.
- Verify the function of each Relay output (NC,NO) wiring by driving each output ON then OFF. Verify the GAP software detects the readback state change.
- When possible, consider using shielded wiring for relay cables.

Additional Wiring Checks When Using LINKnet Nodes

TC, Thermocouple Input Wiring Checks
- Verify each TC(+,–) is not shorted to another input channel.
- Verify each TC(+) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each TC(–) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each TC shield wire is not shorted to PS(+), PS(–).
- Verify no wires are landed accidently on the NC, no-connect terminals.
- Verify each TC shield wire is terminated at the node properly.
- Functionally verify the wiring for each TC channel using a simulator source.
- TC OPENS: A TC input will read MAX DegC if the (+) or (–) wire is broken / open.
- TC SHORTS: A TC input will read zero DegC if the (+) and (–) wires are shorted.

NOTICE | **GROUND FAULTS: Input channels accidently shorted to EARTH will be more susceptible to spurious noise events related to the installation and environment.**

RTD, Input Wiring Checks
- Verify each RTD(+,–) is not shorted to another input channel.
- Verify each RTD(+) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each RTD(–) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each RTD(sense) terminal is not shorted to PS(+), PS(–), EARTH.
- Verify each RTD(sense) terminal is connected properly for 3-wire sensors.
- Verify each RTD(sense) terminal is jumpered to RTD(–) for 2-wire sensors.
- Verify each RTD shield wire is not shorted to PS(+), PS(–).
- Verify each RTD shield wire is terminated at the node properly.
- Functionally verify the wiring for each RTD channel using a simulator source.
- RTD OPENS: RTD channels will read MAX DegC if the (+) or (–) wire is broken.

Chapter 3.
Control Description

Introduction

The Peak200 is designed to operate steam turbines with a single-valve or a single-valve rack that are applied in mechanical drive applications such as pumps, fans, blowers, compressors, etc.

The Peak200 is a product that integrates control hardware, control software, and a graphical user interface (GUI) into a single package. The design of control logic is such that the user can configure the system in the field for any of the above applications and operate the unit completely from the front panel display.

The Speed Relationship diagram (Figure 3-1) shows how the speed settings in the Peak200 relate to each other, and may be helpful when configuring the Peak200 speed setpoints.
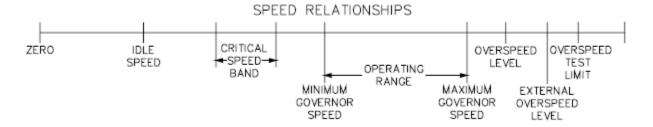
Figure 3-1. Speed Relationships

Front Panel View

Figure 3-2. Front Panel

The keypad is the same on the Bulkhead or Panel Mounted versions.

Four Fixed Operational Action Buttons on Front Panel

RESET—The Peak200 latches when it senses an ALARM or a TRIP condition. After clearing the ALARM or TRIP condition, pressing the ALARM RESET button will clear the latch function. Normal start sequence is to push the ALARM RESET button then the START button.

Along with the ALARM RESET button, you can reset the Peak200 externally with the RESET discrete input, or with the Modbus RESET command.

START—Pressing the START button initiates the Turbine Start Sequence. The START button is inactive until all TRIPS are cleared and RESET.

- In the MANUAL START MODE, pressing the START button opens the VALVE RAMP and ACTUATOR while a turbine operator controls the turbine speed with a trip & throttle valve. Governor speed control begins at the MIN GOVERNOR SPEED.

- In the AUTO START MODE, pressing the START button opens the VALVE RAMP and ACTUATOR while a turbine operator controls the turbine speed with a trip & throttle valve. Governor speed control begins at IDLE SPEED.

- Either START MODE begins operating when the Peak200 receives a START command from the START button, the START discrete input, or a Modbus START command.

 If the external START input is closed, the RESET button will both RESET and START the Peak200.

- In the MANUAL START MODE, the ACTUAL SPEED SETPT will RAMP to the MIN GOVERNOR SPEED.

- In the AUTO START MODE, the ACTUAL SPEED SETPT will RAMP to IDLE speed. When the IDLE / MIN GOV input is closed, the ACTUAL SPEED SETPT will ramp to MIN GOVERNOR SPEED.

ADJUST Up/Down— Button used to adjust all analog values that are available as tunables (on any screens) once that parameter is 'in focus'. If the Shift button (⬆) above the Adjust button is pressed at the same time the value will change at a faster rate.

TRIP—Pressing the TRIP button will trip the turbine. When pressed it sets the ACTUAL SPEED SETPT to minus 1, drives the VALVE RAMP (ACTUATOR) to zero (closed position), and changes the state of the TRIP RELAY. In the Service menu, there is an option to add a 2-second delay to this command to prevent nuisance trips if the button is pressed accidentally. The default setting of this delay is zero (immediate).

User Login Levels

Pressing the MODE key at any time will open the Login and Mode Screen
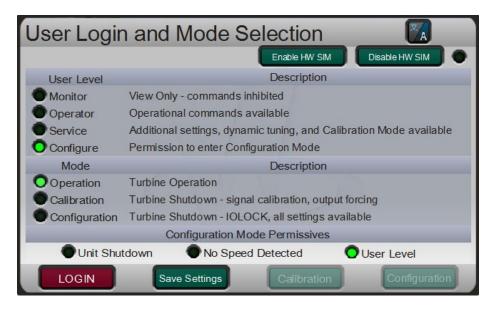
Figure 3-3. Mode Screen

Monitor – (logout to enter this)
Even Keypad Green keys inhibited

Operator –	**Default password:**	*in chapter 8*

Intended for normal turbine operation – default mode
Screen saver initiates to this level

Service –	**Default password:**	*in chapter 8*

Allows tuning of parameters, while turbine is running (PID dynamics) and entering of Calibration Mode

Configure –	**Default password:**	*in chapter 8*

Highest user authority / can enter any Mode

NOTICE   The TRIP button is always available in all modes and logins.

If your unit supports Multi-Lingual operation – then the [icon] icon will appear in the upper right of the Mode screen. Navigating to this icon and pressing Enter will open a pop-up dialog box that will allow the user to select a language other than English for the local display.

Figure 3-4. Language

Once selected the GUI file must be rebooted to initialize all text in the selected language. The Re-Start GUI button will do this, the screen will go to the 'Splash screen' while the GUI re-initializes. This can be done at any time, including during normal operation of the turbine. During this time (a couple of minutes), the control will continue to operate the turbine and any other visualization programs being used will continue to operate normally.

To Login –
1. **Press the LOGIN button**
2. ** Navigate to highlight the Login or Password field
3. Press **Enter** on the Navigation Cross
4. Use the keypad to enter the text field **(hold key down to scroll options)**
5. Press **Enter** on the Navigation Cross – to accept your entry

** Alternatively, you can navigate to the Autofill buttons and press Enter, which will auto-populate the login information, so you only need to enter the password.

Navigation

This is NOT a touchscreen! Due to quality, robustness, screen cleanliness, and long-term reliability concerns Woodward chose not to implement a touchscreen directly on this product. Using the RemoteView tool a user can take advantage of either a mouse device or a touchscreen on an external computer, but for navigation and selection directly on the Peak200 display, buttons and an IN-Focus highlighter indication are used.

In general, the maroon buttons provide navigation from page-to-page and throughout the components on a page. The Navigation cross does most of the navigation.

Figure 3-5. Navigation Cross

1. Use the "Arrow" buttons to move the IN-Focus highlighter to the desired page
2. Press the "Enter" button to launch the page selected
3. Press the "ESC" (Escape) button to go back 1 page from current page
4. Press the "HOME" button to return to the main menu *Note: If in Service or Configure menu a second press of HOME will return to the Operational Home screen*

Figure 3-6. Service Menu showing "Speed Control" IN-Focus

Page Organization

Three primary menu lists organize access to all the information that is available on the display. These menu lists are available at all times. The user simply uses the navigation cross to focus on the desired page and presses Enter or uses the Black 'soft keys' (no Focus needed).

Run/Operation Menus: The HOME page contains the Run/Operation menus and automatically updates to match the configuration of the control.

Service Menus: The Service 'HOME' page contains navigation buttons to all of the service related parameters and special feature of the control, and it too is automatically updated to match the configuration of the

Configuration Menus: The Configuration 'HOME' page contains navigation buttons to all features and options of the Peak200. When the unit is in Configure Mode (IOLOCK) the background of all pages will be a blue gradient as shown below, in addition to the status in the upper right.
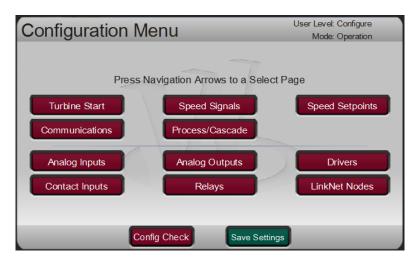
Figure 3-7. Configuration Menu – Operation Mode (View Only)

Figure 3-8. Configuration Menu – Configuration Mode (Edit)

Refer to Chapter 1 for more details about all the keys – below are some general reminders about the keypad functions.

Green keys – initiate operational commands

Red keys - navigate or enter values via the alphanumeric keys

Black keys – are software dependent and may do either, they never require 'IN-Focus' the command shown in above the key is always available

Start Key – defaulted to issue a Start command but can be configured to require a Confirmation. User must be logged-in at appropriate User level (Operator or greater)

TRIP is always available in all modes and logins.

When entering string text from the keypad, holding down the key will make it slowly cycle through the characters available on that key. Releasing the key will select the character shown at that time.

Start Modes

Turbine start-up is accomplished by controlling the inlet steam with the turbine's Trip & Throttle valve and/or the Actuator/Valve. The sequence of operation for these two devices determines the start mode to be selected.

In the Peak200, there are two start options:
Configuration Menu / Turbine Start
    MANUAL START
    AUTOMATIC START

Either start mode begins with the START command from the START button, the START discrete input, or a Modbus START command. (All TRIPS must be cleared and RESET for the Peak200 to respond to the START command).

For either of these modes the HOME/STARTUP CURVE menu is the ideal screen to monitor while starting the turbine. Initially, the user may need to also use the Speed Control menu to adjust the control dynamic settings.
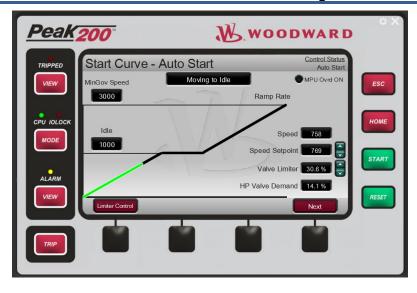
Figure 3-9. Startup Curve Screen

Manual Start Mode

With a manual start, speed control of the Peak200 begins at Minimum Governor Speed setpoint, there will be no critical speed avoidance, and the Idle/MinGov command functionality cannot be used.

When a Start command is given the Peak200 will ramp the speed setpoint up to Minimum Governor and the Valve Limiter will ramp the valve open to Maximum Valve Demand (default = 100%). It will wait for the turbine speed to reach this point and then it will automatically take over speed control of the inlet steam valve (HP Valve).

The MANUAL START MODE is when a turbine operator manually controls the inlet steam by opening the TRIP & THROTTLE VALVE. The operator has control of the turbine speed from zero RPM to the MIN GOVERNOR SPEED.

Auto Start Mode

With automatic start mode, speed control begins at idle speed, which is a setpoint lower than Minimum Governor Speed. In many cases, idle speed is a setpoint at which the turbine can be warmed-up. With this mode, a critical speed range (between Idle and Minimum Governor Speeds) can be programmed. The operator also has flexibility to allow the Peak200 to control the speed within this range, rather than manually controlling it with the T&T valve.

When a Start command is given, the Peak200 will ramp the speed setpoint up to Idle at the Rate to Idle rate and the Valve Limiter will ramp, at the valve limiter rate, to the valve open to Maximum Valve Demand (default = 100%). It will wait for the turbine speed to reach this point and then it will automatically take over speed control of the inlet steam valve (HP Valve).

To automatically start the unit to MIN GOV:
- Close the IDLE / MIN GOV input.
- Press the START button on the front pane

This ramp will accelerate the turbine at the IDLE / MIN GOV RATE

Maximum Valve Demand During a Start

With either mode a protection feature is available that will limit the Maximum demand position of the valve limiter ramp until the turbine is in closed loop speed control. Once the turbine is safely in speed control, the limiter will automatically continue to the maximum setting of the valve limiter (usually 100%)

To enable this feature:

Service / Valve Demand
- Use HP Start Limiter?
- HP Max Limiter at Start (%)

Example: If the unit typically reaches Idle Speed at HP demand of 12%, when enabling this feature and the limit during start value set to 15%. This way as the operator manually brings the unit up on the T& T valve, the governor valve (HP) will be held at a safer limit until speed comes into control at IDLE speed. For initial warm-up of a cold turbine prior to starting, this feature can be disabled (using the checkbox) to allow the HP valve to go to 100%.

Operating Mode (Setting Turbine Speed)

The primary function of the control is as a speed control. The speed setpoint can be adjusted in a variety of ways – for simplicity they are grouped into three modes.
- Manually Adjusting Speed Setpoint
- Remote Speed Setpoint Control via an Analog Input (4-20mA)
- Process/Cascade Controller controls the speed setpoint

Manual Speed Setpoint Adjustments

The turbine operator can adjust the speed setpoint by any of the following commands:
- The RAISE / LOWER buttons on the front panel (when setpoint adjustment component is in-focus)
- The RAISE SPEED / LOWER SPEED discrete inputs
- Entering a value and Go To command directly on the front panel
- The Modbus RAISE SPEED / LOWER SPEED commands
- Entering a speed setpoint value directly via Modbus

These options are available at all times and the speed control will follow the last of these commands. Commanding Raise and Lower at the same time will result in the setpoint lowering.

To use Modbus commands (analog or discrete raise/lower commands) to modulate the speed setpoint, the user must configure Modbus to be used, have a valid communication connection, and have Writes Enabled for that Modbus link.

Remote Speed Setpoint Control Mode

When the Remote Speed Setpoint is enabled, the control will exclusively follow the remote speed setpoint and ignore any of the manual speed adjustments commands above. The turbine speed can only be adjusted between the MIN GOVERNOR SPEED and the MAX GOVERNOR SPEED setpoints with the REMOTE SPEED SET input of a 4–20 mA Analog input. This can be from any source but should always have the range set so that 4 mA is equal to the minimum governor speed setting. The 20 mA value can be maximum governor or any speed lower than that.

This mode is active only when the turbine speed is at or above MIN GOVERNOR SPEED, and the remote speed setpoint has been enabled. The enable or disable command for this mode can be done from a contact input, the front panel display, RemoteView, or via Modbus. Whenever remote speed setpoint is enabled, the control will ramp from the current setpoint to the remote speed setpoint at the REMOTE SPEED NOT MATCHED RATE (set in Configuration) once it reaches the remote setpoint it will then follow this commanded value at the REMOTE SPEED MAX RATE. Whenever remote speed setpoint is enabled and in control, the manual setpoint ramp will always track the remote speed setpoint to ensure that any transition of disabling the remote setpoint is bumpless.

If a contact input is configured to enable this function, it is defaulted as a 'toggle switch' type of input and the remote speed setpoint will be enabled or disabled based upon the state of this contact only. This allows the control to respond exclusively to this command and no others, which produces these two responses:

- The contact input can be held TRUE to have the control automatically switch to using the remote speed setpoint as soon as MinGov speed is reached.
- If while the contact input is held TRUE and the analog input fails, the control will automatically re-enable using the remote speed setpoint as soon as the analog input signal is repaired and reset. (Caution – users need to consider their plant operation to consider whether this action is desirable or undesirable).

This contact input can be optionally configured as a 'momentary switch' type of input where enable/disable state is determined by the transition of this input or a command from another source, such as from Modbus or from the front panel display. Using this option allows the contact input to act the same as the other ways in which this function can be enabled or disabled (from front panel, or remote view, or Modbus), giving more flexibility to turning this mode on or off.

Peak150 Combination Mode & Set Back Functions

The previous model Peak control (Peak150) had an operational mode called Combination mode that directed the control to use the highest selected signal (HSS) of the speed reference setpoint ramp and the analog input remote speed setpoint. There was also a service function called Set Point Set Back that would instantly set the speed setpoint to the actual running speed.

It was decided to not implement these functions in the Peak200, since the user can now always see both the speed and the speed setpoint. The user can also see if the remote speed is enabled or disabled. These functions existed in the Peak150 partially because the user at the panel could not see the speed setpoint. The above modes of speed setpoint control are much more in line with the industry standards and eliminate confusion – with the Peak200, the user can always see the speed and source of the speed setpoint.

Process/Cascade Control

The Process/Cascade control can be configured to control any system process, related to, or affected by turbine speed or load. Typically, this controller is configured and used as a turbine inlet, or exhaust pressure controller or a pump discharge pressure controller.

Process/Cascade control is a PID controller that is cascaded with the Speed PID. The Cascade PID compares a 4–20 mA process signal with an internal set point to directly position the speed set point, thus changing turbine speed or load until the process signal and set point match. By Cascading two PIDs in this fashion, a bumpless transfer between the two controlling parameters can be performed.

When enabled, the Cascade PID can move the speed set point at a variable rate up to the 'Max Speed Set Point Rate' setting (programmed under the CASCADE CONTROL header).
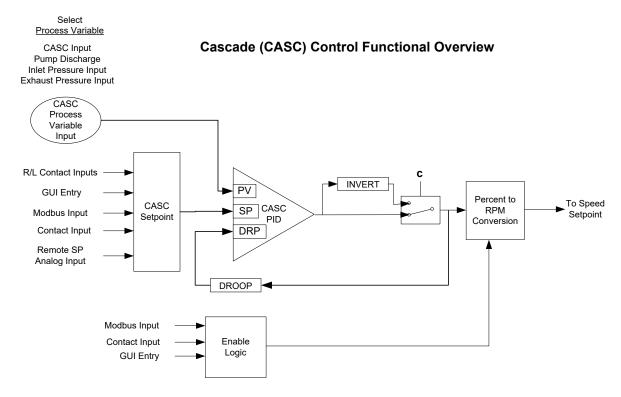
Figure 3-10. Cascade Functional Diagram

Since Cascade is a secondary speed setting function, the Speed PID must be in control of the Peak200's LSS bus for Cascade to take control.

To use this controller an analog input channel must be configured for use as the Process/Cascade input. The Peak 200 will use this input as the Process Variable (PV) for this controller. If at any time while in Cascade control this PV faults, the Cascade controller will be disabled and the speed setpoint will remain at its current setpoint (bumpless).

Cascade control may be enabled and disabled from the front panel keypad, a contact input, or Modbus communications. The last command given from any of these three sources dictates the Cascade PID's control state.

If a contact input is programmed to function as a Process/Cascade Enable contact, when the contact is open Cascade control is disabled, and when it is closed Cascade control is enabled. This contact can either be open or closed when a trip condition is cleared. If the contact is open, it must be closed to enable Cascade control. If the contact is closed, it must be opened and re-closed to enable Cascade control.

Table 3-1. Cascade Control Status Messages

Cascade is Disabled:	Cascade control is not enabled and will have no effect.
Cascade is Enabled:	Cascade has been enabled but is not active or in control. Permissives have not been met (i.e. speed < min gov).
Casc Active/Not Spd Ctl:	Cascade has been enabled but the Speed PID is not in control of the LSS bus (i.e., valve limiter is in control).
Cascade is In Control:	Cascade is in control of the LSS bus.
Casc Active w/Rmt Setpt:	Cascade has been enabled and the Remote Cascade set point is in control of the set point, but the Speed PID is not in control of the LSS bus.
Casc Control w/Rmt Setpt:	Cascade is in control of the LSS bus (via the Speed PID), and the Remote Cascade Set Point is positioning the Cascade set point.
Cascade is Inhibited:	Cascade cannot be enabled; the Cascade input signal has failed, the unit is shut down, or cascade control is not programmed.

Cascade control is automatically disabled on a shutdown condition and must be re-enabled after a successful system start-up. Cascade control is disabled if Remote Speed Set Point is used and enabled. Should another parameter on the LSS bus take control of governor valve position from the Speed PID, Cascade control will stay active, and begin controlling again, when the Speed PID is the lowest parameter on the LSS bus again.

All pertinent cascade control parameters are available through the Modbus links; refer to Chapter 6 for a complete listing of Modbus parameters.

Cascade Dynamics
The Cascade PID control uses its own set of dynamic settings. These values are programmable and may be tuned at any time. Refer to the PID Dynamic Adjustments section in this manual.

Cascade Set Point
The Cascade set point can be adjusted from the front panel keypad, external contacts, Modbus commands, or through a 4–20 mA analog input. A specific setting can also be directly entered from the front panel keypad or through Modbus commands.

The Cascade set point range must be defined in the program mode. Program settings 'Min Cascade Set Point' and 'Max Cascade Set Point' define the range of the Cascade set point and control.

IMPORTANT	**If it is desired to have the Speed raise/lower contact inputs to act as Cascade set point raise/lower contact inputs act when Cascade is enabled or in control, then select the Speed/Cascade function when defining the discrete input channels to be used. This allows a single set of contacts (one SPDT switch) to control the Speed set point when in speed control, and the Cascade set point when it is enabled. Alternatively, a second set of contacts (speed raise and lower) could be used to independently control the speed setpoint.**

When a raise or lower Cascade Set Point command is issued, the set point moves at the programmed 'Casc Setpt Rate' setting. If a Cascade raise or lower command is selected for longer than three seconds, the Cascade set point will move at the fast rate which is three times the cascade set point rate. The Cascade set point rate, fast rate delay, and fast rate can all be adjusted in the Service mode.

The shortest length of time a set point will move for an accepted raise or lower command is 40 milliseconds (120 milliseconds for a Modbus command). If the Cascade set point slow rate is programmed for 10 psi/s, the smallest increment it will move is 0.4 psi (1.2 psi for Modbus).

When a valid set point value is entered, the set point will ramp at the Cascade Set Point Rate to the newly entered set point value. This 'Entered' rate is tunable through the Service mode.

To "enter" a specific set point from the front panel display, use the following steps:

1. From the HOME page go to the Cascade Control page.
2. Press the Commands button until 'Entered Setpoint' appears.
3. Select 'Entered Setpoint' and a pop-up will appear.
4. Press Enter from the Navigation cross and the pop-up value will be highlighted.
5. Adjust the value with the Adjust keys or enter a value from the keypad.
6. Press Enter again when desired value has been entered.
7. The value in the pop-up will be accepted if it is valid. If it is out of range then an error message will appear stating the entered value is invalid.
8. Select the GO button to ramp the setpoint to this entered value.

Cascade Set Point Tracking

To allow a bumpless transfer from turbine Speed/load control to Cascade control, the Cascade PID can be programmed to track its controlling process input when disabled. When this tracking feature is programmed, the Cascade PID will be satisfied when enabled, and no turbine speed or load correction will be performed. After the Cascade control is enabled, its set point can move, as required, to another setting.

Cascade Set Point with No Tracking

If the Cascade control is programmed not to use the set point tracking feature the set point will remain at its last setting (running or shutdown). When the Peak200 is powered-up the set point is reset to the Minimum Cascade Setpoint. With this configuration, when Cascade control is enabled, and its sensed process signal does not match set point, the Cascade control will ramp turbine speed/load up or down to match the two signals, at a controlled "not-matched" rate (defaulted to the 'Speed Set Point Slow Rate' setting, and tunable through the Service mode).

If Cascade is the controlling parameter and one of the permissives is lost or Cascade is disabled, the speed set point will remain at its last setting until another parameter adjusts it.

Cascade Droop

When sharing control of a parameter with another external controller, the Cascade PID can also receive a programmable DROOP feedback signal for control loop stability. This feedback signal is a percentage of the Cascade PID's output. By including this second parameter into the control loop, the Cascade PID becomes satisfied, and does not fight with the other external controller over the shared parameter. If Cascade droop is used, the Cascade input signal will not match the Cascade set point when in control. The difference will depend on the amount (%) of droop programmed and the output of the Cascade PID. The Droop value fed back to the Cascade PID is equal to the following defaulted settings:

PID OUTPUT % x 'CASCADE DROOP %' x 'MAX CASC SET POINT' x 0.0001

Where the 'CASCADE DROOP %' and 'MAX CASC SET POINT' values are set in the Program Mode and the 'PID output %' is determined by the Cascade demand.

Example: 25% x 5% x 600 psi x 0.0001 = 7.5 psi

Invert Cascade

Depending on the control action required, the Cascade input signal can be inverted. If a decrease in inlet governor valve position is required to increase the Cascade process signal, program the 'INVERT CASCADE INPUT' setting to 'YES'. Example of this required control action: when the Cascade PID is configured to control turbine inlet steam pressure. To increase turbine inlet steam pressure, the inlet control valve position must be decreased.

Remote Cascade Set Point

If desired, the Cascade set point can be positioned through an analog signal. Optionally, one of the control's six analog inputs can be programmed to position the Cascade PID set point. This allows the Cascade set point to be positioned remotely by a process control or distributed plant control system.

The programmed Analog input's 4 mA and 20 mA settings determine the Remote Cascade Set Point (RCS) range. The Remote Cascade Set Point range is tunable in the Service mode but cannot be set outside of the min and max Cascade Set Point settings.

The Remote Cascade Set Point input may be enabled from the front panel keypad, contact input, or Modbus communications. The last command given from any of these three sources dictates enable/disable.

If the milliamp signal to the Remote Cascade set point input is out of range, (below 2 mA or above 22 mA) an alarm will occur, and the Remote Cascade set point will be inhibited until the input signal is corrected and the alarm is cleared. Depending on configuration and system conditions, the Remote Cascade Set Point may be in one of the following states (front panel screen messages):

- Disabled—The Remote Set Point function is not enabled and will have no effect on the Cascade set point.
- Enabled—The Remote Set Point has been enabled but cascade control is not active. The breakers are not closed, speed < min gov, or cascade has not taken control.
- Active—The Remote Set Point has been enabled but Cascade is not in control. Cascade has been enabled and the Remote Cascade set point is in control of the set point, but the Speed PID is not in control of the LSS bus.
- In Control—Cascade is in control of the LSS bus (via the Speed PID), and the Remote Cascade Set Point is positioning the Cascade set point.
- Inhibited—Remote Set Point cannot be enabled; input signal is failed, Cascade input signal is failed, a controlled stop is selected, the unit is shut down, or the remote cascade control is not programmed.

When enabled, the Remote Cascade set point may not match the Cascade set point. In this case, the Cascade set point will ramp to the Remote Cascade set point at the programmed 'Casc Setpt Rate' setting (as defaulted in the Service mode). Once in control, the fastest the Remote Cascade set point will adjust the Cascade set point is at the programmed 'Rmt Cascade Max Rate' setting. If the 'Rmt Cascade Max Rate' was set at 10 and the Remote Cascade set point analog input instantly moved from 0 units to 1000 units, the Remote Cascade set point will move to 1000 units at 10 units/s).

Remote Cascade Enable Logic
There are three different options for enabling Remote Cascade Set Point and Cascade control as follows:
- Remote Cascade Setpoint Enable contact input
- Enable command from Modbus
- Enable command from the front panel display

If a contact input is programmed to enable and disable the Remote Cascade Set Point (RCS) input/function and no contact input is programmed for Enable Cascade Control, then this one contact will enable both remote setpoint and cascade control. When this contact is open both Cascade control and the RCS is disabled, and when it is closed, both the Cascade control and the RCS are enabled. The contact can be either open or closed when a trip condition is cleared. If the contact is open it must be closed to enable the functions. If the contact is closed it must be opened and re-closed to enable the cascade functions.

When both Remote Cascade Enable and Cascade Control Enable commands are programmed, each function is enabled by its respective command selection. If Remote Cascade Enable is selected, only the Remote Cascade Set Point will be enabled. If Cascade Control Enable is selected, only Cascade control will be enabled. If Remote Cascade Disable is selected, only the Remote Cascade Set Point will be disabled. If Cascade Control Disable is selected, both Remote Cascade control and Cascade control will be disabled. However, if before the Cascade PID was 'In-control', a Cascade disabled command is given, only Cascade control will be disabled.

If no external contact input or function keys are programmed for the 'Enable' commands, Cascade Control and Remote Cascade Control must be enabled either from the front panel keypad or from Modbus. Since the front panel and Modbus provide both Remote Cascade Enable and Cascade Control Enable commands, they will operate in the same manner as 'both enables programmed'.

Chapter 4.
Configuration Procedures

Program Architecture

The Peak200 is easy to Configure from the built-in graphical user interface (GUI). When the control is powered up and after the CPU self-test has been completed, the control displays the home screen and the CPU LED on the left side of the front panel should be green. At this point the configuration can be done locally on the display or remotely using the RemoteView tool on a user PC.

NOTICE	Using the remote tool may be more convenient as you can use a mouse to navigate and the full keyboard to enter data. Refer to the appropriate appendix in this manual for installing and using RemoteView.
Configuration from Display or PC	

The operating procedures are divided into two sections: the Configuration Mode, discussed in this chapter, and the Run Modes (Operation and Calibration) (refer to Chapter 5 for RUN Mode information). The Configure Mode is used Configures the Peak200 for the specific application and set all operating parameters. The Run Mode is the normal turbine operation mode and is used to view operating parameters and run the turbine.

The configuration cannot be changed or altered while the turbine is running, however, it can be accessed, and all programmed values monitored. This minimizes the possibility of introducing step disturbances into the system. To monitor or review the program while in the run mode, enter the Configuration menu from the first (leftmost) soft key on the Home screen.

Display Modes and User Levels

The Peak200 Display operates in several modes and access user levels, each of which has a different purpose. The modes are:
- Operation
- Calibration
- Configuration

In order to enter and exit a particular mode, the user must be logged in with an appropriate user level. These user levels are:
- Monitor
- Operator
- Service
- Configure

In addition to granting authority to enter and exit modes, user levels also determine what parameters the user is authorized to adjust. See Table 4-1, Mode Access by User Level.

Table 4-1. Mode Access by User Level

		Mode		
		Operation	Calibration	Configuration
User Level	Monitor			
	Operator	X		
	Service	X	X	
	Configure	X	X	X

Mode Descriptions

The OPERATION mode is the only mode that can be used to run the turbine. This is the default mode. Exiting CALIBRATION or CONFIGURATION mode will return to OPERATION mode. User levels are:
• Operator
• Service
• Configure.

The CALIBRATION mode is used to force signal outputs in order to calibrate signals and field devices. In this mode, the actuator, analog, and relay outputs can be manually controlled. To enter this mode the turbine speed must be shutdown with no speed detected. User levels: Service or Configure.

The CONFIGURE mode is used to set up the parameters for a specific application prior to operation of the unit. To enter this mode the turbine speed must be shutdown with no speed detected. When the unit enters CONFIGURE mode the control is placed in IOLOCK which will disable all Output channels. If the control is not shutdown, navigating through the configuration pages will allow viewing of CONFIGURE, but will not permit any changes to be made.

User Level Descriptions

The Peak200 control system requires a password to be entered before access can be given to any of the modes above. These passwords are intended to help prevent unauthorized or untrained personnel from accessing these modes and possibly making changes that could cause damage to the turbine or associated process. The passwords for each of these modes is found in Chapter 8 (Troubleshooting).

To enter the login or password on the front panel display:
        Navigate so the Login or Password field is highlighted (in-focus)
        Press **Enter** on the Navigation Cross
        Use the keypad to enter the text field **(hold key down to scroll options)**
        Press **Enter** on the Navigation Cross – to accept your entry

The Monitor user level is view-only access. All commands from the front panel are inhibited. All values displayed on each screen are continuously updated.

The Operator user level allows for control of the turbine. Front panel commands to start, change setpoints, enable/disable functions, and stop the turbine are accepted.

The Service user level allows the same commands as the Operator user level plus tuning of Service menu parameters and issuing of additional commands.

The Configure user level allows the same commands and access as the Service user level plus tuning of Configuration menu parameters.

Configuring the Peak200

Before the Peak200 can be used to operate any turbine, it must be configured with a valid configuration. A Peak200 Configure Mode Worksheet is provided in Appendix A of this manual. This chapter contains additional information related to completing this worksheet and configuring the specific application. It is recommended that this worksheet is completed and used to document your specific configuration.

It is also possible to configure a unit by loading the configuration (tunable) file from another unit. This is the recommended method for configuring a spare unit. Refer to the appropriate appendix in this manual for installing and using the Control Assistant service tool. It will describe how to retrieve and send these files to and from the control.

Figure 4-1 illustrates the Peak200 screen displayed when power is first applied, and the unit is not configured. This is the HOME screen. It includes tips on how to enter the Configure Mode from this point. A password is required to protect against both intentional and inadvertent configuration changes. The password can be changed if desired, refer to the AppManager appendix for information on changing passwords. This screen will become the main menu once the unit is configured. From this HOME screen, operational screens as well as the Service and Configure menus can be accessed.

Figure 4-1. Initial HOME Screen (unit not configured)

Use the following procedure to begin configuring the Peak200:
1. Press the MODE key.
2. Press the LOGIN softkey to open the User Login pop-up.
3. Login to 'Configure' user level.
4. Close the User Login popup screen.
5. Press the Configuration softkey to enter configuration mode. Verify that the following Calibration and Configuration Mode Permissives are met:
    a. Unit Shutdown
    b. No Speed Detected
    c. "Configure" User Level or greater is logged in
6. Press MODE or HOME to return to the HOME screen.
7. Press the Configuration softkey to access the configuration menus.
8. Use the navigation cross to navigate up/down/left/right and use ENTER to select a menu or item.

The Peak200 configure mode may be accessed if the unit is in a Shutdown state, no speed is detected, and the correct user level is logged in (Configure or higher). For safety reasons the configuration may be monitored only, and no changes will be accepted if the turbine is running.

All configuration values and saved service mode changes are stored as a file on the Peak200 control. To ensure that values are saved, exit Configure mode or select 'Save Settings' from the MODE screen. If power is removed from the Peak200, all saved values will return once power is restored. No batteries or back up power is required.

NOTICE	The field-configured portion of the configuration settings will be zeroed out after factory repair. You must reconfigure these values before the unit is put back into service.

Using Configure Menus

Once the Configure Mode has been entered with the password, the specific application information must be entered into the Peak200. To access the configure menu, select the 'Configuration' softkey from the HOME screen.

The navigation arrow keys (red navigation cross keypad; up, down, left, and right) are used for navigation of the Configure menus. Press ENTER to go into a menu. Then use the navigation cross to move up or down (left/right, if needed) in the menu. In the Configuration mode, the control will generate an error message shown on the Configuration menu home screen as well as the MODE screen if an invalid configuration exits. A configuration error will cause the control to remain tripped. It is possible to exit Configuration mode with such an error, but the control will be tripped until the Configuration mode is entered again and the Configuration error is corrected.

See the tutorial to learn how to adjust a value. The tutorial can be accessed from the HOME screen by pressing the Tutorial softkey before the unit is configured or from the Service menu any time.

To return to the previous screen, press the ESC key. While in a Configure menu, to return to the main Configure menu screen, press the HOME key. To return to the main Home screen, press the HOME key again. To exit the Configure mode, go to the MODE screen, and select the 'Exit Configuration' soft key. This will save values, exit I/O Lock, and reboots the Peak200.

Configuration Menus

To program the control, navigate through the menus and configure the control features for the desired application. The first four configure menus listed below, as well as drivers and other I/O, must be programmed for every installation. The remaining menus contain optional features which can be selected if desired. The configure menus and their basic functions are described below.
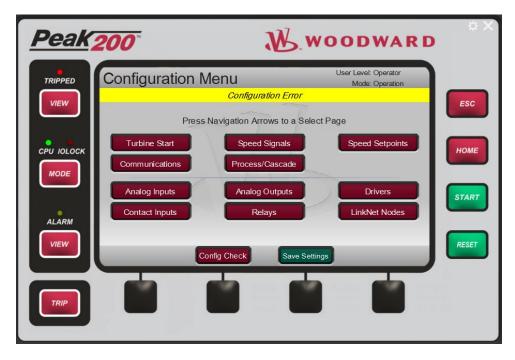
Figure 4-2. Configuration Menu – Configuration Mode (Edit) with Error

Table 4-2. Configuration Menus and Their Basic Functions

Turbine Start:	Configures start mode, idle/MinGov, and auto start sequence settings
Speed Signals:	Configures MPU information
Speed Setpoints	Configures speed set points, overspeed trip set point, remote speed setting control and critical speed avoidance band
Communications:	Configures port settings and Modbus communication options
Process/Cascade:	Configures the process/cascade controller, speed setpoint authority range, and remote cascade setpoint
Analog Inputs:	Configures analog input options
Analog Outputs:	Configures analog readout options
Drivers:	Configures driver output
Contact Inputs:	Configures contact input options
Relays:	Configures relay options
LinkNet Nodes:	Configures additional distributed I/O

The configure menus are described in detail below and contain information detailing each question and/or Peak200 configuration option. Each question/option shows the default (dflt) value and the adjustable range of that parameter (shown in parentheses).

> **Note:** For users that are familiar with the Peak 150 hand-held programmer – the following table is a quick reference to where those parameters are found in the Peak200 configuration menu above.

Table 4-3. Peak150 to Peak200 Configuration Parameter Locations

	Peak 150 Configure Header	Peak200 Configure Header
C1	Speed Signals	Speed Signals
C2	Start Mode	Turbine Start
C3	Actuator Type	Drivers
C4	Operating Mode	Speed Setpoints
C5	Readout Configurations	Analog Outputs
C6	Relay Configurations	Relays
C7	Choice for DI 8 usage	Contact Inputs
C8	Serial Communication Port Settings	Communications

Turbine Start Menu
This menu shows the starting modes.
Start Mode: (Select only 1)

- **MANUAL START**
  (Select this radio button to choose MANUAL START MODE – Speed control will begin when the unit reaches Minimum Governor Speed)
- **AUTOMATIC START** _____
  (Select this radio button to choose the AUTO START MODE – Speed control will begin when the unit reaches Idle Speed)

IMPORTANT	In Manual Start Mode, governor speed control starts at minimum governor speed. In Automatic Start Mode, speed control starts at idle speed which is much lower than minimum governor speed (see Start Modes in Operating Procedures chapter).

Valve Limiter Raise/Lower Rate (%/sec)   _____
Rate at which the valve limiter will ramp open during start

Start Sequence: (LED status - determined by Start Mode chosen)
- No Start Sequence
- Idle/MinGov Sequence (this mode allows ramping of the turbine between Idle speed and the Minimum Governor speed)

Use Confirmation on Keypad Start?   _____
If selected, when the Start button on the keypad is pressed the user will get a dialog box to confirm the action. This will only apply to the front panel and the remote view, not Modbus or a discrete input start command.

Idle/MinGov Settings:

Idle Speed Setpoint (rpm)   _____
Speed setpoint for Idle
Rate to Idle (rpm/sec)   _____
Rate at which the setpoint will ramp from zero to idle
Minimum Governor Speed Setpoint (rpm)   _____
Speed setpoint for Minimum Governor Speed
Rate to MinGov (rpm/sec)   _____
Rate at which the setpoint will ramp between Idle and MinGov
Use Ramp to Idle?   _____
If selected will allow operator to ramp back to Idle from MinGov. If unselected the unit will not accept a command to return to Idle speed – the operator can still manually take control of the setpoint and return to Idle speed.

Speed Signals Menu

This menu is used to set the parameters for the MPU inputs and for scaling the minimum and maximum signal of the MPUs.

To control the speed of a turbine, an MPU senses the speed in Hz (cycles per second). In the Peak200, the MPU speed signal is converted from Hz to RPM. The values of the turbine's operating speeds are set in RPM.

On many turbines (as in **Case 1**), the MPU gear is mounted on the main turbine shaft so that the speed of the MPU gear is the same as the speed of the turbine. On other turbines (as in **Case 2**), the MPU gear is mounted on an auxiliary shaft so that the speed of MPU gear is different from the speed of the turbine. In Case 2, the RPM displayed and controlled by the Peak200 is a function of the number of teeth, the speed of the shaft and the ratio between the main turbine shaft and the MPU gear shaft.

⚠️ **WARNING**   **Before running the turbine, ensure that the correct RATIO between the MPU gear speed and the turbine speed is entered correctly. Failure to set the correct RATIO could result in personal injury, loss of life, or property damage.**

CASE1: Turbine speed and MPU gear speed are same:

Equation 1:

$$MPU\ (Hz) = \frac{RPM * Teeth}{60}$$

For example: with RPM = 3600 RPM
Teeth = 120:

$$MPU\ (Hz) = \frac{3600 * 120}{60} = 7200\ Hz$$

or

Equation 2:

$$RPM = \frac{MPU\ (HZ) * 60}{Teeth}$$

For example: With MPU (Hz) = 3600 Hz
Teeth = 60

$$RPM = \frac{3600 * 60}{60} = 3600\ RPM$$

Case 2: Turbine speed and MPU gear speed are different:

The Gear Ratio is the number of revolutions made by the magnetic pickup gear divided by the number of revolutions of the turbine. For example, if the turbine revolves twice for every revolution of the MPU gear then enter 0.5 for the Gear Ratio. The following is the equation for calculating the MPU Gear Ratio 1:

Equation 3:

$$"MPU\ GEAR\ RATIO\ 1" = \frac{MPU\ Gear\ RPM}{Turbine\ MPU} = X$$

For example: With Turbine speed = 4500 RPM
MPU Gear = 3000 RPM

$$"MPU\ GEAR\ RATIO\ 1" = \frac{3000\ RPM}{4500\ RPM} = 0.66667$$

The equation for calculating turbine RPM is:

Equation 4:

$$RPM = \frac{MPU\ (HZ)*60}{Teeth*Gear\ Ratio} * \text{"MPU GEAR RATIO 1"}$$

For example: With: MPU (Hz) = 3600 Hz
Teeth = 60.
MPU Gear Ratio 1 = 0.6667.

$$RPM = \frac{3600*60}{60*0.6667} = 5400\ RPM$$

The equation for calculating MPU HZ is:

Equation 5:

$$MPU\ (Hz) = \frac{RPM*Teeth*Gear\ Ratio}{60}$$

For example: With Turbine RPM = 3600 RPM
Teeth = 72
MPU Gear Ratio 1 = 2

$$MPU\ (Hz) = \frac{3600*72*2}{60} = 8640\ Hz$$

The following parameters are set in the Speed Signal Menu:

- **Device Tag**   _____
  User text string available to identify the signal
- **Number of Gear Teeth**   _____
  (Enter the number of gear teeth on the MAGNETIC PICKUP gear.)
  (Tunable Range: 1 to 200.)
- **Gear Ratio**   _____
  (Enter the ratio between the speed of the MPU gear shaft and the turbine shaft.)
  (Tunable Range: 0 to 200.)
- **Maximum Speed Level (rpm)**   _____
  (Enter the maximum speed the MPU should ever see – to the right of this a suggested value is shown – make this value equal to or greater than the value shown, the maximum value is 65000)
- **Failed Speed Level (rpm)**   _____
  (Enter the lowest speed at which the MPU signal is valid – below this speed, the MPU signal is considered to be failed. The MPU voltage should be greater than or equal to 1 Vrms at this speed. To the right of this a suggested value is shown – make this value equal to or greater than value shown)

  Note: The suggested values displayed are calculated from the Speed Setpoints entered by the user – once those have been entered, these suggested values will be updated.

Use Speed Input Channel 2   _____

Check this box to enable using second MPU input – control will use the highest signal selected (HSS) of the 2 speed inputs as the turbine speed

User will have repeat of fields shown above for the channel 2 signal

The speed range of the Peak200 needs to be scaled to optimize the resolution of the speed sensing function. Use the following steps for calculating the preferred values:

Determine the Overspeed Test Limit for the turbine in RPM.

Using Equation 5, convert the Overspeed Test Limit to Hz.

Set the MPU #1 – MAX HERTZ equal to 1.02 * (Hz value of the Overspeed Test Limit).

With: Overspeed Test Limit = 4000 RPM
        Teeth = 60
    MPU Gear Ratio 1 = 1

$$\text{MPU (Hz)} = \frac{\text{Turbine RPM} * \text{Teeth}}{60 * (\text{MPU Gear Ratio 1})}$$

$\text{MPU (Hz)} = \frac{4000 * 60}{60 * 1}$ = 4000 Hz

    $\text{MPU \#1 - Max Hertz} = 1.02 * \text{Overspeed Test Limit (Hz)}$
= 1.02 * 4000 Hz = 4080 Hz

IMPORTANT | **MPU #1 or MPU #2 — Maximum speed level will normally both be the same value. This setting must be greater than the Overspeed test Limit Speed (see Service Mode).**

⚠WARNING | **Do not set any set points greater than the value set for MPU #1 or MPU #2 — Maximum speed level. If any speed set points exceed the maximum frequency set by these set points, a configuration error will result**

Speed Setpoints Menu
This menu is used to configure the Speed setpoints used within the control logic. The maximum value for all speed settings is 65000 rpm.

Overspeed Test Limit (rpm)   _____
    Maximum limit for the Speed setpoint when performing an overspeed test

Overspeed Trip (rpm)   _____
    Speed setpoint at which the control will Trip on Overspeed condition

Maximum Governor Speed (rpm)   _____
    Maximum limit for the Speed setpoint during normal operation

Minimum Governor Speed (rpm)   _____
    Minimum limit for the Speed setpoint during normal operation
    (This is the exact same variable that was available in the Turbine Start menu)

Underspeed Setpoint (rpm)   _____
    Underspeed setpoint during normal operation – if the turbine falls below this speed during normal operation an alarm will be annunciated, a trip can be configured, or a relay can be energized.

Use Remote Speed Setpoint   _____
    If selected, and AI must be configured to be used for this signal

Remote Speed Max Rate (rpm/sec)   _____
    Rate at which setpoint will move when Remote speed setpoint is enabled and in control of the actual speed setpoint

Remote Speed Not Matched Rate (rpm/sec)   _____
    Rate at which setpoint will move when Remote speed setpoint is initially enabled, but remote setpoint is more than 0.5% from the current speed setpoint

---

Use DI Enable/Disable as Momentary   _____

If selected, the discrete input will act as a momentary input and the action of enabling or disabling the remote speed setpoint will be determined by the last command from this input, Modbus or the Peak GUI (local or remote view). If this is not checked, enabling, and disabling of the remote speed setpoint will be exclusively determined by the state of this input (a toggle action).

Use Critical Speed Avoidance   _____

If selected, will not allow turbine speed setpoint to stay in this range – only available if Idle/MinGov Sequence is used

Critical Speed Rate (rpm/sec)   _____

Rate at which the setpoint will ramp through the critical range

Critical Speed Minimum (rpm)   _____

Lower setpoint of avoidance range

Critical Speed Maximum (rpm)   _____

Upper setpoint of avoidance range

Communications Menu

This menu is used to configure the Ethernet IP address of Ethernet Port 1, configure a Gateway IP, serial port and whether or not the Modbus data communication link is used. The "Set" command button must be used once on the values for the entire address/mask are set.

Ethernet IP Configuration
ENET 1 ADDRESS   **dflt= 172.16.100.15 (0, 255)**

Enter the integers corresponding to the network TCP/IP address.

ENET 1 SUBNET MASK   **dflt= 255.255.240.0 (0, 255)**

Enter the integer corresponding to the network subnet mask.

Gateway ADDRESS   **dflt= 0.0.0.0 (0, 255)**

Enter the integers corresponding to the network TCP/IP address.

> *NOTE – the ENET 2 address is not changeable at the front panel. It is always available for service tools and is defaulted to the following:*
> *ENET 2 ADDRESS*   *192.168.128.20*
> *ENET 2 SUBNET MASK*   *255.255.255.0*

Use Modbus   _____

Select this to enable the use of the Modbus slave communication block

Use Serial Port (Modbus Link 1)?   _____

Select this to use the serial communication port for Modbus

Use Ethernet 1 Port (Modbus Link 2)?   _____

Select this to use the Ethernet communications port for Modbus

If Ethernet is used -

ETHERNET PROTOCOL   **dflt= TCP (TCP, UDP port 5001)**

Select TCP or UDP to determine the Ethernet communication protocol. Selecting UDP will use port 5001 for Link 2.

DEVICE ADDRESS   **dflt= 2 (1, 247)**

Enter the integer corresponding to the Modbus device number/address required.

ENABLE WRITE COMMANDS   **dflt= NO (Yes/No)**

Select YES to allow this Modbus link to write values to the control. If NO, it will be read only.

If Serial is used -

DEVICE ADDRESS   **dflt= 1 (1, 247)**
> Enter the integer corresponding to the Modbus device number/address required.

ENABLE WRITE COMMANDS   **dflt= NO (Yes/No)**
> Select YES to allow this Modbus link to write values to the control. If NO, it will be read only.

PROTOCOL   **dflt= ASCII (ASCII, RTU)**
> Select ASCII or RTU to determine the format of the Modbus communications.

BAUD RATE   **dflt= 115,200**
> Select the communications baud rate.

BITS   **dflt= 8 (7, 8)**
> Select the integer corresponding to the bits required.

STOP BITS   **dflt= 1 (1, 2, 1.5)**
> Select the stop bits required.

PARITY   **dflt= NONE (NONE, ODD, EVEN)**
> Select the parity required.

DRIVER   **dflt= RS-232 (RS-232, RS-485)**
> Select the serial communications mode required. Enter RS-232, or RS-485 communications.

Process/Cascade Menu

This menu is used to configure an optional process control loop. The output of this PID control will determine the setpoint for the speed control. In Woodward terminology, we refer to this as a 'Cascade' control since its output drives the setpoint for another PID rather than controlling the valve demand directly.

USE PROCESS/CASCADE CONTROL?   **dflt= NO (Yes/No)**
> Select YES to configure the cascade control function. Select NO if the cascade function is not used. If select an analog input signal must be configured as Process/Cascade Input and this signal will be the process variable for this controller. The engineering units are entered with the AI signal.

MIN CASCADE SETPOINT (UNITS)   **dflt= 0.0 (-20000, 20000)**
> Set the minimum cascade set point. This value is the minimum set point value that the cascade set point can be decreased/lowered to (lower limit of cascade set point).

MAX CASCADE SETPOINT (UNITS)   **dflt= 100 (-20000, 20000)**
> Set the maximum cascade set point. This value is the maximum set point value that the cascade set point can be increased/raised to (upper limit of cascade set point).
> *(Must be greater than the 'Min Cascade Setpt' Setting)*

CASCADE SETPOINT RATE (UNITS/s)   **dflt= 5.0 (0.01, 1000)**
> Set the cascade set point rate. This value is the rate (in units per second) at which cascade set point moves when adjusted.

USE SETPOINT TRACKING?   **dflt= YES (Yes/No)**
> Select YES or NO. If YES, the cascade set point tracks the cascade input to provide bumpless transfer to cascade control when it is enabled. If NO, the cascade set point remains at the last position except on power-up or exiting the program mode.

INVERTED?   **dflt= NO (Yes/No)**
> Check this box if the cascade control will be reverse acting. If not selected, the control will be forward acting. The Cascade control drives the speed setpoint and the speed control increases the HP valve to increase speed
> Example 1 – Cascade input is the exhaust steam pressure – not inverted (forward acting) since increasing the speed, increases the exhaust pressure
> Example 2 – Cascade input is the inlet steam pressure – inverted (reverse acting) since increasing the speed, decreases the inlet pressure (pulls in higher volume of steam from inlet header)

SPEED SETPOINT LOWER LIMIT (rpm)   **dflt= 0 (0.0, 20000)**
> Set the minimum speed set point to which the cascade controller can lower the speed set point.
> *(Must be greater than or equal to the 'Minimum Governor Speed Setpoint' Setting)*

SPEED SETPOINT UPPER LIMIT (rpm)   **dflt= 0 (0.0, 20000)**
> Set the maximum speed set point that cascade controller can raise the speed set point to.
> *(Must be less than or equal to the 'Maximum Governor Speed Setpt' Setting)*

MAX SPEED SETPOINT RATE (rpm/s)   **dflt= 20 (0.1, 100)**
   Set the maximum rate at which the cascade control can vary the speed set point.
CASCADE DROOP (%)   **dflt= 0.0 (0.0, 100)**
   Enter the droop percentage. If needed, typically set between 4–6%.
PID PROPORTIONAL GAIN (%)   **dflt= 1.0 (0.0, 100)**
   Enter the cascade PID proportional gain value. This value is used to set cascade control response.
   This value can be changed in the Run Mode while the turbine is operating. If unknown, a
   recommended starting value is 1%.
PID INTEGRAL GAIN (%)   **dflt= 0.3 (0.001, 50.0)**
   Enter the cascade PID integral gain value. This value is used to set cascade control response. This
   value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended
   starting value is 0.3%.
PID DERIVATIVE RATIO (%)   **dflt= 100 (0.01, 100)**
   Enter the cascade PID derivative ratio. This value is used to set cascade control response. This
   value can be changed in the Service Mode while the turbine is operating. If unknown, a
   recommended starting value is 100%. When this value is between 0.01 and 1.0 the derivative term is
   'input dominant' and the derivative is equal to (Deriv Ratio)/(Integral Gain). When this value is
   between 1.0 and 100 the derivative term is 'feedback dominant' and the derivative is equal to
   1.0/[(Deriv Ratio)*(Integral Gain)].
USE REMOTE CASCADE SETPOINT?   **dflt= NO (Yes/No)**
   Set to YES to allow the Cascade set point to be adjusted from an analog input.
   (Must program a 'remote cascade set point' analog input if this is selected)
REMOTE CASCADE MAX RATE (UNITS/s)   **dflt= 5.0 (0.1, 1000)**
   Enter the maximum rate at which the remote input will move the cascade set point.
UNITS OF MEASURE   **(Configured with Analog Inputs)**
DECIMALS DISPLAYED   **(Configured with Analog Inputs)**

Analog Inputs Menu
No two analog inputs can be programmed for the same function. In addition, the function that the analog
input uses must be programmed, or an error message will occur. For example, to use the
Process/Cascade Input, the 'Use Process/Cascade' function must be programmed.

ANALOG INPUT # 1
Input Function   **(must choose from list)**
   Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER,
   using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the
   option/function. Press the ESC key to cancel the selection.

Table 4-4. Analog Input Options

Not Used	Bearing Temperature #1
Remote Speed Setpoint	Bearing Temperature #2
Process/Cascade Input	Bearing Temperature #3
Remote Cascade Setpoint	Bearing Temperature #4
Vibration Input #1	Signal Monitoring #1
Vibration Input #2	Signal Monitoring #2
Vibration Input #3	Signal Monitoring #3
Vibration Input #4	HP Valve Feedback Position

4 mA VALUE (UNITS)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**
   Set the value (in engineering units) that corresponds to 4 milliamps (mA) on the analog input.
20 mA VALUE (UNITS)   **dflt= 100 (-1.0e+38, 1.0e+38)**
   Set the value (in engineering units) that corresponds to 20 milliamps (mA) on the analog input.
   (Must be greater than the 'Input 4 mA Value' Setting)
Device Tag
   This is a user entered field. It allows entry of a short description or tag name for this channel.

Loop Powered?   **dflt= NO (Yes/No)**
>   Check this if the control will supply the loop power for the analog input signal
>   *(Follow the wiring guidelines in chapter 2 – signals are wired differently if Peak200 is supplying the power)*

Units
>   This is a user entered field. It allows entry of a unit label for this channel.

Modbus Multiplier   **dflt= 1.0 (0.01, 0.1, 1, 10, 100)**
>   Set the Modbus multiplier that is applied to the engineering units value on this analog input.

Decimals Displayed   **dflt= 1.0 (0.01, 0.1, 1, 10, 100)**
>   Set the number of decimals that are shown when this value (in engineering units) appears on the front panel display.

Analog Inputs # 2 through # 4 are configured following the same rules as described for Analog Input # 1.

Under the Channel Events screen –

Analog Input xx Signal – *(for each AI channel)*
Use Alarm Setpoint 1?   **dflt= NO (Yes/No)**
Use Alarm Setpoint 2?   **dflt= NO (Yes/No)**
Use Level 2 Setpoint as a TRIP?   **dflt= NO (Yes/No)**
Chan Flt = SD?   **dflt= NO (Yes/No)**
Check this box to initiate a TRIP if this AI signal is faulted
Channel Fault Delay (sec)   **dflt= 0.0 (0, 300)**
Enter any desire delay to avoid nuisance channel signal faults
Level 1 Setpoint (eng units)   **dflt= 0.0 (-90000, 90000)**
>   Enter the alarm level 1 setting in engineering units.

Invert Action 1 alarm?   **dflt= NO (Yes/No)**
>   Select this to trigger the value falling below setpoint

Level 2 Setpoint (eng units)   **dflt= 0.0 (-90000, 90000)**
>   Enter the alarm level 2 setting in engineering units.

Invert Action 2 alarm?   **dflt= NO (Yes/No)**
Setpoint hysteresis (eng units)   **dflt= -3.0 (-100, 100)**
>   Enter the hysteresis setting in engineering units for both alarms. A negative setting will allow the event to occur at the programmed setpoint and stay true until the value falls below the setpoint by this amount.

Delay for Event Action (sec)   **dflt= 2.0 (0, 300)**
>   Enter any desire delay to avoid nuisance events – this delay is applied to both events

Enable Speed Setpoint (rpm)   **dflt= 0.0 (0, 10000)**
>   Enter a value here to inhibit any event from this channel until the turbine has reached this speed

Speed Hysteresis (rpm)   **dflt= -10.0 (-100, 100)**
>   Enter a hysteresis value here that will be applied to the speed setpoint. This is useful if the speed
setpoint is at an Idle speed setting, where the turbine speed may be held and fluxuate around this speed.

Use Start Perm? (Feature Pack Enabled)   **dflt = NO (Yes/No)**
>   Check this box to use the Analog Input as a start permissive.

Perm Setpoint (Feature Pack Enabled)   **dflt = 0(-1.0e+38, 1.0e+38)**
>   Set the value of the start permissive in engineering units.

Invert Perm (Feature Pack Enabled)   **dflt = NO (Yes/No)**
>   Check this box to trigger the value falling below the setpoint.

Analog Outputs Menu

All 4–20 mA analog readouts may be configured. The function that the readout uses must be programmed or an error message will occur. For example, to use the Process/Cascade Set Point readout, the 'Use Process/Cascade' function must be programmed.

ANALOG OUTPUT # 1
Output Function   **(must choose from list)**
>   Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER, using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the option/function. Press the ESC key to cancel the selection.

Table 4-5. Analog Readout Options

Not Used	Remote Cascade Setpoint
Actual Speed	Valve Limiter Setpoint
Speed Setpoint	HP Valve Demand
Remote Speed Setpoint	Signal Monitoring #1
Process/Cascade Input	Signal Monitoring #2
Process/Cascade Setpoint	Signal Monitoring #3

4 mA VALUE (UNITS)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**
> Set the value (in engineering units) that corresponds to four milliamps (mA) on the analog output.

20 mA VALUE (UNITS)   **dflt= 100 (-1.0e+38, 1.0e+38)**
> Set the value (in engineering units) that corresponds to 20 milliamps (mA) on the analog output.
> *(Must be greater than the 'Readout 4 mA Value' Setting)*

Device Tag
> This is a user entered field. It allows entry of a short description or tag name for this channel.

Units
> This is a user entered field. It allows entry of a unit label for this channel.

Enable Readback Fault?   **dflt= NO (Yes/No)**
> Select this to issue an alarm when a fault is detected on this output. If YES, the control will issue an alarm if the analog channel has a fault. If NO, no fault alarm will be issued. A fault will be determined if the current drops below the failure level or if the difference between the current detected on the source and return wires of the circuit is greater than approximately 5%.

Analog Outputs # 2 and # 3 are configured following the same rules as described for Analog Output # 1.

Drivers Menu

This menu is used to configure the actuator channel.

mA at 0% Demand   **dflt= 4.0 (0, 25 or -10, 220)**
> Set the value (in milliamps) that corresponds to the HP Valve being fully closed (0% demand).

mA at 100% Demand   **dflt= 20 (0, 25 or -10, 220)**
> Set the value (in milliamps) that corresponds to the HP Valve being fully open (100% demand).
> *(Must be greater than the 'mA at 0% demand' Setting)*

Actuator Function   **dflt= HP Demand**
> Currently the only option of this channel is the HP valve demand

Actuator Range   **dflt= 4-20 mA (4-20, 0-200)**
> Select the actuator channel output current range. Select 4–20 mA or 0–200 mA. The range can be adjusted via calibration, for example, for a 20-160 mA actuator select the 0-200 mA range.

Dither (mA)   **dflt= 0.0 (0.0, 10)**
> Enter the dither mA for the actuator channel. Enter 0.0 if no dither is required. Woodward TM-type actuators typically require dither.

Device Tag
> This is a user entered field. It allows entry of a short description or tag name for this channel.

Use Actuator Fault Shutdown ?   **dflt= YES (Yes/No)**
> Select YES to issue a trip whenever an actuator fault is detected. If YES, the control will issue a shutdown if Actuator 1 has a fault. If NO, an actuator fault alarm will be issued when a fault is detected. An actuator fault will be determined if the current drops below or goes above the failure levels, basically checking for an open or a short circuit in the actuator wires/coil.

Invert Actuator Output ?   **dflt= NO (Yes/No)**
> Set to YES to invert actuator driver output. This is normally set to NO.
> When Set to YES, the actuator output will go to Max mA at shutdown.

Sub-Menu – Powered Act

Idle/MinGov Start Sequence Used   **<LED status>**
> The Idle/MinGov start sequence must be configured and this LED must be on to enable using a self-powered actuator. This ensures that the Peak200 will have control of the turbine speed at Idle, prior to the unit reaching the normal operating range.

Use Self-Powered Actuator?   **dflt= NO (Yes/No)**
>   Select this if using a self-powered actuator that needs to be fully open to allow starting of the turbine this is normally set to NO.
>   When Set to YES, the actuator output will go to Max mA at shutdown, after the time delay configured below

MPU Override to this % of Idle or MinGov Speed   **dflt= 20.0 (1.0, 100)**
>   When a self-powered actuator is used, the MPU override will be active until the turbine reaches this percent of minimum speed

Self-Powered Time Delay (sec)   **dflt= 60.0 (5.0, 50000)**
>   When a self-powered actuator is used, the MPU override will be active until the turbine reaches this percent of minimum speed

Contact Inputs Menu

Each contact input option may be configured only once. In addition, the function that the contact input uses must be programmed, or an error message will occur. For example, to use the Process/Cascade Control Enable contact input, the 'Use Process/Cascade' function must be programmed.
Contact Input #3 is a dedicated External Trip – same as the Peak 150

CONTACT INPUT 01-08
Input Function   (must choose from list)
>   Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER, using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the option/function. Press the ESC key to cancel the selection.

Table 4-6. Contact Input Options

Not Used	Process/Casc Control Enable
Lower Speed Command	Rmt Cascade Setpoint Enable
Raise Speed Command	External Trip 2
External Trip 1	External Trip 3
Start/External Run	External Trip 4
Idle/MinGov Command	External Alarm 1
Remote Speed Setpoint Enable	External Alarm 2
Select On-Line Dynamics	External Alarm 3
Overspeed Test	Valve Limiter Open
Raise Process/Casc Setpoint	Valve Limiter Close
Lower Process/Casc Setpoint	Clock Sync Pulse
Start Permissive	Speed/Cascade Raise Command
Normal Stop Command	Speed/Cascade Lower Command

Device Tag
>   This is a user entered field. It allows entry of a short description or tag name for this channel.

Invert Logic?   **dflt= NO (Yes/No)**
>   Check this box to invert the active state of the input

Relays Menu

You may configure up to three relays in addition to the one pre-assigned relay #1 (Shutdown). Each relay can be configured as either a level switch or as an indication. An example of a level switch is a Speed Switch, and an example of an indication is Process/Cascade Control Enabled.

Relay Output 01
Relay Output Function   **Trip Relay**
>   This channel is a dedicated trip output.

Device Tag
>   This is a user entered field. It allows entry of a short description or tag name for this channel.

Invert Logic?   **dflt= NO (Yes/No)**
>   Check this box to invert the active state of the relay

Reset Clears TRIP Output?   **dflt= NO (Yes/No)**
>   Check this box to allow the Trip relay state to clear while the RESET input is held True

Include External Trips in Relay?   **dflt= Yes (Yes/No)**

Check this box to include the External Trips (DI #3 and any others) in the state of the Relay output. If this is unchecked, External trips will trip the Peak200, but not affect the state of Relay #1

Trip will set ACT to 0 mA?   **dflt= Yes (Yes/No)**

Check this box to have any Trip condition drive the Actuator Output signal to 0 mA (zero current). If unchecked, then a Trip will send 0% demand (minimum current) to the Actuator Output

Relay Output 02

Relay Output / Level Switch Function   **(must choose from list)**

Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER, using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the option/function. Press the ESC key to cancel the selection.

Table 4-7. Options for Relays ff Used to Indicate State

Not Used	Overspeed Test Enabled
Shutdown Summary	Underspeed Switch
Alarm Summary	Cascade PID Control Enabled
Reset Pulse (2 sec)	Cascade PID Control Active
Speed PID in Control	Process/Cascade PID in Control
Remote Speed Setpoint Enabled	Remote Casc Setpoint Enabled
Remote Speed Setpoint Active	Remote Casc Setpoint Active
Overspeed Trip	HP Valve Limiter in Control
Repeat of Trip Relay	On-Line Speed PID Dynamics
Unit Started Pulse (2 sec)	Ready to Start Status

Device Tag

This is a user entered field. It allows entry of a short description or tag name for this channel.

Invert Logic?   **dflt= NO (Yes/No)**

Use to invert the normal status of the relay. Note that Normally Open and Normally Closed contacts are available when wiring to the relays and that these states will be inverted. In the event of a control power failure, the contact will return to its normal state.

Use as Level Switch?   **dflt= NO (Yes/No)**

Select this to use this relay output as a level switch. Otherwise, the relay output will be a status indication.

Table 4-8. List of Options for Level Switch

Not Used	HP Valve Demand
Actual Speed	AI Signal Monitoring #1
Speed Setpoint	AI Signal Monitoring #2
Process/Cascade Input	AI Signal Monitoring #3
Process/Cascade Setpoint	

Level On (UNITS)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**

Enter the level switch ON setting in engineering units. There is an ON and an OFF setting for each level switch option. This allows the user to program the desired hysteresis for the function selected.

Level Off (UNITS)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**

Enter the level switch OFF setting in engineering units.
(Must be less than the 'Relay On Level' Setting)

Relay outputs # 2 through # 4 are entered following the same rules as described for Relay above.

LinkNet Nodes Menu

If the Peak200 Feature Pack is purchased and a Site Key License is entered into the control (see Appendix I), this menu will become available under the Configuration menu.

This section allows you to expand the I/O capability of the Peak200 using Woodward LinkNet HT distributed I/O nodes. **All LinkNet (LN) nodes are connected via the CAN port 2 and should be configured for a Baud rate of 500K**.

LINKNET I/O NODES
Enable Using LinkNet HT I/O Nodes?   **dflt= NO (Yes/No)**
   Enable Node 1 (AIO)   **dflt= NO (Yes/No)**
   If YES – set the Node Address on this device to 1

   Node 2 is currently reserved/not used

   Enable Node 3 (RTD)   **dflt= NO (Yes/No)**
   If YES – set the Node Address on this device to 3
   Enable Node 4 (BI)   **dflt= NO (Yes/No)**
   If YES – set the Node Address on this device to 4
   Enable Node 5 (BO)   **dflt= NO (Yes/No)**
   If YES – set the Node Address on this device to 5

General comments about using Linknet distributed I/O –
- *Once configured a Linknet I/O button will appear on the HOME run screen to provide quick access to the channel and node status info*
- *It is not intended that these channels be used for closed loop control PV signals or valve driver output signals – use local control channels for those signals*
- *There is no 'Loop Powered' configuration selection for AI's – this is determined by the p/n of the AIO node that is purchased*
- *It is not recommended to program External Trips on these channels, since a loss of a node or the CAN communication link will result in a Trip*
- *Linknet I/O specific alarms and/or trips, relating to channels or nodes will produce a summary event on the VIEW screens. From the VIEW screen a button will be available to display these specific events*

For Node 1 – LN Analog Inputs / Analog Outputs
Each AI/AO node has eight analog input and two analog output channels. Analog Inputs # 2 through # 8 are configured following the same rules as described below.

4 mA VALUE (UNITS)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**
   Set the value (in engineering units) that corresponds to four milliamps (mA) on the analog input.
20 mA VALUE (UNITS)   **dflt= 100 (-1.0e+38, 1.0e+38)**
   Set the value (in engineering units) that corresponds to 20 milliamps (mA) on the analog input.
   (Must be greater than the 'Input 4 mA Value' Setting)
Input Function   **(must choose from list)**
   Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER, using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the option/function. Press the ESC key to cancel the selection.

Table 4-9. LN Analog Input Function Options

Not Used	Bearing Temperature #1
Remote Speed Setpoint	Bearing Temperature #2
Process/Cascade Input	Bearing Temperature #3
Remote Cascade Setpoint	Bearing Temperature #4
Vibration Input #1	Signal Monitoring #1
Vibration Input #2	Signal Monitoring #2
Vibration Input #3	Signal Monitoring #3
Vibration Input #4	HP Valve Feedback Position

Device Tag
This is a user entered field. It allows entry of a short description or tag name for this channel.
Units
This is a user entered field. It allows entry of a unit label for this channel.
Modbus Multiplier   **dflt= 1.0 (0.01, 0.1, 1, 10, 100)**
Set the Modbus multiplier that is applied to the engineering units value on this analog input.
Decimals Displayed   **dflt= 1.0 (0.01, 0.1, 1, 10, 100)**
Set the number of decimals that are shown when this value (in engineering units) appears on the front panel display.

Under the Node Events (or Channel Events) screen –

Analog Input xx Signal – *(for each AI channel)*
Use Alarm Setpoint 1?   **dflt= NO (Yes/No)**
Use Alarm Setpoint 2?   **dflt= NO (Yes/No)**
Use Level 2 Setpoint as a TRIP?   **dflt= NO (Yes/No)**
Chan Flt = SD?   **dflt= NO (Yes/No)**
Check this box to initiate a TRIP if this AI signal is faulted
Channel Fault Delay (sec)   **dflt= 0.0 (0, 300)**
Enter any desire delay to avoid nuisance channel signal faults
Level 1 Setpoint (eng units)   **dflt= 0.0 (-90000, 90000)**
Enter the alarm level 1 setting in engineering units.
Invert Action on this alarm?   **dflt= NO (Yes/No)**
Level 2 Setpoint (eng units)   **dflt= 0.0 (-90000, 90000)**
Enter the alarm level 2 setting in engineering units.
Invert Action on this alarm?   **dflt= NO (Yes/No)**
Setpoint hysteresis (eng units)   **dflt= -3.0 (-100, 100)**
Enter the hysteresis setting in engineering units for both alarms. A negative setting will allow the event to occur at the programmed setpoint and stay true until the value falls below the setpoint by this amount
Delay for Event Action (sec)   **dflt= 2.0 (0, 300)**
Enter any desire delay to avoid nuisance events – this delay is applied to both events
Enable Speed Setpoint (rpm)   **dflt= 0.0 (0, 10000)**
Enter a value here to inhibit any event from this channel until the turbine has reached this speed
Speed Hysteresis (rpm)   **dflt= -10.0 (-100, 100)**
Enter a hysteresis value here that will be applied to the speed setpoint. This is useful if the speed setpoint is at an Idle speed setting, where the turbine speed may be held and fluxuate around this speed

For Node 3 – LN RTD Inputs
The RTD node has eight temperature inputs

Minimal Value (Temp Units)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**
Set the value that corresponds to the lowest temperature expected to be seen as a valid signal
Maximum Value (Temp Units)   **dflt= 1500 (-1.0e+38, 1.0e+38)**
Set the value that corresponds to the highest temperature expected to be seen as a valid signal
(Must be greater than the 'Minimum Value' Setting)

Input Function   **(must choose from list)**

Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER, using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the option/function. Press the ESC key to cancel the selection.

Table 4-10. LN RTD Input Function Options

Not Used	Temperature Monitoring #1
Bearing Temperature #1	Temperature Monitoring #2
Bearing Temperature #2	Temperature Monitoring #3
Bearing Temperature #3	Temperature Monitoring #4
Bearing Temperature #4	Temperature Monitoring #5
Inlet Steam Temperature	Temperature Monitoring #6
Exhaust Steam Temperature	Temperature Monitoring #7
Lube Oil Temperature	Temperature Monitoring #8
Casing Temperature	

Units – use Degrees F for all RTD's   **dflt= YES (Yes/No)**

Check this to use Degree F for all temperatures, if uncheck all temperatures will be in degrees C

Device Tag

This is a user entered field. It allows entry of a short description or tag name for this channel.

Curve Type   **dflt= European (American, European)**

Use this field to select American or European curve for the RTD sensor.

Ohm Value   **dflt= 100 (100, 200)**

Use this field to select either 100 or 200 ohm type RTD sensor

Modbus Multiplier   **dflt= 1.0 (0.01, 0.1, 1, 10, 100)**

Set the Modbus multiplier that is applied to the engineering units value on this analog input.

Decimals Displayed   **dflt= 1.0 (0.01, 0.1, 1, 10, 100)**

Set the number of decimals that are shown when this value (in engineering units) appears on the front panel display.

Under the Node Events (or Channel Events) screen –

RTD Input xx Signal – *(for each RTD channel)*

Use Alarm Setpoint 1?   **dflt= NO (Yes/No)**
Use Alarm Setpoint 2?   **dflt= NO (Yes/No)**
Use Level 2 Setpoint as a TRIP?   **dflt= NO (Yes/No)**
Channel Fault Delay (sec)   **dflt= 1.00 (0, 300)**
Enter any desire delay to avoid nuisance channel signal faults
Level 1 Setpoint (eng units)   **dflt= 0.0 (-90000, 90000)**
Enter the alarm level 1 setting in engineering units.
Invert Action on this alarm?   **dflt= NO (Yes/No)**
Level 2 Setpoint (eng units)   **dflt= 0.0 (-90000, 90000)**
Enter the alarm level 2 setting in engineering units.
Invert Action on this alarm?   **dflt= NO (Yes/No)**
Setpoint hysteresis (eng units)   **dflt= -3.0 (-100, 100)**
Enter the hysteresis setting in engineering units for both alarms. A negative setting will allow the event to occur at the programmed setpoint and stay true until the value falls below the setpoint by this amount
Delay for Event Action (sec)   **dflt= 2.0 (0, 300)**
Enter any desire delay to avoid nuisance events – this delay is applied to both events
Enable Speed Setpoint (rpm)   **dflt= 100.0 (0, 10000)**
Enter a value here to inhibit any event from this channel until the turbine has reached this speed
Speed Hysteresis (rpm)   **dflt= -10.0 (-100, 100)**
Enter a hysteresis value here that will be applied to the speed setpoint. This is useful if the speed setpoint is at an idle speed setting, where the turbine speed may be held, and fluxuate around this speed

For Node 4 – LN Discrete Inputs
The Discrete Input node has 16 channels available

CONTACT INPUT 01-16
Input Function   (must choose from list)
> Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER, using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the option/function. Press the ESC key to cancel the selection.

Table 4-11. LN Discrete Contact Input Options

Not Used	Process/Casc Control Enable
Lower Speed Command	Rmt Cascade Setpoint Enable
Raise Speed Command	External Trip 2
External Trip 1	External Trip 3
Start/External Run	External Trip 4
Reset Command	External Trip 5
Idle/MinGov Command	External Alarm 1
Remote Speed Setpoint Enable	External Alarm 2
Select On-Line Dynamics	External Alarm 3
Overspeed Test	Valve Limiter Open
Raise Process/Casc Setpoint	Valve Limiter Close
Lower Process/Casc Setpoint	Clock Sync Pulse
Start Permissive	Raise Speed/Casc Setpoint
Normal Stop Command	Lower Speed/Casc Setpoint

Device Tag
> This is a user entered field. It allows entry of a short description or tag name for this channel.

Invert Logic?   dflt= NO (Yes/No)
> Check this box to invert the active state of the input

For Node 5 – LN Discrete Outputs
The Discrete Output node has 16 channels available that drive single contact outputs.

CONTACT OUTPUT 01-16

Contact Output / Level Switch Function   (must choose from list)
> Scroll through the menu by navigating the focus highlighter to the desired item, pressing ENTER, using the Adjust Up/Down Arrows, and then pressing the ENTER key again to select the option/function. Press the ESC key to cancel the selection.

Table 4-12. Options for Contact Outputs if Used to Indicate State

Not Used	Overspeed Test Enabled
Shutdown Summary	Underspeed Switch
Alarm Summary	Cascade PID Control Enabled
Reset Pulse (2 sec)	Cascade PID Control Active
Speed PID in Control	Process/Cascade PID in Control
Remote Speed Setpoint Enabled	Remote Casc Setpoint Enabled
Remote Speed Setpoint Active	Remote Casc Setpoint Active
Overspeed Trip	HP Valve Limiter in Control
Repeat of Trip Relay	On-Line Speed PID Dynamics
Ready to Start Status	Unit Started Pulse (2 sec)

Device Tag
> This is a user entered field. It allows entry of a short description or tag name for this channel.

Invert Logic?   dflt= NO (Yes/No)
> Use to invert the normal status of the contact output. In the event of a control power failure, the contact will return to its normal state.

Use as Level Switch?   **dflt= NO (Yes/No)**
Select this to use this contact output as a level switch. Otherwise, the contact output will be a status indication.

Table 4-13. Options for Level Switch

Not Used	HP Valve Demand
Actual Speed	AI Signal Monitoring #1
Speed Setpoint	AI Signal Monitoring #2
Process/Cascade Input	AI Signal Monitoring #3
Process/Cascade Setpoint	

Level On (UNITS)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**
Enter the level switch ON setting in engineering units. There is an ON and an OFF setting for each level switch option. This allows the user to program the desired hysteresis for the function selected.
Level Off (UNITS)   **dflt= 0.0 (-1.0e+38, 1.0e+38)**
Enter the level switch OFF setting in engineering units.
(Must be less than the 'Level On Level' Setting)

If any AI are configured for use as Vibration Inputs, then a VIB Signals screen will be available under the Analog Input Summary screen –
Configure Vibration Monitoring
Using Vibration Signals?   **<status LED>**
How many signals (1-4)?   **<status value>**
The number of vibration sensors that are configured will appear here
Number of healthy signals required to run (1-4)?   **dflt= 0 (1,4)**
Enter minimum total number of channels required to keep running. If this number equals the number of channels used, then a single channel fault will result in a Trip

Chapter 5.
Operating Procedures

> ⚠️ **WARNING**
> **Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.**

> **NOTICE**
> **Do NOT attempt to operate the turbine until the Peak200 control has been programmed. Refer to the program worksheets.**

Software Architecture

The Peak200 is a field configurable steam turbine control and graphical user interface (GUI) integrated into one package. The Peak200 control has been designed to run 2 separate, independent programs on the same platform. One controls the I/O and therefore controls turbine operation. The other program provides all the visual and command interaction with the user.
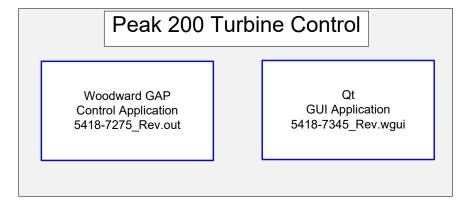
Figure 5-1. Software Architecture

The primary application program is the GAP based control application program. This controls all the system I/O and functional algorithms which control the operation of the turbine.

The secondary application program is the Digia/Qt based graphical user interface (GUI) program. This controls all the screen information that is displayed to the user. It links to the GAP via an internal communication link to pass all required interface variables to and from the display.

The exact information of these software part numbers and revisions in your control can always be found on the Site Info page that is accessible from the main HOME screen.

Both programs launch automatically at power-up. The GAP program MUST always be executing to run the turbine. However, the GUI program may be 'Stopped' using a service tool (AppManager) and restarted at any time without affecting GAP or the turbine operation. This useful feature of the Peak200 allows the following operations to be accomplished (if needed or desired) while the Peak200 control is operating the turbine.

- Change the language on the screen
- Update/Upgrade the GUI program (newer build revisions with improvement/enhancements)

Front Panel Operation

Figure 5-2. Peak200 Keypad with "Splash Screen"

Power-Up Screen

Viewing the front panel display of the Peak200, the following is the correct boot-up sequence of the control. Times are approximant.

> **At Power-up   Screen = BLANK /BLACK**
> **   IOLOCK = ON (RED)**
>
> **After about 0:45   Screen = "Woodward Splash Screen"**
> **   TRIPPED/CPU/ALARM LED's will flash check**
>
> **After about 1:00   TRIPPED=ON (RED)**
> **   IOLOCK = OFF**
> **   CPU = ON (GREEN)**
>
> **After about 1:30   ALARM LED (YELLOW)   Flashes/Blinks**
>
> **After about 2:30   Screen = HOME**

Any time that a display application program is not running, the 'Splash Screen' will appear. If at power-up the Alarm LED stops flashing and this screen still appears, then the GUI program has not initialized correctly.

After configuring the unit, all following power cycles will result in a screen similar to the following, dependent on what functionality has been configured.

Figure 5-3. Boot-up to HOME Screen (RemoteView)

Refer to Figure 4-1 for the view of an initial power-up of an unconfigured unit.

To improve the life of the display screen and reduce heat there are 2 features that are implemented, auto-dimming and a screen saver. If desired, the user does have the ability to adjust and or inhibit these actions. This is intended to be used in cases where the Peak200 may be packaged in a way that the screen is not always accessible during normal turbine operation.

Auto-Dimming:
If the user gives no keypad commands for 30 minutes, the backlight brightness of the display will slowly fade down to 30%. When any keypad key or any user triggered Reset command (contact input, Modbus or RemoteView) is received, the display will immediately step back up to the level at which the user has tuned the brightness adjustment. The initial power-up default of the control is 75%.

Screen Saver:
After a period of the same inactivity, the Screen Saver function is invoked. It is defaulted to 4 hours (adjustable in Service / Screen Settings). When this comes on, a small version of the 'Splash Screen' will bounce around on the screen. Press any key to revive the display (maroon keys are recommended). User login level defaults to Operator When awaking from screen saver. This also is adjustable in Service / Screen Settings if desired where default may be set to awaken in Monitor.

NOTICE	The default factory settings for auto-dimming and screen saver are set to maximize the life of the display and backlight and reduce internal heat load of the control. The disabling of these features is available for troubleshooting – or for cases where the Peak200 is packaged in a way were screen and keypad access is not available.

Control Mode Architecture

See Figure 5-1 for a diagram of basic control program architecture. The control's normal operating architecture divides the control into two states.

> Run – which includes Operation and Calibration modes
> Program - Configuration mode

Pressing the MODE key at any time will open the Login and Mode Screen

In Configuration Mode, the user configures the Peak200 for the specific application and sets all operating parameters (see Chapter 4). In this mode the control will issue an IOLOCK (LED) and the state of all Outputs from the control are disabled. This means that all Relays are de-energized, and all Analog/Driver outputs are at zero current. Initially all Peak200's must be placed in this mode to enter a valid configuration of the I/O and functions desired for the specific turbine application.

After completing the configuration of the Peak200 and exiting Configuration mode, use Calibration Mode to perform calibration of signals, verification of speed signals, and the forcing of outputs of the control in preparation to run the turbine. All I/O is functional in this state. To enter this mode the turbine must be TRIPPED (LED).

Use Operation Mode to view operating parameters and run the turbine. This is the typical mode the control uses and is the default mode it enters after a Power-up. All I/O is functional in this state. The turbine may be either running or not running in this mode. The Peak 200 is defaulted to always boot-up into operational mode. If required by the site, there is a service parameter to change this so it will boot-up in monitor mode. Once the unit is running – it can always be placed in Monitor mode by using the Logout button from the Mode/Login pop-up screen.
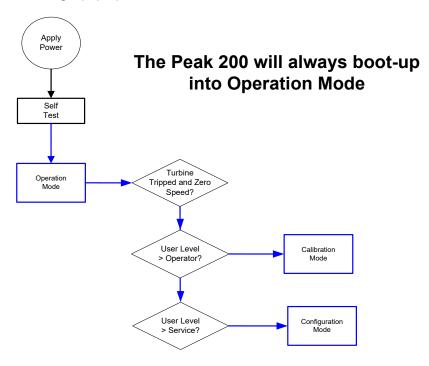
Figure 5-4. Control Mode Architecture

Overview

The Overview screen will adapt to the configuration of the Peak and show all configured options. During normal run operation, this screen should provide the user with all the primary turbine parameter values and operational status.
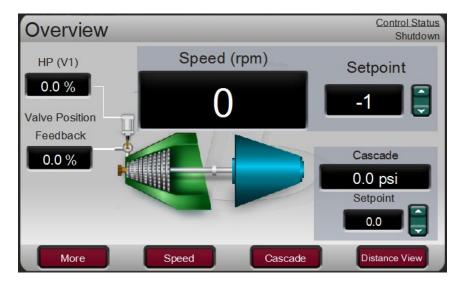
Figure 5-5. Overview Screen

The menu bar functions will allow the user to use typical operational commands related to the control loop selected – such as directly entering a setpoint or enabling or disabling a controller while remaining on the Overview page.

Speed Control

The Speed Control screen will adapt to the configuration of the Peak200 and show all configured options. During normal run operation, this screen provides the user with all details that relate to the turbine when operating in speed control.
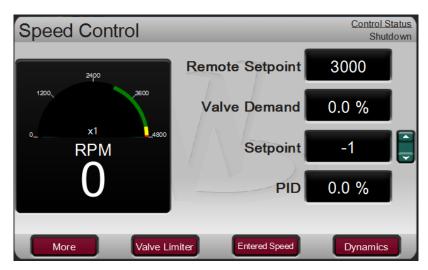
Figure 5-6. Speed Control Screen

The menu bar functions will allow the user to access a number of other screens that are related to speed control, such as directly entering a setpoint, access to the valve limiter feature, adjusting speed control dynamic settings, enabling or disabling a remote speed setpoint, or performing an Overspeed test.

Valve Demand

The Valve Demand screen will adapt to the configuration of the Peak200 and show all configured options that can affect the final output demand to the valve. During normal run operation, this screen provides the user with a clear picture of what control or ramp is controlling the valve demand output. The Low Signal Select (LSS) bus will output the lowest value seen at its inputs. The valve logic box represents options that may be used to adjust this value (such as valve linearization and/or pressure compensation) prior to output to the HP valve. If these options are not used, the HP valve demand output will always equal the LSS value.
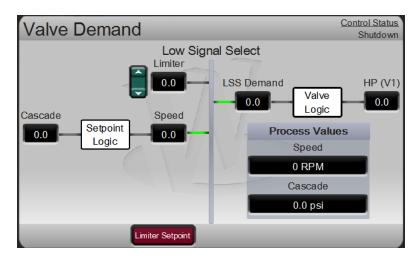
Figure 5-7. Valve Demand Screen

During normal operation, the Valve Limiter setting is at 100% and not limiting. Typically, the only time this parameter adjusts is during a start sequence or when troubleshooting system dynamics problems.

The menu bar will allow the user to access the valve limiter setpoint and the manual valve demand (if configured for use).

Controllers

The Controllers screen will adapt to the configuration of the Peak200 and show all configured options. During normal run operation, this screen provides the user with information similar to the Overview, but in a graphical gauge view. It provides larger values for distance viewing and control PID information that is useful for monitoring when the Peak200 is near transition points between controllers or limiters.
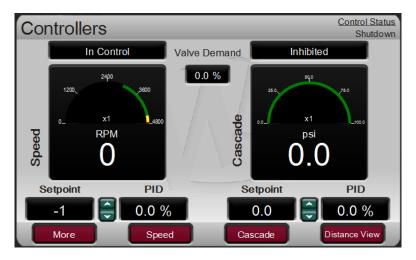
Figure 5-8. Controllers Screen

The menu bar functions will allow the user to use typical operational commands related to the control loop selected – such as directly entering a setpoint or enabling or disabling a controller while remaining on the Controllers page

Cascade Control

The Cascade Control screen will adapt to the configuration of the Peak200. During normal run operation, this screen provides the user with all details that relate to the cascade control loop. The cascade control output determines the setpoint for the speed control. This allows the Peak200 to vary the speed control setpoint as it relates to another process variable selected by the user.

Figure 5-9. Cascade Control Screen

The menu bar functions will allow the user to access several other screens that relate to cascade control, such as directly entering a setpoint, access to the valve limiter, or adjusting cascade control dynamic settings.

Analog Input

The Analog Input Summary screen will display the status of all channels available on the Peak200 hardware. The fault status, function, device tag, engineering value and units display for each channel as well as navigation buttons for each channel that take the user to a page showing all parameters available for that input.
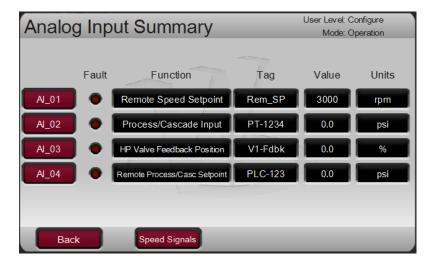
Figure 5-10. Analog Input Summary Screen

The menu bar functions will allow the user to access the detailed page of the speed input signals

Contact Input Summary

The Contact Input Summary screen will display the status of channels available on the Peak200 hardware. The fault status and function display for each channel. Use the Details navigation button to view the full configuration of each channel.
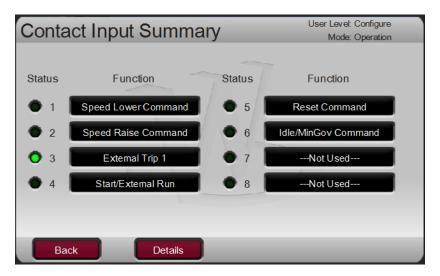
Figure 5-11. Contact Input Summary Screen

Analog Output Channel

The Analog Output Channel screen will display the fault status, function, device tag, engineering value range, present demand value, Readback current and units display for each channel as well as navigation buttons for each channel that take the user to all the other available channels for analog outputs.
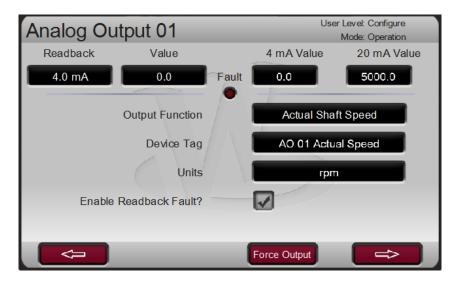
Figure 5-12. Analog Output Channel Screen

Relay Output Summary

The Relay Output Summary screen will display the status of all channels available on the Peak200 hardware. The coil status, function, and device tag display for each channel. Use the Details navigation button to view the full configuration of each channel.
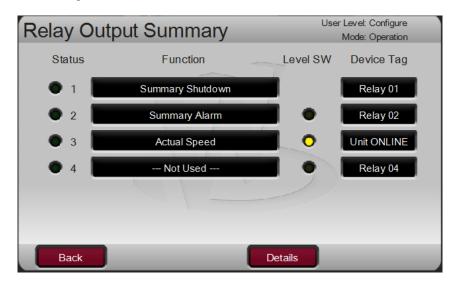
Figure 5-13. Relay Output Summary Screen

Actuator Driver Summary

The Actuator Driver Summary screen displays the status of the actuator output driver channel on the Peak200 hardware. The fault status, function, current value (in mA), engineering value, and unit's display.
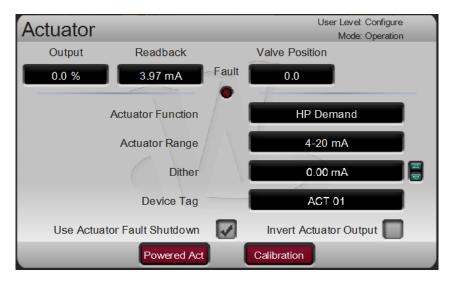
Figure 5-14. Actuator Driver Summary Screen

Overspeed Test Function (Speed Control Screen)

The Peak200's Overspeed Test function allows an operator to increase turbine speed above its rated operating range to periodically test turbine electrical and/or mechanical overspeed protection logic and circuitry. This includes the Peak200's internal overspeed trip logic and any external overspeed trip device's settings and logic. Figure 5-15 shows the screen that displays when pressing the 'Overspeed Test' key from the Speed Control page. It shows the permissives required to be able to perform an overspeed test.
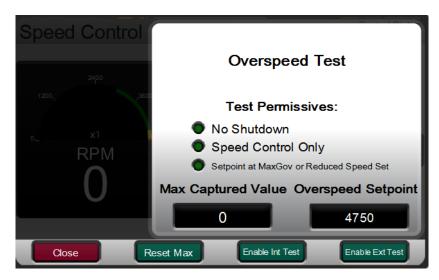
Figure 5-15. Overspeed Test Permissives

<table>
<tr><td>⚠️**WARNING**</td><td>**The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.**

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.</td></tr>
</table>

The control supports two types of Overspeed tests, internal and external. These tests must be done at the front panel, or through the RemoteView tool and the following conditions must be met to perform these tests.

- Unit must be running in speed control mode
- Setpoint must be at Maximum Governor speed, or Reduce Overspeed Setpoint must be selected in Service mode

Anytime the overspeed test mode has been enabled, the control will annunciate an alarm indicating Overspeed Test Enabled. If the operator adjusts the speed, the test mode will be active. If the speed setpoint is not adjusted for a period of more than 30 seconds, the test mode will automatically abort. The time remaining for this action is always displayed in the Test mode screen.

It is intended that the internal overspeed setpoint in the control is lower than the external setting.

Overspeed Test Procedure (from the Peak200 display)

- Raise the Speed Set Point to the maximum governor setting (or use Reduced Overspeed Test Option as described in the following section – this figure is shown with that option used)
- If desired, clear the 'Highest Speed Reached' value, to record the highest speed reached during this overspeed test. (Reset Max key)
- This function has a safety timeout to ensure the unit does not run in this mode unattended. Once entering the mode, the user must begin to raise the speed within 30 seconds. The timeout value resets if the user is adjusting the speed.
- Timeout value is shown, if it expires the test mode will be aborted and the unit will return to the maximum governor limit
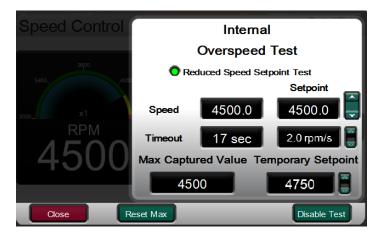
Figure 5-16. Internal (Peak200) Overspeed Test

- To perform an Internal Overspeed Test, press the Enable Int Test key and the above pop-up page will appear. An Alarm will be annunciated that indicates Overspeed Test Enabled.
- Put the Setpoint Adjust button in Focus and use the ADJUST key to raise the speed above the normal Max Governor limit.
- Put the rate Adjust button in Focus and use the ADJUST key to change the rate (in rpm/sec) at which the setpoint moves.

- Once turbine speed reaches the Peak200's internal OVERSPEED TRIP (rpm) setting, the control will TRIP the turbine
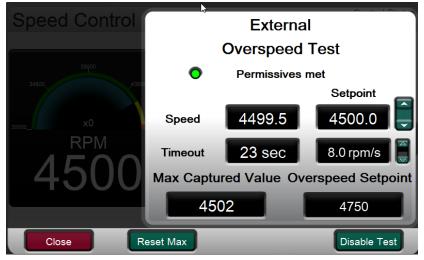
Figure 5-17. External Overspeed Test

The intention of an external trip test is to test the unit's safety overspeed protection device (in many cases a Woodward ProTech). In this mode, the Peak200 internal overspeed trip changes to be just an alarm and the Peak200 will allow the speed to continue increasing up to the Overspeed Test Limit (rpm). If the Peak200 speed OR the Setpoint reaches the Overspeed Test Limit, it will TRIP the turbine

- To perform an External Overspeed Test, press the Enable Ext Test key and the above pop-up page will appear. An Alarm will be annunciated that indicates Overspeed Test Enabled.
- Put the Setpoint Adjust button in Focus and use the ADJUST key to raise the speed above the normal Max Governor limit.
- Put the rate Adjust button in Focus and use the ADJUST key to change the rate (in rpm/sec) at which the setpoint moves.
- Once turbine speed reaches the Peak200's internal OVERSPEED TRIP (rpm) setting, the Peak200 will trigger an alarm that this has been reached.
- If the timeout expires while the unit is above the Overspeed Trip setting, but below the Overspeed Test Limit, the Peak200 will Trip on Overspeed.
- If the Speed or the Setpoint reach the Overspeed Test Limit the Peak200 will issue a Trip.

NOTICE	In the configuration of Speed Setpoints, be sure that the Overspeed Test Limit rpm value is above the expected Overspeed setting of the external safety overspeed protection device.

It is recommended that you perform Overspeed Tests from these screens, either at the control (preferred) or via the RemoteView service tool. Alternatively, you may test the turbine's overspeed logic and circuitry remotely, by programming an Overspeed Test contact input. The Overspeed Test contact functions as the enable external test on the display. When meeting the conditions outlined in the above procedure, closing this contact allows an increase in the Speed set point up to the "Overspeed Test limit" setting. The testing procedure is similar to using the OSPD key. You may program an Overspeed Test Enabled relay to provide testing status feedback.

The Overspeed Test function cannot be performed over the Modbus communications; however, the Overspeed Test Permissive, Overspeed Test In Progress, Overspeed Alarm, and Overspeed Trip indications are available through Modbus.

Reduced Overspeed Test Procedure (from the Peak200 display)
The Peak200 has a feature to allow an Overspeed Test to be performed at a reduced speed – without adjusting the configured Overspeed Trip setpoint (true overspeed setting). This can be useful in testing

the trip system without raising the turbine to a speed level above the normal operating range. This is especially handy for compressor drive systems which may need to physically decouple the turbine and compressor to perform an actual full speed overspeed test. User level of Service or higher is required to use this feature.

In the Service/Speed Control screens, the following options are found:

　　A check box for Use Reduced Overspeed Setpoint

　　A Reduced Overspeed Setpoint adjustment value

Upon power-up or exiting IO Lock, this value will be set equal to the configured Maximum Governor setpoint. It can be adjusted downward to any desired value, and when the check box is selected, the unit will used this Temporary (Lower) setpoint as the Overspeed Trip setpoint. Using the above procedure, the user will see this value in the Overspeed Test dialog boxes while performing the test. Be sure to uncheck this box in service as soon as the test is complete to ensure that no nuisance, unexpected overspeed trips occur at this speed while the unit is in normal operation.

There are two programmable relay options available to indicate overspeed status. One programmable relay option indicates an Overspeed Trip condition. The second relay option provides indication that an Overspeed Test is being performed.

Alarm Summary

The ALARM screen is always available with the VIEW button under the ALARM LED. When an alarm is detected, it is latched in the event logic, the Alarm relay is energized, and the ALARM LED illuminates (Yellow). The cause of the event will be indicated with an Event ID, description, and time/date stamp on the Alarm Summary page. The list will always place the first event at the top of the list; if more than one alarm condition is present, they display with their corresponding time stamp.

If the optional LinkNet I/O is added to the system, then a page navigation button will appear that will allow the user to view a similar list of events that are generated from these signals.

To clear any alarms that are no longer present, press the RESET key, close the Reset contact input, or select Reset from either Modbus communications link. If the cause of the event has been corrected, the alarm will clear, if not it will remain, and the timestamp will remain unchanged.

Figure 5-18. Alarm Summary Screen

The Modbus links to the control send the alarm ID number (Analog Read address 39), so that each individual alarm condition, as per the list below, is available to other systems that monitor the control status. The system also provides a common alarm indication.

You may program Relay indications, which indicate a Common Alarm, in addition to the dedicated Alarm Relay output.

Table 5-1 lists all the potential alarm conditions and their Event ID.

Table 5-1. ALARM Messages

Event ID	DESCRIPTION	MEANING
1	Speed Probe #1 Failed	Speed probe #1 failure — (< Failed Speed Level or 1 Vrms)
2	Speed Probe #2 Failed	Speed probe #2 failure — (< Failed Speed Level or 1 Vrms)
3	Turbine Tripped	TRIP Condition Exists
4	Mod Comm Link #1 (Serial)Failed	Modbus link error on serial port – no communications detected
5	Mod Comm Link #2 (ENET1) Failed	Modbus link error on Ethernet Port 1 – no communications detected
6	Mod Comm Link #3 (ENET2) Failed	Modbus link error on Ethernet Port 2 – no communications detected
7	Chassis Summary Alarm	CPU/OS or Internal Calibration Fault
8	Peak200 Display Comm Fault	Display failed to initialize correctly communicating with the GUI program
9	Internal HW Simulation Enabled	Internal Simulation mode entered from MODE screen
10	Actuator Linearization Curve Error	reserved - not used
11	Overspeed Test Enabled	Control has overspeed test mode enabled
12	Stuck In Critical Band	Turbine is stuck in the critical speed range (turbine failed to get thru the range)
13	Speed Difference on MPUs	A difference exists between the two MPU Speed signals (default setting is >50rpm)
14	Peak200 Display Backlight Fault	Display failed to initialize on power-up or backlight has failed
15	Peak200 Unit Temp High	Internal Temperature of the control has reached high limit alarm of 70 Deg C
16	spare_16	reserved - not used
17	HP Actuator Fault (Act1)	HP Actuator output fault detected (open or short circuit was sensed)
18	spare_18	reserved - not used
19	spare_19	reserved - not used
20	spare_20	reserved - not used
21	External alarm # 1	External Alarm #1 from contact input
22	External alarm # 2	External Alarm #2 from contact input
23	External alarm # 3	External Alarm #3 from contact input
24	spare_24	reserved - not used
25	spare_25	reserved - not used
26	spare_26	reserved - not used

Event ID	DESCRIPTION	MEANING
27	Remote Speed Input Failed	Remote Speed Setpoint analog input failure detected (> 22 mA or < 2 mA)
28	Process/Cascade Input Failed	Process/Cascade PV analog input failure detected (> 22 mA or < 2 mA)
29	Remote Process/Casc Input Failed	Remote Cascade Setpoint analog input failure detected (> 22 mA or < 2 mA)
30	Vibration Input 1 Failed	Vibration 1 analog input failure detected (> 22 mA or < 2 mA)
31	Vibration Input 2 Failed	Vibration 2 analog input failure detected (> 22 mA or < 2 mA)
32	Vibration Input 3 Failed	Vibration 3 analog input failure detected (> 22 mA or < 2 mA)
33	Vibration Input 4 Failed	Vibration 4 analog input failure detected (> 22 mA or < 2 mA)
34	Bearing Temp 1 Failed (AI)	Bearing Temp 1 analog input failure detected (> 22 mA or < 2 mA)
35	Bearing Temp 2 Failed (AI)	Bearing Temp 2 analog input failure detected (> 22 mA or < 2 mA)
36	Bearing Temp 3 Failed (AI)	Bearing Temp 3 analog input failure detected (> 22 mA or < 2 mA)
37	Bearing Temp 4 Failed (AI)	Bearing Temp 4 analog input failure detected (> 22 mA or < 2 mA)
38	Customer Signal Input #1 Failed	Customer Signal 1 analog input failure detected (> 22 mA or < 2 mA)
39	Customer Signal Input #2 Failed	Customer Signal 2 analog input failure detected (> 22 mA or < 2 mA)
40	Customer Signal Input #3 Failed	Customer Signal 3 analog input failure detected (> 22 mA or < 2 mA)
41	HP Valve Position Feedback Failed	HP Valve Position Feedback analog input failure detected (> 22 mA or < 2 mA)
42	AO_01 Readback Fault	Analog Output Chan 1 readback failure detected (> 22 mA or < 2 mA)
43	AO_02 Readback Fault	Analog Output Chan 2 readback failure detected (> 22 mA or < 2 mA)
44	AO_03 Readback Fault	Analog Output Chan 3 readback failure detected (> 22 mA or < 2 mA)
45	AI Chan 1 Level 1 ALM	Analog Input chan 1 user configured alarm at level 1 setpoint
46	AI Chan 1 Level 2 ALM	Analog Input chan 1 user configured alarm at level 2 setpoint
47	AI Chan 2 Level 1 ALM	Analog Input chan 2 user configured alarm at level 1 setpoint
48	AI Chan 2 Level 2 ALM	Analog Input chan 2 user configured alarm at level 2 setpoint
49	AI Chan 3 Level 1 ALM	Analog Input chan 3 user configured alarm at level 1 setpoint
50	AI Chan 3 Level 2 ALM	Analog Input chan 3 user configured alarm at level 2 setpoint
51	AI Chan 4 Level 1 ALM	Analog Input chan 4 user configured alarm at level 1 setpoint
52	AI Chan 4 Level 2 ALM	Analog Input chan 4 user configured alarm at level 2 setpoint
53	HP Valve Pos Fdbk Diff ALM	Error between Valve demand and valve position feedback

Event ID	DESCRIPTION	MEANING
54	Limiter in Control	Valve limiter is in Control
55	Alarm from LinkNet Nodes	Summary of Alarms from LinkNet nodes (if used)
56	Internal OVERSPEED Reached	Turbine overspeed alarm during External Test
57	Manual Valve Control Enabled	Manual HP Valve Control mode is active
58	Underspeed Alarm	Turbine speed has dropped below the underspeed setpoint (this event has a 2 sec delay)
59	Controlled Stop in Progress	A Normal stop sequence has been initiated and is in progress
60	spare_60	Reserved - not used
61 -100		Reserved - not used

Shutdown Summary

The Shutdown Summary screen is always available with the VIEW button under the TRIPPED LED. When a trip is detected, it is latched in the event logic, the Trip relay is de-energized, all steam valve demand outputs go to zero, and the TRIPPED LED illuminates (Red). The cause of the event indicates with an Event ID, description, and time/date stamp on the Shutdown Summary page. The list will always place the first event at the top of the list; if more than one trip condition is present, they list with their corresponding time stamp.

Under the active Trip Latch window, this screen will also display the last 5 previous Trips that were recorded by the Peak200 and are listed with their Event ID, description, and time stamp.

If the optional LinkNet I/O is added to the system, then a page navigation button will appear that will allow the user to view a similar list of events that are generated from these signals.

To clear any shutdowns that are no longer present, press the RESET key, close the Reset contact input, or select Reset from either Modbus communications link. If the cause of the event has been corrected, the event will clear, if not it will remain, and the timestamp will remain unchanged.
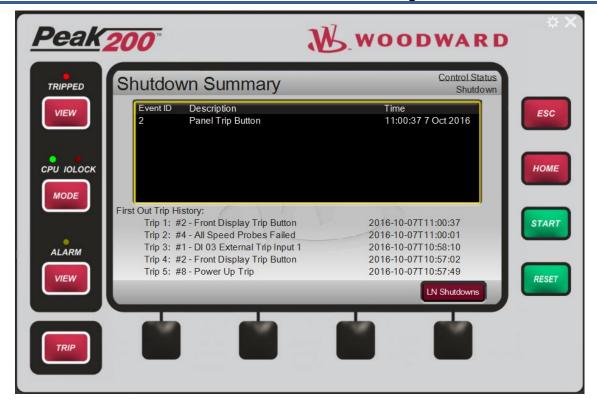
Figure 5-19. Shutdown Summary Screen

Table 5-2 lists all the potential shutdown conditions.

Table 5-2. TRIPPED Messages

Event ID	DESCRIPTION	MEANING
1	External Trip Input 3	External Trip contact input was opened
2	Front Display Trip Button	Front Panel Display Emergency Stop was pressed
3	Overspeed TRIP	Turbine overspeed was sensed
4	All Speed Probes Failed	Loss of all speed probes was sensed
5	Trip Command from Modbus	Modbus communication link trip was commanded
6	Configuration Error	Peak200 has a configuration error
7	Unit in Calibration Mode	Peak200 is in Calibration Mode
8	Power Up Trip	Peak200 lost power or the Configuration mode was exited
9	External Trip 2	External Trip #2 contact input was opened
10	External Trip 3	External Trip #3 contact input was opened
11	External Trip 4	External Trip #4 contact input was opened
12	External Trip 5	External Trip #5 contact input was opened
13	AI Chan 1 Level 2 TRIP	Analog Input chan 1 reached TRIP Level 2
14	AI Chan 2 Level 2 TRIP	Analog Input chan 2 reached TRIP Level 2
15	AI Chan 3 Level 2 TRIP	Analog Input chan 3 reached TRIP Level 2
16	AI Chan 4 Level 2 TRIP	Analog Input chan 4 reached TRIP Level 2
17	Summary TRIP from LinkNet IO	Summary Trip from a device on the LinkNet IO
18	At Overspeed Test Max Setpoint	During External OSPD test Max setpoint was reached

Event ID	DESCRIPTION	MEANING
19	HP Actuator Fault	HP Actuator fault detected (an open or short circuit was sensed)
20	Spare_20	reserved for future use
21	AI Chan 1 SigFail TRIP	Analog Input #1 signal has failed and is configured as a Trip event
22	AI Chan 2 SigFail TRIP	Analog Input #2 signal has failed and is configured as a Trip event
23	AI Chan 3 SigFail TRIP	Analog Input #3 signal has failed and is configured as a Trip event
24	AI Chan 4 SigFail TRIP	Analog Input #4 signal has failed and is configured as a Trip event
25	Normal Shutdown Complete	The Normal stop sequence is complete
26	Underspeed Trip	Turbine speed has dropped below the underspeed setpoint (this event has a 2 sec delay)
27	Trip Cmd from RemoteView	Trip command has been issued from RemoteView
28	Spare_28	Reserved for future use
29	Spare_29	Reserved for future use
30	Tunable TRIP (SIM Mode)	Trip from a tunable in the GAP, used for the demo mode during HW simulation

Each individual trip condition is available through the Modbus links to monitor the control status. The system also provides a common trip indication.

Relay indications can be programmed to indicate a Peak200 Shutdown Condition (energizes for a shutdown condition) or a Trip Relay (de-energizes for a shutdown/trip), in addition to the dedicated Emergency Trip Relay output.

Speed and Cascade Dynamics Adjustments

Dynamic control values are available on the main Operational pages for speed and cascade control. They are only available when logged into the Service user level (or higher). The Proportional and Integral Gain and the Derivative Ratio dynamic adjustments are available under the Dynamics pages for each controller (SPEED and CASC). To adjust the gain settings, the In-Focus highlighter must be on the component value to tune. You move the In-Focus highlighter using the navigation Cross. The ADJUST UP and DOWN keys can then be used to adjust the function In-Focus.

Figure 5-20. Speed Dynamics Adjustment Screen

The Speed and Cascade controls are PID controllers. Adjust the response of each control loop by selecting the dynamics mode as described above. Proportional gain, integral gain (stability), and SDR (speed derivative ratio) are the adjustable and interacting parameters used to match the response of the control loop with the response of the system. They correspond to the P (proportional), I (integral), and D (derivative) terms, and are displayed by the control as follows:

P = Proportional gain (%)
I = Integral gain (%)
D = Derivative (determined by DR and I)

Tuning P & I Gains

Proportional gain must be tuned to best respond to a system transient or step change. If system response is unknown, a typical starting value is 5%. If proportional gain is set too high, the control will appear to be overly sensitive, and may oscillate with a cycle time of less than 1 second.

Integral gain must be tuned gain for best control at steady state. If system response is unknown, a typical starting value is 5%. If the integral gain is set too high, the control may hunt or oscillate at cycle times of over 1 second.

For best response, the proportional gain and integral gain should be as high as possible. To obtain a faster transient response, slowly increase the proportional gain setting until the actuator or final driver output begins to oscillate or waver. Then adjust the integral gain as necessary to stabilize the output. If the integral gain adjustment fails to obtain stability, reduce the proportional gain setting.

A well-tuned system, when given a step change, should slightly overshoot the control point then come into control.

A PID control loop's gain is a combination of all the gains in the loop. The loop's total gain includes actuator gain, valve gain, and valve linkage gain, transducer gain, internal turbine gains, and the Peak 200's adjustable gains. If the accumulated mechanical gain (actuators, valves, valve linkage, etc.) is very high, the Peak 200's gain must be very low to be added to the system gain required for system stability.

In cases where a small change in the Peak 200's output results in a large speed or load change (high mechanical gain), it may not be possible to take the Peak 200's gains low enough to reach stable operation. In those cases, review the mechanical interface (actuator, linkage, servo, valve rack) design and/or calibration and change to achieve a gain of one where 0–100% the Peak 200 output corresponds to 0–100% valve travel.

Dual Dynamics (Speed/Load)

The Speed PID has two sets of dynamics, On-Line and Off-Line; each include Proportional Gain, Integral Gain, and Derivative Ratio (DR) variables. There are two ways to switch the dynamics between On-Line and Off- Line:

- A "Select On-Line Dynamics" contact input is programmed
- User configures the speed setpoint desired to switch from Off-line to On-line

If a contact input is programmed to "Select On-Line Dynamics", it has priority regardless of the speed setpoint setting. On-Line dynamics are selected when the contact is closed; when open, Off-Line dynamics are selected.

If the unit has no "Select On-Line Dynamics" contact input is programmed, when the turbine speed is below the On-Line speed setpoint speed the Speed Off-Line dynamic settings are used, and On-Line is used when the speed is above this setpoint. There is a -100-rpm hysteresis on this speed switch. The default setting of this setpoint is very high, which will in effect always use just the single dynamic settings (the Off-Line dynamics)

You may program a relay to indicate that the On-Line Dynamics mode is selected.

Tuning Derivative

The value of the Derivative Ratio (DR) term can range from 0.01 to 100. If unsure of the correct value, set the Speed control's DR term to 5% and the Cascade controllers' DR terms to 100%. To simplify adjustment of the dynamics, adjusting the integral gain value sets both the I and D terms of the PID controller. The DR term establishes the degree of effect the integral gain value has on the "D" term and changes the configuration of a controller from input rate sensitive (input dominant) to feedback rate sensitive (feedback dominant) and vice versa.

Another possible use of the DR adjustment is to reconfigure the controller from a PID to a PI controller. Do this by adjusting the DR term to its upper or lower limits, depending on whether an input or feedback dominant controller is desired.

- A DR setting of 1 to 100 selects feedback dominant mode.
- A DR setting of .01 to 1 selects input dominant mode.
- A DR setting of .01 or 100 selects a PI only controller, input, and feedback dominant respectively.

The change from one of these configurations to the other may have no effect during normal operation; however, it can cause great differences in response when the governor is coming into control (At start-up, during a full load change, or during transfer of control from another channel).

An input dominant controller is more sensitive to the change-of-rate of its input (Speed or Cascade input) and can therefore prevent overshoot of the set point better than a feedback dominant controller. Although this response is desirable during a start-up or full load rejections, it can cause excessive control motions in some systems where a smooth transition response is desired.

A controller configured as feedback dominant is more sensitive to the change-of- rate of its feedback (LSS). A feedback dominant controller has the ability to limit the rate of change of the LSS bus when a controller is near its set point but is not yet in control. This limiting of the LSS bus allows a feedback dominant controller to make smoother control transitions than an input dominant controller.

Tuning Example

If the system is unstable, make sure the governor is the cause. This can be checked by closing the valve limiter until it has control of the actuator output. If the governor is causing the oscillation, time the oscillation cycle time. A rule-of- thumb is, if the system's oscillation cycle time is less than one second, reduce the Proportional gain term. A rule-of-thumb is, if the system's oscillation cycle time is greater the one second, reduce the Integral gain term (proportional gain may need to be increased also).

On an initial start-up, all PID dynamic gain terms typically require adjustment to match the respective PID's response to that of the entire control loop (controller, actuator, valve, turbine, and speed input signals).

Figure 5-28 shows the typical response to a load change when the dynamics are optimally adjusted.
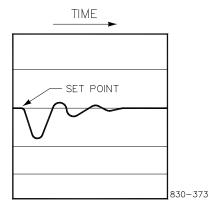
Figure 5-21. Typical Response to Load Change

IMPORTANT	The above information is the traditional information for tuning Woodward's implementation of a PID. Initially these steps should be followed to gain reasonably stable speed control. The Peak200 control also contains a new automated PID Optimization routine that can be used on the Speed PID. For information on using this feature is found in Appendix C.

Process/Cascade Droop

The Process/Cascade controller can be programmed to use droop for control loop stability. If the parameter being controlled is also being controlled by another device (letdown station, boiler, or other turbine), droop is typically required for control loop stability. If required, no less than 5% droop is recommended for stable operation.

Relays

TRIP RELAY (Relay #1): The TRIP relay is activated as part of a turbine trip as a result of pressing the TRIP keypad button, as a result of losing the EXTERNAL TRIP input on Discrete Input #3, or as a result of one of the internal trip conditions on the Peak200. This relay is dedicated to this function and cannot be changed.

The TRIP relay opens a set of contacts when tripped. This set of contacts is used in many systems as part of a trip string where any of the safety systems can open the string and trip the turbine. The string usually consists of inputs from the lube oil system, the turbine vibration system, an over speed trip device or one of the trips on the Peak200.

- It is important to note that if this 'trip string' from the user 'Opens' the EXTERNAL TRIP input contact (on DI03) then the Peak200 can be stuck in a trip loop, in that its output will not clear because it needs this input to be healthy first. The following explains two ways to avoid this – both options are found in the Configuration of the Relay Output 01 – Trip Relay screen
- To overcome this trip loop, the Peak200 can be configured so that RESET CLEARS TRIP. When this is configured TRUE and the RESET is closed momentarily, all trips are overridden, and the TRIP relay resets. This restores the speed control output in the trip string so the turbine operator can RESET the turbine for the next start.
- Another option to avoid this – is the option INCLUDE EXTERNAL TRIP IN OUTPUT? If this box is unchecked then the EXTERNAL TRIP input contact (on DI03) will Trip the control, but it will not include this trip in the status of the Relay #1 output.

The TRIP relay defaults at DE-ENERGIZE to trip. However, the TRIP relay can be configured to ENERGIZE to trip by setting TRIP RELAY ENERGIZES FOR TRIP to TRUE in the program.

ALARM RELAY (Relay #2): The ALARM relay energizes when an alarm condition is detected. Even though the turbine continues to operate with an alarm condition, the ALARM condition should be corrected before it develops into a trip condition. The default is that this will reflect the status of the summary Alarm latch, it will be energized if any alarm is present. It is possible in SERVICE (SCREEN/KEY OPTIONS) to select an option for this relay to blink (toggle) whenever a new alarm comes in. This relay is defaulted to this function; however, it can be changed to another function if needed.

CONFIG RELAY #3 & #4: The CONFIG relays can be configured for via the menu selections for either state indications or a level switch based on one of the analog variables listed. The CONFIG relays will be energized to indicate the function.

Prior To Turbine Start

- Program the Peak200 for the specific turbine application (see Appendix for program worksheets).
- Stroke the actuator (linkage) to ensure that the turbine can be shut down when calling for 0% actuator position and can reach full load when calling for 100% actuator position (see Stroking Actuator).
- Be prepared to adjust the system dynamics when the Peak200 takes control of the speed (see Dynamics Adjustments).

> **IMPORTANT**
> When starting the turbine, monitor the speed readout to ensure you have a good speed signal from the magnetic speed pickups, especially on initial turbine start.

> **IMPORTANT**
> Refer to turbine manufacturer's operating procedures for complete information on turbine start-up.

Turbine Start

When starting the turbine, both the actuator and the Peak200 have minimum startup requirements:
- The Peak200 needs a 1.0 Vrms MPU signal to sense speed.
- The Actuator, when driven directly from the turbine, requires enough speed to develop the force required to operate the steam valves or servo valve.

Starting Procedures (Start Curve Screen)
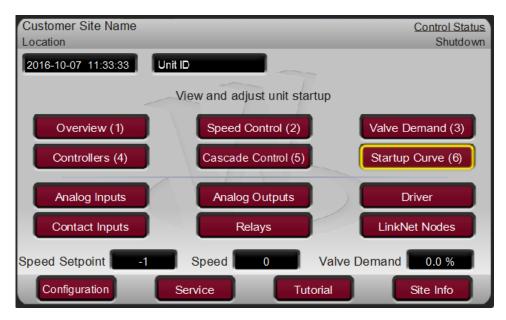
Figure 5-22. HOME Menu Showing "Startup Curve" IN-Focus

Refer to the turbine manufacturer's operating procedures for complete information on turbine start up, and Chapter 3 of this manual for a step-by-step procedure, depending on the start mode selected. The following is a typical start- up procedure:

> ⚠️ **WARNING**
>
> **The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.**
>
> **The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.**

1. Press the RESET key to clear all alarms and trips. If the Peak200's RESET CLEARS TRIP setting is programmed "YES", then the control's shutdown relay will reset or energize upon pressing the RESET key after a shutdown. If the RESET CLEARS TRIP OUTPUT setting is programmed "NO", the control's shutdown relay will reset or energize upon pressing the Reset key ONLY after all trip conditions are cleared.
2. Press the START key to initiate the selected start-up mode. This will function from any screen, but it is recommended that you observe the Startup Curve page during the turbine startup. It will automatically match to show the correct information relative to the start sequence configuration. In either Manual or Automatic Start mode, the control will increase the valve limiter to open the control valve. The control will ramp the valve to 100% open to allow for any pre-heating (warm-up) that needs to be done. The operator must manually increase the Throttle valve to bring the turbine up to the first control speed setpoint (either Idle or Minimum Governor).
   Note: The START keypad command can be configured to require a confirmation dialog box to appear to activate the turbine start. It is default to not use the dialog box so that it will operate the same as the contact input or Modbus commanded start.
3. After performing the selected start-up mode, the turbine will operate at the minimum or idle speed setting. The Peak200's speed set point will move to minimum governor speed unless an idle speed was programmed. You must program the control to use the Auto Start mode for the control to allow the Start Sequence functions for the turbine to control at idle speed. An operator at this time may vary turbine speed through the Peak200's keypad, external switches, or communication links.

The Peak200 and actuator rely on an alternate means of opening the governor valve or applying bypass steam to roll the turbine for startup. The minimum speed at which the Peak200 can control turbine speed depends on the minimum speed required to meet these two conditions (see the actuator specifications).

Idle/Minimum Ramp

If the Peak200 control is programmed for a MANUAL START, this section can be ignored. When MANUAL START is configured, speed control will begin at MIN GOVERNOR SPEED which is much higher than IDLE speed. In the manual start mode, all speed control, including avoiding the CRITICAL SPEED BAND, is the responsibility of the operator until the turbine reaches MIN GOVERNOR SPEED.

If the control is programmed for AUTO START, the Peak200 will begin controlling the turbine speed at IDLE speed. The following apply to the AUTO START mode.

The turbine can be accelerated either manually or automatically from IDLE to

MIN GOVERNOR SPEED.
- To operate the system manually, use the RAISE or LOWER buttons or inputs. When a button is closed, the turbine speed will change. When the button is opened, the turbine runs at the current speed.
- To operate the system automatically, use one of the following:
  o Close the IDLE / MIN GOV input.
  o Use the keypad commands on the START CURVE screen to go to Idle Speed or go to Min Governor Speed
  o Press the START button on the front panel, once the unit has started and reached Idle speed, repressing the START key will command the control to ramp up to Min Governor speed
- This ramp will accelerate the turbine at the Rate to Minimum rate.

If a CRITICAL SPEED BAND has been defined, the ramp rate of the speed increase (or decrease) in this band will be the CRITICAL BAND RATE. When the speed of the turbine is outside the CRITICAL SPEED BAND the ramp rate will return to the IDLE / MIN GOV RATE.

The IDLE to MIN GOVERNOR SPEED ramp can be stopped at any point between IDLE SPEED and MIN GOVERNOR SPEED, except within the CRITICAL SPEED BAND:
- By pressing the RAISE or LOWER button on the front panel.
- By closing the external RAISE or LOWER contact.
- By opening the IDLE / MIN GOV input if one of the following scenarios has been programmed:
    o The USE RAMP TO IDLE function is set FALSE.
    o The USE RAMP TO IDLE function is set TRUE

If the speed is below the MIN GOVERNOR SPEED set point, the IDLE to MIN GOVERNOR SPEED ramp can be changed with the RAISE / LOWER buttons, or it can be restarted:
- By toggling the IDLE / MIN GOV input.
- By pressing the START button on the front panel with the IDLE/MIN GOV input open.

If the speed is below MIN GOVERNOR SPEED and the IDLE / MIN GOV input is opened, the speed set point will move back to IDLE speed at the IDLE / MIN GOV RATE if:
- USE RAMP TO IDLE is set TRUE.

When the speed is at or above MIN GOVERNOR SPEED opening the IDLE / MIN GOV input will not lower the turbine speed to IDLE speed.

The IDLE / MIN GOV input can be open or closed during turbine start-up.

- If the IDLE / MIN GOV input is open, when the trips are cleared, pressing the START button will ramp the turbine speed to IDLE.
- If the IDLE / MIN GOV input is closed, when the trips are cleared, pressing the START button will ramp the turbine speed to the MIN GOVERNOR SPEED.

Critical Speed Band Avoidance

If the unit is configured to use the Automatic Start Mode, then a speed avoidance band can also (optionally) be configured under the Speed Setpoint menu. Many steam turbine OEM's define a speed range, below the minimum governor speed setting, that should be avoided – typically to keep the turbine from operating in areas where high vibrations can occur.

The actual speed setpoint will not be allowed to stop when it is in this range. The ramp will continue at the CRITICAL BAND RATE until the speed setpoint, and actual speed are outside the CRITICAL SPEED BAND then stop.

While operating in the CRITICAL SPEED BAND, if a LOWER command is issued while the ACTUAL SPEED SETPT is increasing, the direction will reverse and return to the CRITICAL SPEED MIN setting. If a RAISE command is issued while the ACTUAL SPEED SETPT is decreasing, the direction will reverse and run the speed to the CRITICAL SPEED MAX setting.

Speed Control

The SPEED CONTROL compares the turbine SPEED with the ACTUAL SPEED SETPOINT. When the two values are equal, the output of this controller will be a constant demand (from 0-100%), the actuator signal will follow this value (The actuator output range is selected in the ACTUATOR CONFIGURATION MENU as either 4-20 mA or 0-200 mA).

The ACTUAL SPEED signal is the output of the MPU HSS (HIGH SIGNAL SELECTOR). The ACTUAL SPEED SETPT is either the LOCAL SPEED SETPT or the REMOTE SPEED SET depending on which mode has been configured and is enabled.

When needed, the speed control can be configured to use DROOP feedback. Droop is defined as a decrease in speed set point proportional to an increase in load. The DROOP Signal is a function of the VALVE POSITION (ACTUATOR) signal. When DROOP is configured, the SPEED CONTROL compares the ACTUAL SPEED SET POINT to the combination of the SPEED signal plus the DROOP signal.

Speed Control Screen

The speed control screen will show two basic modes of adjusting the speed setpoint, manual control and remote speed setpoint control.

IMPORTANT	If the control has been configured for droop, the turbine speed will always be less than the speed set point. The difference will depend on the amount (%) of droop selected during programming.

Manual Speed Setpoint Mode
Manual Speed Setpoint mode is defined as:
- Changing the Speed Setpoint with the RAISE and LOWER buttons on the FRONT PANEL.
- Changed in the Speed Setpoint with the ENTERED SPEED and GO To commands from the FRONT PANEL.
- Changing the Speed Setpoint with the RAISE and LOWER discrete inputs.
- Changing the Speed Setpoint with the RAISE SPEED and LOWER SPEED Modbus commands.

This mode is available at all times when the Remote Speed Setpoint mode is disabled.

The Speed Setpoint will change at the setpoint SLOW RATE, set by the user in Service Mode for either Offline, or Online dependent on the speed of the turbine. If the command is continuously entered for longer than the FAST RATE DELAY time, then the setpoint will move at the FAST RATE.

If the Remote Speed Setpoint option has been configured and the analog input for this value is healthy, the REMOTE SETPOINT mode can be enabled. This can be done through a discrete input, Modbus command or via the FRONT PANEL.

Remote Speed Setpoint Mode
The Remote Speed Setpoint mode is when an external 4–20 mA signal sets the Speed Setpoint. (This 4–20 mA input, called the REMOTE SPEED SETPOINT signal, normally comes from a PLC or manual turbine control station). This mode is enabled by the user through a discrete input, Modbus command, or via the FRONT PANEL.

The user in the Speed Setpoint Configuration menu sets the rate, at which the Remote Speed Setpoint can change. There are two rates – the Normal Rate and the Not Matched Rate, both are also available for adjustment from the Ramp Speed Setpoint pop-up screen during turbine operation and both are set in the units of rpm/sec. If the speed and the setpoint have a difference greater than 0.5% of the current speed setpoint value, the setpoint will move at the Not Matched Rate, if the speed versus setpoint difference is less than this amount, the setpoint ramp will move at the Normal rate.

The remote speed setpoint is defined by an analog input signal. The minimum (4mA) and maximum (20mA) values for this range must be set equal to or within the range set by the values assigned to the MIN GOV SPEED and the MAX GOV SPEED respectively.

Before the Remote Speed Setpoint mode can be enabled, the following operating conditions must be met:
- The turbine speed must be above the MIN GOV SPEED.
- The REMOTE SPEED ENABLE input must be closed.
- The Remote Speed Setpoint signal must be between 2 mA and 22 mA.

With the IDLE / MIN GOV input closed, and the turbine speed above MIN GOV SPEED, when the REMOTE SPEED ENABLE input is closed, the ACTUAL SPEED SETPT will ramp from the current speed to the REMOTE SPEED SET input at the REMOTE-NOT-MATCHED RATE.

The Remote Speed Set Point may be in one of the following states (message status is found on the remote speed setpoint pop-up screen):
- Disabled—The remote set point function is not enabled and will have no effect on the speed set point.
- Enabled—The remote set point has been enabled.
- Active—The remote set point is in control of the Speed set point, but the speed PID is not in control of the actuator output.
- In Control—The remote set point is in control of the Speed set point and the speed PID is in control of the actuator output.
- Inhibited— The remote set point cannot be enabled. The input signal has failed, the unit is shut down, or remote set point is not programmed.

The Peak200 will stay in the remote speed setpoint mode unless one of the following occurs:
- The REMOTE SPEED ENABLE input is opened, or a disable command is given from the front panel or Modbus.
- SPEED is reduced to below MIN GOV SPEED.
- A SHUTDOWN occurs.
- A REMOTE INPUT FAILURE occurs. The ACTUAL SPEED SETPT will be the value of the REMOTE SPEED SETTING input at the time when a REMOTE SPEED SET failure is detected.

Shutdown and Alarm Function Summary

A shutdown condition is signaled by the TRIP relay which defaults as DE-ENERGIZE on trip. It can be configured to ENERGIZE on trip by checking the Invert Logic box on the Configuration / Relay Output 01 screen.

Alarm conditions are signaled by the ALARM relay energizing when an alarm is present. It can be configured to de-energize on alarm by checking the Invert Logic box on the Configuration / Relay Output 02 screen.

The TRIP and ALARM functions latch. A RESET is required once the condition is corrected to clear the latch. If the governor is TRIPPED, a RESET command will clear the TRIP RELAY output and the front panel TRIPPED LED if configured for RESET CLEARS TRIP = TRUE. This does not clear the TRIP input on discrete input channel 3, which may be a part of the turbine trip string. When an operator resets this string, the turbine is ready to start. (If an EXTERNAL TRIP still exists, the control will not initiate a start).

Valve Ramp (Limiter) Control

Either the output of the VALVE RAMP or the SPEED CONTROL is used to open and close the steam valve during turbine operation. These outputs are LOW SIGNAL SELECTED by the LSS Bus so that the control function with the lowest demand sets the position of the actuator.

The VALVE RAMP is opened via the START COMMAND during START UP to run its output out of the way of the SPEED CONTROL (100%-Open). When the control gets a TRIP command, the VALVE RAMP over rides the SPEED CONTROL and closes the ACTUATOR (0%-Closed).

The SPEED CONTROL increases or decreases the steam demand signal during normal turbine operation.

In the MANUAL START MODE, the Trip & Throttle valve holds the steam valve closed while the outputs of the VALVE RAMP and the SPEED CONTROL are driven quickly to 100% and to the MIN GOVERNOR speed. Start is initiated when the Peak200 is RESET and receives a START command. Initial speed control is via the Trip & Throttle valve with the operator in control of the turbine speed.

Initially in the AUTO START MODE, the VALVE RAMP, and SPEED CONTROL hold the ACTUATOR at the closed position. Before a START command is given, the operator opens the Trip & Throttle valve. When given a START command the VALVE RAMP is opened slowly to apply steam to the turbine. At the same time, the LOCAL SPEED SETPT starts ramping from zero to IDLE speed. When the turbine speed exceeds the LOCAL SPEED SETPT, the SPEED CONTROL closes the actuator until it is controlling the turbine speed at the SET POINT.

Manual Valve Demand (Ramp) Control

If desired, the control can be placed into manual valve demand mode. This is only available in Service mode, only enabled for a time-limited period and is intended to be used as a tool for troubleshooting system problems (for example a valve instability problem). It is designed for bumpless transition from speed control into this mode – but the user must manually ensure the speed setpoint is at the correct point when switching back into speed control.

Zero Speed Signal Override

The Peak200 issues a shutdown if no speed signal is detected (magnetic pickup voltage less than 1 Vrms or speed is less than the 'Failed Speed Level'). To allow the control to start with speed not being sensed, this shutdown logic must be overridden. The control provides an automatic speed override for this purpose. For added protection, a timed limit on the override is available. The status of the MPU override logic may be viewed in the Service mode or through Modbus communications. The override logic applies to both speed probes.

Automatic Speed Override

The Automatic Speed Override logic is used by the Peak200 to override the loss-of-speed signal shutdown logic during a turbine start-up. With the Automatic Override logic, the loss-of-speed signal failure is armed when the turbine trips and remains armed until the sensed turbine speed exceeds the programmed ('Failed Speed Level' setting + 50 rpm). Once turbine speed exceeds this level, the loss of speed detection circuit is re-armed and the control will execute a system shutdown if sensed speed drops below the 'Failed Speed Level' setting.

For added protection, a timed limit is available on the automatic speed override function. The timed speed override timer deactivates the loss-of-speed override logic after the programmed time expires. If programmed, this timer starts counting down once a 'START' command has been issued. This timer when programmed provides an extra level of protection, in the event both speed input probes are failed when the unit is started. This timer may be programmed in the Service menu under MPU Override.

Slow Roll Down Failsafe Override

The USE SLOW ROLLDOWN OVRD function differentiates between the gradual loss of the speed signal and a sudden loss of the speed signal. The use of this option is to eliminate a nuisance trip when the turbine is manually shutdown or rolled down with the Trip & Throttle Valve gradually closed.

When the speed gradually drops below the setting of The Rolldown Speed for the time set by the Rolldown Delay, the MPU's override is switched on. This prevents a LOSS OF BOTH MPUs trip and drives the Peak200 governor valve opens fully as turbine speed decreases.

A sudden loss of the MPU inputs trips the turbine and closes the governor valve.

Normal (Controlled) Shutdown

The Normal Shutdown function is used to stop the turbine in a controlled manner, as opposed to an Emergency Trip. When a Normal Stop command is issued, the following sequence is performed:

1. Cascade/Process PID control is disabled (if used).

2. Remote Speed Setpoint is disabled (if used)
3. The Control Status will change to Controlled Shutdown
4. An alarm will be annunciated to indicate that a Controlled Stop is in Progress (ALM Event ID 59) and a boolean status indication is sent via Modbus
5. If the configuration of Start Mode is Manual Start - The Speed Set Point is ramped to the minimum governor set point at the normal stop ramp rate (user setting from Service/Speed Control screen).
6. If the configuration of Start Mode is Automatic Start - The Speed Set Point is ramped to the idle set point, at the normal stop ramp rate (user setting from Service/Speed Control screen).
7. Once the unit is down to either Minimum Governor or Idle setpoint based on the above settings, the control will wait 10 seconds and then issue a Trip.
8. The shutdown summary list will annunciate this with SD Event ID 25 – Normal Shutdown Complete

A controlled shutdown can be initiated or aborted from the Peak200 Overview screen (via the front panel or RemoteView), a programmed contact input, or a Modbus communication command. When initiated from the Peak200 Overview screen, the user will be prompted for a confirmation to initiate the normal stop sequence. Verification is not required if a controlled shutdown command is initiated by a programmed contact input or Modbus communication link. There is an option in the Service menu, Speed Control screens to disable access to this Normal Stop button on the Overview screen if desired.

If an external contact is programmed to issue a controlled shutdown command, closing the contact will initiate the controlled shutdown sequence. Opening the programmed contact will stop the sequence. The contact can be either open or closed when a trip condition is cleared. If the contact is open, it must be closed to issue the command. If the contact is closed, it must be opened and re-closed to issue the command.

The Modbus initiated Control Shutdown Sequence requires two commands, one to start the sequence and the other to stop it. There is also a Boolean Read status indication of "Controlled Stop in Progress" when the sequence is active. Refer to the Modbus Boolean Reads & Writes section of this manual (Tables 6-5 and 6-6) for these Modbus addresses.

Anytime the controlled shutdown sequence is aborted, the control will cancel the sequence and the speed reference will hold at the current setpoint. At this point the shutdown sequence can be re-initiated when desired, or the unit can be brought back to a fully operational state.

If critical speed avoidance range is enabled, the ramp rate through this range will be at the critical speed rate, not the normal stop ramp rate. If the Normal Stop is canceled while in this speed range, the speed setpoint will continue to decrease to the bottom of the range.

The speed sensor failure trip is overridden when the trip command from the end of the controlled shutdown sequence is initiated.
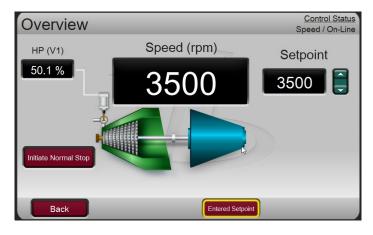
Figure 5-23. Overview Screen with Normal Stop Button Access

Actuator Calibration/Stroking Procedure

> ⚠️**WARNING**   **Before calibrating or testing, the unit must be tripped, and the steam supply removed. This is to ensure that opening the control valve(s) will not allow steam into the turbine. Overspeeding the turbine may cause damage to turbine and can cause severe injury or death to personnel. STEAM TO THE TURBINE MUST BE SHUT OFF BY OTHER MEANS DURING THIS PROCESS.**

1. The Peak200 must be shutdown to enter Calibration Mode.
2. Go to the MODE screen by pressing the MODE key.
3. Enter Calibration Mode by pressing the 'Calibration' softkey. The following permissives must be met:
   a. Unit Shutdown
   b. No Speed Detected
   c. Appropriate User Level Login (Service or higher)
4. Navigate to the Driver page by pressing the 'Driver' in either the HOME menu or Configure menu.
5. On the Actuator screen, press the 'Calibration' softkey to access the calibration options.
6. Press the 'Force Output' softkey to access the Actuator Forcing screen.
7. Verify the green "Calmode Enabled" LED is ON to confirm that the unit is in Calibration Mode.
8. Press the 'Forcing' sofkey. Then confirm on the popup that actuator forcing can be enabled by selecting 'OK' and pressing ENTER.
9. Verify that the green "Forcing Enabled" LED is now also ON.
10. Use the focus navigation to select and adjust items on the screen (Manual Adjust, Goto Demand, Force Rate, etc.).
11. Actuator current output at min and max can be adjusted by selecting "mA at 0% Demand" or "mA at 100% Demand". Use the up/down Adjust arrows or numerical keypad and ENTER key to the change the values. (Ideally the minimum and maximum current values should be adjusted, and the Gain and Offset values left at 1 and 0 respectfully)
12. Press the 'Commands' softkey to access other commands such as "Go to Min", Go to Max", and "GO". "GO" can be used with the "Goto Demand" value.
13. When finished, make sure to save the settings by pressing any 'Save Settings' softkey. A 'Save Settings' softkey can be accessed on the MODE screen.
14. Exit Calibration Mode by pressing the 'Exit Calmode' softkey from the MODE page. Exiting this mode will automatically disable the force mode.

If changes are made to the minimum or maximum current values, they can be recorded on the Configure Mode worksheets. Exiting the Calibration Mode or Forcing Mode will not permanently save any calibration changes.

> **NOTICE**   **Press the 'Save Settings' softkey to permanently save any minimum or maximum actuator settings into the Peak 200. If variables are tuned or changed but not stored to a file, then those changes will be lost if power is removed from the control or if the control receives a CPU reset.**

Chapter 6.
Modbus Communications

Introduction

The Peak200 control can communicate to other devices via serial RS-232 or RS-485 using an ASCII or RTU MODBUS transmission protocol. The pertinent serial port communications parameters are all adjustable in the Configuration mode of the Peak200 control. The loss of the communications link is annunciated if the Modbus serial port is configured for use.

The control can also communicate Modbus information via Ethernet. Either Modbus UDP or TCP/IP protocol which can be utilized from Ethernet port 1. Modbus utilizes a master/slave protocol. This protocol determines how a communication network's master and slave devices establish and break contact, how a sender is identified, how messages are exchanged, and how errors are detected. The configuration of the Peak200's TCP/IP address is available in the Configuration menu under Communications.

All pertinent control parameters are programmed to be displayed on a CRT or plant DCS computer. In addition, all relevant control functions (i.e., raise/lower or enable) can be executed through this link. The functional block diagram (see Chapter 2) shows all Modbus parameters and their address. See Figure 2-1 for an example showing the Modbus communications connections. The example shows that Boolean write registers 1 and 2 are for raising and lowering the speed set point, respectively. It also shows that analog read register 2 contains the speed set point value.
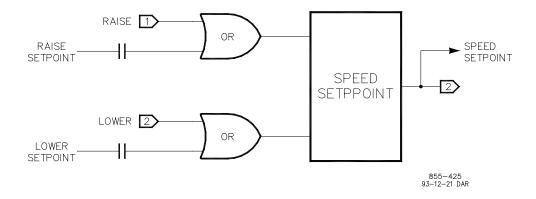
Figure 6-1. Modbus Communication Connections

Modbus Wiring

The Peak200 control with Modbus option can communicate to one device via RS- 232 or RS-485 using an ASCII or RTU MODBUS transmission protocol. The communications port is brought out to terminal blocks for wiring. Each communications mode is wired to different terminals. The following section identifies the terminal landings required for each mode.

RS-232 Wiring

An RS-232 link is limited to 15 m (50 feet). The Peak200 control utilizes the COM 1 terminal block on the side of the unit for RS-232 connections. Figure 6-2 shows typical RS-232 communications connection. The transmit data (TXD), receive data (RXD), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected at one end only.
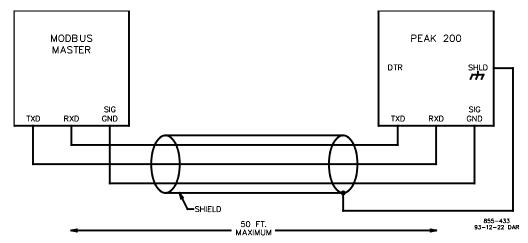
Figure 6-2. Typical RS-232 Communications

RS-485 Wiring

RS-485 can also accommodate transmission distances up to 1200 m (4000 feet). The Peak200 control utilizes the COM 1 terminal block on the side of the unit for RS-485 connections. Figure 6-3 shows a typical RS-485 communications connection. The data lines (485+ and 485–), and signal ground (SIG GND) must be properly connected as shown. In addition, the shield (SHLD) should be connected at one end only. The last unit in the Modbus network chain should have its receiver terminated with a resistor. The Peak200 control has termination resistors built-in and available at the terminal block (TERM RES + and TERM RES -). Properly terminate the RS-485 cable at the Modbus master. Use the alternate wiring if no signal ground is available at the Modbus master.
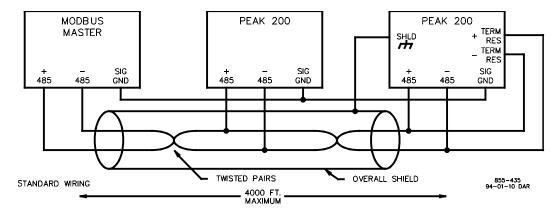
Figure 6-3. Typical RS-485 Communications

Basic Modbus Overview

The Peak200 control utilizes Modicon Inc.'s Modbus protocol (see Figure 6-4 for Basic Modbus Overview). There are two transmission modes available for use with the Modbus protocol; ASCII and RTU (see Figure 2-6). The Peak200 control can only act as a slave unit, it responds only after being asked for a set of parameters. Typically, the Peak200 control will communicate with a Modbus Master device with a separate link to each device (i.e., point to point wiring). However, if Ethernet or serial RS-485 is used, several Peak200 controls can be connected to one Master device on a single link (i.e., multidropping). The data is passed between the Master and the Peak200 control in the form of message frames (see Table 6-1). The default slave address for the Peak200 control is 01, however, this address is adjustable in the configure mode. On any single link, each slave address must be unique.

Modbus Points of Interest
- Master, Slave network protocol
- One master and up to 32 slaves on a common line
- Only the master initiates a transaction
- A transaction comprises a single query and a single response
- Data passed between master and slave in the form of message frames
- It may be helpful to use slower baud rates if multi-dropping is used
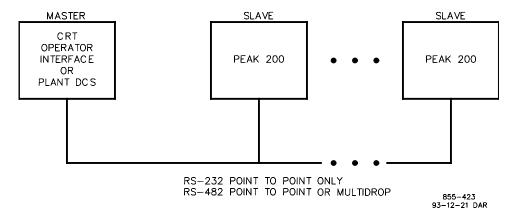
Figure 6-4. Basic Modbus Overview

Modes of Transmission

- ASCII and RTU are the two modes allowed.
- Mixing of modes is not allowed.
- ASCII mode requires twice as many characters as RTU mode to transmit the same amount of data.
- RTU mode has more elaborate error checking.

The control supports both ASCII and RTU message frame types. The following table shows the definition of each type.

Table 6-1. Modbus Transmission Modes

Characteristic	ASCII	RTU
Coding System	Hexadecimal	8 Bit Binary
Bits per Character	7	8
Parity	Even, Odd, None	Even, Odd, None
Stop Bits	1 or 2	1 or 2
Transmitted Data Per Character	4 bits	8 Bits
Error Checking	LRC (Longitude Redundancy Check)	CRC (Cyclical Redundancy Check)

Frame Definition

- Each slave must have a unique address.
- The function code tells the addressed slave what function to perform.
- The high order bit of the function code is used to indicate an exception response.
- The data field contains information needed by the slave or collected by a slave to perform a specific function.
- The error checking assures that the slave or master does not react to messages that have changed during transmission.

Table 6-2. Modbus Frame Definition

Function	ASCII	RTU
Beginning of Frame	:	3 Characters Dead Time
Slave Address	2 Characters, 8 Bits	1 Character, 8 Bits
Function code	2 Characters, 8 Bits	1 Character, 8 Bits
Data	4 Bits Data per Character	8 Bits Data per Character
Error Check Code	2 Characters, 8 Bits	2 Characters, 16 Bits
End of Frame	CR LF	3 Characters Dead Time

The data is passed between the Master and the Peak200 control in the form of message frames. The function code portion of the frame tells the addressed slave what function to perform (see Table 6-3).

Function Code Definition

Table 6-3. Modbus Function Codes

Code	Description
1	Read Digital Outputs
2	Read Digital Inputs
3	Read Analog Outputs
4	Read Analog Inputs
5	Write Single Digital Output
6	Write Single Analog Output
7	Loopback Test - Returns the Query Message
8	Write Digital Outputs
9	Write analog Outputs

Table 6-2 shows typical Modbus frames for the various function codes. If a slave detects an error in a message, it will not act on or respond to that message. For any requested data that is undefined, the slave will respond with a value of zero. The slave will respond with an exception response if it detects illegal data in a message. The following table lists the exception errors displayed by the Peak200 control. If the Peak200 control has an exception error, it will be annunciated under the Port Adjustments heading in the Service mode (see Chapter 7).

Table 6-4. Peak200 Exception Errors

Code	Name	Meaning
1	Illegal Function	The message function is not an allowable action
2	Illegal Data Address	The message start address is not an allowable address
9	Checksum Error	The received message had an incorrect error check code
10	Garbled Message	The received message could not be decoded

Figure 6-5. Modbus Messages

Port Adjustments

Following is listed the parameters that can be set in the SERVICE Mode under Communications

- Use Modbus Trip - Enable or Disable a Trip command via Modbus
- Enable Link 1 (Serial) Writes – Enable or Disable writes from this link
- Enable Link 2 (Ethernet) Writes – Enable or Disable writes from this link

- Link Status: This will indicate Green if the Modbus communication link is healthy – when off the Alarm will annunciate that this link has been lost.

- Exception Error: This will indicate TRUE if an exception error is found in the transmitted data.

- Error Code: This indicates the cause of the exception error. The following list shows the error codes and their meanings.
  1 =　Illegal Function: The message function is not an allowable action.
  2 =　Illegal Data Address: The message start address is not an allowable address.
  3 =　Illegal Data Value: Amount of data requested from slave to too large for slave to return (our maximum is 118 registers)
  9 =　Checksum Error: The received message had an incorrect error check code.
  10 = Garbled Message: The received message could not be decoded.

- Time-out Delay: This indicates the amount of time that the link will attempt to communicate before annunciating that a link error exists.

Modbus Addresses

The Modbus communication port has address locations for the analog and Boolean reads and writes. The Boolean reads and writes are also referred to as input and holding coils. The analog reads are also referred to as input registers. Following is a list of these register values along with a brief description of the parameter.

Boolean Writes (holding coils)—Holding coils are logical signals that are both readable from and writable to the Peak200 control. The holding coils available are listed below. A logical true denoted by the value 1 will cause the command listed in the description to be executed. For example, if a 1 is written to address 0:0001, the manual speed set point will increase until a 0 is written to address 0:0001. The Peak200 control supports function codes 1, 5, and 15. These correspond to reading selected holding coils, writing to a single holding coil, and writing to multiple holding coils, respectively.

Table 6-5. Available Holding Coils

Address	Description
0:0001	Raise Speed Setpoint
0:0002	Lower Speed Setpoint
0:0003	Emergency Shutdown
0:0004	System Reset
0:0005	Start / Run
0:0006	Go To Min Governor
0:0007	Go To Idle
0:0008	Enable Remote Speed SP
0:0009	Disable Remote Speed SP
0:0010	Raise (Open) Valve Limiter
0:0011	Lower (Close) Valve Limiter
0:0012	Raise Process/Cascade Setpoint
0:0013	Lower Process/Cascade Setpoint
0:0014	Enable Remote CASC SP
0:0015	Disable Remote CASC SP
0:0016	Enable Process/CASC Control
0:0017	Disable Process/CASC Control
0:0018	Go to Entered Speed Setpoint
0:0019	Go to Entered Cascade Setpoint
0:0020	External Heartbeat Pulse
0:0021	Initiate Controlled Shutdown
0:0022	Abort Controlled Shutdown

IMPORTANT   **The functional block diagram (Chapter 2) shows all Modbus communications inputs and outputs to the Peak200 control's software. It shows both the functional location of the parameter as well as the Modbus address. This information is shown with the symbol xx where xx is the Modbus address.**

Boolean Reads (input coils)—Input coils are logical signals that are readable from but not writable to the Peak200 control. The input coils available are listed below. The input coil will have the value 1 if the statement in the description column is true and a 0 if false. The "1:" term in the address identifies an input coil. The Peak200 control supports MODBUS function code 2, which involves reading selected input coils.

Table 6-6. Available Input Coils

Address	Description	Block Output Name (for OPC)
1:0001	Shutdown Exists (Trip Indication)	SHUTDOWNS.ANY_SD.B_NAME
1:0002	Alarm Exists (Common Alarm Indication)	ALARMS.ANY_ALM.B_NAME
1:0003	Alarm - MPU #1 Failed	ALARMS.ANY.SEL_1
1:0004	Alarm - MPU #2 Failed	ALARMS.ANY.SEL_2
1:0005	Turbine is Tripped	ALARMS.ANY.SEL_3
1:0006	Trip - External Trip	SHUTDOWNS.ANY.SEL_1
1:0007	Trip - Loss of Speed Signals	SHUTDOWNS.ANY.SEL_4
1:0008	Trip - Overspeed Trip	SHUTDOWNS.ANY.SEL_3
1:0009	Trip - ESD Button	SHUTDOWNS.ANY.SEL_2
1:0010	Trip - From Modbus	
1:0011	Remote Speed Setpt Is Enabled	IFACE_OUT_SPEED.RMT_SPD_ENABLED.B_NAME
1:0012	Remote Speed Setpt Is Active	IFACE_OUT_SPEED.RMT_SPD_ACTIVE.B_NAME
1:0013	HSS/LSS Remote Control	
1:0014	Ramping to Min Governor	SPDC.A07_STEP.SFC_STEP
1:0015	Ramping to Idle	SPDC.A01_STEP.SFC_STEP
1:0016	Overspeed Test In progress	IFACE_OUT_SPEED.OSPD_TEST_EN.B_NAME
1:0017	Speed PID In Control	IFACE_OUT_VLV.ACT_LSS_SEL_1.B_NAME
1:0018	Speed Sensor Failed Overide ON	MPU_OVRD.OVRD1_OR.OR
1:0019	Alarm - Cascade Input Failed	ALARMS.ANY.SEL_7
1:0020	Alarm - Stuck in Critical Alarm	ALARMS.ANY.SEL_67
1:0021	Remote Speed Setpt Is In Control	MESSAGE.RMT_IN_CTL.AND
1:0022	Remote Speed Setpt Is Inhibited	RMT_ENBL.RMT_SPD_INH.AND
1:0023	Cascade Is Enabled	IFACE_OUT_CASC.ENABLED.B_NAME
1:0024	Cascade Is Active	IFACE_OUT_SPEED.CASCADE_ENABLED.B_NAME
1:0025	Cascade Is In Control	MESSAGE.CASC_CTL_DELAY.DELAY
1:0026	Cascade Is Inhibited	CASC_ENBL.INHIBITED.LATCH1
1:0027	Rmt Cascade Is Enabled	IFACE_OUT_CASC.RMT_CAS_EN.B_NAME
1:0028	Rmt Cascade Is Active	IFACE_OUT_CASC.REM_CAS_SEL.B_NAME
1:0029	Rmt Cascade Is In Control	MESSAGE.CASC_RMT_DELAY.DELAY
1:0030	Rmt Cascade Is Inhibited	RMT_CAS_EN.RCASC_IH.LATCH1
1:0031	VLV Limiter Is Open	HP_LIMTER.AT_MAX.OR
1:0032	VLV Limiter Is Closed	HP_LIMTER.HP_RAMP.P_LIM_1
1:0033	VLV Limiter In Control	IFACE_OUT_VLV.ACT_LSS_SEL_2.B_NAME
1:0034	Ready to Start	IFACE_OUT_START.SD_CLEAR.B_NAME
1:0035	Discrete Input 1 State	CNFG_BI.BI_01_FLEX.BI_FLEX
1:0036	Discrete Input 2 State	CNFG_BI.BI_02_FLEX.BI_FLEX
1:0037	Discrete Input 3 State	CNFG_BI.BI_03_FLEX.BI_FLEX
1:0038	Discrete Input 4 State	CNFG_BI.BI_04_FLEX.BI_FLEX
1:0039	Discrete Input 5 State	CNFG_BI.BI_05_FLEX.BI_FLEX
1:0040	Discrete Input 6 State	CNFG_BI.BI_06_FLEX.BI_FLEX
1:0041	Discrete Input 7 State	CNFG_BI.BI_07_FLEX.BI_FLEX
1:0042	Discrete Input 8 State	CNFG_BI.BI_08_FLEX.BI_FLEX

Address	Description	Block Output Name (for OPC)
1:0043	Relay Output 1 State	CNFG_BO.RELAY_1.DISPLAY
1:0044	Relay Output 2 State	CNFG_BO.RELAY_2.DISPLAY
1:0045	Relay Output 3 State	CNFG_BO.RELAY_3.DISPLAY
1:0046	Relay Output 4 State	CNFG_BO.RELAY_4.DISPLAY
1:0047	LN Node 4 DI 1 State	MOD_LN_IO.LN_B_STATES.LIST_1
1:0048	LN Node 4 DI 2 State	MOD_LN_IO.LN_B_STATES.LIST_2
1:0049	LN Node 4 DI 3 State	MOD_LN_IO.LN_B_STATES.LIST_3
1:0050	LN Node 4 DI 4 State	MOD_LN_IO.LN_B_STATES.LIST_4
1:0051	LN Node 4 DI 5 State	MOD_LN_IO.LN_B_STATES.LIST_5
1:0052	LN Node 4 DI 6 State	MOD_LN_IO.LN_B_STATES.LIST_6
1:0053	LN Node 4 DI 7 State	MOD_LN_IO.LN_B_STATES.LIST_7
1:0054	LN Node 4 DI 8 State	MOD_LN_IO.LN_B_STATES.LIST_8
1:0055	LN Node 4 DI 9 State	MOD_LN_IO.LN_B_STATES.LIST_9
1:0056	LN Node 4 DI 10 State	MOD_LN_IO.LN_B_STATES.LIST_10
1:0057	LN Node 4 DI 11 State	MOD_LN_IO.LN_B_STATES.LIST_11
1:0058	LN Node 4 DI 12 State	MOD_LN_IO.LN_B_STATES.LIST_12
1:0059	LN Node 4 DI 13 State	MOD_LN_IO.LN_B_STATES.LIST_13
1:0060	LN Node 4 DI 14 State	MOD_LN_IO.LN_B_STATES.LIST_14
1:0061	LN Node 4 DI 15 State	MOD_LN_IO.LN_B_STATES.LIST_15
1:0062	LN Node 4 DI 16 State	MOD_LN_IO.LN_B_STATES.LIST_16
1:0063	LN Node 5 DO 1 State	MOD_LN_IO.LN_B_STATES.LIST_17
1:0064	LN Node 5 DO 2 State	MOD_LN_IO.LN_B_STATES.LIST_18
1:0065	LN Node 5 DO 3 State	MOD_LN_IO.LN_B_STATES.LIST_19
1:0066	LN Node 5 DO 4 State	MOD_LN_IO.LN_B_STATES.LIST_20
1:0067	LN Node 5 DO 5 State	MOD_LN_IO.LN_B_STATES.LIST_21
1:0068	LN Node 5 DO 6 State	MOD_LN_IO.LN_B_STATES.LIST_22
1:0069	LN Node 5 DO 7 State	MOD_LN_IO.LN_B_STATES.LIST_23
1:0070	LN Node 5 DO 8 State	MOD_LN_IO.LN_B_STATES.LIST_24
1:0071	LN Node 5 DO 9 State	MOD_LN_IO.LN_B_STATES.LIST_25
1:0072	LN Node 5 DO 10 State	MOD_LN_IO.LN_B_STATES.LIST_26
1:0073	LN Node 5 DO 11 State	MOD_LN_IO.LN_B_STATES.LIST_27
1:0074	LN Node 5 DO 12 State	MOD_LN_IO.LN_B_STATES.LIST_28
1:0075	LN Node 5 DO 13 State	MOD_LN_IO.LN_B_STATES.LIST_29
1:0076	LN Node 5 DO 14 State	MOD_LN_IO.LN_B_STATES.LIST_30
1:0077	LN Node 5 DO 15 State	MOD_LN_IO.LN_B_STATES.LIST_31
1:0078	LN Node 5 DO 16 State	MOD_LN_IO.LN_B_STATES.LIST_32
1:0079	Controlled Stop In Progress	SPDC.Z01_STEP.SFC_STEP
1:0080	Moving to Min Setpoint	START.IDLE.OR
1:0081	Trip - Normal Stop Complete	SHUTDOWNS.ANY.SEL_25
1:0082	Control Heartbeat (2 sec on/off)	IFACE_MODE.GAP_HEARTBEAT.B_NAME
1:0083	Analog Input Chan 1 Failed	CNFG_AI.AI_01.CHN_FLT_OUT
1:0084	Analog Input Chan 2 Failed	CNFG_AI.AI_02.CHN_FLT_OUT
1:0085	Analog Input Chan 3 Failed	CNFG_AI.AI_03.CHN_FLT_OUT
1:0086	Analog Input Chan 4 Failed	CNFG_AI.AI_04.CHN_FLT_OUT
1:0087		
1:0088		

Analog Reads (input registers)—Input registers are analog values that are readable from but not writable to the Peak200 control. The input registers available are listed below. The value of the input registers are stored internal to the control as floating point numbers representing engineering units (i.e., rpm). The values that are transmitted are integer values ranging from -32767 to +32767. The Peak200 control supports MODBUS function code 4, which involves reading selected input registers.

Table 6-7. Available Input Registers

Address	Description	Block Output Name (for OPC)
3:0001	Actual Turbine Speed (RPM)	MPU.TURB_SPD.A_NAME
3:0002	Speed Setpoint (RPM)	SPD_CTRL.SPD_SETPT.A_NAME
3:0003	Remote Speed Setpoint	IFACE_OUT_SPEED.RMT_SPD_INPUT.A_NAME
3:0004	Remote Speed Setpoint Input	AI_MUX.RMT_SPD_SP.A_NAME
3:0005	VLV Limiter Output x 100	MOD_SCALE.VLV_100.MULTIPLY
3:0006	Speed PID Output (%) x100	MOD_SCALE.SPD_100.MULTIPLY
3:0007	HP Actuator Demand (%) x100	MOD_SCALE.ACT1_HSS.MULTIPLY
3:0008	Process/Cascade PID Output (%) x100	MOD_SCALE.CASC_100.MULTIPLY
3:0009	Process/Cascade Process Value	IFACE_IN_CASC.CASC_IN_NAME.A_NAME
3:0010	Process/Cascade Setpoint	IFACE_OUT_CASC.CASC_SP.A_NAME
3:0011	MPU Speed Signal 1	CNFG_SPEED.TSS_01.MONITOR
3:0012	MPU Speed Signal 2	CNFG_SPEED.TSS_02.MONITOR
3:0013	Analog Input 1 Value	CNFG_AI.AI_01.VALUE_OUT
3:0014	Analog Input 2 Value	CNFG_AI.AI_02.VALUE_OUT
3:0015	Analog Input 3 Value	CNFG_AI.AI_03.VALUE_OUT
3:0016	Analog Input 4 Value	CNFG_AI.AI_04.VALUE_OUT
3:0017	Actuator Output (mA x100)	MOD_IO.ACT1_100.MULTIPLY
3:0018	Analog Output 1 Value	CNFG_AO.AO_01.VALUE_OUT
3:0019	Analog output 2 Value	CNFG_AO.AO_02.VALUE_OUT
3:0020	Analog Output 3 Value	CNFG_AO.AO_03.VALUE_OUT
3:0021	LN Node 1 Analog Input 1 Val	MOD_LN_IO.LN_A_VALUES.LIST_1
3:0022	LN Node 1 Analog Input 2 Val	MOD_LN_IO.LN_A_VALUES.LIST_2
3:0023	LN Node 1 Analog Input 3 Val	MOD_LN_IO.LN_A_VALUES.LIST_3
3:0024	LN Node 1 Analog Input 4 Val	MOD_LN_IO.LN_A_VALUES.LIST_4
3:0025	LN Node 1 Analog Input 5 Val	MOD_LN_IO.LN_A_VALUES.LIST_5
3:0026	LN Node 1 Analog Input 6 Val	MOD_LN_IO.LN_A_VALUES.LIST_6
3:0027	LN Node 1 Analog Input 7 Val	MOD_LN_IO.LN_A_VALUES.LIST_7
3:0028	LN Node 1 Analog Input 8 Val	MOD_LN_IO.LN_A_VALUES.LIST_8
3:0029	LN Node 1 Analog Output 1 Val	MOD_LN_IO.LN_A_VALUES.LIST_9
3:0030	LN Node 1 Analog Output 2 Val	MOD_LN_IO.LN_A_VALUES.LIST_10
3:0031	LN Node 3 RTD Input 1 Temp	MOD_LN_IO.LN_A_VALUES.LIST_11
3:0032	LN Node 3 RTD Input 2 Temp	MOD_LN_IO.LN_A_VALUES.LIST_12
3:0033	LN Node 3 RTD Input 3 Temp	MOD_LN_IO.LN_A_VALUES.LIST_13
3:0034	LN Node 3 RTD Input 4 Temp	MOD_LN_IO.LN_A_VALUES.LIST_14
3:0035	LN Node 3 RTD Input 5 Temp	MOD_LN_IO.LN_A_VALUES.LIST_15
3:0036	LN Node 3 RTD Input 6 Temp	MOD_LN_IO.LN_A_VALUES.LIST_16
3:0037	LN Node 3 RTD Input 7 Temp	MOD_LN_IO.LN_A_VALUES.LIST_17
3:0038	LN Node 3 RTD Input 8 Temp	MOD_LN_IO.LN_A_VALUES.LIST_18
3:0039	First Out Alarm	ALARMS.FIRSTOUT_A.OUT_1

Address	Description	Block Output Name (for OPC)
3:0040	First Out Trip	SHUTDOWNS.FIRSTOUT_A.OUT_1
3:0041	Turbine Starts Counter	COND_MON.STRT_TURB.A_NAME
3:0042	Total TRIPS Counter	COND_MON.SD_NUM.A_NAME
3:0043	TRIPS with Load/Valve > 25%	COND_MON.SDLOAD1_NUM.A_NAME
3:0044	TRIPS with Load/Valve > 75%	COND_MON.SDLOAD2_NUM.A_NAME
3:0045	Overspeed TRIPS Counter	COND_MON.OSPD_NUM.A_NAME
3:0046	Total Run Time Hours	COND_MON.TRUNHRS.A_NAME
3:0047	Total Run Hours with Load/Valve > 25%	COND_MON.TRUNLDHRS.A_NAME
3:0048	Total Run Hours with Load/Valve > 75%	COND_MON.TRUNLD2HRS.A_NAME
3:0049	Spare_49	
3:0050	Spare_50	

Analog Writes (holding registers)—Holding registers are analog values that are readable from and writable to the Peak200 control. The holding registers available are listed below. The values transmitted are integer values ranging from -32767 to + 32767. The Peak200 control supports Modbus function codes 3, 6, and 16. These correspond to read analog output, write single analog output, and write analog outputs respectively.

Table 6-8. Available Holding Registers

Address	Description	Multiplier
4:0001	Modbus Entered Speed Setpoint	'(1)
4:0002	Modbus Entered Casc Setpoint	'(1)
4:0003		'(1)
4:0004		'(1)
4:0005		'(1)

Chapter 7.
Service Menus

Introduction

Before running the turbine, the Peak200 control must be configured (see Program Mode Worksheets in the Appendix). After the initial configuration of the unit is complete, the SERVICE MODE parameters can be viewed and adjusted while the turbine is running.
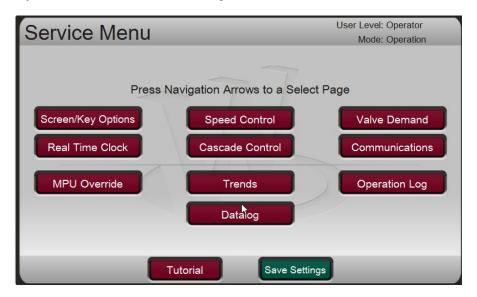
Figure 7-1. Service Menu

Screen/Key Options Menu

This menu is used to set the Service mode parameters. These values can be adjusted while the turbine is running.

- Screen Saver Delay (hr)   (*4.0 0.01, 24)
  After this amount of time with no keypad commands – activate screen saver

- Disable Screen Saver   (No Y/N)
  Fully deactivates the screen saver

- Disable Dimming   (No Y/N)
  Fully deactivates the screen dimming feature

- Auto Login as Operator / Password   (Yes – wg1111)
  If NO – auto login will be as User Level = Monitor

- Blink Alarm LED upon New Alarm   (No Y/N)
  If YES – each new alarm will cause LED and Relay to blink whenever a new alarm is triggered

- Internal Operating Temp (degrees C)   (*status indication only*)
  Shows internal temperature of the control

- Screen Brightness Level (%)   (*status indication only*)
  Adjusted with keypad brightness & adjust keys

- Use 2-second delay on TRIP key?   (No Y/N)
  If yes – then the TRIP key must be held down for 2 seconds before unit will TRIP

- Use RemoteView TRIP   (No Y/N)
  If yes – then the TRIP command button from the Remote View will be active

- Switch to Different Screen after Boot-up   (No Y/N)
   If selected a menu list will appear for choosing a page that the unit will switch to after it completes a
   boot-up cycle (either a power cycle, .wgui restart, or exiting IOLOCK)

- Select Screen
  User can select Overview, Speed Control, Valve Demand, Controllers or Distance View

- Enable TRIP on Power-up   (No Y/N)
  Defaulted to True, unchecking this will disable the TRIP condition that is set upon power-up and
  initialization of the control. Unique applications may require this, but it is recommended to be left
  checked so that the event log files will show this as a clear indication the control went through a
  power cycle.

- Have TRIP also trigger an Alarm?   (No Y/N)
  Defaulted to false, which prevents any Trip event from also triggering an alarm annunciation.
  Checking this will enable alarm event ID 3 "Turbine Tripped", whenever a Trip occurs.

- CPU Idle Time (%)   (*status indication only*)
   This value indicates how much 'extra' free run time the CPU must handle task such as Ethernet
   communications or responding to the front panel display and keypad. If this value is below 10%,
   then it is possible that network problems may be present and slowing down the control's
   communications. This value has no effect on the Peak200's control of the turbine or I/O functions.

Speed Control Menu

This menu is used to set the Service mode parameters. These values can be adjusted while the turbine is
running.

- Rate to Minimum Governor Speed   _____
  Rate in rpm/sec of speed setpoint ramp up to MinGov speed

- Slow Rate Offline (rpm/sec)   _____
  Rate in rpm/sec of speed setpoint adjustment when offline

- Slow Rate Online (rpm/sec)   _____
  Rate in rpm/sec of speed setpoint adjustment when online

- Fast Rate Delay (sec)   _____
  If discrete raise or lower command is held continuous for more than this time the rate will changed
  from slow to fast

- Fast Rate Offline (rpm/sec)   _____
  Fast Rate of speed setpoint adjustment when offline

- Fast Rate Online (rpm/sec)   _____
  Fast Rate of speed setpoint adjustment when online

- Hot Start Multiplier   _____
  Set the multiplier on the Rate To Minimum when a Hot Start is selected.

- Entered Setpoint Go To Rate (rpm/sec)   _____

Rate of speed setpoint ramp to entered value
- Underspeed Setting   _____
- Speed setpoint for activating the Underspeed switch relay output

- Enable the Underspeed condition to generate an Alarm?   (No Y/N)
  If yes – then this event will cause an alarm (Event ID 58)

- Enable the Underspeed condition to generate a TRIP?   (No Y/N)
If yes – then this event will cause a TRIP (Event ID 26)
- Online Speed Deadband   _____
  Adds a deadband (in rpm) to the PID control

- Speed Droop (%)   _____
  Adds actuator droop (converted to rpm) to the PID control. It will calculate the droop value as
  Droop% * Min Gov Setpoint * Valve Demand and subtract this value from the setpoint. This is
  typically left at 0% (default) for mechanical drive applications. When this is used – an offset will
  always exist between the Setpoint and the Speed.

- Display Gauge Multiplier   _____
  Changes the multiplier on the Speed Control speed indication gauge

- Speed Switch to Online dynamics   _____
  Speed at which speed control dynamics switch from Offline to Online

- Use Reduced Overspeed Setpoint   _____
  Allows the use of a separate variable for overspeed tests and enables Overspeed Trip function within
  the MinGov to Max Gov speed range

- Reduced Overspeed Setpoint (rpm)   _____
  Temporary overspeed trip value – control will only allow this value to be equal to or lower than the
  configured Overspeed trip setting

- MPU Speed difference alarm setpoint (rpm)   _____
  If configured to use 2 MPU signals, an alarm will be triggered if the speed signals differ by this
  amount or greater

- Enable Normal Stop from Overview Page?   (No Y/N)
  If yes – a button to open the Normal Stop function will appear on the Overview screen, if unchecked
  then the button will not be visible

- Speed setpoint normal stop ramp rate (rpm/sec)   _____
  Rate at which the speed setpoint will decrease when control is in a Normal Stop sequence

Valve Demand Menu

This menu is used to set the Service mode parameters. These values can be adjusted while the turbine is
running.

- HP Limiter Maximum (%)   _____
  Sets the upper limit of the valve limiter demand

- HP Limiter Entered Value Rate (%/sec)   _____
  Rate in %/sec of the valve limiter ramp to an entered value

- HP Limiter Raise/Lower Rate (%/sec)   _____
  Rate in %/sec of the valve limiter ramp to raise/lower commands

- Use HP Start Limiter?   _____
  Limits the valve limiter output until speed control is reached – once in speed control the limiter will automatically ramp up to the maximum

- HP Max Limiter on Start (%)   _____
  Sets the upper limit of the valve limiter demand until speed control is reached

- Use HP Manual Valve Demand   _____
  Allows temporary manual valve control for troubleshooting

- HP Manual Demand Rate (%/sec)   _____
  Rate at which ramp adjustments to the manual valve demand will move

- Manual Demand Timeout Limit (sec)   _____
  Time after which manual demand will automatically be disabled

Real Time Clock Menu

This menu is used to set the Service mode parameters for the real time clock functionality. These values can be adjusted while the turbine is running.

- Use SNTP Synchronization?   _____
  Yes to use – must have an Ethernet connection to the plant LAN
  No – set time manually from this page

- Time Zone   _____
  Rate in rpm/sec of speed setpoint adjustment when offline
  ** If a Half hour is required to match your time zone – use the Winpanel tool in Control Assistant and adjust the following parameter to *TRUE
  (PEAK200_IO.USE_HALF.CTRL)

- SNTP IP address   _____
  Set the LAN IP address for the clock synchronization

- SNTP Rate (sec)   _____
  Set time rate at which the control will sync to the LAN clock

- SNTP Timeout (sec)   _____
  Set the timeout for a fault indication if no LAN sync is received (should be equal to or longer than SNTP Rate)

- SNTP Fault   (***status indication only***)
  Status of the SNTP connection from control to LAN

  If SNTP is not used -
- Year   _____
  Set the year for the real time clock

- Month   _____
  Set the month for the real time clock

- Day   _____
  Set the day for the real time clock

- Hour   _____
  Set the hour for the real time clock

- Minutes   _____
  Set the minutes for the real time clock

- Seconds   _____
  Set the seconds for the real time clock

Once the above values are set, the SET CLOCK soft key button will set the control real time clock to these settings. If a discrete input pulse is used (instead of SNTP) to synchronize the Peak200 clock with other devices, set the Hours/Minutes/Seconds to the correct time this pulse will be received and then Save Settings with this value.

For example, if the DI sync pulse will be sent to the control every day at 2:30 am, then set the Hours to 2, Minutes to 30 and Seconds to 0.

Cascade Control Menu

This menu is used to set the Service mode parameters of the Process/Cascade control loop, if configured to use this option. These values can be adjusted while the turbine is running.

- Slow Rate (units/sec)   _____
  Rate in units/sec of cascade setpoint adjustment

- Fast Rate Delay (sec)   _____
  If discrete raise or lower command is held continuous for more than this time, the rate will change from slow to fast

- Fast Rate (units/sec)   _____
  Fast Rate of cascade setpoint adjustment

- Entered Rate (units/sec)   _____
  Rate of cascade setpoint ramp to the entered value

- Droop (%)   _____
  Percent of droop added to process signal (this will create an offset between the control PV and the actual setpoint)

- Rated Cascade Setpoint (units)   _____
  If droop is used, the setpoint for maximum % setting

- Cascade Not Matched Rate (units/sec)   _____
  Rate at which setpoint will move when remote setpoint does not equal the current setpoint

- Maximum Speed Rate (rpm/sec)   _____
  Maximum rate that process/cascade output will move the speed setpoint ramp

- Minimum Speed Setpoint (rpm)   _____
  Lowest speed to which the cascade output can drive speed setpoint

- Maximum Speed Setpoint (rpm)   _____
  Highest speed to which the cascade output can drive speed setpoint

- Cascade Deadband (%)   _____
  Percent deadband of process value to cascade PID

- Display Gauge Multiplier   _____
  Changes the multiplier on the Cascade Control process variable indication gauge

Communications Menu

This menu is used to set the Service mode parameters of the communication ports. These values can be adjusted while the turbine is running.

- Use Modbus Trip   _____
  Enable (Yes) or Disable (No) allowing a TRIP command from the Modbus link

- Enable Link 1 (Serial) Writes?   _____
  Allows write commands to be entered from this device

- Enable Link 2 (Ethernet) Writes?   _____
  Allows write commands to be entered from this device

- Time out delay for Link 1 (Serial)   _____
  This indicates the amount of time that the link will attempt to communicate before annunciating that a link error exists.

- Time out delay for Link 2 (Ethernet)   _____
  This indicates the amount of time that the link will attempt to communicate before annunciating that a link error exists.

MPU Override Menu

This menu is used to set the Service mode parameters of the MPU override actions. These values can be adjusted while the turbine is running.

- Use MPU Override Timer?   _____
  Enables the use of override timer once Start has been initiated

- Override Time (sec)?   _____
  Sets the time the override will be active once Start has been initiated

- Override Time remaining (status only)   _____
  Enables the use of override timer once Start has been initiated

- Use Rolldown Override?   _____
  Enables the use of the rolldown override during a controlled shutdown

- Rolldown Speed (rpm)   _____
  Speed at which the override will come on (must be above failed speed level)

- Rolldown Delay (sec)?   _____
  Speed must be below rolldown speed for this amount of time before override will come on

- Status of MPU Override is also shown

Operation Log Menu

This menu has accumulated turbine operational information. These values are maintained during power cycles and are only lost if the GAP application is updated (by a service pack/service bulletin) or if the control fails.

These values can be preset or overwritten in configuration mode. For example, to track turbine operation between outages or overhauls or to preset the values for a spare unit if the control is updated or replaced.

- Number of Turbine Starts   (***status indication only***)
  Total number of turbine starts

- Total of Turbine Trips   (***status indication only***)
  Total number of turbine trips

- Total of Turbine Trips with Load/Valve > 25%   (***status indication only***)
  Total number of turbine trips at low load

- Total of Turbine Trips with Load/Valve > 75%   (***status indication only***)
  Total number of turbine trips at high load

- Overspeed Trips   (***status indication only***)
  Total number of turbine overspeed trips

- Total Run Time Hours   (***status indication only***)
  Total hours of turbine runtime

- Run Time Hours with Load (Valve) > 25%   (***status indication only***)
  Total hours of turbine runtime at low load

- Run Time Hours with Load (Valve) > 75%   (***status indication only***)
  Total hours of turbine runtime at high load

- Peak Speed Reached   (***status indication only***)
  Maximum speed registered by the control

- Maximum Acceleration Reached   (***status indication only***)
  Maximum acceleration registered by the control

Chapter 8.
Troubleshooting

General

This manual documents most problems you will encounter. Use the index to locate the sections of the manual that may describe your problem. This troubleshooting section contains a description of the diagnostic programs as well as a few troubleshooting guidelines that our field service technicians and engineers have suggested.

User Level Password

Operator –   **Default password:**   wg1111
Intended for normal turbine operation – default mode
Screen saver initiates to this level

Service –   **Default password:**   wg1112
Allows tuning of parameters, while turbine is running (PID dynamics) and entering of Calibration Mode

Configure –   **Default password:**   wg1113
Highest user authority / can enter any Mode

ServiceUser –
Login as ServiceUser (no autofill key available must be entered manually):
        Login: ServiceUser
        Password: ServiceUser@1

This is the highest level of authority in the control program and will give access to all available parameters that are found in Service and Configure user levels.

Diagnostics

If after power-up if the correct bootup sequence (as shown in Power Up Screen section of Chapter 5) is not successful, the following information can be helpful in troubleshooting the most probable cause of the problem.

Hardware or Operating System Problems
When the control is powered on the microprocessor will begin executing a variety of internal diagnostic checks, initialize the OS and launch the application software programs. Initially the front panel CPU LED will be RED, once the complete boot-up is complete this LED will illuminate. The CPU LED remains on as long as the microprocessor is running. This LED is controlled in hardware by a watchdog timer circuit and under normal operating conditions, should never turn off. If an error is found during bootup, or if during operation the microprocessor stops executing at any time, the watchdog timer will time out and the CPU LED will turn to RED. If this happens the I/O Lockout will be activated, which will also illuminate RED, all discrete outputs and all analog outputs.

The CPU board runs diagnostics that display troubleshooting messages through the debug Service Port and AppManager. Additional information on diagnostics tests, subsequent LED flash codes, and serial port messages is contained in the VxWorks manual.

Table 8-1 shows the CPU fault LED flash codes:

Table 8-1. CPU LED Flash Codes

Failure	Flash Code
CPU not operational, IOLOCK state	Solid Red
RAM Test Failure	2, 1
FPGA Test Failure	2, 9
Watchdog not enabled	2, 10
RAM drive error	2, 11
Flash drive error	2, 12

If the CPU LED is RED or flashing, the only way to re-boot the microprocessor is to turn off the power to the control and then turn the power back on.

Application Software Problems

When the control is powered on or when it is rebooting after being configured, the software performs several diagnostic tests. If an application software problem is found during this testing, the CPU LED on the front panel will be GREEN, but the IOLOCK LED is RED. The control will annunciate the error by sending specific messages to a system log file that can be accessed with AppManager. Some of the messages will appear in the status window of AppManager which could help troubleshoot the issue.

If after rebooting, the CPU LED on the front panel is GREEN, the IOLOCK LED is off, but the display shows the 'splash screen' or it shows red X's and question marks where the parameter data should be (as shown below), this indicates a problem with launching of the display application software (GUI). Connect the AppManager program and switch to the GUI view window to access information as to the probable cause.

Figure 8-1. GAP-to-GUI Communication Problem

The software in this control is user configurable. Before running the control, make sure that the software is configured properly for your application. See Chapter 4. The chart below gives specific steps for troubleshooting possible symptoms.

Troubleshooting Chart

Symptom:
All keypad LED's are off and display is blank.

Possible Causes:
- Power supply input wiring is incorrect.
- Power supply input voltage is not present.
- Power supply fuse is blown.

Solution:
Check the possible causes listed above.

Symptom:
CPU LED is GREEN, IOLOCK LED is RED, and GUI screen shows RED locks where data should be

Possible Causes:
- GAP Control Application program is stopped
- GAP Control Application program is not running due to a fault
- The microprocessor has stopped because of a hardware failure.

Solutions:
- Check the application status using AppManager to connect to the control.
- Start the application, it may have been stopped to configure LAN settings or to install a service pack or new application
- If status box shows application error – use AppManager to 'Retrieve System Log Files'
- Cycle the input power off for several seconds and then back on. If the unit does not successfully reboot, then the hardware has failed and must be returned to the factory.

Symptom:
Discrete outputs are not operating correctly.

Possible Causes:
- Incorrect wiring.
- The IOLOCK LED is on activating the I/O Lock mechanism.
- The Normally Open/Normally Closed jumper options are not properly selected.
- +24 Volt power supply is shorted or bad.
- The software is not configured properly.

Solutions:
- Remove the wiring and use an ohmmeter to check for proper contact closure. If the meter indicates the output is working properly, then there is a problem with the field wiring.
- Check the IOLOCK LED on the front door. If it is on, determine if unit is in Configuration Mode or if application is running (using AppManager).
- Check the software to see what control is telling the outputs to do. Go to Relays from the HOME page and view the status LED of each channel. Also look at the Details of any specific channel in question to verify whether the active state of the Function defined as been inverted.
- Use the Calibration mode to Force the relay state output and verify proper functioning of the internal relay.

Symptom:
Discrete inputs are not operating correctly.

Possible Causes:
- Incorrect wiring.
- The internal +24 Volt power supply is shorted or bad.
- The external power supply is bad or is wired incorrectly.

Solutions:
- Make sure that the wiring is correct. Refer to Figures x-x and x-x to see how the contacts and power supplies should be wired.
- If the internal +24 V power supply is used, check the voltage at the Discrete Input (DIN) terminal block connectors as per the wiring label.
- If an external power supply is used, check it to make sure the voltage is correct. Refer to Figures x-x and x-x to see how the contacts and power supplies should be wired.
- Check the software to see what it senses at the inputs. Go to Contact Inputs from the HOME page and view the status LED of each channel. Also look at the Details of any specific channel in question to verify whether the active state of the Function defined as been inverted

Symptom:
Analog outputs are not operating correctly.

Possible Causes:
- Incorrect wiring.
- The IOLOCK LED is on, activating the I/O Lock mechanism.
- Excessive load at device end (600 ohm max)
- The software is not configured properly.

Solutions:
- Make sure that the wiring is correct. Refer to Figure x-x to see how the analog outputs should be wired.
- Remove the wiring from these terminals and check /verify that the +24 V power supply voltages at the AO terminal block is present with no wires connected to the field. If it is correct, the field wiring is shorting it out.
- Check the front IOLOCK LED. If on, the unit is in IOLOCK due to being in Configuration mode or IOLOCK has been initiated by a hardware fault. Cycle the input power and verify if the unit reboots properly. This will reset the I/O Lock mechanism.
- Check what the software is telling the outputs to do. Go to Analog Outputs from the HOME page and view the status LED and current readback value of each channel.
- Use the Calibration mode to Force the analog output and verify proper functioning of the channel in question

Symptom:
Actuator output is not operating correctly.

Possible Causes:
- Incorrect wiring.
- +24 Volt power supply is shorted or bad.
- The IOLOCK LED is on, activating the I/O Lock.
- The 0–200 mA/0–20 mA configuration option is not properly selected.
- Excessive load at device end (600 ohms low range / 65 ohms high range)
- The software is not configured properly.

Solutions:
- Make sure that the wiring is correct. Refer to Figure x-x to see how the actuator output should be wired.
- Check the front IOLOCK LED. If on, the unit is in IOLOCK due to being in Configuration mode or IOLOCK has been initiated by a hardware fault. Cycle the input power and verify if the unit reboots properly. This will reset the I/O Lock mechanism.
- Check the configuration of the current range to make sure it is correct.
- Remove the wiring from these terminals and check /verify that the +24 V power supply voltages at the ACT terminal block is present with no wires connected to the field. If it is correct, the field wiring is shorting it out.
- Check the software to see what it is telling the output to do. Go to Driver menu from the HOME page and view the status LED and current readback value of each channel.
- Use the Calibration mode to Force the actuator driver output and verify proper functioning of the channel in question

Symptom:
Speed sensor inputs are not operating correctly.

Possible Causes:
- Incorrect wiring.
- The magnetic pickup is not functioning properly. Only MPU's are supported
- Configuration of teeth/gear ratio is incorrect

Solutions:
- Make sure that the wiring is correct. Refer to Figure xx-xx to see examples of recommended speed sensor inputs wiring.
- Check the magnetic pickup. It must provide at least a 200 Hz, 1 Vrms signal. If the voltage is low adjust the gap on the probe to increase the signal voltage.
- Check the software to see what it senses at the inputs. To do this, go to the Analog Inputs/Speed Signal menu from the HOME page and view the current values seen by the control. Use a calibrated frequency generated signal to confirm the control input.

Symptom:
Analog input is not operating correctly.

Possible Causes:
- Incorrect wiring.
- The 4–20 mA option for internal loop power or external power are not properly selected.
- External power supply is bad.

Solutions:
- Make sure that the wiring is correct. Refer to Figure xx-x to see how the analog inputs should be wired.
- Check/verify that the correct configuration option is selected as loop powered for internal power (from control) or unselected for self-powered or externally powered transmitters.
- If internal power is used (loop powered = yes), remove the wiring from these terminals and check /verify that the +24 V power supply voltage exists at the AIN terminal block (P and -) is present with no wires connected to the field. If it is correct, the field wiring is shorting it out.
- Check the software to see what it senses at the input. To do this, go to the Analog Inputs menu from the HOME page and view the current values seen by the control for the channel in question.
- If external power is used for the transmitter, use a mA current source meter to verify the signal and correct range into the control. If this operates correctly, the issue is in the field side of the wiring or the transmitter device.

Symptom:
Operator Control Panel not operating correctly.

Possible Causes:
- Screen brightness has been reduced too low
- GUI application was stopped via AppManager (perhaps to change languages)
- GUI application did not initialize correctly
- Screen or backlight fault

Solutions:
- Check the screen brightness to insure it has not been turned all the way down
- Check the ALARM view summary to see if the control has annunciated a Display Backlight Fault (ID = 14)
- Verify that HOME key will return the unit to correct screen
- Check to see if the RemoteView tool will function correctly
- Check using AppManager verify that the GUI program is running
- Check using AppManager if any status messages are present in the GAP or GUI view window

IMPORTANT	The CPU LED should always be on and GREEN. If it is not, see the "CPU Flash codes in the diagnostic section": Typically, if it is solid RED or giving a flash code, it will require a power cycle to possibly clear the issue.

Alarms / Shutdowns

If the control shuts down due to a CPU fault or watchdog timer failure, indicated by the CPU LED being RED or off, you must turn off control power then turn the power back on.

After any shutdown, reset the Shutdown relay contacts to ensure proper start-up.

Wiring / Component Problems

Most Peak200 control problems are caused by wiring problems. Carefully and thoroughly check all wiring connections at both ends. Be very careful when installing wires into the Peak200 control terminal blocks. Check all shields for proper grounding at the control end only.

You can measure all inputs and outputs directly at the terminal strips. The display screen for each channel will show what the Peak200 control measures. This comparison will tell you if the Peak200 control is interpreting the input signal correctly.

⚠ **WARNING**	**EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.** **Substitution of components may impair suitability for Class I, Division or Zone applications.**

⚠ **AVERTISSEMENT**	**RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.** **La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, applications Division ou Zone.**

Actuators / Control Adjustments

If the actuator output is unsteady or hunts, try limiting the steam valve by closing the valve ramp, or if needed enter manual valve demand mode to temporarily lock the output demand to the actuator. If you limit the demand to the steam valve in this manner and the actuator output is steady but the turbine still hunts, then the problem is outside the governor. If an actuator hunts, it may need dither (especially TM type).

If the Peak200 control is not able to fully close or open the actuator, check to make sure that the actuator is calibrated correctly. If the Peak200 control is not able to control speed above or below a certain speed, the steam valve may not be adjusted correctly. An indication of this is if the control is calling for minimum actuator but the speed is still climbing or staying the same, or if the control is calling for maximum actuator but the speed will not increase. Shut down the control and verify that the actuator is closed. If it is, then partially open the T&T valve and verify that the turbine does not turn.

If the T&T valve allows the turbine to turn, then the T&T steam valve is not seating properly to close off steam supply to the turbine.

Other Operating Problems

If actual speed is less than the speed called for by the speed reference, check for speed droop. Droop causes the actual speed to be less than the speed reference.

If the Remote Speed input values are reading incorrectly, ensure the input wire shielding is properly grounded at the Peak200 control end only.

Chapter 9.
Product Support and Service Options

NOTICE	Do not attempt to service internal electronic components nor attempt to remove any of the circuit boards. If the control requires repair, contact Woodward or your nearest Woodward authorized service facility.
	The field-configured portion of the program will be zeroed out after factory repair. To prevent damage to your equipment, you must reconfigure the Program Mode before the unit is put back into service.

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:
- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full-Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.

- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.

- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at www.woodward.com/local-partner

Product Service Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward, or a service is performed:
- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who needs immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in "like-new" condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:
- Return authorization number
- Name and location where the control is installed
- Name and phone number of contact person
- Complete Woodward part number(s) and serial number(s)
- Description of the problem
- Instructions describing the desired type of repair

Packing a Control

Use the following materials when returning a complete control:
- Protective caps on any connectors
- Antistatic protective bags on all electronic modules
- Packing materials that will not damage the surface of the unit
- At least 100 mm (4 inches) of tightly packed, industry-approved packing material
- A packing carton with double walls
- A strong tape around the outside of the carton for increased strength

NOTICE	**To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.**

Replacement Parts

When ordering replacement parts for controls, include the following information:
- The part number(s) (XXXX-XXXX) that is on the enclosure nameplate
- The unit serial number, which is also on the nameplate

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.
- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at www.woodward.com/local-partner.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at https://www.woodward.com/support, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems	Products Used in Engine Systems	Products Used in Industrial Turbomachinery Systems
Facility --------------- Phone Number	**Facility --------------- Phone Number**	**Facility --------------- Phone Number**
Brazil ------------- +55 (19) 3708 4800	Brazil ------------- +55 (19) 3708 4800	Brazil ------------- +55 (19) 3708 4800
China------------+86 (512) 8818 5515	China------------+86 (512) 8818 5515	China------------+86 (512) 8818 5515
Germany:-------+49 (711) 78954-510	Germany ------ +49 (711) 78954-510	India --------------- +91 (124) 4399500
India --------------- +91 (124) 4399500	India --------------- +91 (124) 4399500	Japan -------------+81 (43) 213-2191
Japan -------------- +81 (43) 213-2191	Japan -------------- +81 (43) 213-2191	Korea ------------- + 82 (32) 422-5551
Korea -------------- +82 (32) 422-5551	Korea ------------- + 82 (32) 422-5551	The Netherlands - +31 (23) 5661111
Poland ------------ +48 (12) 295 13 00	The Netherlands - +31 (23) 5661111	Poland ------------ +48 (12) 295 13 00
United States ---- +1 (970) 482-5811	United States ---- +1 (970) 482-5811	United States ---- +1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name	
Site Location	
Phone Number	
Fax Number	

Prime Mover Information

Manufacturer	
Turbine Model Number	
Type of Fuel (gas, steam, etc.)	
Power Output Rating	
Application (power generation, marine, etc.)	

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	

Control/Governor #2

Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	

Control/Governor #3

Woodward Part Number & Rev. Letter	
Control Description or Governor Type	
Serial Number	

Symptoms

Description	

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Appendix A
Configuration Mode Worksheets

Introduction

The program mode worksheets provide a quick reference for programming the Peak200 control. On the system documentation CD, an Excel spreadsheet with the Configuration and Service information can be used to document all settings for your system. It is recommended that you either use the Excel spreadsheet or record your system settings here in this manual.

⚠ **WARNING**	**EXPLOSION HAZARD—The Peak200 control box should not be opened when a hazardous atmosphere is present. Wiring connections which could cause sparks are exposed inside the cabinet.**

⚠ **WARNING**	**Errors in configuration or programming of the Peak200 control may create dangerous overspeed conditions. The turbine must be equipped with an overspeed device completely separate from the Peak200 control or actuators attached to the Peak200 control. The turbine must never be run when this device is not present or not operating correctly.**

⚠ **WARNING**	**To prevent damage to the turbine resulting from improper control settings, make sure you save the set points before removing power. Failure to save the set points before removing power causes them to revert to the previously saved settings. Dangerous conditions such as turbine overspeed may result from operating the turbine with incorrect settings, possibly resulting in equipment damage and injury or death of personnel.**

NOTICE	**Do NOT attempt to operate the turbine until the Peak200 control has been programmed. To do so could cause equipment damage.**

Control Part Number/Revision   _____

Control Serial Number   _____

Application   _____

Site Information –
This information is a free form text entry that can be entered or modified at any time. This is also the location to find the software part numbers running on the control, the GAP runs the control (I/O) application and the WGUI controls the graphical user interface screens

GAP Application ID   _____

WGUI Application ID   _____

Customer Site Name   _____

Location   _____

Unit ID   _____

Configure Mode Program
(Shut down the turbine prior to entering this mode.)

TURBINE START

Manual Start		YES/NO
Automatic Start		YES/NO
Valve Limiter Raise/Lower Rate		%/sec
Use Idle/MinGov Sequence		<status>
Use Confirmation on Keypad Start?		
Idle Speed Setpoint		rpm
Rate to Idle (rpm/s)		rpm/sec
Minimum Governor Setpoint		rpm
Rate to MinGov		rpm/sec
Use Ramp to Idle		YES/NO
Use Rated Setpoint?		YES/NO
Rated Speed Setpoint (rpm)		rpm

SPEED SIGNALS

Device Tag (MPU 1)		
Number of Gear Teeth (MPU 1)		
Gear Ratio (MPU 1) :		
Maximum Speed Level (MPU 1)		rpm
Failed Speed Level (MPU 1)		rpm
Use Speed Input #2?		YES/NO
Device Tag (MPU 2)		
Number of Gear Teeth (MPU 2)		
Gear Ratio (MPU 2) :		rpm
Maximum Speed Level (MPU 2)		rpm
Failed Speed Level (MPU 2)		rpm

SPEED SETPOINTS

Overspeed Test Limit		rpm
Overspeed Trip Setpoint		rpm
Max Governor Speed		rpm
Min Governor Speed		rpm
Underspeed Setpoint		rpm
Use Remote Speed Setpoint?		YES/NO
Remote Speed Setpt Max Rate		rpm/sec
Rmt Spd Setpt Not Matched Rate		rpm/sec
Use DI Enable/Disable as Momentary?		YES/NO
Use Critical Speed Avoidance?		YES/NO
Critical Speed Rate		rpm/sec
Critical Speed 1 Minimum		rpm
Critical Speed 1 Maximum		rpm

COMMUNICATIONS

Ethernet (ENET) 1 Address		IP
Ethernet (ENET) 1 Subnet Mask		IP
Gateway Address		IP
Use Modbus Communications?		YES/NO
Use Serial Port (Modbus Link 1)?		YES/NO
Use Ethernet Port 1 (Modbus Link 2)?		YES/NO
If Serial Port is used:		
Modbus Device Address (slave #)		1-247
Enable Write Commands from Serial?		YES/NO
Protocol (ASCII, RTU)		
Port #1 Baud Rate		
Port #1 Data Bits		7, 8
Port #1 Stop Bits		1,1.5,2
Port #1 Parity		O/E/none
Port #1 Driver		232/485
If Ethernet Port 1 is used:		
Ethernet Protocol (Modbus Link 2)		TCP/UDP
Modbus Device Address (slave #)		1-247
Enable Write Commands from ENET?		YES/NO

PROCESS/CASCADE

Use Process/Cascade Control?		YES/NO
Minimum Cascade Setpoint		Units
Maximum Cascade Setpoint		Units
Cascade Setpoint Rate		Units/sec
Use Cascade Setpoint Tracking?		YES/NO
Invert Cascade?		YES/NO
Speed Setpoint Lower Limit		rpm
Speed Setpoint Upper Limit		rpm
Max Speed Setpoint Rate		rpm/sec
Cascade Droop		%
Cascade PID Prop Gain		
Cascade PID Integral Gain		
Cascade Derivative Ratio (SDR)		
Use Remote Casc Setting		YES/NO
Remote Casc Max Rate		Units/sec
Cascade Units of Measure		
Decimals Displayed on Display		

ANALOG INPUTS

Analog Input #1 -		
Value at 4 mA		
Value at 20 mA		
Input Function		
Device Tag		
Loop Powered?		YES/NO
Engineering Units		
Modbus Multiplier		0.01 -100
Decimals Display on Screen		0-3
Gain		
Offset		
Analog Input #2 -		
Value at 4 mA		
Value at 20 mA		
Input Function		
Device Tag		
Loop Powered?		YES/NO
Engineering Units		
Modbus Multiplier		0.01 -100
Decimals Display on Screen		0-3
Gain		
Offset		
Analog Input #3 -		
Value at 4 mA		
Value at 20 mA		
Input Function		
Device Tag		
Loop Powered?		YES/NO
Engineering Units		
Modbus Multiplier		0.01 -100
Decimals Display on Screen		0-3
Gain		
Offset		
Analog Input #4 -		
Value at 4 mA		
Value at 20 mA		
Input Function		
Device Tag		
Loop Powered?		YES/NO
Engineering Units		
Modbus Multiplier		0.01 -100
Decimals Display on Screen		0-3
Gain		
Offset		

CONTACT INPUTS

Contact Input #1 -		
Input Function		
Device Tag		
Invert Logic?		YES/NO
Contact Input #2 -		
Input Function		
Device Tag		
Invert Logic?		YES/NO
Contact Input #3 -		
Input Function		Ext Trip 1
Device Tag		
Invert Logic?		YES
Contact Input #4 -		
Input Function		
Device Tag		
Invert Logic?		YES/NO
Contact Input #5 -		
Input Function		
Device Tag		
Invert Logic?		YES/NO
Contact Input #6 -		
Input Function		
Device Tag		
Invert Logic?		YES/NO
Contact Input #7 -		
Input Function		
Device Tag		
Invert Logic?		YES/NO
Contact Input #8 -		
Input Function		
Device Tag		
Invert Logic?		YES/NO

ANALOG OUTPUTS

Analog Output #1 -		
Value at 4 mA		
Value at 20 mA		
Input Function		
Device Tag		
Engineering Units		
Enable Readback Fault		YES/NO
Gain		
Offset		
Analog Output #2 -		
Value at 4 mA		
Value at 20 mA		
Input Function		
Device Tag		
Engineering Units		
Enable Readback Fault		YES/NO
Gain		
Offset		
Analog Output #3 -		
Value at 4 mA		
Value at 20 mA		
Input Function		
Device Tag		
Engineering Units		
Enable Readback Fault		YES/NO
Gain		
Offset		

RELAY OUTPUTS

RELAY #1		
Output Function		TRIP
Device Tag		
Invert Logic?		NO
Reset Clears Trip Relay Output?		YES/NO
Include External Trips in Relay?		YES/NO
Trip will set ACT to 0 mA?		YES/NO
RELAY #2		
Output Function (State / Level Switch)		
Device Tag		
Invert Logic?		YES/NO
Use as Level Switch?		YES/NO
Level ON		
Level OFF		
RELAY #3		
Output Function (State / Level Switch)		
Device Tag		
Invert Logic?		YES/NO
Use as Level Switch?		YES/NO
Level ON		
Level OFF		
RELAY #4		
Output Function (State / Level Switch)		
Device Tag		
Invert Logic?		YES/NO
Use as Level Switch?		YES/NO
Level ON		
Level OFF		

DRIVER (Actuator Output)

mA Value at 0% Demand		
mA Value at 100% Demand		
Actuator Function		HP Dmd
Actuator Range (0-20 / 0-200)		
Dither (mA)		
Device Tag		
Use Actuator Fault as Shutdown		YES/NO
Invert Actuator Output?		YES/NO
Gain		
Offset		
Use Self-Powered Actuator		YES/NO
MPU OVRD to this % of MinSpd		%
Self-Powered Time Delay (sec)		sec

Channel Events (Under each AI)

AI Chan 1		
Use Alarm Setpoint 1?		YES/NO
Use Alarm Setpoint 2?		YES/NO
Use Level 2 as a Trip (not alarm)		YES/NO
Chan Flt = SD?		YES/NO
Chan Fault Delay		sec
Level 1 Setpoint		units
Invert Action at Level 1?		YES/NO
Level 2 Setpoint		units
Invert Action at Level 2?		YES/NO
Setpoint Hysteresis		units
Delay for Event action		sec
Enable Speed Setpoint		rpm
Speed Setpoint Hysteresis		rpm
Use as a Start Permissive?		YES/NO
Start Permissive Setpoint		
Invert Start Permissive trigger?		YES/NO
AI Chan 2		
Use Alarm Setpoint 1?		YES/NO
Use Alarm Setpoint 2?		YES/NO
Use Level 2 as a Trip (not alarm)		YES/NO
Chan Flt = SD?		YES/NO
Chan Fault Delay (sec)		
Level 1 Setpoint		
Invert Action at Level 1?		YES/NO
Level 2 Setpoint		
Invert Action at Level 2?		YES/NO
Setpoint Hysteresis		
Delay for Event action (sec)		
Enable Speed Setpoint (rpm)		rpm
Speed Setpoint Hysteresis		rpm
Use as a Start Permissive?		YES/NO
Start Permissive Setpoint		
Invert Start Permissive trigger?		YES/NO

Channel Events (Under each AI)

AI Chan 3		
Use Alarm Setpoint 1?		YES/NO
Use Alarm Setpoint 2?		YES/NO
Use Level 2 as a Trip (not alarm)		YES/NO
Chan Flt = SD?		YES/NO
Chan Fault Delay (sec)		
Level 1 Setpoint		
Invert Action at Level 1?		YES/NO
Level 2 Setpoint		
Invert Action at Level 2?		YES/NO
Setpoint Hysteresis		
Delay for Event action (sec)		
Enable Speed Setpoint (rpm)		rpm
Speed Setpoint Hysteresis		rpm
Use as a Start Permissive?		YES/NO
Start Permissive Setpoint		
Invert Start Permissive trigger?		YES/NO
AI Chan 4		
Use Alarm Setpoint 1?		YES/NO
Use Alarm Setpoint 2?		YES/NO
Use Level 2 as a Trip (not alarm)		YES/NO
Chan Flt = SD?		YES/NO
Chan Fault Delay (sec)		
Level 1 Setpoint		
Invert Action at Level 1?		YES/NO
Level 2 Setpoint		
Invert Action at Level 2?		YES/NO
Setpoint Hysteresis		
Delay for Event action (sec)		
Enable Speed Setpoint (rpm)		rpm
Speed Setpoint Hysteresis		rpm
Use as a Start Permissive?		YES/NO
Start Permissive Setpoint		
Invert Start Permissive trigger?		YES/NO

LinkNet Nodes (for additional I/O)

Optional		
Enable Using LinkNet HT I/O Nodes?		YES/NO
Enable Node 1 (AI/AO)?		YES/NO
Enable Node 3 (RTD)?		YES/NO
Enable Node 4 (BI)?		YES/NO
Enable Node 5 (BO)?		YES/NO

Appendix B
Service Mode Worksheets

SCREEN/KEY OPTIONS

Screen Saver Delay (hr)		hr
Disable Screen Saver?		YES/NO
Disable Dimming?		YES/NO
Auto Login as Operator?		YES/NO
Blink LED upon New Alarm?		YES/NO
Internal Operating Temp (Deg C)		deg C
Screen Brightness		
Use 2 second delay on TRIP key?		
Use TRIP key from RemoteView?		
Switch to Different Screen after Boot-up		YES/NO
Select Screen		screen list
Enable TRIP on Power-up?		YES/NO
Have TRIP also trigger an Alarm?		YES/NO
CPU Idle Time (%)		

REALTIME CLOCK

Use SNTP Time Synchronization?		YES/NO
Time Zone		
SNTP IP Address		
SNTP Rate		
SNTP Timeout		

MPU OVERRIDE

Use MPU Override Timer?		YES/NO
Override Time (sec)		sec
Override Time Remaining		sec
Use Rolldown Override?		YES/NO
Rolldown Speed (rpm)		rpm
Rolldown Delay (sec)		sec

SPEED CONTROL

Rate to Minimum (units/sec)		units/sec
Slow Rate Off-Line (rpm/sec)		
Slow Rate On-Line (rpm/sec)		
Fast Rate Delay (sec)		sec
Fast Rate Off-Line (units/sec)		units/sec
Fast Rate On-Line (units/sec)		units/sec
Hot Start Multiplier		
Entered Setpoint Go to Rate (units/sec)		units/sec
Underspeed Setting		rpm
Enable Underspeed Alarm?		YES/NO
Enable Underspeed Trip?		YES/NO
On-Line Speed Deadband		rpm
Speed Droop (%)		%
Display Gauge Multiplier		x1
Speed Switch to On-Line Dynamics		rpm
Use Reduced Overspeed Setpoint?		YES/NO
Reduced Overspeed Setpoint		rpm
MPU Speed Probe Difference Alarm Setpoint		rpm
Enable Normal Stop from Overview Page?		YES/NO
Speed setpoint normal stop ramp rate		rpm/sec

CASCADE CONTROL

Slow Rate (units/sec)		units/sec
Fast Rate Delay (sec)		sec
Fast Rate (units/sec)		units/sec
Entered Rate (units/sec)		units/sec
Droop (%)		%
Rated Cascade Setpoint (units)		units
Cascade Not Matched Rate (units/sec)		units/sec
Maximum Speed Rate (rpm/sec)		rpm/sec
Minimum Speed Setpoint		rpm
Maximum Speed Setpoint		rpm
Cascade Deadband		%
Display Gauge Multiplier		x1

VALVE DEMAND

HP Limiter Maximum (%)		%
HP Limiter Entered Value Rate		%/sec
HP Valve Limiter Raise/Lower Rate		%/sec
Use HP Start Limiter?		YES/NO
HP Max Limiter at Start (%)		%
Use HP Manual Valve Demand?		YES/NO
HP Manual Demand Rate (%/s)		%/sec
Manual Demand Timeout Limit		sec

COMMUNICATIONS

Use Modbus Trip?		YES/NO

Enable Link 1 Writes (Serial)?		YES/NO
Enable Link 2 Writes (ENET 1)?		YES/NO
Link 1 Timeout Delay (Serial)		sec
Link 2 Timeout Delay (Ethernet)		sec

OPERATION LOG (View only)

login as ServiceUser/CONFIG mode to rewrite values

Number of Turbine Starts		
Total Trips		
Trips with Load/Valve > 25%		
Trips with Load/Valve > 75%		
Overspeed Trips		
Total Run Time Hours		hrs
Runtime with Load/Valve > 25%		hrs
Runtime with Load/Valve > 75%		hrs
Peak Speed Reached		rpm
Max Acceleration Detected		rpm/sec

TRENDS

no user settings - views only		

Appendix C
Automatic Speed PID Dynamic Analysis

The Automated PID Dynamic Optimizer is a routine which allows the control to automatically analyze the system and calculate the P, I, and D terms. The PID Optimizer routine can be initiated from the controller Dynamics Optimizer screen and will provide reasonable and stable results. To calculate optimized system dynamics, small and progressively larger adjustments are made to the valve demand in order to measure the turbine system. The optimizer routine remains within user specified process and valve movement limits to ensure that the turbine system remains within acceptable operating limits.

By running the PID Optimizer, the resulting dynamics provide the following benefits:
1. Improved system response to events such as load changes and load rejection
2. Tighter control at the setpoint
3. Response behavior which matches the control loop and application (offline speed control vs load control, etc.)
4. Improved system diagnostics. The routine provides insight into turbine system control problems outside of PID tuning and can help to identify them. Some examples include:
    a. Non-Linear turbine response due to poppet staging or slew rate limited valve response
    b. High system dead-time
    c. High signal noise
    d. Response time variation due to high system friction, loose linkage, or coupling, varying hydraulic pressure, or varying steam conditions.

Overview of the Automated PID Optimizer Routine

Figure C-1. Speed PID Dynamic Optimizer

The Dynamics Optimizer screen in Figure C-1 above displays the current status which is overviewed on the left-hand side of the screen and results are displayed on the right. The menu bar on the bottom of the screen contains buttons for configuration and operation of the Optimizer routine.

The process of finding optimized system dynamics includes two modes: first the analysis mode and then the setpoint step mode. The trend below gives an overview of the entire Optimization routine. The actuator demand displayed in yellow, speed setpoint in white, and speed in red. The left portion of the trend is the Analysis Mode. The right portion of the trend is the Setpoint Step Mode.

Figure C-2. Speed vs Actuator Trends During Analysis

Analysis Mode

During the Analysis Mode, the optimizer begins by making small actuator movements which progressively increase until the measured process signal movement can be differentiated from signal noise. The initial movement direction (up or down) depends on system conditions. Once there is enough process signal movement, the optimizer begins moving the actuator up and down until the process signal moves beyond the +/- the threshold values (calculated from signal noise) and performs the system analysis to calculate gains.

On the front panel, the status will progress through the following steps during the Analysis Mode:
- OPID Enabled/Settling
- Analysis Movement
- Movement to Thresholds
- Calculating Gains

Setpoint Step Mode

Once new gains have been calculated for P, I, and D the PID will control at the setpoint using the newly calculated gains. The routine then performs setpoint step tests to validate the system response.

During the Setpoint Step Mode there are 4 setpoint step tests:
1. Step the setpoint up or down (amount depends on system noise, but less than the **Process Limit** configured). Whether it moves up or down depends on the sign of the **Process Limit**.
2. Step the setpoint back to the initial setpoint
3. Step the setpoint by a higher amount than the first setpoint step test
4. Step the setpoint back to the initial setpoint

At any stage in this mode, if a fault occurs, the optimizer will abort and change the PID gains from the calculated values back to the initial values.

On the front panel, the status will progress through the following steps during the Setpoint Test Mode:
- Settling at Setpoint
- Step Tests with OPTI Gains
- System Settling
- Complete – Using New Gains

Once the routine is complete, the new gains can either be accepted by pressing the 'Accept' button within the Test Menu at the bottom of the screen. Alternatively, the gains can be rejected by pressing the 'Reset Test' button at the bottom of the screen, and the PID gains will change back to the initial values. If accepted, the current dynamics (offline or online, depending on the current operating mode) will be updated to the calculated values and the optimizer will reset.

Configuring the Automated PID Optimizer

The configuration parameters are provided in the 'Configure' pop-up. The defaults for these values should allow most systems to successfully optimize. If needed, adjustments can be made to these values to ensure that the automatic tuning completes successfully. Changing any of these values while the Optimizer test is running will cause the test to fault and abort.
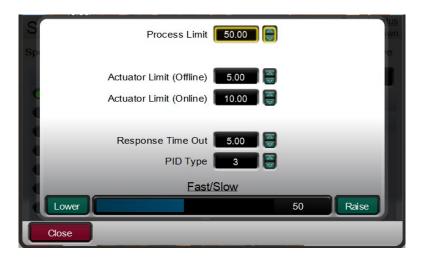
Figure C-3. Speed PID Optimizer Configuration

Process Limit (rpm)　　　　　　　dflt= 50.0 (-200.0, 200.0)

This value limits the process signal movement allowed. If movement occurs during automatic tuning that is more than this value, the Automated PID Optimizer routine will abort and control at the initial SP. This value should be set based on what the system can tolerate. If it is too low, the automatic tuning process may fault and abort due to normal process changes. The limit is centered around the current process value at the time the optimizer is enabled. The small analysis test steps will be in the direction relative to the sign of the value, with the default of 50 the small initial steps will be above the current process value.

For example, if the PID Optimizer is calculating Speed PID gains, and the Process Limit is 50 rpm and current speed signal is 3000RPM

　　Upper Process Movement Limit: 3000 + 50 = 3050 RPM
　　Lower Process Movement Limit: 3000 – 50 = 2950 RPM
If the turbine speed moves outside of the Upper Process Movement Limit or Lower Process Movement Limit, the PID Optimizer routine will be aborted.

Act Limit (offline) (%)　　　　　　dflt= 8.0 (0.25, 100.0)

This value limits how much the actuator demand will move during the Analysis Mode when the turbine is using Offline dynamics. The percentage will limit the output +/- from the actuator position when the optimizer is enabled. The optimizer will not abort if this limit is reached, but an alarm will be annunciated.

Act Limit (online) (%)　　　　　　dflt= 10.0 (0.5, 100.0)

This value limits how much the actuator demand will move during the Analysis Mode when the turbine is using Online dynamics. The percentage will limit the output +/- from the actuator position when the optimizer is enabled. The optimizer will not abort if this limit is reached, but an alarm will be annunciated.

Response Timeout (sec)   dflt= 5.0 (0.005, 100.0)
This value determines how long the PID Optimizer will wait for a response during the automatic tuning process. This value should be at least 2 times longer than the system slew and settling time. During the Setpoint Step Mode, this value determines the step times and times between steps. A fault and abort will occur if the total PID optimizer time exceeds a value of 40 times the Response Timeout.

PID Type   dflt= PID (P, PI, PID)
This setting determines the mode of the PID controller and allows the automatic tuning of the appropriate control loop.
- P = Proportional Only
    - P Term Calculated
    - I Term 0
    - D Term is 0.01 if D is less than 1 or 100 if D is greater than 1
- PI = Proportional and Integral
    - P Term Calculated
    - I Term Calculated
    - D Term is 0.01 if DR is less than 1 or 100 if DR is greater than 1
- PID = Proportional, Integral, and Derivative
    - P Term Calculated
    - I Term Calculated
    - D Term Calculated

In addition, even if automatic tuning mode is not enabled, if this is set to P, the PID will switch to a proportional controller. Note that selecting PI will not switch the PID to a PI controller; this is done by changing S_D_R.

Fast/Slow   dflt= 50 (0, 100)
This value allows for the calculated system response to be more or less aggressive. If faster response time is needed, this value should be increased. If slower response time is needed, this value should be decreased.

System Diagnostics
The Automated PID Optimizer has alarm and fault codes that can be generated at various stages. An alarm being generated will not abort the optimizer and does not mean that the calculated gains are unreliable. Alarms are given to indicate response conditions that are less than ideal, but might be acceptable, the user should monitor the response to decide. A fault will abort the Automated PID Optimizer routine and indicates that reliable gains could not be calculated.

Most of the time, an alarm or fault indicates a problem with the steam turbine system that is outside of PID tuning. The descriptions below help identify what in the system may be causing the less than ideal control conditions. In some cases, suggestions to the Automated PID Optimizer configuration are included, to try to achieve successful automatic tuning.

Alarms
Alarm 1 - Rate group not fast enough
> This alarm indicates that the rate group of the block is not fast enough to provide optimum control for the control loop, as measured. The rate group should be at least 20 times as fast as the system response.

> Some causes of this alarm could be:
> - The process loop (like speed) controlled by the PID is too fast for the rate group (RG) of PID
> - If the control loop is position droop, the problem may be that there is no lag or other filter on the between the PID output and the process input.

Some solutions for this alarm could be:
- If it is not possible to change the rate group, the second solution would be to accept the suggested dynamics if adequate, or detune the PID
- If there is no lag or other filter on the between the PID output and the process input for position droop, the solution would be to add a lag.

Alarm 2 – High overshoot on test step
This alarm indicates that the overshoot on the test step was greater than 50% of the step size. The performance might be acceptable, depending on the system.

Some causes of this alarm could be:
- The valve or turbine response is non-linear. This could occur due to:
- Poppet valve staging, resulting in higher flow with the larger movement of the step, and lower flow with the earlier smaller movements.
- The actuator or valve response is slew rate limited

If the amount of overshoot is unacceptable, some solutions would be:
- Verify that the poppet valve staging is correct.
- If the poppet valve staging cannot be fixed, the turbine operating point could be adjusted (i.e., the speed (process) and speed setpoint (SP) could be increased) to tune at the higher/lower flow point.
- The FAST/SLOW input may need to be reduced, to achieve the desired response.

Alarm 4 – Response to test step sluggish
The test step response did not reach 50% of the setpoint during the test step, the response was sluggish. The performance might be acceptable, depending on the system demands.

Some causes of this alarm could be:
- The valve or turbine response is non-linear. This could occur due to:
- Poppet valve staging, resulting in higher flow with the lower movement of the step, and higher flow with the earlier smaller movements.
- The actuator or valve response is slew rate limited
- The process or sensor has a long dead time

If the speed or the response is unacceptable, some solutions would be:
- Verify that the poppet valve staging is correct.
- If the poppet valve staging cannot be fixed, the turbine operating point could be adjusted (i.e., the speed (process) and speed setpoint (SP) could be increased) to tune at the higher or lower flow point.
- The FAST/SLOW input could be increased, to achieve the desired response.

Alarm 8 - Actuator movement is limited
This alarm indicates that the actuator movement was limited during the Analysis Mode. This can result in a response that is not optimum, depending on the system conditions.

Some causes of this alarm could be:
- The **Act Limit** input is too low
- The valve or actuator is close to its end of travel, limiting movement or effect.

If the response is not acceptable, some solutions would be:
- If the response is not acceptable, the **Act Limit** could be increased
- The system operating point could be moved away from the ends of the actuator and valve travel. This would mean increasing or decreasing the SP input to the block.

Alarm 16 – High relative deadtime
This alarm indicates high deadtime in the system, relative to the system bandwidth. Deadtime is typically measured on a step and is defined as the amount of time between when the SP starts to move, and when the process starts to move.

Some causes of this alarm could be:
- High friction on the valve or actuator
- Lost motion on the valve or actuator or linkage
- Hysteresis in the valve or actuator
- Long lines, such as a pressure transducer or other transducer not located near the pressure of interest.
- A relatively slow recursion rate in the sensor, control, and/or driver
- Asynchronous I/O in the sensor, control, and/or driver
- Asynchronous communications between the sensor and control or control and driver (if digital)

Some solutions for this alarm could be:
- With an oscilloscope, Datalog, or logic analyzer, measure the system deadtimes.
- The optimum solution to this problem would be to fix the system and remove the deadtime. If that is not possible, de-tune the control, to ensure adequate stability.

Alarm 32– Process movement greater than Droop movement during Droop parameter tuning
This alarm indicates that the movement of the process parameter exceeded the movement of the Droop parameter during droop tuning.

Some causes of this alarm could be:
- Improper connections in the GAP. The process (speed) should be connected to the process input, and the droop parameter (load, scaled in RPM) should be connected to the Droop input
- The amount of initial actuator movement is set by the system noise. If this is too high, the machine might move more than the system can support.
- The utility or plant frequency could be moving around.
Some solutions for this alarm could be:
- Ensure that the block is connected correctly.
- Reduce system noise.
- Ensure that the **Act Limit** field is set correctly.

Alarm 64– **Response Timeout** too short
This alarm indicates that the movement of the system did not respond enough during the **Response Timeout**.

Some causes of this alarm could be:
- The **Response Timeout** is too short for the turbine system response time

Some solutions for this alarm could be:
- Increase **Response Timeout**.

Faults
Fault 1 – CLR_STATE was toggled TRUE
This fault will only occur if the CLR_STATE input is toggled TRUE
Some causes of this fault could be:
- The CLR_STATE input was toggled TRUE
  - This can occur when system dynamics are changed from Offline to Online

Some solutions for this fault would include:
- Ensure that the CLR_STATE logic is correct; CLR_STATE has priority over automatic tuning.

Fault 2 – Process or droop movement limit low with respect to noise
This fault indicates that the process/droop movement (or noise on the process/droop input) is greater than 10% of the **Process Limit** or **Droop Limit** during the first seconds after the Automated PID Optimizer routine is enabled. This is usually due to noise or drift on the process or droop input.

Some causes of this fault could be:
- The **Response Timeout** is too long, the PID cannot increase the output movement fast enough to counteract system drift.
- The noise or system swing on the process/droop input is greater than 10% of the **Process Limit** and/or **Droop Limit**.
- The system is not at steady state. As an example, if the Integral Gain input is low, there could be a large error between process and setpoint.

Some solutions would include:
- Decrease **Response Timeout** if the system is much faster than the time-out time.
- Proportional Gain could be adjusted to make the system stable, if applicable.
- Integral Gain could be adjusted to allow system to minimize error and/or slow hunt, if applicable.
- The **Process Limit** or **Droop Limit** could be increased if the system allows.
- Check for excessive noise on process or droop signal, check shielding, and grounding on the applicable sensors and actuator(s).

Fault 3 – High response time variation
This fault indicates that the response variation exceeded the allowable limit. This fault will occur if the response time variation is greater than a factor of four, tuning would be unrepeatable.

Some causes of this fault could be:
- The system has high friction, resulting in initial movements which are lower than later movement, after the actuator or valve has broken free
- The system has loose linkage or coupling, sometimes the system moves a lot, and sometimes it does not.
- The hydraulic pressure is moving during the tuning process.
- The steam supply pressure is moving during the tuning process.

Some solutions for this fault would include:
- Monitor the performance of the system, including the valve, steam pressure, hydraulic pressure, etc.
- Use a Datalog to verify proper I/O to the PID

Fault 4 – Process movement didn't correlate to actuator movement
This fault indicates that the response did not correlate to the actuator movement.

Some causes of this fault could be:
- The hydraulic pressure or steam supply is moving during the tuning process, if the actuator demand is increasing but the supply is dropping, the actuator could close, or vice versa.

Some solutions for this fault would include:
- Monitor the performance of the system, including the valve, steam pressure, hydraulic pressure, etc.
- Use a Datalog to verify proper I/O to the PID

Fault 5 – Process movement greater than **Process Limit**
>   This fault indicates that the process input exceeds the **Process Limit**.

>   Some causes of this fault could be:
>   - The **Response Timeout** is too long, the PID cannot increase the output movement fast enough to counteract system drift.
>   - The system is not at steady state. As an example, if the Integral Gain input is relatively low, there could be a large error between process and setpoint.
>   - The **Process Limit** is too low
>   - The **Act Limit** is too high; resulting in actuator movements that are too large for the **Process Limit** (this is unlikely).

>   Some solutions for this fault would include:
>   - Decrease **Response Timeout** if the system is much faster than the time-out
>   - Proportional Gain could be adjusted to make the system stable, if applicable.
>   - Integral Gain could be adjusted to allow system to minimize error and/or slow hunt, if applicable.
>   - **Process Limit** could be increased if the turbine system allows
>   - Check for excessive noise on the process input, check shielding and grounding on the applicable sensors and actuator(s).

Fault 6 – Optimizer time-out
>   This fault indicated that the optimizer time exceeded the allowable time-out time, of 40 times the specified **Response Timeout**, or 20 cycles of movement.

>   Some causes of this fault could be:
>   - The **Act Limit** is too low, this is the most common cause of this fault
>   - The **Response Timeout** is too short for the process input response.
>   - The system response is restricted, by low steam pressure, a partially closed trip, and throttle valve, etc.
>   - The valve or actuator is against a stop or at the end of its travel, not allowing the PID to control the process completely.
>   Some solutions for this fault would include:
>   - The **Act Limit** could be increased.
>   - The **Response Timeout** could be increased if the system was still increasing/decreasing at the time-out times.
>   - The operating point (Setpoint) could be adjusted if an actuator or valve is close to the end of its travel.
>   - Check the system variables, ensure that inlet pressure is high enough, hydraulic pressure is high enough, the trip and throttle valve is open, etc.

Fault 7 – Droop input movement, greater than limit.
>   This fault indicates that the Droop input exceeded its allowable movement, similar to fault 5 for the process input.

>   Some causes of this fault could be:
>   - The **Response Timeout** is too long, the PID cannot increase the output movement fast enough to counteract system drift.
>   - There is noise on the Droop input
>   - The system is not stable, the Droop input is moving around too much with respect to the **Droop Limit** input.
>   - The system is not at steady state. As an example, if the Integral Gain input is relatively low, there could be a large error between process+droop and setpoint.
>   - The **Droop Limit** is too low.
>   - The **Act Limit** is too high; resulting in actuator movements that are too large for the **Droop Limit** (this is unlikely).

Some solutions for this fault would include:
- Decrease **Response Timeout** if the system is much faster than the time-out
- Check the Droop input for noise and for the correct level.
- Proportional Gain could be adjusted to make the system stable, if applicable.
- Integral Gain could be adjusted to allow system to minimize error and/or slow hunt, if applicable.
- **Droop Limit** could be increased if system allows.
- Check for excessive noise on Droop input, check shielding and grounding on the applicable sensors and actuator(s).

Faults 8 through 20 – Input or System status change occurred during the Automatic Tuning routine. Input conditions and System status are monitored while the optimizer is active to detect changes that could invalidate the results of the tuning routine.

Fault 16
A copy of the S_D_R input is made when the optimizer is started and is used to detect if the S_D_R input value crosses 1.0 in either direction. For example, this fault will be annunciated if S_D_R is 0.5 when the optimizer is started and subsequently S_D_R changes to 1.1 while the optimizer is active. Similarly, this fault will also be annunciated if S_D_R transitions from greater than 1.0 to less than 1.0 while the optimizer is active.

Appendix D
Servlink-to OPC Server (SOS) Tool

SOS Communication Link

The Woodward SOS Servlink OPC server ("SOS") provides an OPC interface for Woodward controls. It runs on a Windows PC that accesses data on controls using the Woodward proprietary Servlink protocol through an Ethernet connection. Woodward OPC client applications, such as Monitor GAP and Control Assistant connect to SOS by selecting a 'Servlink OPC server' connection. SOS implements the OPC Data Access 2.0 standard, so other OPC client applications may also function with it.

The install for this program is included on the system documentation CD, the latest releases and updates are always available on the Woodward.com website.

Features of SOS
- Establishes communication link between control and a PC
- Can support redundant Ethernet links to a single control
- Can support links to many controls at the same time
- Can be used to retrieve (save) tunable settings from the control to a file (.tc file)
- Can be used to place the control in IOLock and send (load) a tunable file into the control
- Can create a .CSV file of all alarm and trip events

Prior to installing SOS, you must install the Microsoft .net framework program which is available on the Woodward website (www.woodward.com). This will install some operating system library files that are used by Control Assistant.

Installing SOS

License agreement & Setup
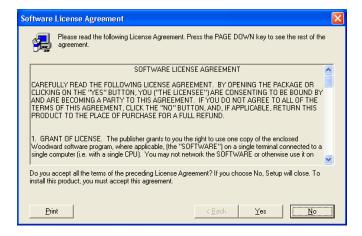
Figure D-1. SOS
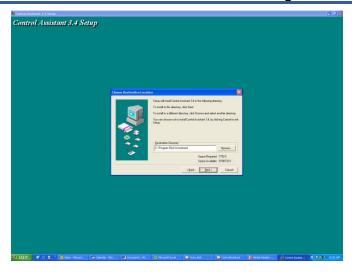
Figure D-2. SOS Install Window

Define the desired directory to save.

Connecting a PC/Laptop to the Control

You will need to connect to the Peak200 with an RJ45 Ethernet cable. Any Ethernet port can be used, however it is most convenient to use the same network port that handles all LAN communications (if the Peak200 is connected to a plant network). You will need to know the IP address of the Ethernet port.
   The Default IP for Ethernet 1 = 172.16.100.15 (subnet = 255.255.0.0)

IMPORTANT   **All information in the communication link between the Peak200 and the PC is done via a Woodward Servlink connection (using the SOS tool). It is recommended to initially launch this tool independently to establish a healthy communication link. Once this is done the PC will cache this information so that future launches will remember Peak200 controls.**

Servlink-to-OPC Server (SOS)

The Woodward SOS tool is a sub-component of Control Assistant that handles all the communications between one or many Peak200's on a network and the PC. It can be run independently, which is a useful way to clearly establish a connection prior to using the Control Assistant or other programs.

To launch SOS on independently:
Under Start / All Programs / Woodward / SOS Servlink OPC Server

Click on SOS Servlink OPC Server
You should see the following dialog box appear –

Figure D-3. SOS Server Status Dialog Box

Under Session – scroll down and select New Session and a dialog box similar to the one below will appear. In the top entry box, enter the IP address of the Peak200.
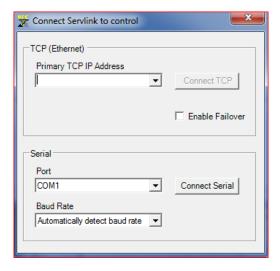
Figure D-4. SOS – New Session Box

If system connected to Ethernet Port 1 of the Peak200, enter the IP address of this port. The Peak200 default is shown below or enter the IP for the plant LAN network.
Then click on the Connect TCP button
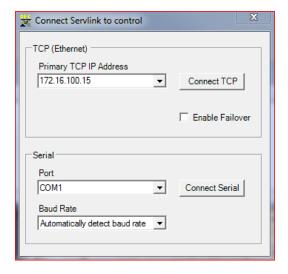
Figure D-5. SOS - Enter Peak200 TCP/IP Address

The SOS program will locate the control and establish a Woodward Servlink connection between the control and your PC. This will take a few seconds to establish; the dialog box should now look like this (with the IP address being equal to what you typed in above).
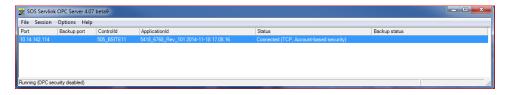
Figure D-6. SOS – Active Links Dialog Box

Appendix E.
Control Assistant—Software Interface Tool

Features of Control Assistant

Control Assistant is an optional software interface tool design to help experienced users maintain setup and configuration settings and troubleshoot system problems. It provides a flexible window into the application software with multiple features for the user.

The install for this program is included on the system documentation CD, the latest releases and updates are always available on the Woodward.com website.

Features
- Using WinPanel (similar to the previous Watch Window products)
- Receiving Control Tunables (Download/Receive Tunables from Peak200)
- Sending Control Tunables (Upload/Send a Tunable File to the Peak200)
- Trending Control Parameters

Viewing Datalog files

Prior to installing Control Assistant, you must install the Microsoft .net framework program which is available on the Woodward website (www.woodward.com). This will install some operating system library files that are used by Control Assistant.

Installing Control Assistant

License Agreement & Setup
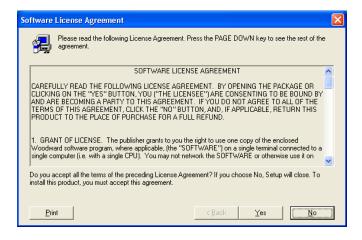
Figure E-1. Control Assistant License Agreement
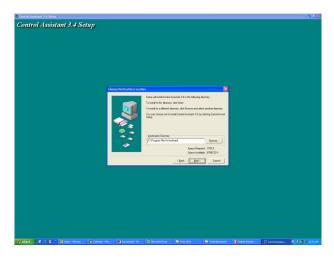
Figure E-2. Control Assistant Install Window

Define the desired directory to save Control Assistant and press 'Next'. It is preferable to use the default, as it will keep all Woodward Software in a common folder. If the program folder field is blank, type in "Woodward" and the install will create a program folder named Woodward.
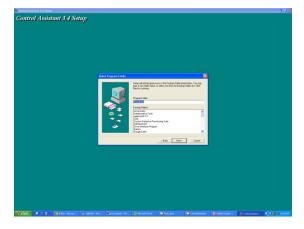
Figure E-3. Control Assistant Folder Selection

Choose the desired folder in the 'Start Menu' to save the shortcuts.
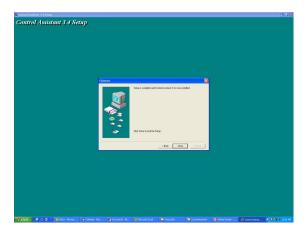
Figure E-4. Control Assistant Install Complete

After Control assistant is installed press 'Close'. You may or may not have to restart your computer depending on whether you had a previous version installed.
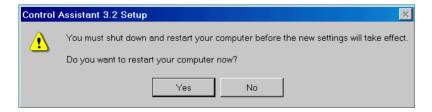
Figure E-5. Install Restart Window

Press 'Yes' to restart your computer now, or press 'No' to restart your computer later. Control Assistant will NOT function properly until restarting the PC.

Using Control Assistant

To launch Control Assistant:
Under Start / All Programs / Woodward / Control Assistant 4

Click on   Control Assistant 4

NOTICE	Use the Control Assistant HELP in the menu list to get familiar with all features of this product, or for additional information about using the features discussed in this chapter.

You should see the following dialog box appear –
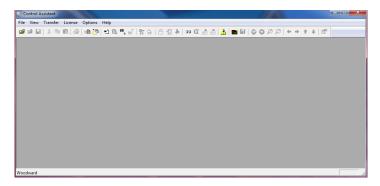
Figure E-6. Control Assistant Window

Next click on the New Winpanel icon [icon] in the toolbar- and the following dialog box will appear.
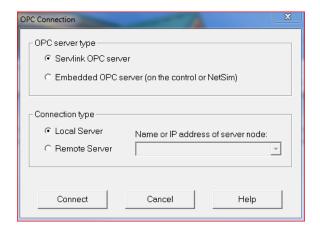
Figure E-7. Dialog for Servlink OPC Connection

Clicking on Connect will open a WinPanel window that will look like the figure below.
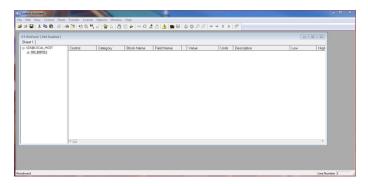
Figure E-8. WinPanel Session

Using WinPanel (.ws files)

Control Assistant includes a feature called WinPanel that provides a text listing of all the GAP blocks in the application. The WinPanel window allows viewing of any software variable in the system and is therefore intended to be used by users familiar with the architecture of the control software. WinPanel is a typical Windows application that provides a powerful and intuitive interface. The menu structures are familiar to Windows users. Variable navigation is provided through the Explorer window similar to the Explorer in Windows. This tool will look very familiar to users with experience using Woodward's Watch Windows products.

The WinPanel window acts as an OPC client and establishes the data link with SOS. For this reason, the WinPanel window must be opened, and a control selected to enable uploading or downloading the tunables or trending data from the control (next sections). If multiple controls are available in SOS, they will all appear in the WinPanel window.

Typical Peak200 users are not familiar with the GAP and therefore it is not expected to normally need to create new WinPanel views.

What is valuable for a Peak200 user is the ability to Open WinPanel View files that have been created by Woodward or by commissioning engineers. These files are identified as *<filename>.ws* files. This is a handy way to be able to gather system information, support tasks such as valve stroking, tuning or system checkout.

Retrieving Control Tunables (Tunables from Peak200 to a PC)

NOTICE	**Tunables can be RETRIEVED from the control at any time with no effect on turbine operation.**

Once the control is configured and the signals are calibrated, it is recommended that the user save a file containing this information. This is useful for setting up a spare unit, as a replacement or for initially configuring other units of the same type.

1. The first step is to follow the above steps up to the point of having a WinPanel open and the correct control selected
2. Select Transfer/Receive Debug Tunable List from the menus or the Retrieve Icon from the tool bar

(Note the send icon is not available)

The following box should appear

Figure E-9. Control Assistant – Retrieve Tunable Dialog Box

3. Click on the Open button and the file will be automatically created with the control ID, time, and date in the filename and the extension .tc. Save this file.

Sending Control Tunables (Tunables from PC to Peak200)

⚠WARNING	**To send tunable settings to the control the Peak200 must be in the IO Lock condition, therefore the turbine must be shutdown and the Peak200 must be in a TRIPPED state. Entering into I/O Lock mode while the turbine is running will cause an automatic shutdown of the turbine with resulting process stoppage. Do not enter the I/O Lock to upload tunables into the control while the turbine is running.**

To load a previously created tunable file (.tc) into a Peak200, the turbine must be shut down since the control will need to enter configuration mode to complete this process. Once the turbine is shutdown, follow these steps:

1. From within Control Assistant Open the tunable (.tc) file
2. Follow the steps in the previous section up to the point of having a WinPanel open and the correct control selected
3. From the menu select Control/Lock IO or select the Lock IO icon from the tool bar
4. Once selected a dialog box will appear asking for the Debug password – Enter 1112
5. If the Peak200 TRIPPED LED was ON (Trip is present) a confirmation box will appear that Lock IO was issued. If the Peak200 TRIPPED LED was OFF (no trips present) then the confirmation box will state it was not allowed
6. Click on the tunable file and select Transfer/Send Tunable List from the menus or the Send Icon from the tool bar (Note in this state both retrieve and send are available)
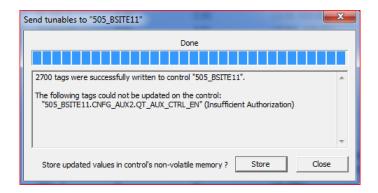
7.   The following box should appear

Figure E-10. Control Assistant – Send Tunable Dialog Box

8.   Click on Store and the control will save these values.
9.   Next click back onto the WinPanel window and then select Control/Reset from the menus or the Reset

     Icon from the tool bar

10. A dialog confirmation box will appear with some warnings and requires a confirmation check that these
     have been consider. There is also an option to Save Values again if desired. Checking the warning
     acknowledge box will allow the Reset button to be selected.
11. Selecting Reset will issue a 'soft' reset to the control and it will perform a soft reboot – similar to when the
     user exits the Configuration mode. The procedure is now complete.

IMPORTANT

It is highly recommended that the user maintains a current tunable
list file available at site. This will make the configuration and setup of
a spare unit very simple and assist in troubleshooting system
problems.
The System Documentation CD contains a file named
"*Factory_Default_Tunables_Rev_xx.tc*" that can restore the control
to the original 'as shipped' settings, if that is desired load this file.

Trending Control Parameters
Done at any time and will not interfere with any Peak200 control functions.

The first step is to follow the previous steps that were listed up to the point of having a WinPanel open
and the correct control selected

Use File/Open to open a previously saved trend script file (if you have one). To create new trends, the
user will need some understanding of how Woodward's GAP software is constructed as well as some
specific knowledge of the Peak200 application software. If the user is not familiar with GAP, it is
recommended that you limit use to existing trend script files.

Opening Existing Trend Script Files
When you open an existing trend script, the graph will automatically begin trending the control data. The
graph will auto scale or the scale can be adjusted to fixed values by the user. There are two vertical
curser lines that the user can slide along the X axis – the Y1 and Y2 values below the graph relate to
these values and the Total Difference (lower right corner) will show the time difference between the two
cursers lines at all times.

The control assistant tool bar has Stop/Start/Zoom button and options to save the data buffer of values
into a file for later viewing or analysis. Use the Help menu item to learn more.

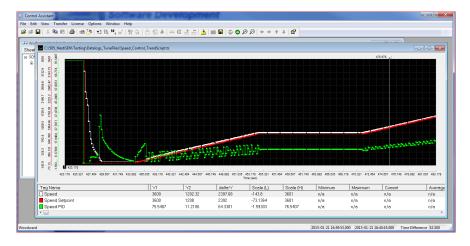Figure E-11 is an example of the Speed Control Trend Script.

Figure E-11. Control Assistant – Speed Control Trend Script

Creating a Trend Script File

Click on the New Trend icon [icon] if you want to create a new trend of parameters. A dialog box will appear, and the user will be able to build a trend script file for view system parameters by expanding the explorer window on the left and 'drag & drop' GAP block field parameters into the window on the right.
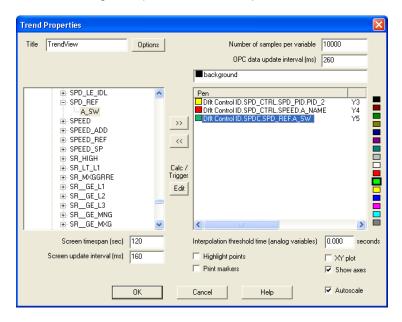

Figure E-12. Control Assistant – Create Trend Script File

Once the script file is complete, clicking on OK will launch the trend file enabling viewing live control data. For additional information on the trending capabilities, refer to the Control Assistant Help menu.

Appendix F.
AppManager Service Tool

File Management with App. Manager

AppManager is a Windows based remote access tool for Woodward controls. The Peak200 is loaded with a service that allows it to interface with AppManager. AppManager is used to manage the applications on the Peak200 and provide access to operating system information.

The install for this program is included on the system documentation CD, the latest releases and updates are always available on the Woodward.com website.

Features of App. Manager
- Send/Retrieve files from the control
- Retrieve Datalogs from the control
- Change Ethernet Network addresses
- Start/Stop the GAP or WGUI application that is running on the control
- Load Service Packs

Installing App Manager

License Agreement & Setup

Figure F-1. App Manager Install Window

Select Next to continue with the installation.

Figure F-2. App Manager License Agreement Window

To install App Manager, select "I accept the terms in the license agreement". Once this has been selected, select Next to continue the installation.
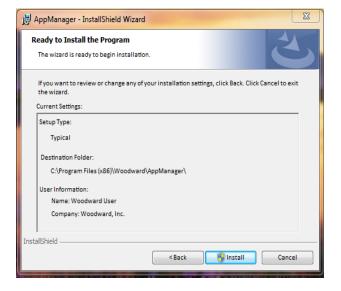
Figure F-3. App Manager Installation

Choose the desired folder in the 'Start Menu' to save the shortcuts.

Figure F-4. App Manager Install Complete

After App Manager is installed press 'Finish'. You may need to restart your computer depending on whether you had a previous version installed.

The topics covered below will highlight the main functions that a Peak200 user may want to do using this tool. For user already familiar with this tool the only new feature is the ability to access the GUI files. For complete information on this tool, use the help menu

To Launch App Manager:
Under Start / All Programs / Woodward / AppManager

Click on AppManager

You should see the following dialog box appear –
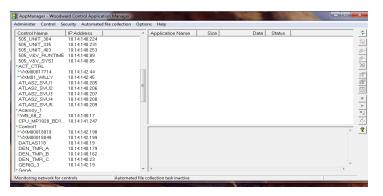
Figure F-5. AppManager Window

AppManager will display three panels; the left side panel will show the Control Name and IP Address for each control available on the network. The right-side panels will not show information until you are logged into a specific control. When that is done, the right upper panel will show the list of applications available, and the right bottom panel will show control status information.

Next click on the "Control Name" of the Peak200 you want to connect. The following dialog box will appear.
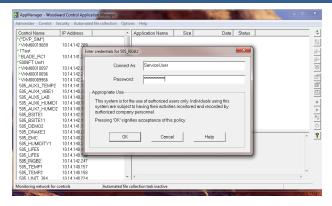
Figure F-6. Dialog for App Manager Connection

To connect to the control, use the following
    Connect As: ServiceUser
    Password: ServiceUser@1

Click OK and the window should look something like this.
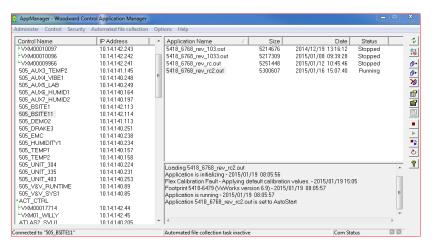
Figure F-7. App Manager Connected to a Control

Control Information Parameters

From the main screen – click on the Control Name and then from the Control menu pull-down select Control Information. The figure below shows an example of the all the information available here. This is a useful place to obtain embedded software part numbers, memory usage, Ethernet IP assignments, and total hardware run hours (power up time).
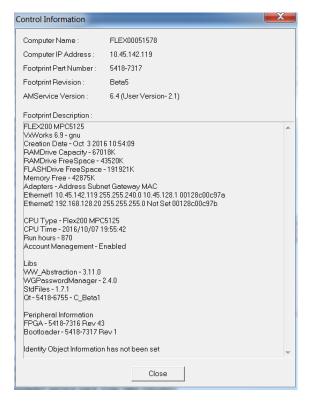
Figure F-8. AppManager Control Info Window

Switching Application Panel Views

The application panel has two views - the control application panel has a white background while the GUI application window has a maroon background. To toggle between the panels, use the swap button on the far right side (the second button down from the top).
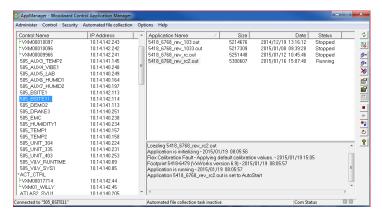
Figure F-9. AppManager Control (GAP) Application Panel
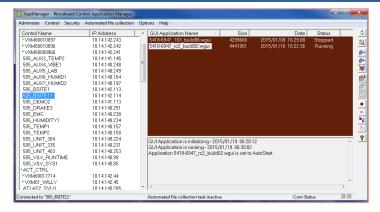
Figure F-10. AppManager GUI Application Panel

Retrieving Files

The most common use of AppManager is to retrieve data files from the control, specifically Data log and Trend log files. Do this by using the menus and selecting Control/Retrieve Files. A dialog box will open and show the files that are available in that application directory.

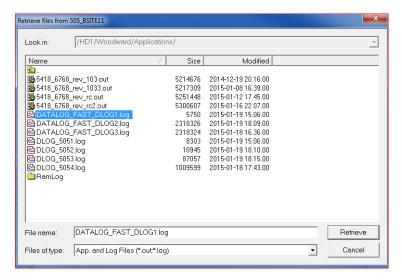All Data and Trend log files are in the control application folder.

Figure F-11. Retrieving Files

Transferring Files

For most users there will not be any need to transfer new files to the Peak200, but if this need arises, AppManager is the tool for doing this. To transfer files to the control, first be sure you are in the correct application window. For example, to transfer a customized or updated GUI file – switch to the GUI application file panel before transferring the new file.

Use the menu and select Control/Transfer Application Files. A dialog box will open so that you can browse your PC to fine the correct file needed to be transferred.

The control will allow any file to be transferred unless it says an existing file on the control with the same name. If this occurs the user must first delete the file on the control before the new one can be transferred. Woodward typically adds a revision or a build number to the end of the file name so that any updates can be added to the control and the previous revisions will still be available. All user tunable settings are associated with a specific program revision.

Changing the Ethernet IP addresses

It is recommended that the user configures the IP addresses through the GUI in configuration mode at the same time that the control is setup. It is possible to set them up with AppManager, but the control applications must be stopped first. It is best for only experienced users do this via AppManager. In either method, the turbine must be shutdown to change the IP addresses.

Start/Stop Applications

AppManager is the tool that is used to Start or Stop the execution of the GAP (control and IO) program and/or the GUI (display) program. The GAP and the GUI are handled very differently and will be explained below.

GAP Applications – Control logic and I/O

The GAP program (*filename.out*) has logic checks to ensure that it is never stopped while the turbine is in operation. Stopping the GAP program puts the control in IOLOCK. There is typically no need for the user to stop the GAP program unless loading an OS service pack or the unit is being updated to a newer GAP revision.

GUI Applications – Display Graphics

The GUI program (*filename.wgui*) contains all the pages of information that appear on the front screen. It can be stopped and restarted without any interruption of the turbine operation (does not affect the GAP execution).

The typical use of stopping and restarting the GUI program is:
1. Change the program (to a different build revision)
2. Change the default language of the screen

To change the language, go to the MODE screen and navigate to the Globe Icon and press Enter. A list of language options will appear – after selecting the desired language the GUI must be restarted. If the turbine is shutdown, you could just power cycle the control. If the turbine is in operation – or it is not desired to stop the GAP application, then the GUI can be selected, stopped, and started from the screen shown in Figure F-10.

Install a Woodward Service Pack

Use the AppManager tool to install a service pack to update the OS or the real-time process that executes the GUI application.

Woodward representatives or a service bulletin directing the user through the process typically does this. Nominally, these are the steps:
1. Shutdown the turbine to a complete stop
2. Stop the GAP and GUI applications that are running
3. Under the Control menu click on Install Service Pack
4. Locate and launch the Woodward service pack (may take minutes)
5. At the end there will be a dialog box asking to Reset the control click yes
6. After the control reboots – log into the control again
7. Start the GAP and GUI applications

Appendix G.
Using Peak200 Internal Simulation Mode

The Peak200 has an available speed simulation mode that is intended to be used to verify the control configuration and as a training tool. Any unit (a spare unit is ideal) can be setup in an office, lab, or conference room to use this feature and allow the user to configure and simulate some functions of the Peak200 prior to using the unit or wiring it to the turbine. This can be extremely valuable and is used to:

- Test the operation of the configured start routine
- Explore all the options available on the product
- Train and document startup procedures
- Learn how to connect and use the service tools

To enter this mode:

> Give the control an external Trip command by making the DI03 External Trip discrete input FALSE. (This gives a TRIP command to the Peak200).
> Then go to the MODE screen and log in as **User Level = Configure**

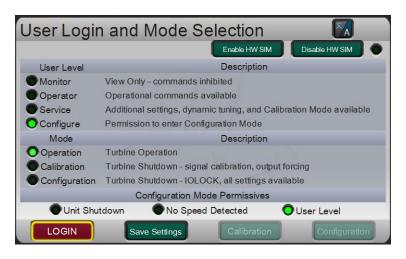This will make two buttons available and an LED which will Enable and Disable the H/W simulation mode.

Figure G-1. HW Simulation Mode Access

When entering this mode, the following actions will take place:

1. The DI03 External Trip will be inverted (so that a FALSE = OK, in normal operation this must be TRUE= to run the turbine) – Thus a 'Reset' will now clear this Trip condition.
2. Actuator fault trips will be overridden.
3. Event 009 Alarm will be active stating "Internal HW Simulation is Enabled".
4. A simulated speed ramp will produce speed based upon the valve demand increasing

When any of these actions take place, the H/W Simulation mode will abort:

1. If DI channel 3 goes TRUE (Normal run mode must be True to Run)
2. If Speed is ever seen on either of the MPU input channels
3. Exiting Configuration Mode (Peak200 resets user level to Operator – so re-enter Sim mode after any configuration changes are made)

Typical use would be:

1. Configure the unit for the required steam turbine start routine
2. Configure any start sequence items and/or a critical speed range
3. Configure the ramp rates at rate times as a fraction of what you want (for example for a 4 hour idle delay use 0.24 minutes instead of 240 min)
4. Exit the configuration mode and re-login as Configure User
5. Simulate a start

DEMO MODE -

Once entering a valid configuration and the unit is in H/W simulation mode, there is also a "Demo Mode" available under the Service/Tutorial menus.

To place the unit in Demo mode:
1. Press the TRIP button and then Press the 'Reset' button and clear all TRIP conditions
2. From the HOME screen verify a 'Ready to Start' message appears in the Control Status in the upper right corner of screen
3. Press HOME/Service/Tutorial and press the "DEMO Mode On" key – this will do the following – The unit will cycle through the following sequence –
    Start
    Complete the programmed Start Sequence to Rated
    Ramp the Speed Setpoint to Maximum Governor Speed
    Issue a Trip
    Reset the Trip and repeat the sequence

While in this mode, the unit will automatically switch to five different screens during this routine. The length of the demo cycle will mostly depend on the Ramp rates setup for the start sequence and the Fast Rate Offline rate (found under Service/Speed Control).

Any time the DEMO mode is active screens will automatically switch showing a small sample of features and pages without need for operator/user commands. You can navigate to other pages while in this mode, however when the sequence calls for a page switch it will jump back into its automated page sequence. DEMO mode is the only time the screen will ever switch automatically.

Any time the Demo mode is disabled, press the TRIP button to clear all sequence steps prior to re-enabling.

The following is a very simple example configuration that works well for the Demo mode

Table G-1. Example Demo Configuration Settings

Configuration Menu

      Turbine Start Menu

Start Mode:	Automatic Start	Screen 1
This selects Start Sequence as:	Idle/MinGov Sequence	Screen 1
Idle Speed Setpoint (rpm)	1000	Screen 2
MinGov Speed Setpoint (rpm)	3000	Screen 2
Rate to MinGov (rpm/s)	50	Screen 2

      Speed Input Channel 1 ->

Max Speed level (rpm)	6000	Screen 1

      Speed Setpoints

Overspeed Test limit (rpm)	4800	Screen 1
Overspeed Trip (rpm)	4750	Screen 1
Max Gov Speed (rpm)	4500	Screen 1
Min Gov Speed (rpm)	3000	Screen 1
Underspeed Setpoint (rpm)	2800	Screen 1

      Can add a critical speed avoidance range under this menu, if desired

Service Menu

      Speed Control Menu

Fast Rate Offline (rpm/sec)	50	Screen 1

When finished simulating with the unit, it is recommended to load either site tunables or the factory default tunables into the unit to avoid any problems when the unit is installed (for example, if this unit is to be a spare on the shelf). To do this, follow the procedure for uploading/downloading tunables using the Control Assistant tool.

To return to factory default conditions – use this file found on the System Documentation BCD. Factory_Default_Tunables_Rev_xx.tc

Appendix H.
Startup and Commissioning Checklist

The Peak200 is a user-friendly control that is intended to be configurable in the field by a variety of users with various levels of turbine control experience. Success is ultimately dependent on the knowledge of the user

The following is a brief list of the minimum checks that should be done prior to attempting to start the turbine for the first time (initial control commissioning).

Test to be done prior to powering up the control:
- Verify that control supply power voltage matches the supply voltage
- Verify if Analog Input signal loops are powered internally or externally (wired correctly)
- Verify if Discrete Input circuits wetting voltage is supplied by control DI power or by external power (wired correctly)
- Verify that the Configuration worksheet (or optional Excel spreadsheet file) is complete

Tests to Be Done Prior to Running the Turbine

Verify speed signals.	Verify number of teeth/gear ratio.
Loop check all AI signals.	Verify ranges.
Check all DI signals.	Verify active state.
Loop check all AO signals.	Verify ranges / force test.
Check all relay outputs.	Verify active state / force test.
Loop check all ACT signals.	Perform manual stroke test.
Verify Comm links.	Modbus
Verify TRIP and External DI TRIP from customer.	Verify with customer.
Verify w/ Frequency input that Peak 200 reads the correct speed.	Freq * Num Teeth * Gear Ratio /60 = Speed
Verify an External Overspeed Trip Device is in place and functions properly.	Verify with customer.
Verify that configuration on Peak 200 Front display matches info from Program Worksheets.	Verify with customer, start routine, I/O signals, ranges, and optional functions.

Tests to be Done While the Turbine is Running

Start the turbine and verify the customer's expectations of the start routine.

Verify in SERVICE/Speed Control the speed switch setting for changing to ONLINE dynamics is correct.	Determine when unit switches between settings – if only single settings are needed, raise this speed switch value above OSPD trip value.
Validate performance at Idle Speed - Tune OFFLINE dynamics (if required).	Use Control Assistant trend script file - Speed_PID.ts. Save settings when completed.
Perform an OPTI PID analysis at Idle Speed & capture Datalog.	Optional test - If Datalog is available, capture this event.
Verify stable operation through the start routine up to MinGov speed.	Check critical speed avoidance range if used.
Validate performance at Rated Speed - Tune ONLINE dynamics if required.	Use Control Assistant trend script file - Speed_PID.ts. Save settings when completed.
Perform an OPTI PID analysis at MinGov Speed & capture Datalog.	Optional test - If Datalog is available, capture this event.
Verification of any configurable control mode options that are used (CASC, …..)	Verify operation and tune as required.
Verify use of the Manual Valve demand (Service) if configured for use.	
Verify the typical TRIP/Stop routine used by the site.	Save settings when all tests are complete.
Verify an overspeed trip test (internal or external) full or reduced speed tests available.	Verify settings with customer.
Update customer configuration and service settings worksheets and download the final tunable settings file for archival.	Name the tunable file with an appropriate name (such as the control ID, date, site unit name, commissioner's initials. Ex: FLEX00051578 2016-12-06_Unit308G_sdo.tc).

Appendix I.
Feature Pack (FP) Software Add-ons for Peak200

Beginning with application software GAP/GUI Revision D (released in early 2023), Woodward has made all product features detailed in this appendix available to all users, without the purchase of the FP software license (p/n 8447-5004). Peak200 units that are shipped or upgraded in the field with the following application part numbers and revisions will not need to follow the "Activating a Feature Pack" procedure (step 2 below) to activate these features. The first step below details a procedure to upgrade units in the field with these application revisions.

    GAP AppID: 5418-7275_d
    WGUI AppID: 5418-7345_d

To verify the application software in your unit, go to the "Site Info" screen (accessible from the HOME screen). The Peak200 hardware serial number has been added to this page.
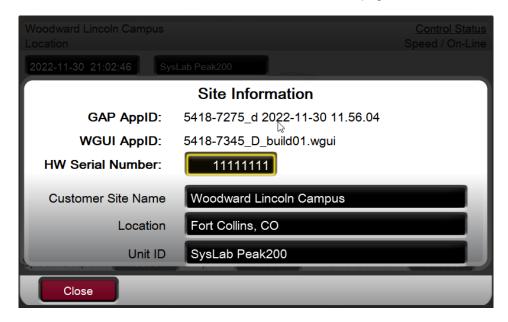

Figure I-1. Site Info Page (Application Software Rev D and Later)

The Peak200 has some optional software features that can be added to the base product offering. These are called "Feature Packs" and are fully tested by Woodward and are available from Woodward or your authorized Woodward service provider.

There are two steps to enabling these features.
1. Verify the application software part numbers in your control and compare them with the software required revisions listed with the feature pack. If you do not have the minimum required revision, you will need to obtain that upgrade package and install it first. The turbine will need to be in a shutdown state to perform this application software upgrade.
2. Purchase the feature pack license and enter the supplied 'Site Key' to enable the features.

Updating the Application Software

IMPORTANT	The turbine must be shut down to perform the following procedure. If it is not, the AppManager program will not allow the application to be stopped, which will prevent the procedure from being performed.

Use the following procedure to update the GAP or GUI applications to a newer revision:
1. If the unit has been configured, download the current tunable settings file from the control. If unfamiliar with using Control Assistant, refer to Appendix E for step-by-step instructions on "Retrieving Control Tunables" from the unit.
2. If unfamiliar with using AppManager, refer to Appendix F for step-by-step instructions.
3. In the Control application view panel, Stop the application by selecting Control/Stop Application or the Maroon Square button on the right-side Toolbar. The IOLOCK LED will come on.
4. Switch to the GUI application view panel (brown background) and Stop the application by selecting Control/Stop Application or the Maroon Square button on the right-side Toolbar. The status of this application will now say Stopped.
5. The display on the control will switch to the "splash screen" when no GUI is running.
6. Switch back to the Control application view panel.
7. Under the Control menu, select Transfer Application Files.
8. In the dialog box that opens, browse to find the new GAP executable file (on your PC) named: **5418-7275_x.out**.
9. When transfer is complete, select the file, and start the application by selecting Control/Start Application or the blue triangle button on the right-side toolbar.
10. Switch to the GUI application view panel (brown background) by using the Swap button on the right-side toolbar (or Control/Show GUI Applications View).
11. Under the Control menu, select Transfer GUI applications.
12. In the dialog box that opens, browse to find the new GUI file (on our PC) named: **5418-7345_x_build01.wgui**.
13. When transfer is complete (takes about a minute), select the file, and start the application by selecting Control/Start Application or the blue triangle button on the right-side Ttoolbar, the GUI initialization will take about two minutes.
14. If unit was configured, upload the current tunable settings file (from step 1) from your PC into the control. Refer to Appendix E, "Sending Control Tunables".
15. Procedure complete. Both application files are now in AutoStart, and the control will boot up normally after any power cycle.

Activating a Feature Pack

When purchasing the feature pack license, you must supply the serial number of the target control that will receive the license. The site key supplied with the purchase of the license will be unique to that control serial number and will only work on that unit. Each control requires its own license, the license will not transfer from one unit to another (spares would need their own license). Once the "Site Key" is obtained, follow the steps below to license the control.

Feature Pack 1 in the Peak200:
1. From the HOME screen of the unit (Figure 2) – Go to the Site Info page
2. From the Site Info page (Figure 3) – go to the Site Key page
3. On the Site Key page (Figure 4) – enter the Site Key for enabling the Feature Pack functions. With the value highlighted (in focus), press Enter to edit the value and then enter the Site Key from the keypad and press Enter to accept the value. The factory default is 1111.
4. If correctly entered and accepted the Site Key Validated LED will illuminate green.
5. Return to the HOME screen and press the Service button.
6. From this screen, press the Save Settings button to retain the site key entry.
7. All features listed in the table above will now be accessible

Figure I-2. HOME Page

Figure I-3. Site Info Page (Application Software Rev C and Earlier)

Figure I-4. Site Key Pop-up Page

Contents of Feature Pack 1
(License p/n: 8447-5004 – Release Aug/2017)

Software P/N and Revision Requirements –
(for powered units, this is found on Site Info screen accessible from the HOME page)
       GAP AppID   5418-7275_A
       WGUI AppID   5418-7345_A

Table I-1. Additional Control Features

| Feature	Description	Where is it found?	Requirement to use
Add I/O - LinkNet Nodes	Enables access to a LinkNet I/O section of the Configuration menu for increasing the available Input/Output channels in the system	Configuration menu – *Linknet Nodes*	Turbine Shutdown & control in Configuration mode
Data Logging (10ms resolution)	Woodward's datalogging feature allows the user to capture specific parameter values in a continuous 'running buffer' of memory. User can configure the data points and the sample rate at which the data is gathered. high-speed	Service menu – *Datalog*	None
Multi-Lingual	Enables access to a language translation icon on the MODE screen to allow the selection of languages other than English – (initial release of FP1 contains Portuguese)	Mode Screen – *Icon in upper right corner*	None – GUI needs to restart, but does not affect turbine operation
Event History	Adds an event history feature under the TRIP or ALARM view page that accesses a continuous log of all alarms & events (with time & date stamp) captured by the control	Trip or Alarm View screen *History button*	None
DI Start Permissive	Adds an option in the functional menu list for a discrete input to be used as a start permissive. When configured for use, the start command will be inhibited until this input is TRUE. Once the unit has started this input will be ignored	Configuration menu – *Contact Inputs*	Turbine Shutdown & control in Configuration mode
AI Level Start Permissive	Adds an option in the Channel Events for AIs to add a setpoint for a Start Permissive. For example, if the AI is configured as a Monitoring signal for Lube Oil Pressure, a setpoint can be used as a requirement to start.	Configuration Menu – Analog Input – Channel Events	Can be enabled & disabled in Service once the AI is configured for use.
Hot Start	Adds the option for operators to set the unit to start with a multiplier on the Rate to Minimum, if the unit is hot, to allow for a faster startup. This needs to be set from the startup curve page after any shutdown.	Enabled/Disabled from the Startup Curve Page. The multiplier is set in Service Menu > Speed Control	None
Rated Setpoint	Adds option to the Automatic Start to ramp to a Rated Speed Setpoint instead of Min Governor	Turbine Start Configuration Menu	Automatic Start Used

Adding LinkNet Distributed I/O
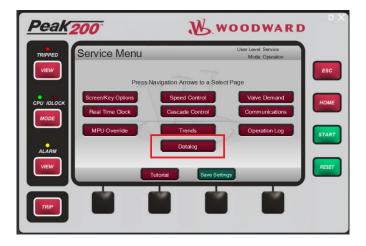
A navigation button will appear on the Configuration Menu page to allow the user to program additional I/O for the system.

Figure I-5. Additional Control I/O

Datalogging

The Datalog button under the Service Menu screens will allow the user to access a high-speed data buffer available in the Peak200.
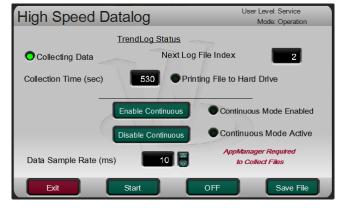

Figure I-6. Datalog Feature Screens

The Datalog is a fixed configuration which samples and stores data every
10ms (default sample rate) and contains approximately 3 minutes of data per file. The data that is stored includes all IO channels, controller inputs and output, limiters, and other pertinent information in order to analyze the system. This Datalog file can also have signals added through a configuration file (created with Control Assistant).

The Datalog buffer begins collecting data automatically when any of the following occurs:
1. User command to start from the Datalog page in the Service Menu
2. The turbine is started
3. A file is stored on the drive

The Datalog stops when
1. User command to stop from the Datalog page in the Service Menu
2. A shutdown occurs – it will wait 20 seconds after the Trip event and then stop the Datalog

A Datalog file automatically prints to the control Hard Drive for retrieval when the Datalog is stopped, which in turn restarts the Datalog buffer when the file is printed. The control will store three log files on the control and then begin to overwrite previous Datalog files when generating a new file. The files are indexed with a value from one to three which increments each time a new file is generated.

Datalog File Retrieval
Datalog files can be retrieved from the Peak200 for analysis using AppManager (see Appendix F). The name of these files are:
    TREND_DLOG1.log
    TREND_DLOG2.log
    TREND_DLOG3.log
Since the files overwrite to never have more than three, the file time & date information is needed to determine the most recent file.

Datalog File Analysis
Open Datalog files with Control Assistant (after download onto your PC) from the control using AppManager. With Control Assistant open, go to File > Open… and navigate to file location on your PC and select Open. The Graph Properties page will open with the list of available signals in the left window. Signals plotted (referred to as pens), can be moved from the available signals list to the right window. Once in the right window, the pen color and order customization is an option:
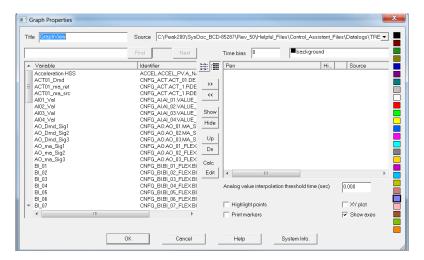

Figure I-7. Selecting Datalog Trend Parameters

Generate the graph by selecting OK in the Graph Properties Menu. Once generated, the plot displays in the top portion of the screen and the pen details are given on the bottom. The Scale (Low) and Scale (High) are automatically set initially but can also be set manually. Two cursors can be dragged on the plots to see exact values and compare data between two time stamps (Y1 column in the Pen details is Cursor 1, Y2 column is Cursor 2, and Delta-Y is the change in the signal value between the two cursors). In the bottom right hand corner of the window, the 'Time Difference' is in seconds and is the amount of time difference between the cursors. Please see the help menu within Control Assistant for detailed information on all menu options.

Continuous DataLog

The Continuous DataLog feature allows for Datalog files generations, which merge in Control Assistant to create a plot over very long periods. This mode supports commissioning or troubleshooting efforts. For that reason, the Continuous Mode will change the Data Sample Rate to 10ms. Use the Continuous Mode with AppManager to automatically collect the Datalog files as they are generated.

Press the 'Enable Continuous' button on the Datalog page in the Service Menu to enable Continuous Mode. You will need to stop the current collection and re-start the TrendLog to place it into Continuous collection mode.

Next, in AppManager, go to Automated File Collection > Configure Automated File Collection Task. Select the control from the 'Available Control' list and add it to the 'Controls to gather files from' list. Within the 'Datalog retrieval options', set the folder on your PC where files will be stored. Press 'OK' to exit the configuration menu.

> **Note**: By default, each file is approximately 3.4 megabytes and generates a file once each collection time internal (shown on Datalog page – default is 265 sec). This means that approximately 65 megabytes of data will be stored every hour on your PC, when collecting at 10 ms data rates.

After clicking OK you will be prompted if you would like to start collecting now – if yes – it will gather all current Datalog files on the control. To begin collecting files you can also go to Automated File Collection > Start Automated File Collection Task. Once started, AppManager will display 'Monitoring Network for New Files' in the bottom window indicating that new files on the control are automatically saved to your PC.
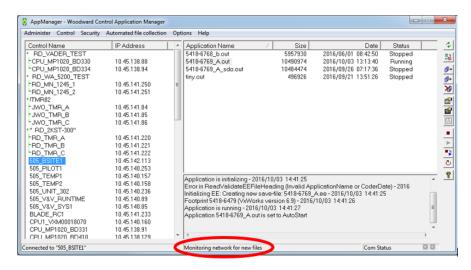

Figure I-8. AppManager Setup for Automatic Collection of Datalog Files

The Control will remain in Continuous Mode for 8 hours or until it is manually disabled from the Datalog page.

To View the continuous Datalogs, select all the files (instead of just one) when opening the file and then follow the same steps as above to construct the graph of the desired variables.

See the Control Assistant Appendix for more information of how to use this feature.

Typical use would be:
1. Initial commissioning and tuning system dynamics – high speed Datalog for troubleshooting any issues
2. Automatically capturing this data on any trip, to help analysis/solve any unclear causes
3. Adjust the settings to capture slow speed process data (over hours of operation) to troubleshoot plant operation data when needed

Multi-Lingual Support

The language selection button appears in the upper right corner of the Mode screen – feature packs may turn on additional language options than the base Peak200 offers.

Figure I-9. Language Icon on Mode Screen

At the time of this release, Portuguese is the only alternate language currently available for the Peak200 product.

Event History Access

The control retains a continuous file of all alarm and trip events in a file named ae_eventlog.csv recorded onto the hard drive. Use the AppManager tool (Retrieve File option) to retrieve the file for analysis at any time.

The feature pack allows file access and viewing conveniently on the front panel display. It will make available an Event History page that will be accessible from either the Trip or the Alarm View page.

Figure I-10. Navigation to Event History Page

The Event History page shows each alarm and trip event, and any acknowledge or reset commands entered. This is a raw/unfiltered file so each of these displays with the corresponding time stamp. Use the Adjust key to scroll up/down the list. If you leave the page and return, it will always initialize back at the top of the list (most recent first).

Notes:
- The Reset and Acknowledge commands will always appear twice as both the Alarm and Trip latch blocks receive this command.
- This is accessing a continuously updating file that is in English only. Translation not available.
- The Event number has been added to the beginning of each event message string and equates to the Event ID in the manual and the number shown on the current VIEW screens of alarms and trips.
- If an external discrete input Trip exists as the unit powers up, a TRIP_01 logs with a time stamp of 0:0:0 1 Jan 1970. This is because the DI Trips are time stamped at 1 ms intervals and the Real time Clock block does not initialize until the control application has run for 10 ms.
- When using RemoteView, this History Page is not available (the GUI component looks at a specific file location on the Peak200 drive, not your PC). However, the full event file of all alarms and trips is retrievable remotely using the AppManager tool (filename = ae_eventlog.csv).

Start Permissive Discrete Input

An additional option will appear in the Discrete Input (DI) functional menu selection for a Start Permissive input. When configured for use, any Start command to the control will be inhibited while this input is false. Once this input is TRUE and the Start command is re-issued then the unit will start. Once the unit has started, the status of this input (true or false) is ignored and will not affect turbine operation. There is also an additional relay output menu selection that allows the status of this Start Ready to Start indication below to drive a relay output.

If all shutdowns are clear, but this input is false the Control Status message (upper right of every screen) will read "Start Perm Not Met". If a start command is issued at this time the Start dialog pop-up box will appear to further annunciate this condition.

Figure I-11. Start Pop-up Page with Start Permissive

Figure I-12. Menu Selections for DI and Relay Output

Start Permissive Analog Input

An additional option will appear in the Channel Events screen for Analog Inputs (AI) and RTD inputs to configure a setpoint to be used as a start permissive functional menu selection for a Start Permissive input. When configured for use, any Start command to the control will be inhibited while the signal level is less than (or greater, if inverted) the setpoint. Once the setpoint condition is met the Start command is re-issued then the unit will start. Once the unit has started, the status of this input compared to the setpoint is ignored and will not affect turbine operation.

If all shutdowns are clear, but the condition is not met the Control Status message (upper right of every screen) will read "Start Perm Not Met". If a start command is issued at this time the Start dialog pop-up box will appear to further annunciate this condition.

Figure I-13. Menu Selection for Analog Input Start Permissive

Hot Start

An additional option will appear in the Speed Control Service Menu for a Hot Start Multiplier. This multiplier is applied to the Ramp to Minimum rate when a Hot Start is activated. This allows the turbine to start at a faster rate when the turbine is determined to be hot. For example, if the Ramp To Minimum rate is 30 RPM/s, and the Hot Start Multiplier is 2, then the ramp rate will be 60 RPM/s. The Hot Start can be enabled and disabled from the Startup Curve menu bar. The Hot Start is disabled after any shutdown, requiring it to be enabled prior to each startup.

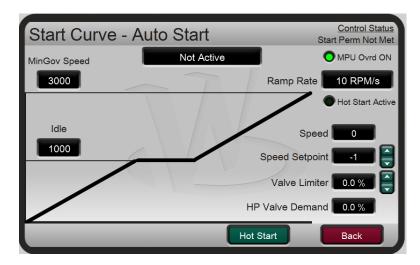Figure I-14. Menu Selection for Hot Start Multiplier

Figure I-15. Hot Start Enable and Active LED

Rated Setpoint Start

When using an Automatic Start Sequence, an additional option will appear in the Turbine Start menu to enable a Rated Speed Setpoint. This allows the turbine to ramp to a pre-defined Rated Setpoint between Minimum and Maximum Governor Speeds. When configured for use, speed control begins at idle speed, which is a setpoint lower than Minimum Governor Speed. The command to go to Rated can be issued by closing the IDLE/MIN GOV input, from the front panel, or from the Go To Minimum Governor Modbus command (0:0006). When the command is issued, the turbine will accelerate to the configured Rated Speed Setpoint at the Rate to MinGov rate.

Revision History

Revision G—
- Revised the Regulatory Compliance section
- Updated EU Declarations and added UKCA Declarations

Revision F—
- Revised Tables 1-3, 1-5
- Revised Auto Start Mode section (Chapter 3)
- Various revisions throughout Chapter 4
- Revised Tables 4-6, 4-7, 4-11, 4-12
- Added content to Overspeed Test Procedure (from the Peak200 display) in Chapter 5
- Replaced Figure 5-17
- Revised Tables 5-1, 5-2
- Added Normal (Controlled) Shutdown content to Chapter 5
- Added Figure 5-23
- Revised Tables 6-5, 6-6
- Replaced Figure 7-1
- Added content to Screen/Key Options Menu section in Chapter 7
- Added content to Speed Control Menu section in Chapter 7
- Revised Configuration Mode Worksheets (Appendix A)
- Revised Service Mode Worksheets (Appendix B)
- Added content to Features of SOS (Appendix D)
- Added content to Appendix I
- Added new Figure I-1 and renumbered remaining figures in Appendix I
- Renamed Figure I-3

Revision E—
- Added sentence to the 2nd paragraph on pg. 18
- Fixed second equation on pg.18
- New text into Warning box and new content for last paragraph on pg. 71
- Multiple equation fixes and new Gear Ratio content on pg. 72
- New content in last paragraph on pg. 98
- Changed last bullet under Modbus Points of Interest on pg. 116
- Replaced content for Address 1:0005 in Table 6-6

Revision D—
- Added RoHS Directive
- Edited two paragraphs within Special Conditions for Safe Use
- Added Explosion Hazard Warning box
- Inserted new paragraph in Start Mode section of Chapter 3
- Added new content to the Configuration Mode section of Chapter 4
- Edited bullet in Idle/Minimum Ramp section of Chapter 5
- Added new content to the Speed Control Menu in Chapter 7
- Replaced Table I-1 in Appendix I
- Added Start Permissive Analog Input, Hot Start, and Rated Setpoint Start sections to the end of Appendix I
- Replaced DoC 00109-45-EU-02-02

Revision C—
- Large portions of Appendix I have been revised/added
- Revised Optional Distributed I/O section
- Added three new functions to the Screen/Key Options Menu
- Added new content to the Channel Events Screen and the LinkNet Node section
- Revised content in the LinkNet Nodes Menu section

- Added new content to Appendix A Configuration Mode Worksheets
- Added new content to Appendix B Service Mode Screen/Key options worksheet

Revision B—
- Added INMETRO certification

Revision A—
- Updated ATEX and IECEx certifications
- Updated EU Declaration of Conformity

Declarations

EU DECLARATION OF CONFORMITY

EU DoC No.:	00109-45-EU-02-01
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	Skarbowa 32 32-005 Niepolomice, Poland
Model Name(s)/Number(s):	Peak200 Bulkhead Mount Version, PN: 8200-1500, 8200-1501 Peak200 Front Panel Mount Version, PN: 8200-1503, 8200-1504
The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC) Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
Applicable Standards:	
EMC:	EN 61000-6-2:2005, EN 61000-6-2:2005/AC:2005; Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments EN 61000-6-4:2007, EN 61000-6-4:2007/A1:2011; Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
LVD:	EN 61010-1:2010, EN 61010-1:2010/A1:2019/AC:2019-04, EN 61010-1:2010/A1:2019; Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

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This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Annette Lynch
Signature

Annette Lynch
Full Name

Engineering Manager
Position

Woodward, Fort Collins, CO USA
Place

28 June 2023
Date

5-09-1183 Rev 39

EU DECLARATION OF CONFORMITY

EU DoC No.:	00109-45-EU-02-02
Manufacturer's Name:	WOODWARD POLAND SP. Z.O.O.
Manufacturer's Contact Address:	Skarbowa 32
	32-005 Niepolomice, Poland
Model Name(s)/Number(s):	PEAK200 BULKHEAD MOUNT VERSION, PN: 8200-1502, 8200-1508
	PEAK200 FRONT PANEL MOUNT VERSION, PN: 8200-1505, 8200-1509

The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:

Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC).

Markings in addition to CE marking: ⟨Ex⟩ II 3 G, Ex ic nA nC IIC T4 Gc

Applicable Standards:

ATEX: EN60079-0, 2018 : Explosive Atmospheres - Part 0 : Equipment – General requirements.

EN60079-11, 2012 : Explosive Atmospheres – Part 11 : Equipment protection intrinsic safety "i"

EN60079-15, 2010 : Explosive Atmospheres – Part 15 : Equipment protection by type of protection "n"

EMC: EN61000-6-4, 2011 : EMC Part 6-4 : Generic Standards- Emissions for Industrial Environments

EN61000-6-2, 2005 : EMC Part 6-2 : Generic Standards- Immunity for Industrial Environments

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This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Annette Lynch

Signature

Annette Lynch

Full Name

Engineering Manager

Position

Woodward, Fort Collins, CO, USA

Place

07 December 2022

Date

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5-09-1183 Rev 38

UKCA DECLARATION OF CONFORMITY

UKCA DoC No.:	00109-45-EU-UKCA-02-01
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	Skarbowa 32
	32-005 Niepolomice, Poland
Model Name(s)/Number(s):	Peak200 Bulkhead Mount Version, PN: 8200-1500, 8200-1501
	Peak200 Front Panel Mount Version, PN: 8200-1503, 8200-1504

The object of this Declaration is in full conformity with the following UK Statutory Instruments (and their amendments):

S.I. 2016 No. 1091	Electromagnetic Compatibility Regulations 2016
S.I. 2016 No. 1101	Electrical Equipment (Safety) Regulations 2016

The Object of this Declaration is in conformity with the applicable requirements of the following designated standards and technical specifications.

EN 61000-6-2:2005, EN 61000-6-2:2005/AC:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4:2007, EN 61000-6-4:2007/A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
EN 61010-1:2010, EN 61010-1-2010/A1:2019/AC:2019-04, EN 61010-1:2010/A1:2019	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Regulations(s).

MANUFACTURER

Annette Lynch
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Signature

Annette Lynch
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Full Name

Engineering Manager
_____
Position

Woodward, Fort Collins, CO USA
_____
Place

28 June 2023
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Date

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5-09-1183 Rev 39

UKCA DECLARATION OF CONFORMITY

UKCA DoC No.:	00109-45-EU-UKCA-02-02
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Contact Address:	Skarbowa 32 32-005 Niepolomice, Poland
Model Name(s)/Number(s):	Peak200 Bulkhead Mount Version, PN: 8200-1502, 8200-1508 Peak200 Front Panel Mount Version, PN: 8200-1505, 8200-1509
Markings in addition to UKCA marking:	⟨Ex⟩ II 3 G, Ex ic nA nC IIC T4 Gc

The object of this Declaration is in full conformity with the following UK Statutory Instruments (and their amendments):

S.I. 2016 No. 1107	Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016
S.I. 2016 No. 1091	Electromagnetic Compatibility Regulations 2016

The Object of this Declaration is in conformity with the applicable requirements of the following designated standards and technical specifications.

EN IEC 60079-0:2018	Explosive atmospheres - Part 0: Equipment - General requirements
EN 60079-11:2012	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
EN 60079-15:2010	Explosive atmospheres - Part 15: Equipment protection by type of protection "n"
EN 61000-6-2:2005, EN 61000-6-2:2005/AC:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4:2007, EN 61000-6-4:2007/A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

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5-09-1183 Rev 39

We appreciate your comments about the content of our publications.

Send comments to: **industrial.support@woodward.com**

Please reference publication **35051**.

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