WOODWARD

Product Manual 26518V3
(Revision G, 4/2017)
Original Instructions

MicroNet TMR® 5009FT
Fault-Tolerant Steam Turbine Control

Configuration and Commissioning Tool (CCT) and Modbus® Software Interface Manual

Manual 26518 consists of 4 volumes (26518V1, 26518V2, 26518V3, 26518V4)

Volume 3

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. To verify that you have the latest revision, check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, on the *publications page* of the Woodward website:** **www.woodward.com/publications** **The latest version of most publications is available on the *publications page*. 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.**

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

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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 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.**

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. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

General Installation and Operating Notes

Peripheral equipment must be suitable for the location in which it is used.

Wiring must be in accordance with the authority having jurisdiction.

⚠WARNING	**EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.**

Chapter 1.
General Information

Introduction

The technical documentation for the 5009FT control system consists of the following volumes:

Volume 1—provides information on system application, control functionality, fault tolerant logic, control logic, PID setting instructions, and system operation procedures.

Volume 2—provides hardware descriptions, mechanical and electrical installation instructions, hardware specifications, hardware troubleshooting help, and basic repair procedures.

Volume 3—provides installation procedures for the 5009FT control's personal computer based interface software program (CCT), information on all CCT features and modes (Configure, Service and Run), and a lists of the control's Modbus® * registers and DDE tag names.

*—Modbus is a registered trademark of Schneider Automation Inc.

Volume 4—provides details on installation and operation of the HMI operator control station, if provided with your system.

This volume provides software installation, configuration and troubleshooting information for the 5009FT control's PC Interface program.

Configuration & Commissioning Tool (CCT)

The 5009FT control is a field configurable steam turbine control. A full function PC is delivered with every standard 5009FT control cabinet to allow users to configure, service, and operate (Run) their 5009FT control. The different modes of the CCT allow it to function as an engineering workstation and or an operator control panel.

Refer to Figure 1-1 of this manual for installed software program relationships. The CCT is preloaded with the following Woodward software programs:

- ToolKit—primary configuration & operator interface
- Control Assistant—debugging/troubleshooting/trending
- AppManager—File transfer/IP address assignment/troubleshooting
- GAP™ Programmer—Read-only & Help of turbine application program

IMPORTANT **The CCT is intended to always be actively connected to the control. Once the 5009FT is initially configured, however, it is not required to run the control (or turbine). The CCT does capture some alarm event history data continually, but it can be disconnected or turned off any time without causing any disturbance to turbine operation.**

ToolKit Program

The 5009FT Toolkit program is the interface program which will be started and used to configure, service, and operate the 5009FT control. This program's interface modes are as follows:

Configure Mode—This mode has password based security and is used when the system is shutdown to:

- Configure the control to an application
- Enter numbers/values directly (not restricted to up/down tune buttons)
- Change control input/output assignments
- Load a control's configuration from a computer file

Service (or Limited Configuration) Mode—This mode has password based security and is used when the system is operating on-line to:

- Calibrate control inputs and outputs
- Tune system settings
- Monitor Control Health
- Test Voting Logic
- Test control and system protection logic

Run Mode—This mode can be used as an operator control panel to:

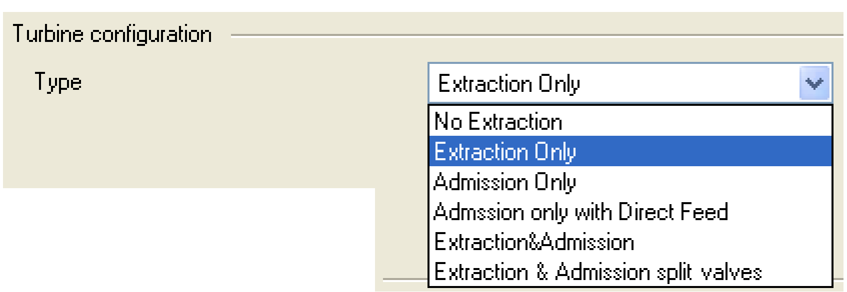
- Start and Stop the turbine
- Enable and Disable all system control modes (Cascade, Auxiliary Control, Extraction/Admission, etc.)

This volume applies to all 5009FT control systems but may include information that is not used or not applicable to your system. This volume and the CCT software described cover only the 5009FT application program as generated by Woodward.

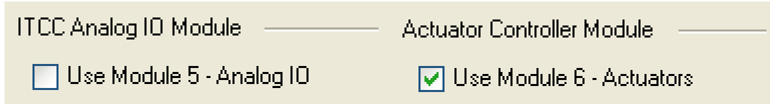
As with any Windows based program, the pages displayed and the navigation between pages will change depending on the input from the user. If certain options of the ToolKit Tool File program are not used, navigation to some pages may disappear and not be shown. For the purpose of this manual, all options and all pages have been displayed in the figures that follow. The folders and screens that you as the user will see on your own unit will be different. Sometimes conflicting options have been shown so that the figure can display all the information necessary to the different types of applications. For example, Extraction, Admission, and Extraction/Admission navigation buttons cannot all appear at the same time on the PC.

The primary way to select options in the 5009FT control is to use the navigation button menus. An option will appear in the appropriate folder with a pull down box shown after it. The selected option will be displayed in the pull-down box. If the user clicks on the box with the mouse or touch screen (placing the mouse cursor over it and clicking the left mouse button) the program will navigate to that page.

For some selections pull-down menus are provided. Clicking on any of the options will place that option in the display area of the pull-down box, and make that option the selected one for the 5009FT control. At that time additional options may appear or disappear depending on whether they are valid.



The other way to select options in the 5009FT control is the check box. An option will appear in the appropriate folder with a small box in front of the text. If the option or the box is clicked on with the mouse (placing the mouse cursor over it and clicking the left mouse button), the box will show a small check mark inside it. If the option is clicked on again, the check mark will disappear. The check mark determines the use or non-use of the option.



Option Not Selected Option Selected

As options are selected (check mark appears) other options or input values appear on the page and allow the user to further define the 5009FT control. If Use Remote Speed Setpoint is “checked”, the necessary analog input signal must be assigned to one of the available AI channels or a **configuration error** will be annunciated. Some options will not be available for a certain configuration, but will remain visible. These options will be shaded to inform the user that they cannot be selected due to a conflicting option selected elsewhere.

Control Assistant Program

The Control Assistant program is a troubleshooting and debugging tool that provides a window into the control system. This program is provided with all Woodward 5009FT controls to allow internal program calculation and logic monitoring by Woodward technicians and engineers and by other users that are already familiar with this tool. It is anticipated that a typical 5009FT control user may never use this program once the unit is configured and commissioned.

Many features are:

- Trending
- Tunable Maintenance (Upload/Download)
- WinPanel viewing
- Datalog Analysis

Trending
A live Trending feature allows user to create or open script files of certain control parameters to assist in typical commissioning procedures like tuning of control loops.

Tunables
The ability to save, compare, upload and download tunables to and from the control. (The ToolKit Tool File will also handle this operation)

WinPanel
The WinPanel feature presents variables in a tabular format. The user chooses the variables to view at any given time. Multiple pages of variables can be created, each with useful parameters for various trouble shooting or tuning procedures. The user can toggle between screens depending on the work being done.

Datalog Viewing
Control Assistant also has the ability to open datalog files that are captured and stored on the MicroNet CPU’s. The GAP application has automated logic (as well as manual user triggers) to capture and create a file from a running buffer of control program data whenever a turbine shutdown occurs.

Servlink Program

The Toolkit software program internally runs a communications program called Servlink. Servlink is an interface program which directs and manages the transfer of data between the tool program and the 5009FT control. If the Control Assistant program is launched - an additional Servlink program called SOS (Servlink-to-OPC-Server) will launch to create a link to this tool.

The setup program that installs the Toolkit and Control Assistant programs on your computer will also install the Servlink program. All control communications to these programs are performed through the Servlink program.

Service Interface Definition (.sid) File

The Servlink program uses a network definition file to communicate with the 5009FT control's application software. This file acts as an encoded tag-name look up table so that only encoded tag names are used when communicating with the control. This type of encoding logic allows for faster communications speeds. Both ToolKit and SOS will automatically retrieve and save this file, there is no action is required by the user to do anything with these files.

AppManager Program

The application manager tool is mainly used to view & transfer files to and from the CPUs on the control. It is also used to install service packs, configure CPU IP addresses, and help debug system problems.

GAP Program

GAP (Graphical Application Programmer) is the Woodward software tool used to program the control hardware. It is a pictures-to-code language software tool that allows control programmers to develop the functionality that the control hardware will provide.

This program is provided to allow the user to learn the internal logic of the control. Monitoring the live values of the control is a powerful tool to help debug system problems, but using and understanding this tool is not required by the user of the 5009FT.

Installation of CCT Programs on other PCs

All Woodward software installed on the 5009FT CCT is available on the supplied System Documentation CD. This software can be installed on the CCT software kit on a computer that meets the below listed requirements. Once installed, the CCT programs and associated computer function together as an engineering workstation and operator control panel. All programs on the CCT are provided with licenses (if required). Some programs only require a license for advanced features. Additional licenses for these tools to be installed on other computers are available.

Optional Configuration using Simulation Software

One convenient way to initially configure the 5009FT is to use Woodward's NetSim™ simulation software running on any laptop or desktop computer. This method allows users to configure the unit at their desk or workspace without requiring them to do this work on the 5009 CCT installed in the cabinet. This simulation package and associated files can be found on the BCD85249 DVD provided with the control (the entire DVD is also loaded onto the hard drive of the CCT, if included). Under BCD85249\NetSim_Simulation, there is a readme_instructions.txt file with the steps to initiate this simulation. Refer to Chapter 6 for instructions on saving and loading ToolKit settings files.

IMPORTANT	**Woodward recommends deleting previous versions of CCT software prior to installing updated versions.**

Requirements

All Woodward software installed can be installed and run on any compatible PC hardware platform with the following minimum restrictions:

Pentium 200 MHz
512 Meg RAM
20 Meg Disk Drive Space
Windows 7
CD-ROM drive

Any PC that has the above list of features can function as a host for the CCT software package. As the speed and memory capabilities of the PC are increased, so will the speed of the CCT software program.

The connection between the user PC and the 5009FT control consists of an Ethernet connection to the Ethernet 1 network of the 5009FT control.

This manual is not intended to teach the user the basics of how to operate a Windows based program. The user should be familiar with how to open and close folders and how to execute pull-down menu options.

Chapter 2. Communication to ToolKit

Introduction

All communications from the 5009FT to the Woodward service tools is done over Ethernet TCP/IP.

Default IP Addresses

The 5009FT system ships from Woodward with the following default IP Addresses

For **Kernel A CPU**
Ethernet 1 =
Enter the IP address **172.16.100.47**
Enter the Subnet mask 255.255.0.0
Ethernet 2 =
Enter the IP address **192.168.128.21**
Enter the Subnet mask 255.255.255.0

For **Kernel B CPU**
Ethernet 1 =
Enter the IP address **172.16.100.48**
Enter the Subnet mask 255.255.0.0
Ethernet 2 =
Enter the IP address **192.168.128.22**
Enter the Subnet mask 255.255.255.0

For **Kernel C CPU**
Ethernet 1 =
Enter the IP address **172.16.100.49**
Enter the Subnet mask 255.255.0.0
Ethernet 2 =
Enter the IP address **192.168.128.23**
Enter the Subnet mask 255.255.255.0

For **Touch screen Panel CCT computer**
Ethernet 1 =
Enter the IP address **172.16.100.50**
Enter the Subnet mask 255.255.0.0
Ethernet 2 =
Enter the IP address **192.168.128.25**
Enter the Subnet mask 255.255.255.0

The user can decide to leave all IP addresses at these defaults and the system will be completely ready to communicate via the following steps. The optional HMI offering will also be shipped from the factory to plug & play with the 5009FT according to these settings.

For **HMI computer**
Ethernet 1 =
Enter the IP address **172.16.100.45**
Enter the Subnet mask 255.255.0.0
Ethernet 2 =
Enter the IP address **192.168.128.27**
Enter the Subnet mask 255.255.255.0

IMPORTANT **If it is desired to place the control on an existing plant network, one or both of the Ethernet domain and subnet mask TCP/IP addresses will need to be setup by the user to communicate with their network.**

The ToolKit Tool program is setup to communicate to the 5009FT primarily via the CCT Ethernet 1 connection to the Kernel A CPU – ENET1 (**172.16.100.47).** If for some reason the Kernel A CPU is faulty or unavailable or the ETH1 network switch is unusable, then the user can manually re-establish a network connection to Kernel B CPU – ENET2 (**192.168.128.22**).

To Open a Connection

Double click (or Double tap) on the ToolKit File in Application Files>Woodward>Toolkit_CCT. There are two Toolkits, a CF (Configuration) and RS (Run/Service) version.

The ToolKit application will launch and the following screen should be seen:

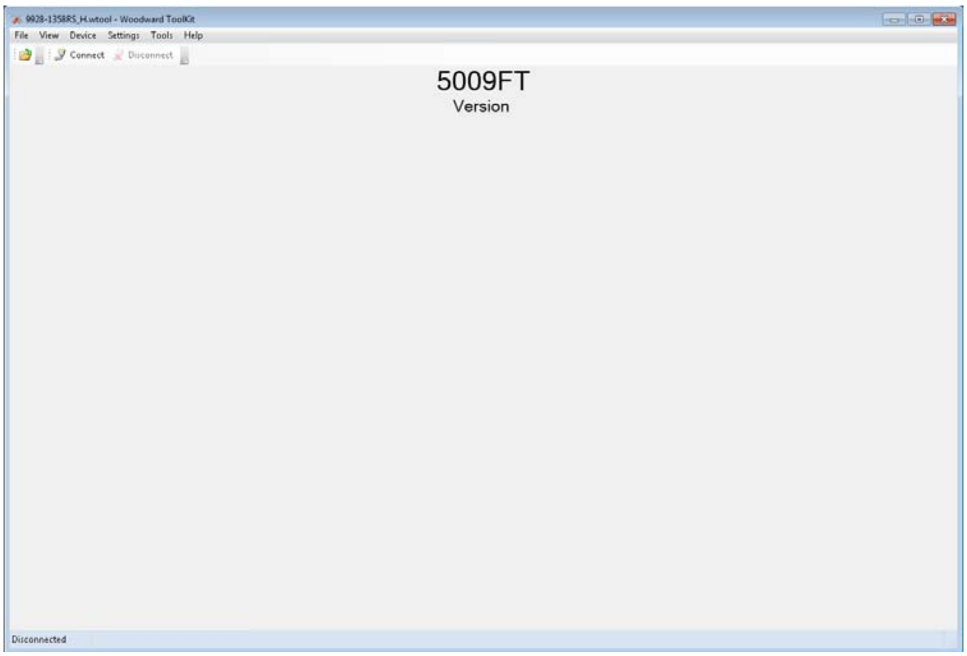


Figure 2-1. Initial Home Screen of Run and Service ToolKit

Next, click on the Connect icon on the center of the Toolbar. It will open a pull-down menu as shown below. Select on the Kernel A IP address and click on the Connect button at the bottom of the menu.

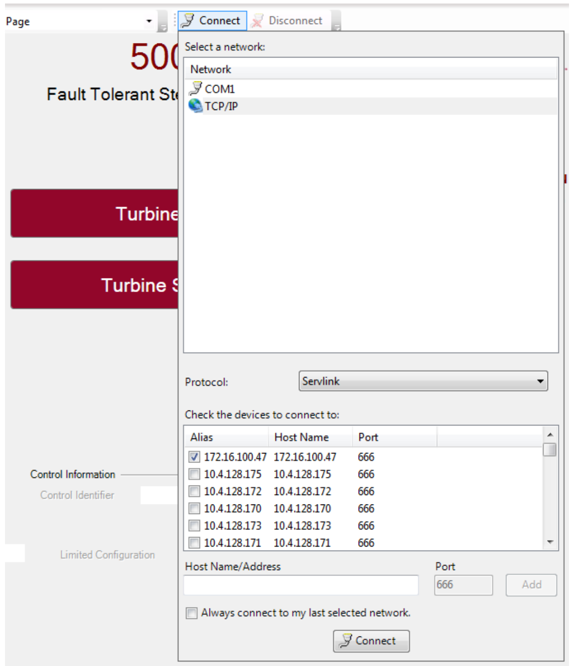


Figure 2-2. Connect Pull-down menu

Toolkit will connect to the control and the following dialog box will appear. If Login box does not automatically appear, click on the 'Details' block at the bottom of the window and under 'Tool Devices' choose Device1.

Figure 2-3. Connect Pull-down menu

Entering Modes

The 5009FT has 3 security levels with the following passwords:

Operator	1111	(Lowest)
Service	1112	
Configuration	1113	(Highest)

For initial configuration of the unit login using Configuration level security. Once the unit has been configured, commissioned and started up, the Service or Operator level logins can be used to prevent the user from changing critical parameters, or entering a mode that will place the control in an IO Lock condition.

The ToolKit Tool program will automatically initialize into the selected mode.

It is not required that the user Disconnect and Re-connect to enter a different user level (although that will work). While connected the user can click on the 'Details' block at the bottom of the window. A details window will pop-up and allow the user to Log Out and one can then return to another user mode via the Log In button.

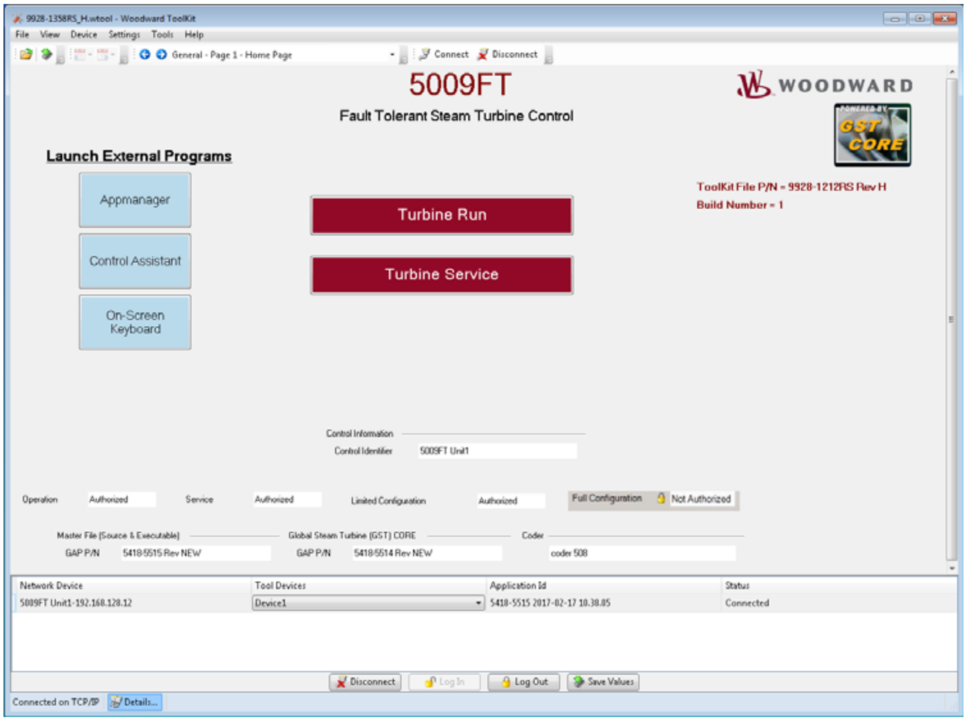


Figure 2-4. Details Reveal/Hide Button

To re-hide the details dialog, just re-click on the details button.

Chapter 3.
Configuration Mode Procedures

Overview

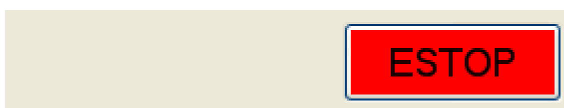
For initial configuration of the unit, login to the Configuration ToolKit Tool using Configuration level security.

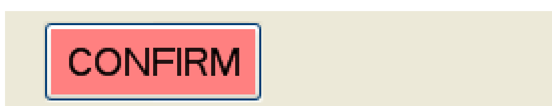
The Configure Mode of the Toolkit Tool program is a step by step procedure to program the MicroNet TMR 5009FT control. A series of pages are used to escort the user through every option the 5009FT control contains. The following screens will step a user through all of the configurable features of the control system. For a better feel of the available options, the user can refer to the sample applications and the functional descriptions in Volume 1.

Program Information—Additional program information is displayed on the initial HOME screen. This information displays the version of the 5009FT's operating software, application software, and what configuration file is being used. The software version information is for Woodward documentation and troubleshooting purposes only. This screen also gives the user authorization level once the user has logged in to the ToolKit program.

Emergency Shutdown Button

The CCT has an Emergency Shutdown button that can be used to Trip the turbine. When the Emergency Shutdown Button (ESTOP) is selected, a confirmation pop-up box will appear, to the left of this button. This is to avoid an unintended double 'click' in the same spot on the touch screen. The user must then confirm the shutdown command by clicking on the "CONFIRM" button in the pop-up confirmation box within 5 seconds, or the command is automatically canceled. After an Emergency Shutdown confirmation is given, the control will immediately trip the turbine to a failed-safe condition.





Opening the Configuration Mode

Two Program mode options are offered within the Toolkit Tool program (Full Configuration, Limited Configuration). The Full Configuration mode is used to configure the control to the application, and is only accessible when the turbine is shutdown. The Limited Configuration mode allows the user to view these same page screens, change some selections, but disables the selection of some configuration settings that should not be changed with the turbine running.

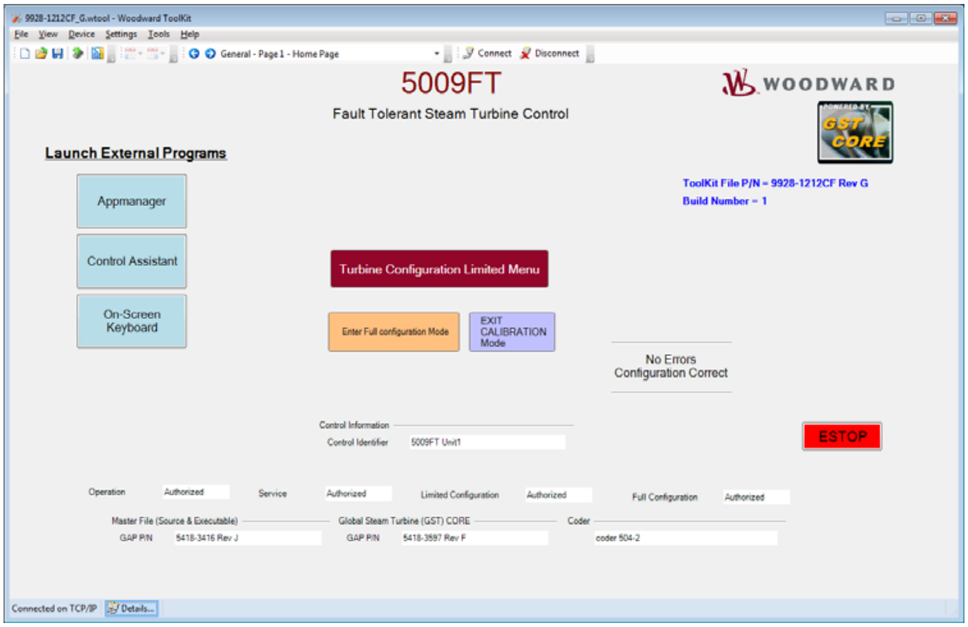


Figure 3-1. Initial View of Mode Selection Menu (Home) Screen

The first time the 5009FT is powered up with factory default tunable settings the initial screen will look like Fig 3.1. The 'Turbine Never Configured' indicates that the user has not successfully gone through the configuration mode.

To enter the full configuration mode do the following:

1. **BE SURE THE TURBINE IS SHUTDOWN & STEAM BLOCK VALVES CLOSED**
2. Enter Calibration Mode by clicking on the button
3. Click the Enter Full Configuration Mode button that now appears (Fig 3.2)
4. A Confirm Action button will appear, click this again and the Full Configuration Menu button will appear
5. Click on this button to enter Full Configure Mode
6. During this mode the control CPUs will issue an IO Lock to the hardware interface modules and all outputs from the control will be disabled.

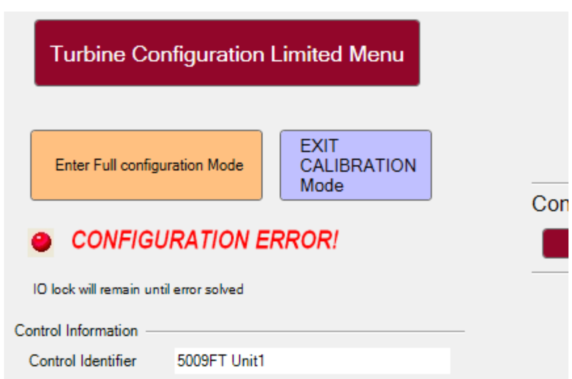


Figure 3-2. Navigation button to Full Configure Mode

Full Configuration Mode

Start at the initial screen (Conf – Page 1 -Turbine General Overview) and begin to configure the 5009FT for your particular turbine type and application. The navigation menu buttons at the top will change as different selections are made. Once the selections on this sheet are complete, the user should step through the rest of the configuration in order using the navigation menu buttons at the top.

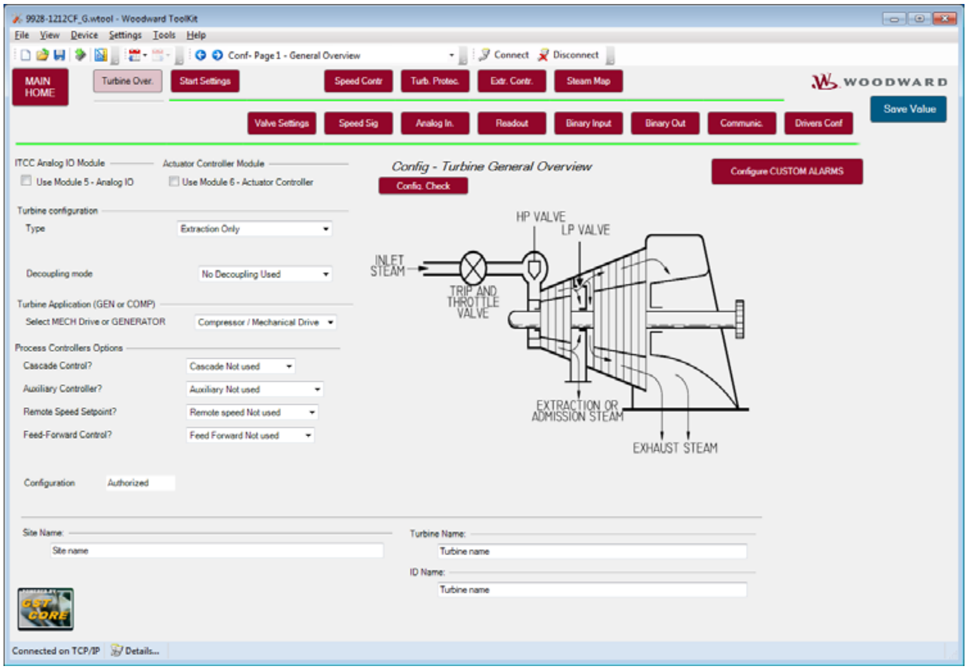


Figure 3-3. Turbine Overview Minimal Example (Single Valve)

Figure 3-3 shows this screen with a minimal configuration for a single valve / speed control only turbine.

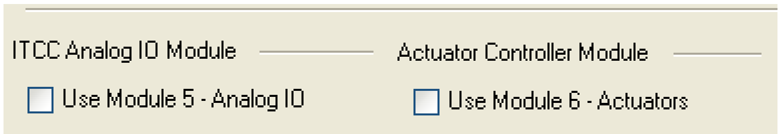
Note: The GST CORE icon identifies that the 5009FT has incorporated Woodward's Global Steam Turbine CORE software logic which contains steam turbine control algorithms jointly developed by a global Woodward application engineering team. The CORE s/w is under engineering control by its own GAP part number and can be enhanced by Woodward without affecting site configurations.

NOTICE	On the CCT ToolKit, pages were designed to minimize the need for Up/Down and Left/Right Scroll bars in the RUN mode so that normal operations can be handled easily via the touch screen. The CONFIGURE mode pages, however, will require a keyboard and mouse to comfortably step through a complete configuration.

Conf – Page 1 –Turbine General Overview

Configuration of Additional IO

The 5009FT is available with a couple of Optional IO modules and also gives the user the capability to add these features to their system at a later date. Use these check boxes to configure the control to recognize the presence of these additional hardware components.

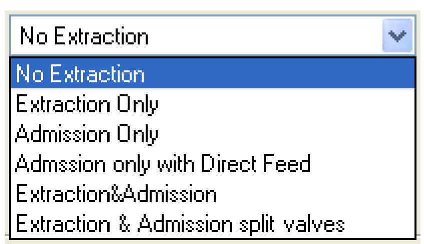


Module 5 – This kit places 1 additional Analog High Density module into slot A5 of each of the Kernels (A, B, & C). This hardware kit is **required** to perform Integrated Turbine Compressor Control (control of Turbine and Anti-Surge valve) in the 5009FT. It is possible, however, to add this module merely to expand the available system Analog IO.

Module 6 – This kit places 1 additional Actuator Controller (2 Channel) module into slot A6 on Kernels A & B. This is typically added to provide Integrating Actuator capability for the 5009FT so that it can directly interface to servo-valves requiring an integrating drive current (with Null) and electrical position feedback (LVDTs) into the control. It can eliminate the need for an additional external device such as a remote final driver, servo-position controller or other.

Application Definitions—Site, Turbine, and ID Tag fields may be used to distinguish between applications and turbines. This information can help identify a turbine when downloading a program to a turbine or retrieving a program from a turbine. This information is saved in the control and is also saved in the configuration file when the control's configuration is saved to a file. When a file is retrieved, this information can identify which turbine is associated with this file.

Turbine Configuration Type **dflt = No Extraction**



No Extraction
: Select this option if the turbine being controlled is a basic steam turbine with only one steam valve.

Extraction Only
: Select this option if the turbine being controlled is a single controlled extraction turbine (has two modulating control valves; one inlet control valve and one extraction control valve).

Admission Only
: Select this option if the turbine being controlled is a single controlled admission (induction) turbine (has two modulating control valves; one inlet control valve and one admission control valve)

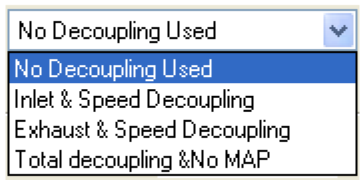
Admission Only with Direct Feed
: Select this option if the turbine being controlled is a single controlled admission (has two modulating control valves; one inlet control valve and one admission control valve) directly feeding the LP body, or a unit with an external Trip/Stop valve on the admission inlet.

Extraction and Admission
: Select this option if the turbine being controlled is a single controlled extraction/ admission turbine (has two modulating control valves; one inlet control valve and one extraction/admission control valve). With this type of application, the turbine can extract or admit steam, depending on system requirements.

Extraction and Admission split

Select this option if the turbine being controlled is a single controlled extraction/admission turbine (has three modulating control valves; one inlet control valve, one extraction control valve and one admission valve). With this type of application, the turbine can extract or admit steam, depending on system requirements. The opening/closing of extraction and admission valves will be coordinated by the steam Map.

Decoupling (Ratio/Limiter) Mode **dflt = No Decoupling Used (Couple HP & LP)**



This application option is only visible when configured for extraction, admission, or extraction/admission turbine types. The ratio/limiter logic controls the interaction of both HP and LP valves to control the desired turbine related parameters (i.e. speed, extraction pressure/flow, inlet pressure/flow, exhaust pressure/flow) and minimize the effects of one controlled process on the other controlled process.

When correcting for a system demand change in one process it may be desirable to have the control move both turbine valves at the same time in order to reduce or stop the interaction of one process on the other. For this reason the 5009FT's Ratio/ Limiter can be configured in the following operational modes depending on the parameters being controlled and the turbine's function within the system (reference Volume 1, Chapter 4 for detailed descriptions).

Coupled HP and LP

This mode is typically used when the two controlled parameters during normal operation are turbine speed/load and extraction pressure (or flow).

Inlet & Speed Decoupling (Decoupled Inlet HP)

This mode is typically used when the two controlled parameters during normal operation are turbine inlet pressure (or flow) and speed

Exhaust & Speed Decoupling (Decoupled Exhaust LP)

This mode is typically used when the two controlled parameters during normal operation are turbine exhaust pressure (or flow) and speed.

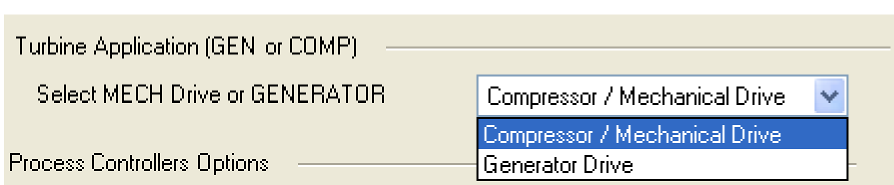
Total Decoupling & No Map (Decoupled HP and LP)

This mode is typically used when the two controlled parameters during normal operation are turbine inlet pressure (or flow) and exhaust pressure (or flow).

When any Inlet or Exhaust decoupled mode are selected, a page will appear in the CCT software, relative to the decoupling parameters (DCPL).

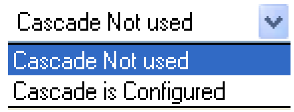
Turbine Application (GEN or COMP)

Selection of whether the unit is a Generator or a Mechanical Drive (Compressor).



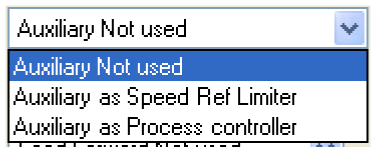
This selection will affect many other options on other pages.

Cascade Control? **dflt = Cascade Not Used**



The 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, compressor suction/discharge pressure controller. Cascade Control is a PID controller that is cascaded with the Speed PID.
By cascading these two PIDs, a bumpless transfer between the two controlling parameters can be performed.

Auxiliary Controller? **dflt = Auxiliary Not Used**



Select the Auxiliary PID's functionality by configuring it as a Limiter or a Process Controller. The Auxiliary PID can be used to limit or control generator power, plant import power (control only) \export power, turbine inlet pressure, turbine exhaust pressure, pump/compressor discharge pressure, or any other auxiliary parameters directly related to turbine speed/load.

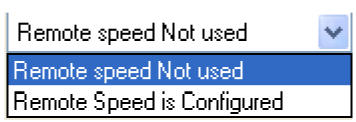
Limiter

When configured as a limiter, the Auxiliary Control is low signal selected (LSS) with the Speed PID, allowing it to limit turbine speed/load based on any process directly related to turbine speed/load. In a compressor or mechanical drive application it will act as a limiter on the speed Reference

Process Controller

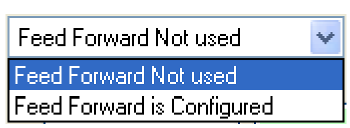
When configured as a controller, the Auxiliary PID may be enabled and disabled on command. When Auxiliary Control is enabled, it instantly takes full control of the LSS bus and the Speed PID is switched to a tracking mode. When Auxiliary Control is disabled the Speed PID instantly takes control of the LSS bus. When the Auxiliary PID is disabled, its setpoint tracks the Auxiliary PID's input process signal.

Remote Speed Setpoint? **dflt = Remote Speed Not Used**



Use this to configure the control to utilize a remote speed setpoint signal
(4-20 mA input) from some other system device. If this is configured the Configuration Error Check will expect to find at least one AI configured for this function, otherwise an error will be annunciated.

Feed Forward Control? **dflt = Feed Forward Not Used**



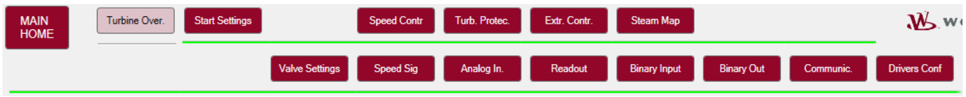
In some cases, it is necessary to decouple the speed control and some other device such as anti surge controller.

The feed Forward loop is a **special feature not normally required**. It is used to temporarily bias the internal speed reference based on an external 4-20 mA signal, such as the Anti-surge valve position.

This feature includes also, the possibility to enable an emergency decoupling in case of surge a compressor.

When configured, a page will appear for configuration, and an analog input will need to be assigned to this function.

Continue on in Sequence through the Navigation buttons available as per your Turbine General Overview page dictates.



Conf – Page 2 –Turbine Start Settings

This page is used to configure the turbine start mode, start-up sequence, speed setpoints and the Hot/Cold loading curve information.

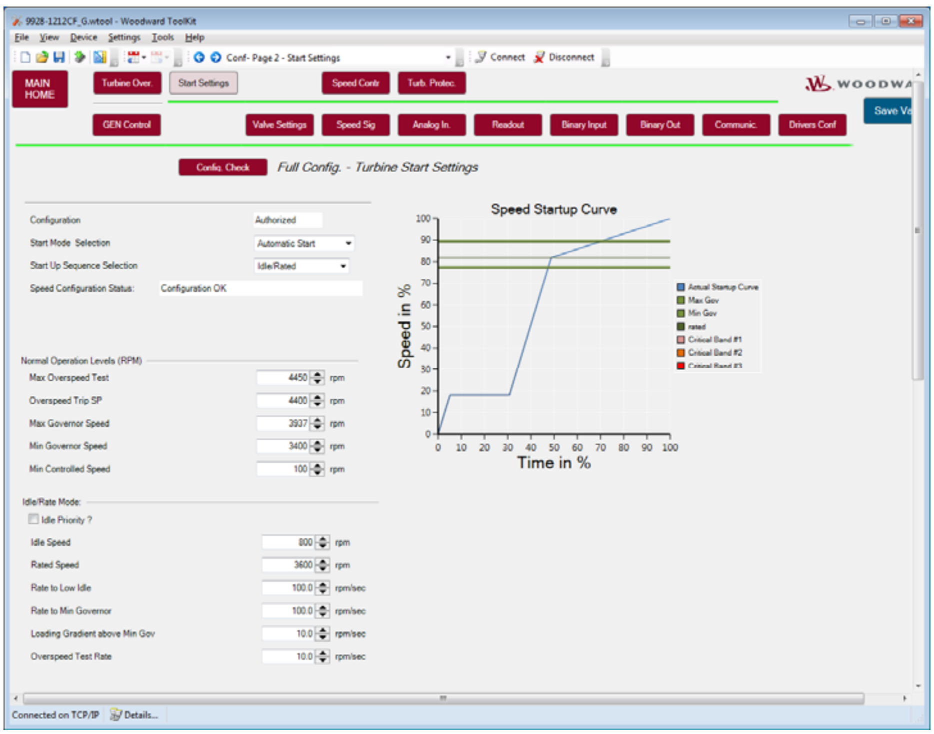


Figure 3-4. Start Settings

Start Mode Configurations

There are three basic types of start mode procedures (Manual/semiautomatic/ automatic). They are discussed in length in Volume 1 with all of the different options that are available. The control's Program Mode configuration will determine how the turbine is started.

Only if manual start mode is configured, the speed setpoint can be manipulated when the engine speed is below Low Idle. In any other type of configuration, speed and speed reference must be at low idle to authorize Raise setpoint commands.

Start Mode Selection **dflt = Automatic Start**

Automatic Start

When configured for an automatic start mode, the 5009FT controls the turbine speed from zero up to the minimum control speed. The Automatic Start Sequence would be: Operator opens the T&T valve, then issue a Start command. The HP valve limiter opens automatically until the governor takes control.

Semiautomatic Start

When configured, the 5009FT's HP limiter must be manually opened by the operator, slowly, to open the control valve and bring the turbine speed from zero up to the minimum control speed. The Semiautomatic Start Sequence would be: Open the T&T valve, then issue a Start Command. The 5009FT control's valve limiter must then be raised by the operator until governor takes control.

Manual Start

When configured for a manual start mode, the operator controls the turbine speed from zero up to the minimum control speed using an external trip- throttle valve. The Manual Start Sequence would be: Issue a Start command. The actuators automatically move to HP max position at start-up. Lastly, the operator slowly opens the trip-throttle valve until the governor takes control.

Start Up Sequence Selection **dflt = Idle/Rated**

Idle/Rated

Select this routine to have the control begin controlling speed at an Idle speed setting, then allow an operator to manually raise the speed setpoint or issue a "Ramp to Rated" command. The control will ramp from the Idle speed setting to the Rated speed setting when a Ramp to Rated command is given (via the PCI, Modbus or an external contact input). Critical avoidance bands can be used with this routine. Reference this Volume's Service mode descriptions for options on allowing the re-selection of idle speed.

Auto Start Sequence

Select this routine to have the control turbine speed from zero up to rated speed using Hot and Cold start routines based on how long the turbine was shutdown. Once a Start command is given, this routine ramps the speed setpoint to a low idle speed setting, holds for a set delay time, ramps the speed setpoint to a high idle speed setting, holds for a set delay time, then ramps the speed setpoint to a rated speed setting. This routine can be halted and continued at any point through PCI, Modbus or external contact input commands. Even though configured for an automatic start, an operator can at any time choose to raise or lower the speed setpoint manually to complete a system start-up.

No Idle

Select this routine to have the control begin controlling turbine speed at the Min Control Setting. From the Min Control setting, the control's speed setpoint can be manually adjusted between the min and max control setpoint settings. Critical avoidance bands are not used or allowed with this routine.

Multi Curve Start

This is a special feature that allows the user to select from a variety of load curves using an analog input signal

Normal Operation Level Settings

Max Overspeed Test **dflt =4450 (10.0, 25000)**

Set this value to the maximum desired speed reference needed to test external Overspeed trips. Recommend about 2% above that level. The 5009FT will Trip if it sees the speed reach this setpoint.

Overspeed Trip SP **dflt = 4400 (10.0, 25000)**

Set this value to the desired overspeed trip point for the 5009FT control. This value must be below the Max Overspeed Test setpoint.

Max Governor Speed **dflt = 3937 (10.0, 25000)**

Set this value to the upper control limit of the speed reference.

Min Governor Speed **dflt = 2625 (10.0, 25000)**

Set this value to the lower control limit of the speed reference

Normal operation of the turbine should be from min to max governor.

Min Controlled Speed **dflt = 100 (10.0, 25000)**

Set this value to the lowest speed at which the 5009FT could begin controlling speed. Lowest Idle setpoint must be above this speed

Idle/Rated Sequence

This routine, upon command, ramps turbine speed from an idle speed setting to the turbine's rated speed setting at a configured rate. The ramp-to-rated command can be issued through the CCT program, an external contact closure, or Modbus communications.

The Idle/Rated function can be used with any start mode (manual, semiautomatic, automatic). When a START command is issued, the speed setpoint will ramp from zero rpm up to and hold at the idle speed setting. When a ramp-to-rated command is given, the speed setpoint ramps to the rated speed setting at the Idle/Rated rate setting. While ramping to rated speed, the setpoint can be stopped at any time by a issuing a raise or lower speed command or directly entering a valid speed setpoint.

The control will inhibit a ramp to idle speed or ramp to rated speed command if the generator breaker is closed, remote speed setpoint is enabled, Cascade PID is in control, or the Auxiliary PID is in control (as defaulted in the Service Mode, see Volume 3). Alternatively, the Idle/Rated routine's functionality can be changed via the Service Mode's Use Idle and "Idle has priority over Rmt Speed, Casc, Aux" selections. Refer to Volume 3 for details on these selections and how they can be used to change the Idle/Rated routine's functionality.

If a contact input is configured for the "Idle/Rated" function, idle speed is selected when the contact is open and rated speed is selected when it is closed. The Idle/ Rated contact can be either open or closed when all trip conditions are cleared. If the contact is open, it must be closed to initiate a Ramp-to-Rated command. If the contact is closed, it must be opened and re-closed to initiate a Ramp-to-Rated command.

When the turbine is used for mechanical drive applications, rated speed may be set at or above the minimum governor speed setting. When the turbine is used to drive a generator, the "rated speed" setpoint may be set at minimum governor speed, at synchronous speed, or at any intermediate speed setting. All pertinent Idle/ Rated parameters are available through Modbus communications.

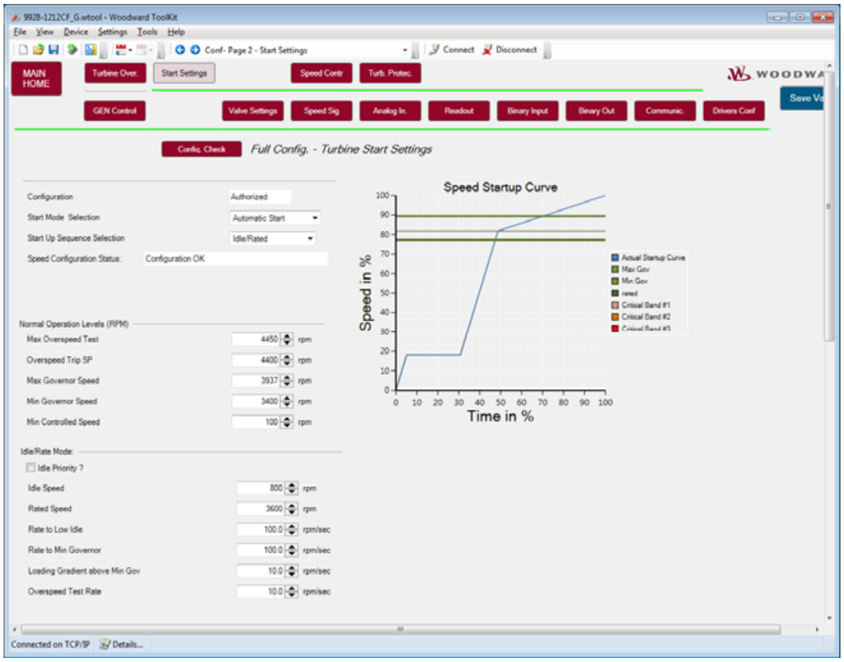


Figure 3-5. Turbine Idle/Rated Start Settings

Idle/Rate Mode Settings

Idle Priority?

Enabling this option replaces the Hold functionality with Idle functionality.
Clicking or selecting the Hold button is used to issue a halt command to the control. This is used to hold the start procedure at any moment and to keep the turbine at that place in the start procedure.
With Idle Priority enabled during start-up and the Idle command is issued will result in the turbine ramping back to idle speed instead of Hold.

Idle Speed Initial=500 (100, 25000)

Enter the Idle Speed setpoint.

Rated Speed Initial=3750 (100, 25000)

Enter the Rated Speed setpoint. This is the speed that the turbine is running in normal operating conditions between minimum and maximum governor speed.

Rate to Low Idle Initial=100.0 (0.01, 1000)

Enter the ramp rate in rpm/sec for going to Idle Speed.

Rate to Min Governor Initial=100.0 (0.01, 1000)

Enter the ramp rate in rpm/sec for going to Minimum Governor Speed.

Loading Gradient above Min Gov Initial=10.0 (0.01, 1000)

Enter the ramp rate in rpm/sec for going to between Minimum Governor and Maximum Governor Speed.
In Generator applications, the Rate to Min Governor is used when the control is initially ramping to the rated speed, even when the speed is above the Min Governor setting. Once rated speed has been reached, the Loading Gradient above Min Gov is used for speed changes.

Overspeed Test Rate Initial=10.0 (1.0, 5000)

Enter the ramp rate in rpm/sec above Maximum Governor Speed during overspeed test.

Automatic Start Sequence

With this start routine, once a Start command is issued and Speed PID in control of the speed, the control determines whether to use the cold start routine, hot start routine or in-between start routine, based on how long the control was shutdown or a remote HOT/COLD analog signal or a configured contact input. This routine will:

- Ramp the speed setpoint to a low idle speed setting, and verify that turbine speed is at or above the low idle setting.
- Holds for a set delay time,
- Ramp the speed setpoint to a medium idle (if used) speed setting, and verify that turbine speed is at or above the medium idle setting
- Holds for a set delay time
- Ramps the speed setpoint to a high idle speed setting (if configured) and verify that turbine speed is at or above the high idle setting
- Holds for a set delay time
- Then ramps the speed setpoint to the rated speed setting.

This routine can be halted and continued at any point through CCT, Modbus or external contact input commands. Even though configured for an automatic start, an operator can at any time choose to raise or lower the speed setpoint manually to complete a system start-up.

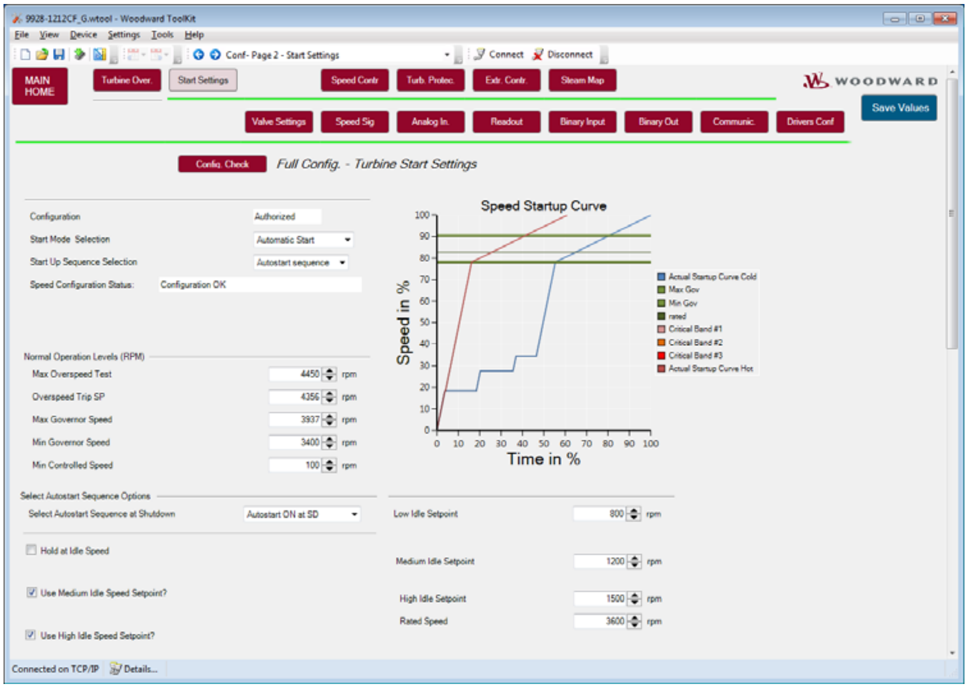
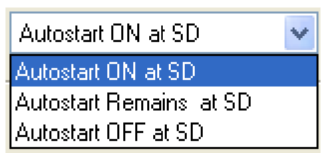


Figure 3-6. Turbine Automatic Start Settings

Selection Autostart sequence at SD



Select one option (default is Autostart ON at SD).

When the engine is tripped, if “Autostart ON at SD” is selected, the auto start sequence will remain enabled regardless of the contact input E/D autostart sequence, Modbus commands or CCT commands.

When the engine is tripped, if “Autostart OFF at SD” is selected, the auto start sequence will remain disabled regardless of the contact input E/D autostart sequence, Modbus commands or CCT commands.

When the engine is tripped, if “Autostart Remains at SD” is selected, the auto start sequence can be Enabled/disabled via the contact input E/D autostart sequence, Modbus commands or CCT commands at any time.

Hold at Idle Speed? **dflt = Checked**
Low Idle Setpoint **dflt = 700 (10.0, 25000)**

Enter the Low Idle Speed Setting. This is the first hold speed. The speed setpoint will remain at this setting until the low idle delay/hold time has expired. If the Hold at Idle Speed box is checked it will hold at Idle until operator action continues the sequence.

Use Medium Idle Speed Setpoint? **dflt = Checked**
Medium Idle Setpoint (rpm) **dflt = 900 (0.0, 25000)**

If the Use box is checked it will use this setpoint in the sequence and allow the option of having a third point (high idle).
If selected, the auto start sequence will ramp the speed from Low idle to medium idle when Hot/cold delay are passed.
When speed is between Low idle and medium Idle, in manual mode, and continue sequence is selected the auto start sequence will ramp the reference to medium Idle, regardless to the delays.
If not selected, the auto start sequence will ramp the speed from Low idle to rated speed when Hot/cold delay are passed.
When the speed reference is between Low idle and min governor Idle, in manual mode, and continue sequence is selected, it will ramp to Rated speed regardless to the delays.

Use High Idle Speed Setpoint? **dflt = Checked**
Use High Idle Setpoint (rpm) **dflt = 1100 (0.0, 25000)**

If the Use box is checked it will use this setpoint in the sequence.
Enter the Hi Idle Speed Setting. This is the third speed setting when using the automatic start sequence. *(Must be greater than medium Idle Setpoint' Setting)*

Rated Speed (rpm) **dflt = 3750 (0.0, 25000)**
Setpoint

Enter the Rated Speed Setting. This is the final speed setting when using the automatic start sequence. Once this speed setpoint is reached, the start sequence is complete.
(Must be greater than or equal to the 'Minimum Control Setpoint' Setting)

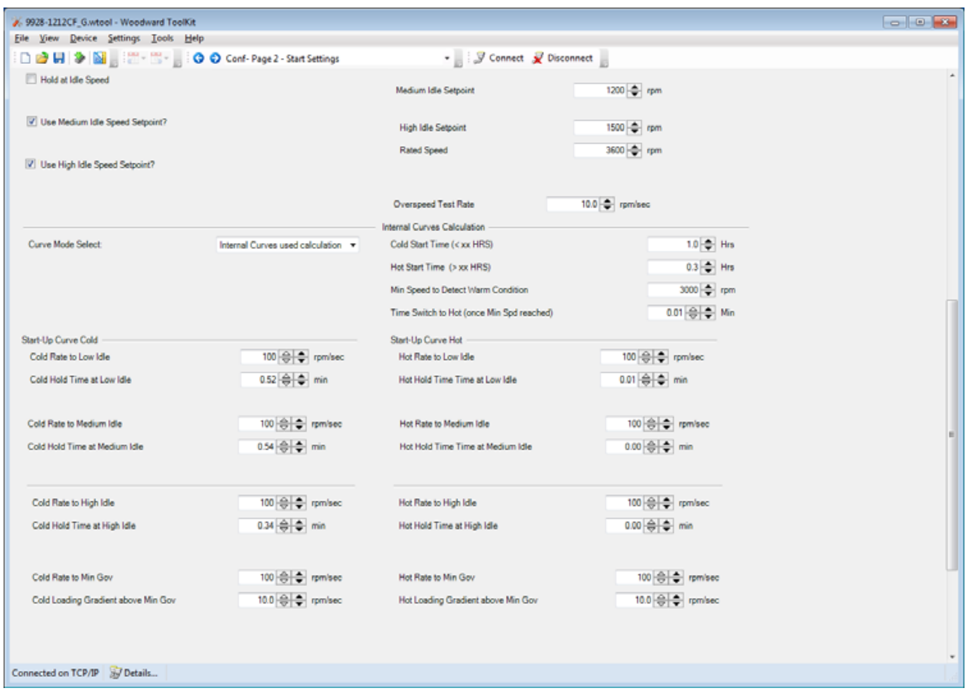
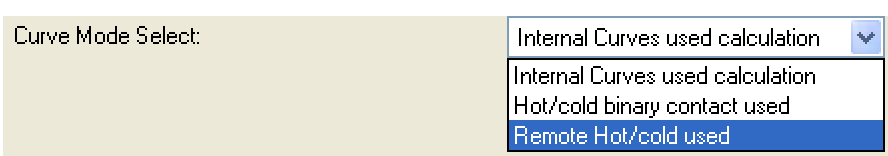


Figure 3-7. Turbine Start – Hot/Cold Settings

Curve Mode Select **dflt = Internal Curves used calculation**

Enter the desired startup curves to be used for the turbine.



Internal Curves are calculated from the data entered below.

Hot/Cold Binary Contact used – Control will switch between HOT/COLD curves based on a discrete contact. False will select COLD curve.

Remote Hot/Cold used - Select this option if instead of the internal HOT/COLD timer, an external 4-20 mA signal is used to determine if the engine is HOT or cold

Internal Curve Calculation – (if Used)

Cold Start Time (< xx Hours) **dflt = 20 (0.0, 500)**

Enter the time in hours allowed after a trip before the 'cold start' sequence curves are to be used. If this much time has expired (or more) after a trip condition, then the control will use the cold start values. If less than this time has expired, the control will interpolate between the hot and cold start values to determine rates and hold times.

Hot Start Time (< xx Hours) **dflt = 4.0 (0.0, 500)**

Enter the maximum time allowed after a trip for the 'hot start' sequence curves to be used. If less than this time has expired after a trip condition, then the control will use the hot start values. *(Must be less than or equal to the 'Cold Start' Hours)*

Min speed to Detect Warm Condition (rpm) **dflt = 3000.0 (0.0, 1500.0)**

Enter the minimum speed to start to switch from COLD curve to HOT curves

Time Switch to Hot **dflt = 4.0 (0.0, 500)**

Enter the time to transfer from fully cold to fully HOT parameters when Min speed for hot is reached.

Remote HOT/COLD Signal Range & Settings – (if Used)

Hot/cold levels:

Remote PV Value COLD **dflt = 0 (0.0, 20000)**

Set the value of the remote HOT/COLD in EU when engine is COLD

Remote PV Value HOT **dflt 100 (0.0, 20000)**

Set the value of the remote HOT/COLD in EU when engine is HOT

Sensor Value range:

Range Low Remote Hot/Cold PV **VIEW ONLY - Set in AI Config**

VIEW the sensor range of the remote HOT/COLD signal for 4 mA

Range High Remote Hot/Cold PV **VIEW ONLY - Set in AI Config**

VIEW the sensor range of the remote HOT/COLD signal for 20 mA

Start-up Curve Cold –

COLD Rate to Low Idle (rpm/s): **dflt = 100 (0, 1000)**

Set the acceleration value from zero to low-idle speed when engine is cold.

COLD Delay Time at Low Idle (min): **dflt = 1.0 (0.0, 500)**

Enter the cold start hold time desired at low idle. This is the programmable time, in minutes, that the turbine will wait/hold at the low idle speed when a cold start is determined.

COLD Rate to Medium Idle (rpm/s): **dflt = 100 (0, 1000)**

Set the acceleration value from low-idle to medium idle speed when engine is cold.

COLD Delay Time at Medium Idle (min): **dflt = 1.0 (0.0, 500)**

Enter the cold start hold time desired at medium idle. This is the programmable time, in minutes, that the turbine will wait/hold at the medium idle speed when a cold start is determined.

COLD Rate to High Idle (rpm/s): **dflt = 100 (0, 1000)**

Set the acceleration value from medium idle to high idle speed when engine is cold.

COLD Delay Time at High Idle (min): **dflt = 1.0 (0.0, 500)**

Enter the cold start hold time desired at high idle. This is the programmable time, in minutes, that the turbine will wait/hold at the high idle speed when a cold start is determined.

COLD Rate to Min Gov (rpm/s): **dflt = 100 (0, 1000)**

Set the acceleration value from high idle to min governor speed when engine is cold.

COLD Loading Gradient above Min Gov(rpm/s): dflt = 10 (0.0, 1000)

Set the acceleration value when unit is above min governor speed when engine is cold. This is the programmable rate, in rpm per second, that the speed setpoint will accelerate at when moving from min governor to max governor when a cold start is determined. If cascade or remote speed setpoint are taking the control of the speed reference, this will remain the maximum rate to move the speed reference, in order to protect the engine against overloading/rotor stress.

Start-up Curve Hot –

HOT Rate to Low Idle (rpm/s): dflt = 100 (0, 1000)

Set the acceleration value from zero to low-idle speed when engine is hot.

HOT Delay Time at Low Idle (min): dflt = 0.10 (0.0, 500)

Enter the hot start hold time at low idle. This is the programmable time, in minutes, that the turbine will wait/hold at the low idle speed when a hot start is determined. If the turbine has been shutdown for longer than the Hot time but shorter than the Cold time, the control will interpolate between the Hot and Cold delays to determine the low idle hold time.

(Must be less than or equal to the 'Low Idle Delay Time—Cold' Setting)

HOT Rate to Medium Idle (rpm/s): dflt = 100 (0, 1000)

Set the acceleration value from low-idle to medium speed when engine is hot.

HOT Delay Time at Medium Idle (min): dflt = 0.10 (0.0, 500)

Enter the hot start hold time at medium idle. This is the programmable time, in minutes, that the turbine will wait/hold at the medium idle speed when a hot start is determined. If the turbine has been shutdown for longer than the Hot time but shorter than the Cold time, the control will interpolate between the Hot and Cold delays to determine the medium idle hold time.

(Must be less than or equal to the 'Low Idle Delay Time—Cold' Setting)

HOT Rate to High Idle (rpm/s): dflt = 100(0,1000)

Set the acceleration value from medium idle to high idle speed when engine is hot.

HOT Delay Time at High Idle (min): dflt = 0.10 (0.0, 500)

Enter the hot start hold time at high idle. This is the programmable time, in minutes, that the turbine will wait/hold at the high idle speed when a hot start is determined. If the turbine has been shutdown for longer than the Hot time but shorter than the Cold time, the control will interpolate between the Hot and Cold delays to determine the high idle hold time.

(Must be less than or equal to the 'High Idle Delay Time—Cold' Setting)

HOT Rate to Min Gov (rpm/s): dflt = 100 (0, 1000)

Set the acceleration value from high idle to min governor speed when engine is hot.

HOT Loading Gradient above Min Gov(rpm/s): dflt = 20 (0, 1000)

Set the acceleration value when unit is above min governor speed when engine is hot. This is the programmable rate, in rpm per second, that the speed setpoint will accelerate at when moving from min governor to max governor when a hot start is determined.

If cascade or remote speed setpoint are taking the control of the speed reference, this will remain the maximum rate to move the speed reference, in order to protect the engine against overloading/rotor stress.

No Idle

Select this routine to have the control begin controlling turbine speed at the Minimum Controlled Speed. The control speed setpoint can be manually adjusted between the Minimum and Maximum Governor Speed. Critical avoidance bands are not used or allowed with this routine.

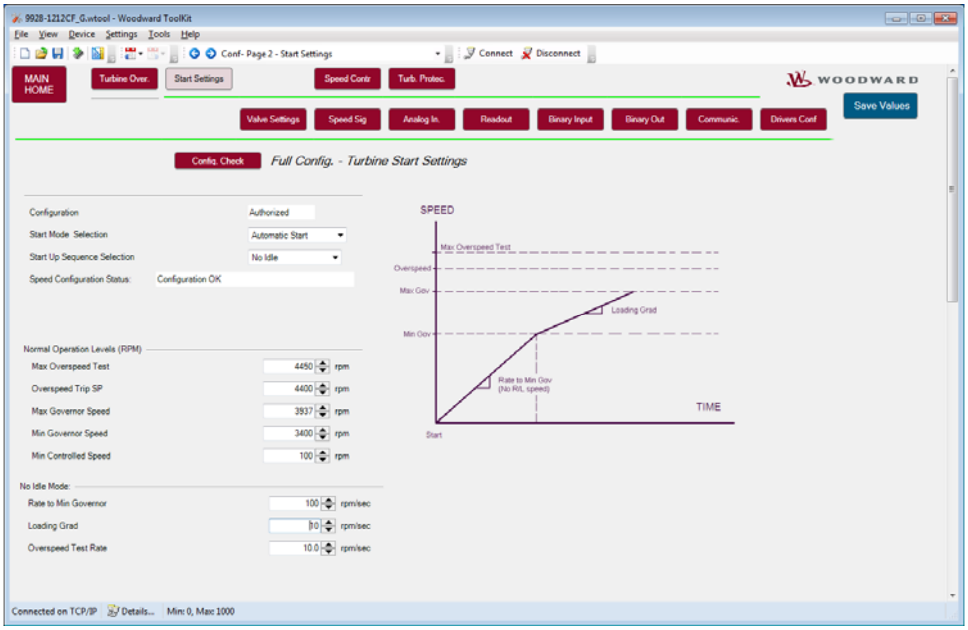


Figure 3-8. Turbine No Idle Settings

Rate to Min Governor Initial=100 (0.01, 1000)
Set the acceleration value from minimum controlled speed to minimum governor speed.

Loading Gradient Initial=10 (0.01, 1000)
Set the loading gradient from minimum governor speed to maximum governor speed.

Overspeed Test Rate Initial=10.0 (1.0, 5000)
Enter the ramp rate in rpm/sec above Maximum Governor Speed during overspeed test.

Multi Curve Start

The controller has the ability to allow the user to define an elaborate hot/cold start curve that can have up to 10 curves (slopes) each with tunable rates and delay times. This feature would be used with an external binary for curve selection or analog signal that would provide a remote hot/cold temperature measurement that correlates to the turbine manufacturer warm-up profile.

Auto Startup Curve Generic Settings

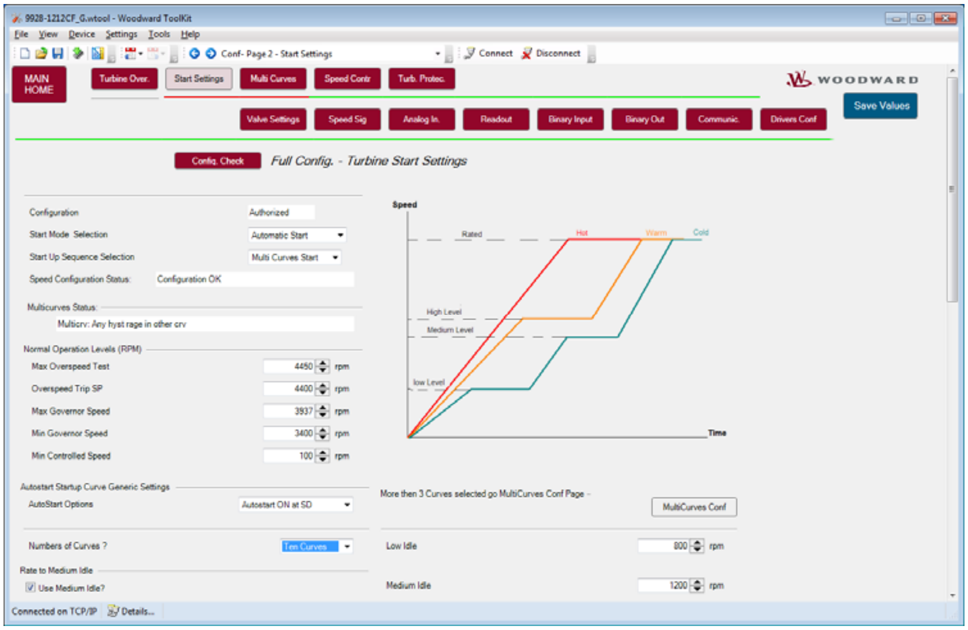


Figure 3-9. Turbine Multi Curve Settings

Auto Startup Curve Generic Settings

Some settings are similar as for the Auto-Start Sequence selection:

- Sequence Status at Shutdown
- Hold at Idle Speed Levels?
- Low Idle
- Use Medium Idle?
- Medium Idle
- Use High Idle?
- High Idle
- Rated Speed
- Curve Mode Select
- Units
- PV at 4 mA
- PV at 20 mA
- Tag

Number of Curves Used

Up to ten curves can be selected.

Curve Settings

The following descriptions apply for every curve selected.

Ramp to Low Idle Rate Initial=25.0 (5.0, 1000)

Set the acceleration value from zero to low-idle speed for the applicable curve.

Ramp to Medium Idle Rate Initial=50.0 (5.0, 1000)

Set the acceleration value from low-to medium idle speed for the applicable curve.

Ramp to High Idle Rate Initial=50.0 (5.0, 1000)
Set the acceleration value from medium to high-idle speed for the applicable curve.

Ramp to Min Gov Rate Initial=12.5 (5.0, 1000)
Set the acceleration value from high-idle to minimum governor speed for the applicable curve.

Loading Rate Initial=12.5 (0.01, 1000)
Set the acceleration value when unit is above min governor speed for the applicable curve.

Delay at Low Idle Rate Initial=0.2 (0.0, 1000)
Set the hold time at low idle.

Delay at Medium Idle Rate Initial=0.5 (0.0, 1000)
Set the hold time at medium idle.

Delay at High Idle Rate Initial=0.0 (0.0, 1000)
Set the hold time at high idle.

Transition

The following descriptions apply for every curve selected when the selected curve mode is Hot/Cold Process Value Used.

Level to Select Curve to Curve Initial=90.0 (5.0, 1000.0)
Set the level for the external measurement on which the 505CC-2 determines its transition to the next curve.

Hysteresis Initial=0.0 (-500.0, 0.0)
Set the deficiency for the transition level from curve to curve. This prevents a continuous swapping between curves when the external measurement is at the transition level.

For example:
The transition level to go from curve 1 to 2 is at 90 degree C. The Hysteresis is set to -10 °C. The result is that the transition back from curve 2 to 1 will be at 80 °C.

Conf – Page 3 –Turbine Multi Curve (if used)

The 5009FT has the ability to allow the user to define an elaborate hot/cold start curve that can have up to 10 curves (slopes) each with tunable rates and delay times. Ideally this feature would be used with an external signal that would provide some remote hot/cold temperature that correlates to the OEM's turbine warm-up profile for the turbine.

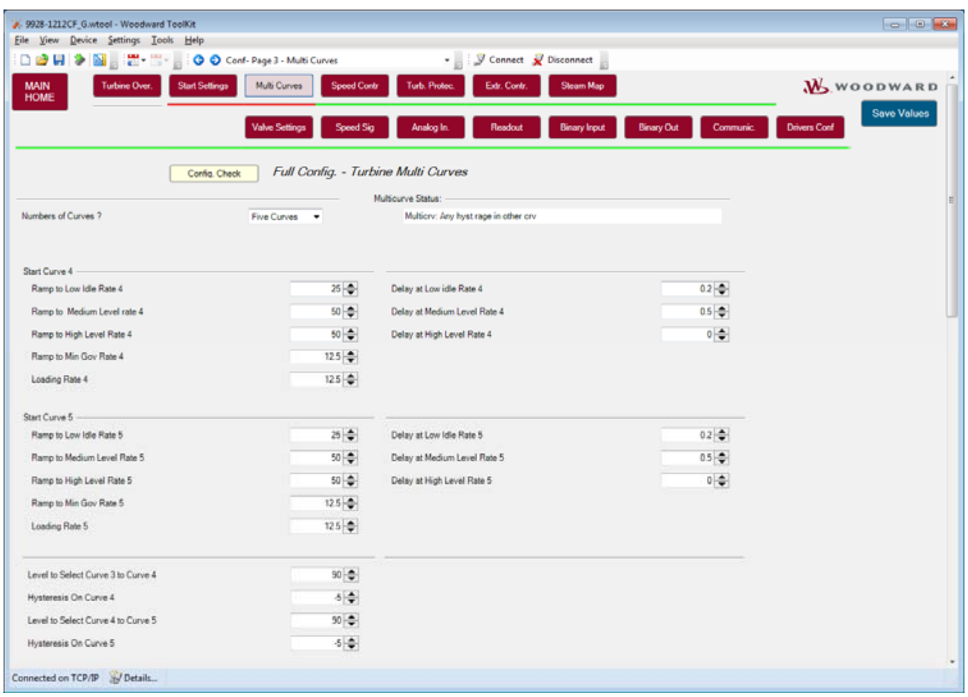


Figure 3-10. Multi-Curve Hot/Cold Settings (5 curve example)

Conf – Page 4 –Turbine Speed Control

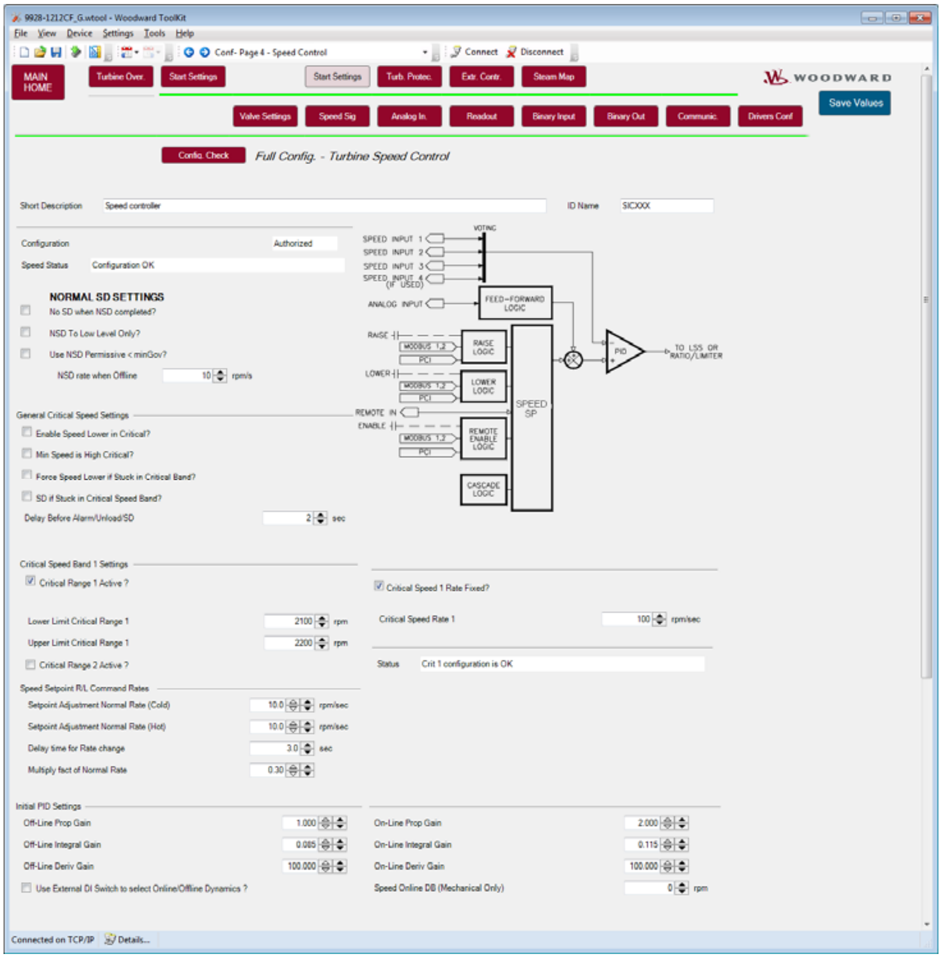


Figure 3-11. Turbine Speed Control

Normal SD Settings –
No SD when NSD completed? dflt = Unchecked
Check this to have the 5009FT NOT issue a Trip output when a normal shutdown sequence has been completed.

NSD to Low Level Only? dflt = Unchecked
This will take the unit all the way down to the low idle speed setpoint and remain there until manually tripped by the operator.

Use NSD Permissive < Min Gov? dflt = Unchecked
This will allow the operator to bring the unit down to Min Gov speed and then have the normal shutdown routine sequence take over

NSD rate when Offline dflt = 10 (0.1, 10000.0)
Set the rpm/s rate of change of the speed setpoint for Normal Shutdown. Actual rate of speed setpoint is higher between NSD and each process.

General Critical Speed Settings –
If configured, Critical Speed ranges will be avoided and ramped through at the rates configured. Once turbine speed is at or above the Minimum governor Speed setting, the turbine is considered to be started, and the critical speeds have been avoided and normal turbine operation begins.

Enable Speed Lower in Critical **dflt = Unchecked**
When selected, a lower speed command will be accepted even if the speed is inside the critical band. If not selected, it is not possible to lower the speed until the speed is not anymore inside the critical band.

Min Speed is High Critical? **dflt = Unchecked**
When selected, is the critical band is passed, then using R/L commands, it is not possible to lower the speed below Max critical band.

Force speed lower if stuck in critical band? **dflt = Unchecked**
When the speed do not accelerate more than 0.2 time the supposed rate during 2 seconds, then an alarm, "stuck in critical will be generated. If the option lower is selected, the speed will be lowered below min critical speed.

Critical Speed Band 1 Settings
Critical Range 1 Active? **dflt = Checked**
Check this box to use Critical Speed Band #1
Lower Limit Critical Range 1 **dflt = 2100 (1.0, 25000)**
Set the lower limit (in rpm) of the critical speed avoidance band.
(Must be less than the 'Critical Speed Maximum' Setting)
Upper Limit Critical Range 1 **dflt = 2200 (1.0, 25000)**
Set the upper limit (in rpm) of the critical speed avoidance band.
(Must be less than the 'Minimum Governor Speed' Setting)

Critical Speed 1 Rate Fixed? **dflt = Unchecked**
When not selected, the speed reference acceleration will depends on the autostart sequence parameters. This will allow Hot/Cold acceleration while speed reference is inside critical band.
When selected, the speed reference will accelerate at a fixed rate, necessary higher than the rate used for auto start sequence
Critical Speed Rate 1 **dflt = 100.0 (1.0, 2000)**
Set the rate that the speed setpoint will move through the critical speed avoidance ranges (in rpm/second) when fixed rate is selected.
(Must be greater than the 'fastest rate in auto start sequence' Setting)

Critical Speed Band 2 Settings
Critical Range 2 Active? **dflt = Unchecked**
Check this box to use Critical Speed Band #2
Lower Limit Critical Range 2 **dflt = 2300 (1.0, 25000)**
Set the lower limit (in rpm) of the critical speed avoidance band.
(Must be less than the 'Critical Speed Maximum' Setting)
Upper Limit Critical Range 2 **dflt = 2400 (1.0, 25000)**
Set the upper limit (in rpm) of the critical speed avoidance band.
(Must be less than the 'Minimum Governor Speed' Setting)

Critical Speed 2 Rate Fixed? **dflt = Unchecked**
When not selected, the speed reference acceleration will depends on the autostart sequence parameters. This will allow Hot/Cold acceleration while speed reference is inside critical band.
When selected, the speed reference will accelerate at a fixed rate, necessary higher than the rate used for auto start sequence
Critical Speed Rate 2 **dflt = 100.0 (1.0, 2000)**
Set the rate that the speed setpoint will move through the critical speed avoidance ranges (in rpm/second) when fixed rate is selected.
(Must be greater than the 'fastest rate in auto start sequence' Setting)

Critical Speed Band 3 Settings
Critical Range 3 Active? **dflt = Unchecked**
Check this box to use Critical Speed Band #3

Lower Limit Critical Range 3 **dflt = 2300 (1.0, 25000)**

Set the lower limit (in rpm) of the critical speed avoidance band.
(Must be less than the 'Critical Speed Maximum' Setting)

Upper Limit Critical Range 3 **dflt = 2400 (1.0, 25000)**

Set the upper limit (in rpm) of the critical speed avoidance band.
(Must be less than the 'Minimum Governor Speed' Setting)

Critical Speed 3 Rate Fixed? **dflt = Unchecked**

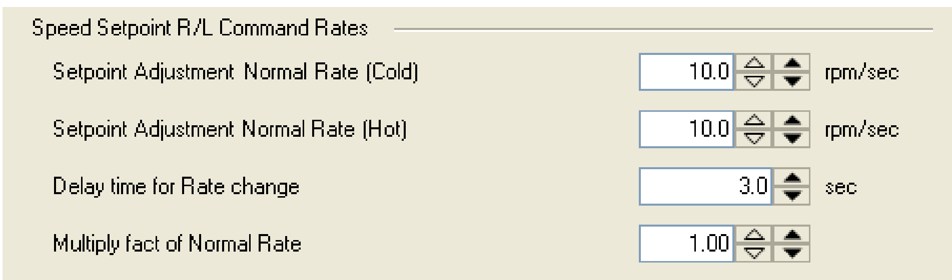
When not selected, the speed reference acceleration will depends on the autostart sequence parameters. This will allow Hot/Cold acceleration while speed reference is inside critical band.
When selected, the speed reference will accelerate at a fixed rate, necessary higher than the rate used for auto start sequence

Critical Speed Rate 3 **dflt = 100.0 (1.0, 2000)**

Set the rate that the speed setpoint will move through the critical speed avoidance ranges (in rpm/second) when fixed rate is selected.
(Must be greater than the 'fastest rate in auto start sequence' Setting)

Speed Setpoint Raise/Lower Command Rates –

These are the rates used while the turbine is within its typical load range of Minimum to Maximum governor speed.



Setpoint Adjustment Normal Rate (Cold) rpm/s **dflt = 10.0 (0.005, 100)**

Enter the desired rpm/s rate of change of the speed reference setpoint that should be used while the turbine is cold.

Setpoint Adjustment Normal Rate (Hot) rpm/s **dflt = 20.0 (0.005, 100)**

Enter the desired rpm/s rate of change of the speed reference setpoint that should be used while the turbine is hot.

Delay time for Rate change **dflt = 3.0 (0.0, 60.0)**

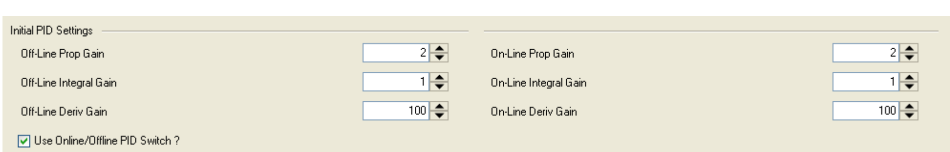
Set the delay time (seconds) for rate change.

Multiply factor of Normal Rate **dflt = 0.3 (0.01, 100.0)**

If value of multiply factor less than 1, the momentary raise/lower commands to adjust the setpoint will move at the slow rate (below) for any command less than delay time period (seconds). When the command is held TRUE for longer than delay time the rate will switch to the Normal rate (above). The slow rate will equal the normal rate times this factor in rpm/s.

If value more than 1, the momentary raise/lower commands to adjust the setpoint will move at the normal rate for any command less than delay time period (seconds). When the command is held TRUE for longer than delay time the rate will switch to the Fast rate. The fast rate will equal the normal rate times this factor in rpm/s.

Initial PID Settings



Off-Line Proportional Gain **dflt = 2.0 (0.005, 100)**
Enter the off-line PID proportional gain percentage. This value is used to set speed/load control response when the turbine speed is below minimum governor speed. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 1%.

Off-Line Integral Gain **dflt = 1.0 (.005, 50)**
Enter the off-line PID integral gain in repeats-per-second (rps). This value is used to set speed/load control response when the turbine speed is below minimum governor speed. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 0.5 rps.

Off-Line Derivative Ratio **dflt = 100.0 (0.0, 100)**
Enter the off-line PID derivative ratio. This value is used to set speed/load control response when the turbine speed is below minimum governor speed. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 100%.(disabled)

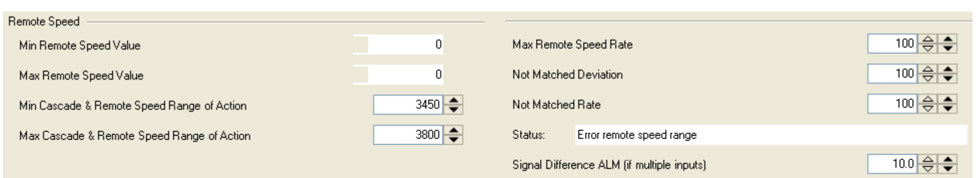
On-Line Proportional Gain **dflt = 2.0 (0.0, 100)**
Enter the on-line PID proportional gain percentage. This value is used to set speed/load control response when the turbine speed is above minimum governor speed. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 1%.

On-Line Integral Gain **dflt = 1.0 (0.01, 50)**
Enter the on-line PID integral gain, in repeats-per-second (rps). This value is used to set speed/load control response when the turbine speed is above minimum governor. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 0.5 rps.

On-Line Derivative Ratio Gain **dflt = 100.0 (0.0, 100)**
Enter the on-line PID derivative ratio. This value is used to set speed/load control response when the turbine speed is above minimum governor speed. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 100%.(disabled)

Use External DI Switch to select ONLINE/OFFLINE Dynamics?dflt = Checked
Check this box to switch the dynamic settings. The control always uses dual dynamics, if this setting is false control will switch to On-Line when speed is > Min Gov (mechanical drive) or at Breaker closure (Generator).

Remote Speed Settings – (if Used)



Use 4-20 mA Remote Speed Setpoint **dflt = No (0.0, 25000)**
If checked, allows an external 4–20 mA signal to change the speed setpoint.

Remote Speed Sensor Range
Min Remote Speed Value **VIEW ONLY - Set in AI Config**
Speed reference for a signal of 4 mA

Max Remote Speed Value VIEW ONLY - Set in AI Config
Speed reference for a signal of 20 mA

Min Cascade & Remote Speed Range of Action **dflt = 0 (0, 25000)**
Minimum speed reference possible using the remote speed setpoint.
(Must be inside sensor range, above or equal to min governor and below or equal to maximum governor)

Max Cascade & Remote Speed Range of Action **dflt = 100 (0, 25000)**
Maximum speed reference possible, using the remote speed setpoint.
(Must be inside sensor range, above the min value and below or equal to maximum governor). If the Remote Input is ranged to go from 0 to 4000 RPM by an external device, but the user wishes the speed to be limited to 3500—3700 RPM, this option will allow for it.

Max Remote Speed Rate (rpm/s) **dflt = 100 (0.1, 1000)**
This value determines the rate the setpoint moves when remote is enabled and the remote input doesn't match the actual speed setpoint.

Not-Matched Deviation (rpm) **dflt = 100 (0.1, 1000)**
This value determines the max deviation authorized for the remote speed setpoint. When the deviation is above this value, the not Matched rate will be used.
Not-Matched Rate (rpm/s) **dflt = 100 (0.1, 500)**
This value determines the rate the setpoint moves when remote is enabled and the remote input doesn't match the actual speed setpoint.

Signal Difference ALM (if multiple inputs) (rpm) **dflt = 10 (0.01, 10000)**
When multiple Speed inputs are used, this value determines the maximum difference between the speeds before an alarm is enunciated.

Conf – Page 5 –Turbine Protection

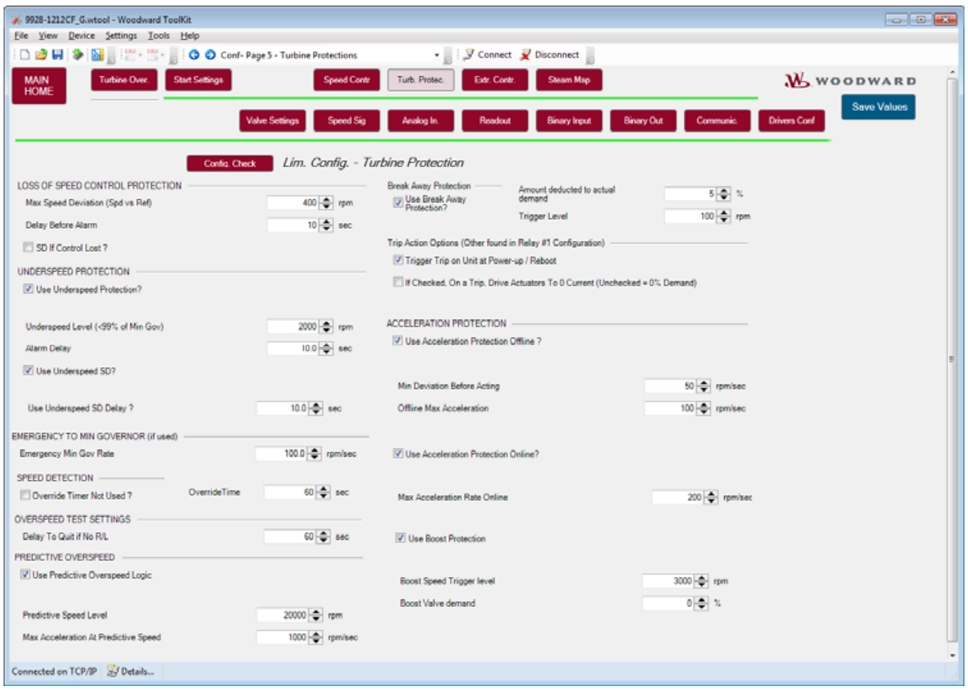


Figure 3-12. Turbine Protection

Loss of Speed Control Protection
This protection is used to prevent any loss of speed control by the 5009FT.
If the 5009FT is used for mechanical drive, it must be, at all time, in control of the speed.
Max Delta Speed Deviation (Spd-Ref) **dflt = 400 (0, 25000)**
Define the maximum acceptable absolute deviation of speed (rpm).
Delay before Alarm (sec) **dflt = 10 (0, 60)**
If the deviation is greater than the acceptable level, during more than this time (in seconds), an alarm will be generated.
SD (Shutdown/Trip) if Control Lost? **dflt = Unchecked**
If selected, instead of an alarm, a trip will be generated if the deviation is greater than the acceptable level, for more than the alarm delay.
Underspeed Protection
This protection is used to annunciate or trip the unit if the speed falls significantly under the Min Gov speed.
Use Underspeed Protection? **dflt = Unchecked**
If checked, underspeed protection will be active.

Underspeed Level (<99% of Min Gov) dflt = 2000 (1, 10000)
Define the minimum acceptable speed setpoint (rpm).
Alarm Delay (sec) dflt = 10 (0, 60)
If the drops below underspeed level for more than this time delay, after a complete start-up, an alarm will be generated.
Use Underspeed SD? dflt = Unchecked
If checked, a Trip will be initiated if the underspeed condition lasts more than the Underspeed SD Delay.
Use Underspeed SD Delay (sec) dflt = 10 (0, 60)
If the drops below underspeed level for more than this time delay, after a complete start-up, a trip will be generated.
Emergency to MIN GOVERNOR (if used)
Emergency Min Gov Rate (rpm/s) dflt = 100 (1, 1000000)
If the emergency Go to Min Gov input is triggered it will ramp/step the speed setpoint to Min Gov at this rate.

Speed Detection
Override Timer NOT Used? dflt = Unchecked
If checked, the control will look for a discrete input to override the speed sensor faults when the unit is not running.
Override Time (sec) dflt = 10 (0, 60)
If the above box is not checked the control will automatically override the speed sensor faults until this time has elapsed after a start turbine command is issued.

Overspeed Test Setting
Delay to Quit Overspeed test routine in No Speed R/L (sec)dflt = 60 (10, 300)
If no raise or lower speed commands are received for this amount of time during an Overspeed Test routine, then the control will exit the test mode and reduce the speed setpoint to max governor.

Use Predictive Overspeed
Use Predictive Overspeed Protection? dflt = Unchecked
If checked, the control will use a high speed and max acceleration calculation around that speed to preemptively trip the unit on anticipation of an overspeed event. This should only be used on units that experience OSPD trips and are looking to reduce the max speed reached during an overspeed event.
Predictive Speed Level (rpm) dflt = 2000 (500, 20000)
If the above box is not checked the control will automatically override the speed sensor faults until this time has elapsed after a start turbine command is issued.
Max Acceleration at Predictive Speed (rpm/s) dflt = 500 (10, 20000)
If this acceleration rate is reached when the unit is at or above the predictive speed level, the predictive overspeed logic will generate a trip.
Trip Action Options (Other found in Relay #1 Configuration)
Trigger Trip on Unit Power-up / Reboot dflt = Checked
If checked, the unit will Trip on a Power-up or Reboot event.
Check to have Trip Relay drive Actuators to 0 Current dflt = Unchecked
If checked, on a trip the unit will drive the actuator output to zero current. If un-checked, the unit will drive to zero percent position on a trip.

Conf – Page 6 –Extraction/Admission Control

The 5009FT can be configured for extraction, admission, or extraction/admission types of steam turbines. Due to the similarities in the Extraction, Admission, and Extr/Adm configuration pages, the following sections show extraction as the example therefore your pages may appear slightly different, but all optional selections will be shown in the text descriptions.

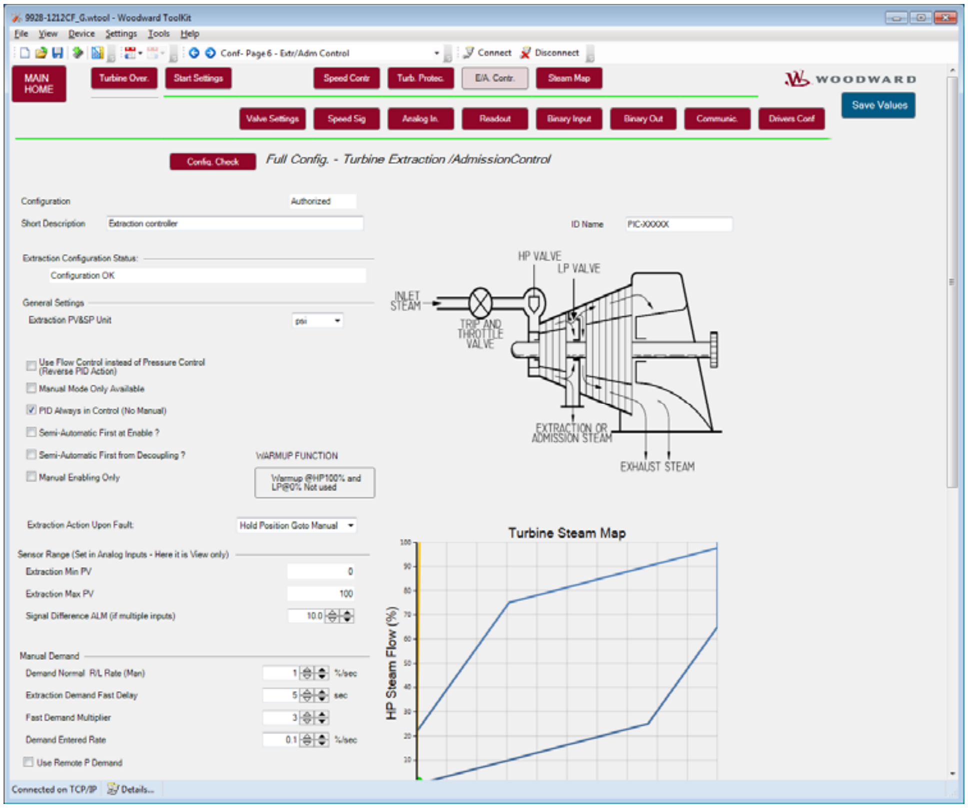


Figure 3-13. Turbine Extraction/Admission Control (top half)

Extraction PV&SP Unit **dflt = psi (strings)**
This selection will define the engineering units (E/U) of the extraction signals and user settings.

Invert (Reverse) PID Action **dflt = Unchecked**
Check this box to reverse the action of the PID in relation to an error between the PV and the SP. Default action is that when an increase in extraction pressure is desired, the valve demand moves down from 100% (forcing more extraction flow).

Manual Mode Only Available **dflt = Unchecked**
When this is checked Manual mode is selected, then the operator can manipulate the Pressure/flow demand in OPEN loop by giving the control a manual valve % demand setpoint.

PID Always in Control (No Manual) **dflt = Unchecked**
When this is selected the control will always stay in closed loop PID control of the extraction or admission process variable.

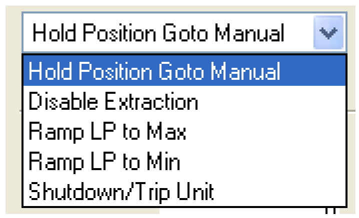
SemiAutomatic First at Enable? **dflt = Checked**
When this selection is checked, Extraction control will be put into Semiautomatic mode when Extraction is first enabled. If left unchecked, extraction control will be in manual mode when first enabled.

SemiAutomatic First from Decoupling? **dflt = Unchecked**
When this selection is checked, Extraction control will be put into Semiautomatic mode when Decoupling is disabled. If left unchecked, extraction control will be in manual mode when Decoupling is disabled.

Manual Enabling Only? **dflt = Unchecked**
Select this function if it is not desired to ramp the LP valve limiter automatically (zero for Extraction or Admission with external valve) when extraction/admission is requested.

WARMUP FUNCTION
If this function is used, then HP ramps up to 100%, and LP ramps down to 0%.

Extraction Action Upon Fault **dflt = Hold Position Goto Manual**
This defines the control action when an extraction input signal fault occurs



When an extraction/admission/E/A sensor is detected faulty, then the control will decide the strategy to apply based on this settings:

If Hold Position/Go to Manual mode is selected, then the operator can manipulate the Pressure/flow demand in OPEN loop, until the sensor is repaired.

If P max is selected, then the control will ramp P to 100% (minimum position of LP according steam map load).

If P min is selected, then the control will ramp P to zero (maximum LP position according steam map load).

If SD is selected, then the turbine will trip as soon as the sensor is detected fault.

Sensor Range (Set in Analog Inputs – view only here)

Extraction Min Value **VIEW ONLY - Set in AI Config**
Ext/Adm Process value for a signal of 4 mA
Extraction Max Value **VIEW ONLY - Set in AI Config**
Ext/Adm Process value for a signal of 20 mA
Signal Difference ALM (if multiple inputs) dflt = 10 (0, 10000)

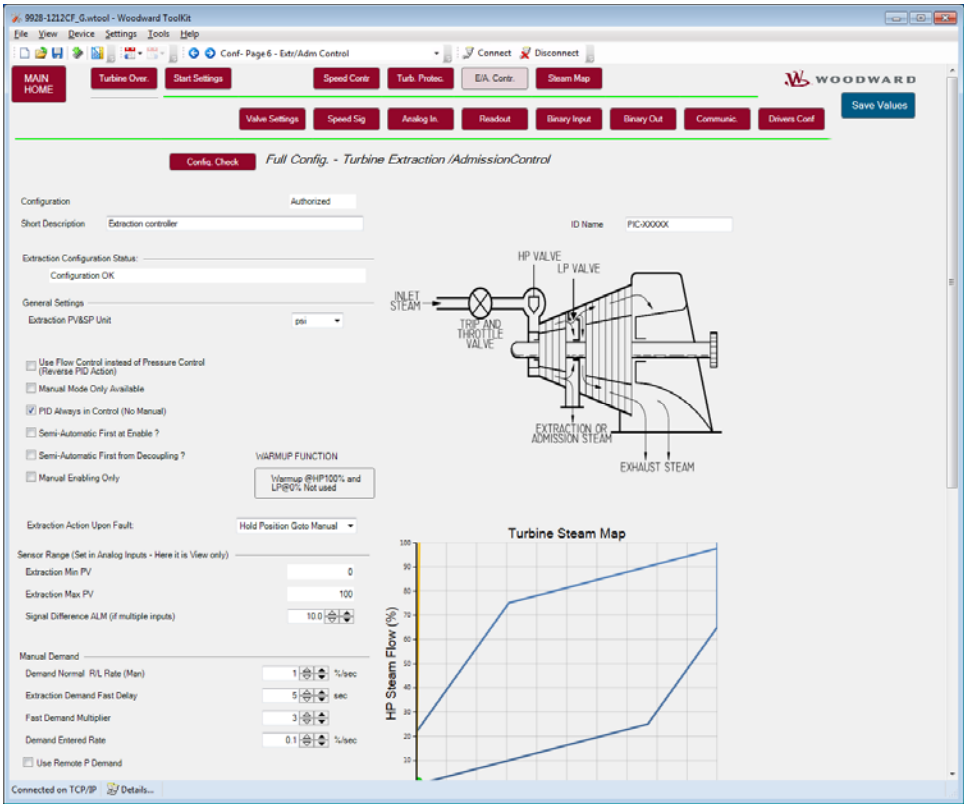


Figure 3-14. Turbine Extraction/Admission Control (bottom half)

Manual Demand

Demand Normal R/L Rate (Manual) **dflt = 1.0 (0, 100)**
Rate in %/s that the manual Raise and Lower commands move the valve

Extraction Demand Fast Delay **dflt = 5.0 (0, 20)**
Time (sec) it will use normal rate before the rate will change to Fast rate

Fast Demand Multiplier **dflt = 3.0 (1, 10)**
Fast rate equals the normal rate times this number

Demand Entered Rate **dflt = 0.1 (0.001, 10)**
Rate in %/s that the GO TO commands move the valve

Use Remote P Demand **dflt = Unchecked**
Check this box to use a remote P Demand signal

Remote Demand Max Deviation Level **dflt = 0.10 (0.01, 10)**

Max Remote P Demand Rate **dflt = 1.0 (0.01, 100)**

Signal Difference ALM (if multiple signals used) **dflt = 10.0 (0.01, 10000)**

If not used – Extraction Inhibited below MinGov

Use Speed Permissive
Check this to use a different speed permissive for allowing extraction
Extraction Min Speed to Enable
Set the speed at which Extraction can be enabled **dflt = 2000 (50, 20000)**

Extraction Setpoint

Minimum Setpoint **dflt = 0.0 (-20000, 20000)**
Set the minimum extraction/admission setpoint. This value is the minimum setpoint value that the extraction/admission setpoint can be decreased/lowered to (lower limit of extraction/admission setpoint).

Maximum Setpoint **dflt = 100.0 (-20000, 20000)**
Set the maximum extraction/admission setpoint. This value is the maximum setpoint value that the extraction/admission setpoint can be increased/raised to (upper limit of extraction/admission setpoint).
(Must be greater than the 'Minimum Setpoint' Setting)

Setpoint Entered Rate **dflt = 1.0 (0.01, 1000)**
Rate in %/s that the GO TO commands move the valve

Setpoint Initial Value **dflt = 0.0 (-200000, 200000)**
Enter the setpoint initialization value for the extraction/admission setpoint., this is the value that the setpoint initializes to upon power-up or exiting the program mode.
(Must be less than or equal to the 'Max admission Setpt' Setting)

Use Setpoint Tracking **dflt = Checked**
If checked, at power up, the setpoint will track the process value when extraction/admission are disabled or in manual mode.
The tracking/Not tracking command can later be changed via Modbus/PCI only.
If tracking is not selected, then the operator can change the setpoint at any time.
However, to avoid any bump while extraction/Admission automatic mode is enabled, an internal (hidden) setpoint of the 5009FT will take care of a smooth transfer at the "not match rate" configured in Service mode.

Setpoint Raise / Lower Normal Rate **dflt = 1.0 (0.01, 10000)**
Enter the extraction/admission setpoint slow rate (in units per second) at which extraction/admission setpoint moves when adjusted for less than 3 seconds. After 3 seconds, the rate will increase to 3 times this rate. The slow rate, fast rate time delay (defaulted to 3 seconds), and fast rate settings are all adjustable in the PCI's Service mode.

Delay for Fast Setpoint rate **dflt = 2.0 (0, 10)**
Time (sec) it will use normal rate before the rate will change to Fast rate

Fast Demand Multiplier **dflt = 3.0 (1, 10)**
Fast rate equals the normal rate times this number

Use Remote Extraction Setpoint **dflt = Unchecked**
Check this box to use a remote Extraction Setpoint signal

Maximum Remote setpoint rate **dflt = 1.0 (0.01, 100)**
Max %/s that the remote setpoint will be limited to

Remote SP Max Deviation Level **dflt = 1.0 (0, 1000)**
Max difference between remote setpoint and PV allowed

Signal Difference ALM (if multiple signals used) **dflt = 10.0 (0, 10000)**
Max allowable difference between inputs

PID Settings

Proportional Gain **dflt = 1.0 (0.0, 99.99)**
Enter the Extraction/admission PID proportional gain value. This value is used to set extraction/admission control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 1%.

Integral Gain **dflt = 0.3 (0.001, 50)**
Enter the Extraction/admission PID integral gain value, in repeats-per- second (rps). This value is used to set extraction/admission 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 rps.

Derivative Ratio **dflt = 100 (0.01, 100)**

Enter the Extraction/Admission PID derivative ratio. This value is used to set extraction/admission control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 99.99%.

Sliding Deadband (% of sensor range) **dflt = 0 (0.0, 100)**

If required, enter the deadband, typically set between 4–6% and not more than 10%.

Droop **dflt = 0.0 (0.0, 100)**

If required, enter the droop percentage, typically set between 4–6% and not more than 10%.

Conf – Page 7 –Turbine Steam Map

Extraction/Admission Steam Map Information

Before configuring the extraction/admission control folders and steam maps, read the Steam Map description below. This discusses steam maps and how to convert your steam map information into a format usable by the 5009FT control.

The steam map is a graphical representation of the operating range and limitations of an extraction and/or admission steam turbine. This map is often called a steam envelope, since normal turbine operation must be contained within the envelope lines.

The 5009FT uses the values programmed to calculate the turbine's internal pressure ratios and limits. In order to get these values from your steam map, you must first check the following conditions and, if necessary, modify the map so it meets these conditions:

- The map must be linear (all lines must be straight).
- Lines extraction/admission flow = 0% and extraction/admission flow =100% must be parallel, and lines LP valve = 0% and LP valve = 100% must be parallel.

If your envelope lines are not all straight and parallel (conditions 1 and 2), redraw the envelope so that they are (use graph paper). Make sure your redrawn envelope approximates the old envelope as closely as possible.

The lines on the envelope define the operating characteristics of your turbine. Refer to the example steam maps in this manual. The different lines or limits of a Steam map are:

- The horizontal axis shows turbine power (S).
- The vertical axis shows HP valve position (HP).
- The vertical line called S=100 is the maximum power limiter. This limiter prevents turbine operation beyond the maximum power limit.
- The horizontal line called HP=100 is the maximum HP flow limiter. The HP flow limiter prevents turbine operation beyond the desired maximum HP flow limit.
- The parallel lines called P=0 and P=100 define the extraction/admission flow range (from no flow or maximum admission flow to maximum extraction flow). The "P" term is used to represent pressure demand.
- The parallel lines called LP=0 and LP=100 define the LP valve position range (from closed to 100% open).

The turbine's operating characteristics are programmed into the 5009FT as extraction/admission data. This data is taken from the turbine's steam map or envelope. When entering extraction/admission data into the 5009FT, it does not matter which units you use, as long as you use the same units throughout for power, and the same units throughout for HP and extraction/admission flow.

The 5009FT calculates an extraction and/or admission turbine's ratios and limits from the steam map's Max power, Max HP Flow, point A, point B, and point C values (as shown in the following example figures). The points A, B, and C are entered through programming their horizontal and vertical axis values, as explained below.

Steam maps often show a series of parallel lines representing extraction flow, as do our examples. The bottom line of all the flow lines must be P=0, and the top of the flow lines must be P=100. The “P” term is used to represent pressure demand. The higher the pressure at this point in a turbine the higher the extraction steam flow is, or the lower the admitted steam flow is. Notice, that all the “P” lines in our examples are indeed parallel.

The remaining pair of lines on opposite sides of the envelope must correspond to LP=0 (extraction valve closed) and LP=100 (extraction valve fully open). Note that the LP=0 line is parallel to the LP=100 line (condition 2).

Extraction Only Steam Map—Before a turbine’s extraction steam map can be programmed into the control, it must have the intersection points A, B, & C (refer to Figure 3-11).

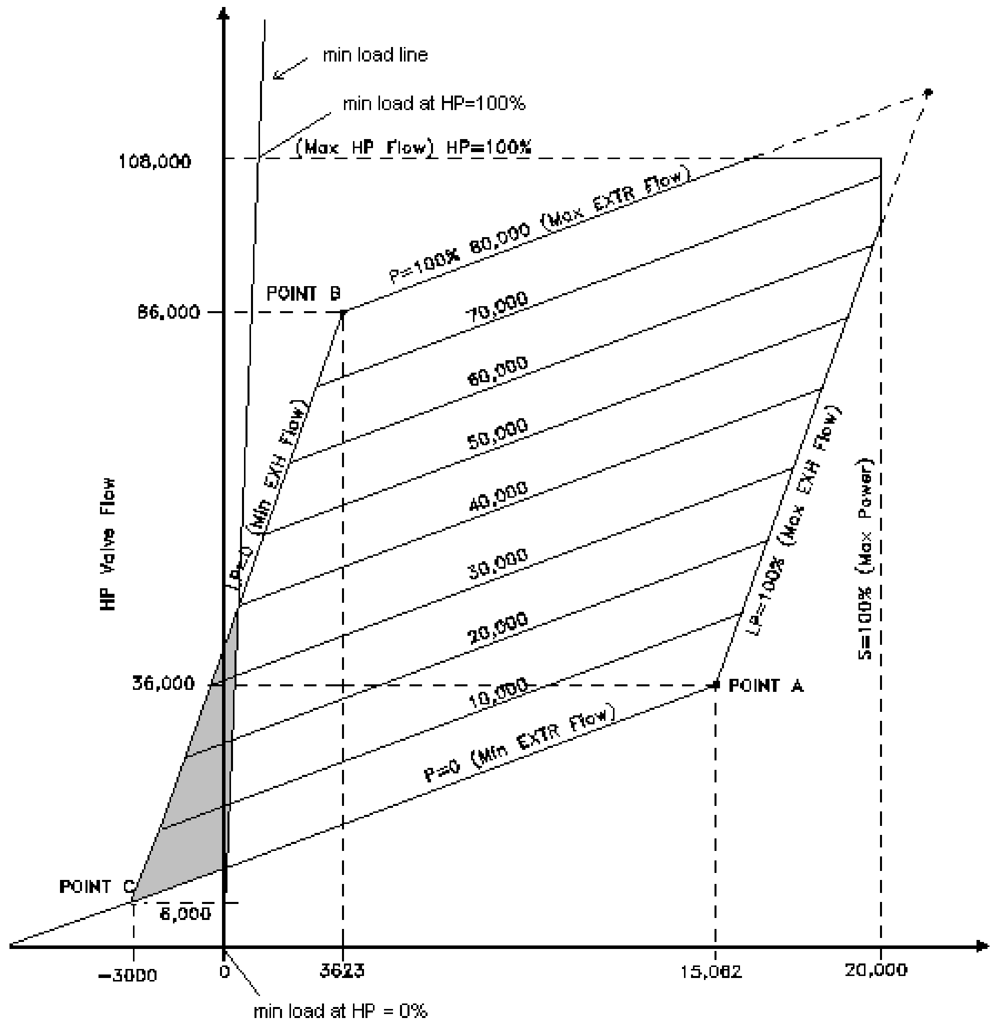


Figure 3-15. Typical Extraction Steam Map

Typically Point C the intersection of the LP=O line and the P=0 line does not exist. If this is the case, it will be necessary to convert your steam map. The only conversion necessary is the extension of the LP=0 line and the P=0 line until they cross or intersect. This point where the LP=0 line intersects the P=0 line is defined as Point C, and is required by the control to calculate the turbine’s internal pressure ratios and limits.

The eight values needed can be taken from the converted steam map. As an example, the following data was derived, using the above steam map in Figure
3-10:

The MAX POWER value is the load where the S=100 line crosses the s-axis (about 20,000 KW in our example). The MAX HP FLOW value is the flow where the HP=100 line crosses the HP-axis (about 108,000 lbs/hr).

Point A is where the P=0 and LP=100 lines intersect (MAX POWER @ MIN EXTRACTION = about 15,062 KW; HP FLOW @ MIN EXTRACTION = about 36,000 lbs/hr).

Point B is where the LP=0 and P=100 lines intersect (MIN POWER @ MAX EXTRACTION = about 3,623 KW; HP FLOW @ MAX EXTRACTION = about 86,000 lbs/hr).

Point C is where the LP=0 and P=0 lines intersect (MIN POWER @ MIN EXTRACTION = about -3,000 KW; MIN HP FLOW @ MIN EXTRACTION = about 6,000 lbs/hr).

The ratio of one value to another is what is important. It does not matter if values are entered in engineering units, percentages, or values. As long as all values are entered in the same units, the map will ratio correctly.

For monitoring purpose (HMI), the 5009FT will convert all the point in percentage, and send the result through Modbus.

If the 5009FT is configured for extraction, admission, or extraction/admission types of steam turbines, the page to enter Steam Map information will be available.

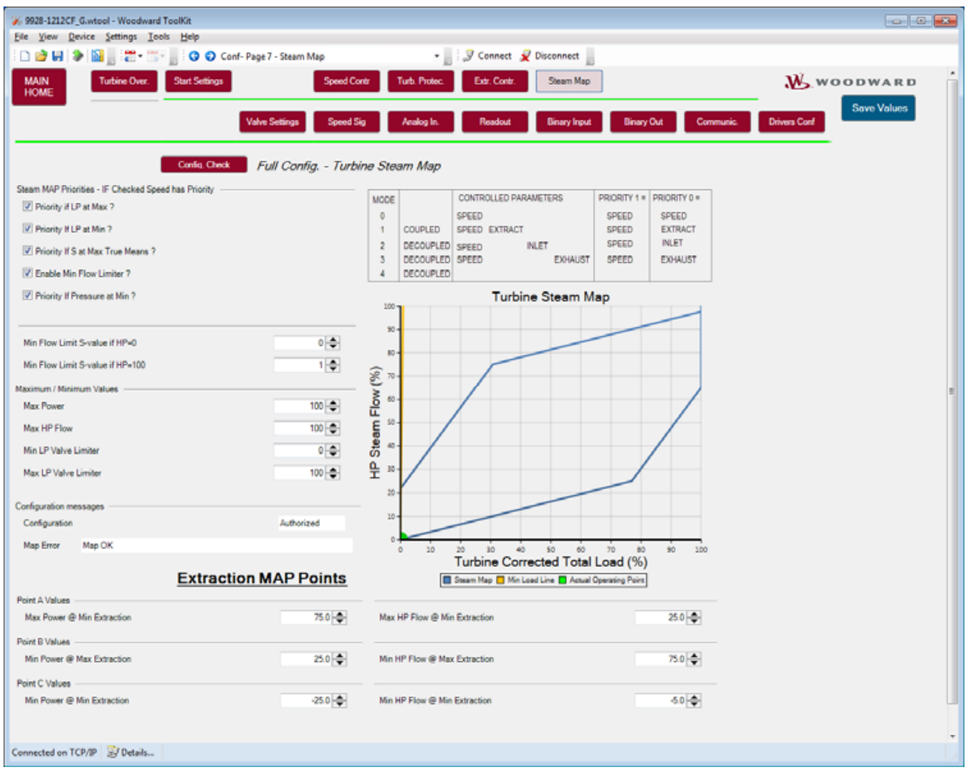


Figure 3-16. Turbine Steam Map

Extraction Steam Map Values

Maximum/minimum Values
Maximum Power **dflt = 20000 (0.0, 100000)**
Enter the Maximum Rated turbine Power.

Maximum HP Flow **dflt = 108000 (0.0, 999999)**
Enter the Maximum Rated HP Valve Flow.

Minimum LP lift

Recopy of the parameter set in extraction folder (can be tuned from here also).

Maximum HP lift

Recopy of the parameter set in extraction folder (can be tuned from here also).

Min load limit

The min load limit is the minimum load limit when extraction is in control.
It represents the intersection of the steam MAP and the (Y) axis
This line can be shift (right/Left) and its inclination can be changed
For control reason, this line cannot be vertical. A minimum of 1% load change for HP-0% and HP=100% is required.

Min Load limit at HP=0% **dflt = 0 (-100000, 100000)**
Set the intersection point of the min load line when HP=0%
Min Load limit at HP=100% **dflt = 0 (-100000, 100000)**
Set the intersection point of the min load line when HP=100%

Point A Values
Maximum Power @ Minimum Extraction **dflt = 15062 (0.0, 999999)**
Enter the maximum power attainable at zero extraction flow.
Maximum HP Flow @ Minimum Extraction **dflt = 36000 (1.0, 999999)**
Enter the maximum HP Valve Flow attainable at zero extraction flow.

Point B Values
Minimum Power @ Maximum Extraction **dflt = 3623 (-99999, 999999)**
Enter the minimum power attainable at 100% or maximum extraction flow.
Minimum HP Flow @ Maximum Extraction **dflt = 86000 (-99999, 999999)**
Enter the minimum HP Valve Flow at 100% or maximum extraction flow.

Point C Values
Minimum Power @ Minimum Extraction **dflt = -3000.0 (-99999, 999999)**
Enter the minimum power attainable at zero extraction flow.
Minimum HP Flow @ Minimum Extraction **dflt = 6000.0 (-99999, 999999)**
Enter the minimum HP Valve Flow at zero extraction flow.

Priority On Map Limits
(Due to the similarities in control functionality, the following descriptions include extraction only, admission only, and extr/adm turbine applications.)

With two unlimited valves (HP&LP), the control can control two parameters at a time. However, when the turbine reaches an operating limit (maximum power or one of the valves reaches a mechanical limit), only one parameter can be controlled. This field determines which controlling parameter will be controlled when the turbine reaches an operating limit. Speed/load is the default priority during a start-up, and when extraction is disabled.

Because the 5009FT controls only mechanical features, speed as always the highest priority, except for two limits configurable

Pressure Priority Override on LP Maximum Lift Limit **dflt = Unchecked**

Check this box to have the control switch to extraction/admission priority whenever the LP valve is on its maximum limit.
In this case, if the limit is reached, speed Raise command is inhibited.
When this limit is reached, the actual speed will be lower than the reference,
Care should be taken that the loss of control setting configure in the speed settings, won’t be triggered.
This protection prevent over pressure after the HP stage.

Pressure Priority Override on Minimum load Limit dflt = Unchecked

Check this box to have the control switch to extraction/admission priority whenever the min load is reached, while extraction is in control.
In this case, if the limit is reached, speed Lower command is inhibited.
When this limit is reached, the actual speed will be higher than the reference,
Care should be taken that the loss of control setting configure in the speed settings, won't be triggered.
This limit prevents an overheating at the exhaust of the HP stage, due to insufficient flow.

Table 3-1. Steam Map Priority

Steam Map Priority		
	Checked	Unchecked
Priority if LP at Max?	Speed Priority	When the turbine control is reached at LP=100% line on the Steam MAP, P_TERM will be given priority over S_TERM.
Priority if LP at Min?	Speed Priority	When the turbine control is reached at LP=0% line on the Steam MAP, P_TERM will be given priority over S_TERM.
Priority if S at Max Ture Means?	Not used	Not used
Enable Min Flow Limiter?	On the ToolKit, ・If check「Priority if LP at Min?」, P_TERM will be limited by adjust the value of 'Min Flow Limit S-value if HP=0/100'.（Coupled Mode, Decoupled Inlet&Speed Mode, Decoupled Exhaust&Speed Mode） ・If uncheck「Priority if LP at Min?」, S_TERM will be limited by adjust the value of 'Min Flow Limit S-value if HP=0/100'.（Coupled Mode, Decoupled Inlet&Speed Mode, Decoupled Exhaust&Speed Mode）	No Effect
Priority if Pressure at Min?	・When the turbine control is 'Decoupled Inlet&Speed mode', P_TERM will be not less than the value of 'K1×S_TERM＋K3'. ・When the turbine control is 'Decoupled Exhaust&Speed mode', P_TERM will be not exceeded the value of 'S_TERM×K4＋K6'.	・When the turbine control is 'Decoupled Inlet&Speed mode', S_TERM will be not exceeded the value of '（P_TERM－K3）／K1'. ・When the turbine control is 'Decoupled Exhaust&Speed mode', S_TERM will be not less than the value of '（P_TERM－K6）／K4'.

Admission Only Steam Map

Before a turbine's admission steam map can be programmed into the control, it must have the intersection points A, B, & C (refer to Figure 3-13).

If points A & B already exist, the only conversion necessary is the extension of the LP=100 line and the P=100 line until they cross or intersect (this is Point C for programming).

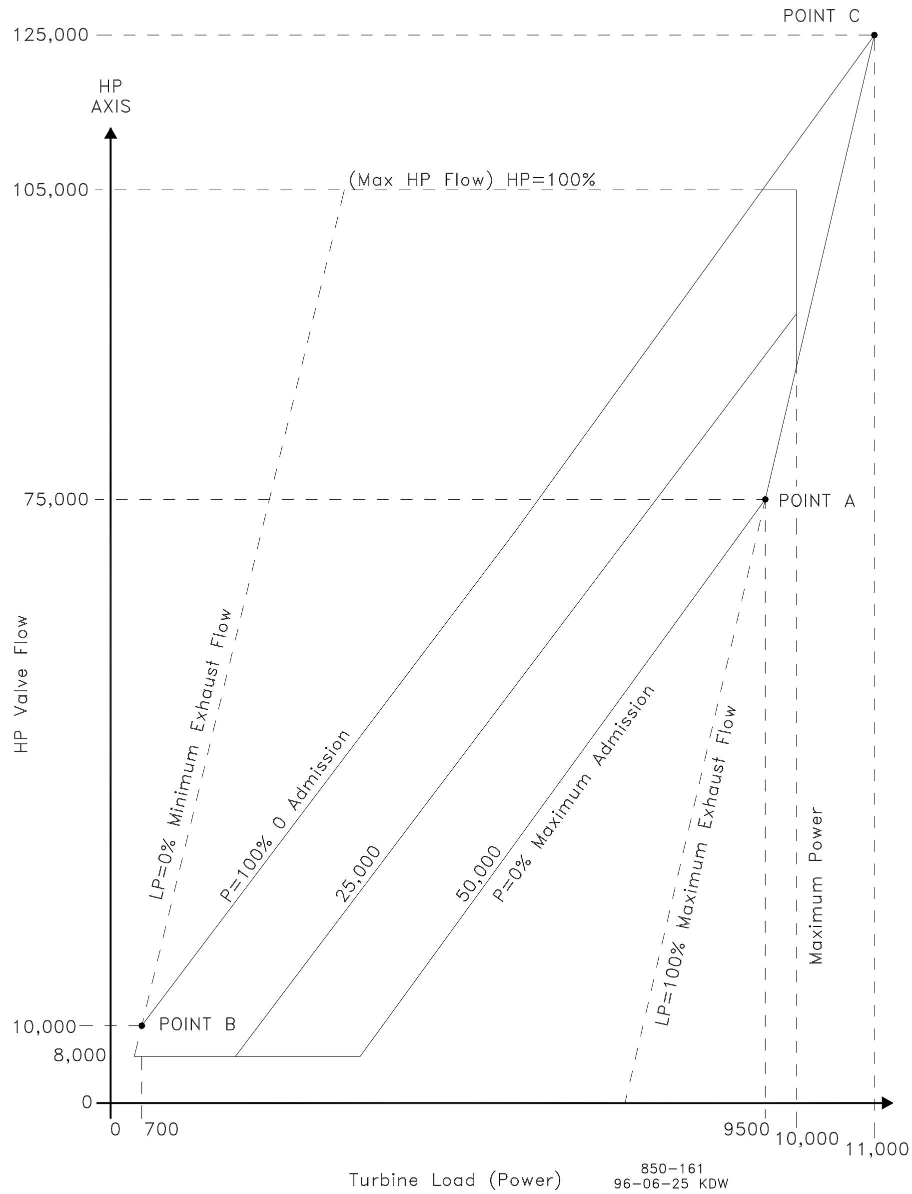


Figure 3-17. Typical Admission Steam Map

If only point A exists, your map will have to be modified to include points B & C. The LP=0 line will need to be created. To create the LP=0 line you must know the minimum required steam flow through the back-end of the turbine. In our example steam map (Figure 3-13) the minimum required flow was 10,000 lbs/hr.

1. Extend the zero admission (or induction) line (p=100%). Refer to Figure 3-13.

   Find your turbine's minimum back-end steam flow (this will be point B's HP flow).

2. Mark the intersection of the zero admission line and the turbine's minimum back-end (cooling) steam flow. This mark will be Point B for programming.

   Draw a line parallel to the LP=100 line, through the mark created in step 3. This will be your LP=0 line or LP valve closed line.

3. Mark the intersection of the P=100 and the LP=100 line. This will be Point C for programming. Typically Point C the intersection of the LP=100 line and the P=100 line does not exist.

Points A, B, and C are required by the control to calculate the turbine's internal pressure ratios and limits.

The nine values needed can be taken from the converted steam map. An example has been provided using the steam map in Figure 3-14.

> The MAX POWER value is the load where the S=100 line crosses the s-axis (about 10,000 KW in our example). The MAX HP FLOW value is the flow where the HP=100 line crosses the HP-axis (about 105,000 lbs/hr).
>
> Point A is where the P=0 and LP=100 lines intersect (MAX POWER @ MAX ADMISSION = about 9,500 KW; HP FLOW @ MAX ADMISSION = about 75,000 lbs/hr).
>
> The ADMISSION FLOW @ MAX ADMISSION = about 50,000 lbs/hr.
>
> Point B is where the LP=0 and P=100 lines intersect (MIN POWER @ MIN ADMISSION = about 700 kW; HP FLOW @ MIN ADMISSION = about 10,000 lbs/hr). This point was used because 10,000 lbs/hr is the minimum back-end cooling steam flow required by the turbine.
>
> Point C is where the LP=100 and P=100 lines intersect (MAX POWER @ MIN ADMISSION = about 11,000 kW; MAX HP FLOW @ MIN ADMISSION = about 125,000 lbs/hr).

An additional parameter, MIN HP LIFT (%), would also be set to 8000/105,000 = 7.6%.

The ratio of one value to another is what is important. It does not matter if values are entered in engineering units, percentages, or values. As long as all values are entered in the same units, the map will ratio correctly.
For monitoring purpose (HMI), the 5009FT will convert all the point in percentage, and send the result through Modbus.

Admission Steam Map Page

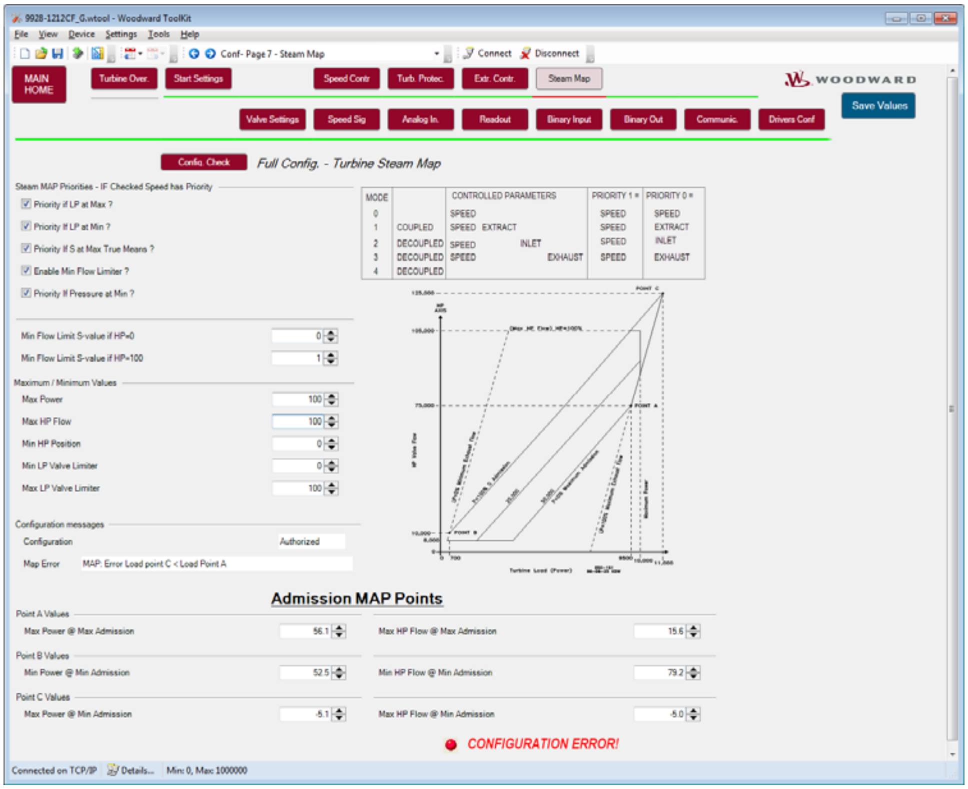


Figure 3-18. Admission Steam Map

Admission Steam Map Values

Maximum Values

Maximum Power

Enter the Maximum Rated Turbine Power.

Maximum HP Flow

Enter the Maximum Rated HP Valve Flow.

Point A Values

Maximum Power @ Maximum Admission

Enter the maximum power attainable at 100% or maximum admission flow.

Maximum HP Flow @ Maximum Admission

Enter the maximum HP Valve Flow attainable at 100% or maximum admission flow.

Point B Values

Minimum Power @ Minimum Admission

Enter the minimum power attainable at zero admission flow.

Minimum HP Flow @ Minimum Admission

Enter the minimum HP Valve Flow at zero admission flow.

Point C Values

Maximum Power @ Minimum Admission

Enter the maximum power attainable at zero admission flow.

Maximum HP Flow @ Minimum Admission

Enter the maximum HP Valve Flow at zero admission flow.

Priority On Map Limits—Select the desired control priority when the turbine is operating on a limit. Refer to the “Priority On Map Limits” description under the Extraction Steam Map Folder section of this chapter for a detailed description of each option.

Extraction & Admission Steam Map

Extraction & Admission Steam Map—Before a turbine's extraction/ admission steam map can be programmed into the control, it must have the intersection points A, B, & C (refer to Figure 3-15).

If points A & B already exist, the only conversion necessary is the extension of the LP=0 line and the zero extraction and admission flow line until they cross or intersect (this is Point C for programming). If point A does not exist, the extension of the LP=100 line and the zero extraction and admission flow line until they cross or intersect is Point A for programming.

If points B & C do not exist, your map will have to be modified to include points B & C. The LP=0 line will need to be created. To create the LP=0 line you must know the minimum required steam flow through the back-end of the turbine. In our example steam map (Figure 3-15) the minimum required flow was 8,000 lbs/hr.

1. Extend the maximum extraction line. Refer to Figure 3-15.
2. Extend the zero extraction & admission line.
3. Find your turbine's minimum back-end steam flow (this will be point C's HP flow).
4. Mark the intersection of the zero extraction & admission flow line and the turbine's minimum back-end steam flow. This mark will be Point C for programming.
5. Draw a line parallel to the LP=100 line, through the mark created in step 4. This will be your LP=0 line or LP valve closed line.
6. Mark the intersection of the maximum extraction line and the created LP=0 line. This will be Point B for programming.

Points A, B, and C are required by the control to calculate the turbine's internal pressure ratios and limits.

An additional parameter, MIN HP LIFT (%), would also be set to 4000/54,000 = 7.4%.

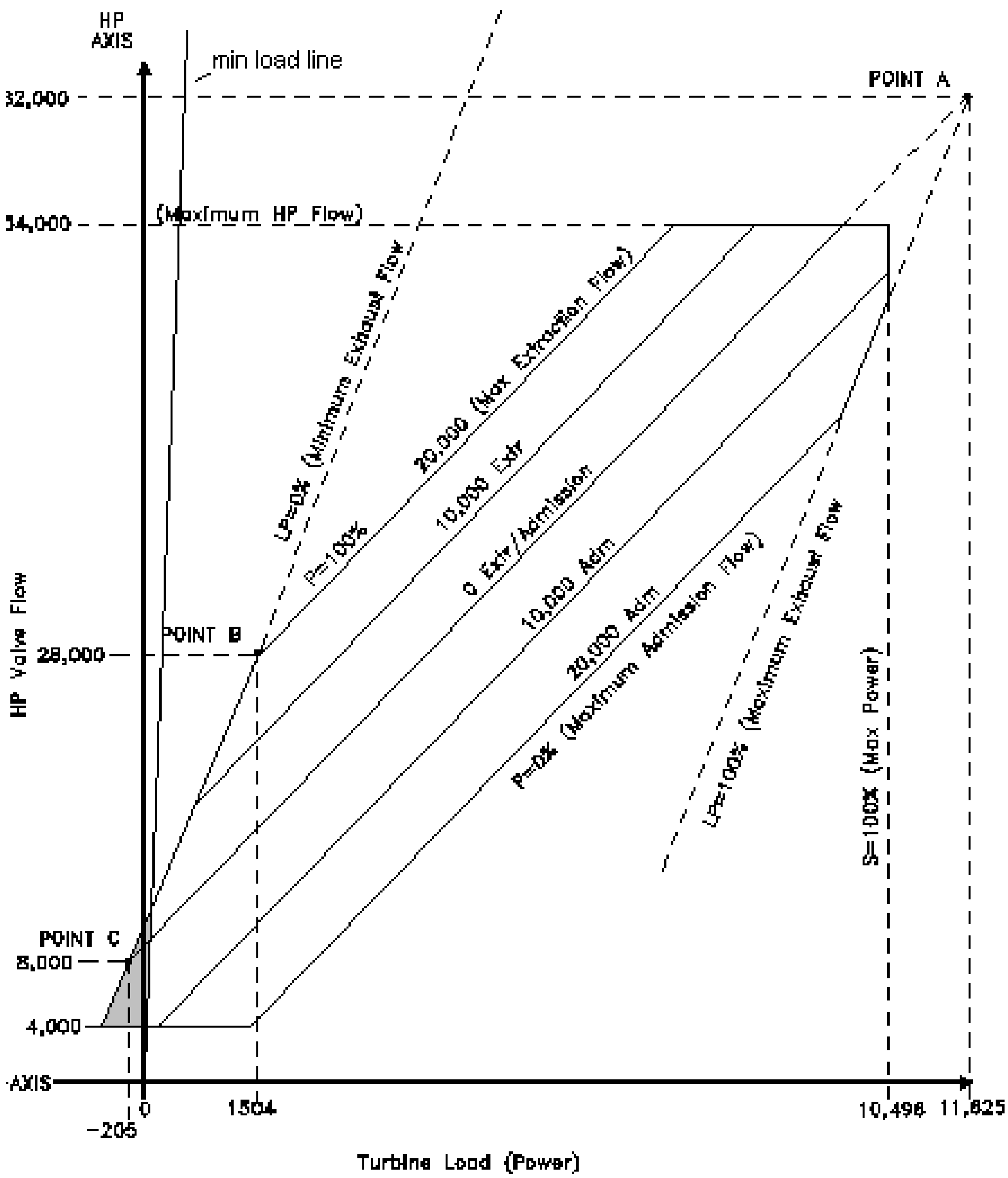


Figure 3-19. Typical Extraction & Admission Steam Map

The ten values needed can be taken from the converted steam map. An example has been provided below, using the steam map in Figure 3-15:

The MAX POWER value is the load where the S=100 line crosses the s-axis (about 10,496 kW in our example). The MAX HP FLOW value is the flow where the HP=100 line crosses the HP-axis (about 54,000 lbs/hr).

Point A is where the P=0 extr/adm and LP=100 lines intersect (MAX POWER @ 0 EXTR/ADM = about 11,625 kW; MAX HP FLOW @ 0 EXTR/ ADM = about 62,000 lbs/hr). MAX ADMISSION = about 20,000 lbs/hr.

Point B is where the LP=0 and P=100 lines intersect (MIN POWER @ MAX EXTRACTION = about 1504 kW; MIN HP FLOW @ MAX EXTRACTION = about 28,000 lbs/hr).

Point C is where the LP=0 and zero extraction & admission flow lines intersect (MIN POWER @ ZERO EXTRACTION/ADMISSION = about—205 kW; MIN HP FLOW @ ZERO EXTRACTION/ADMISSION = about 8,000 lbs/hr).

An additional parameter, MIN HP LIFT (%), would also be set to 4000/54000 = 7.4%.

The ratio of one value to another is what is important. It does not matter if values are entered in engineering units, percentages, or values. As long as all values are entered in the same units, the map will ratio correctly.
For monitoring purpose (HMI), the 5009FT will convert all the point in percentage, and send the result through Modbus.

Extraction/Admission Steam Map Page

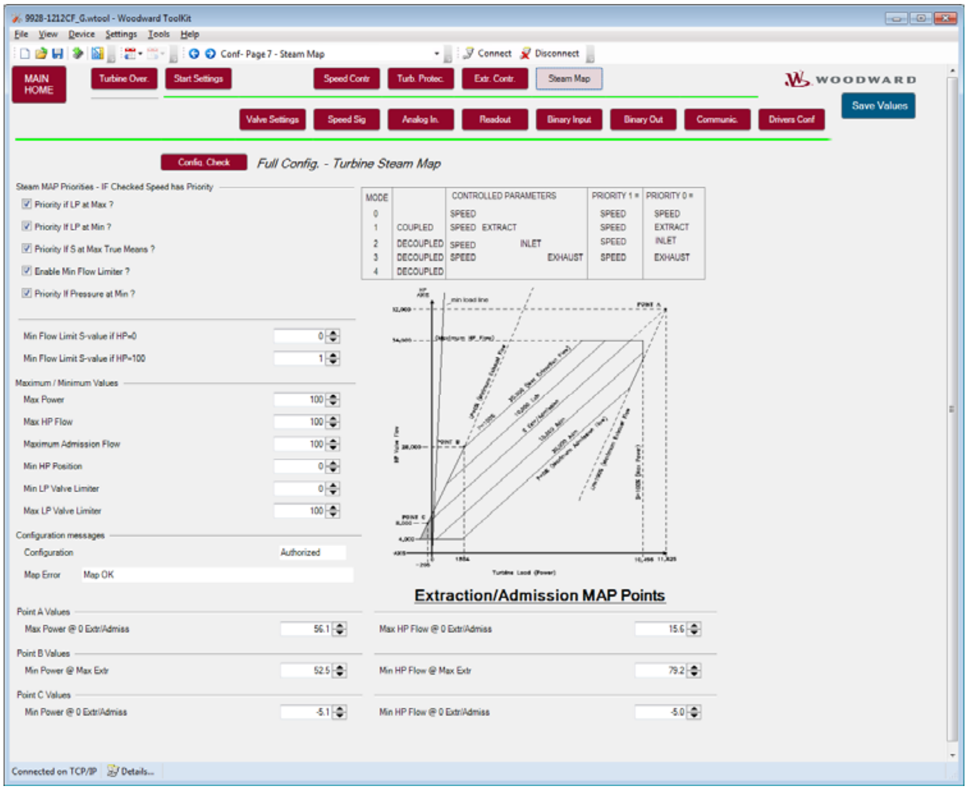


Figure 3-20. Extraction/Admission Steam Map

Extraction/ Admission Steam Map Values

Maximum Values
Maximum Power **dflt = 100 (0.0, 999999)**
Enter the Maximum Rated Turbine Power.

Maximum HP Flow **dflt = 100 (0.0, 999999)**
Enter the Maximum Rated HP Valve Flow for the turbine.

Maximum Admission Flow **dflt = 0.0 (0.0, 999999)**
Enter the Maximum Rated Low Pressure Valve Flow (Admission) for the turbine.

Point A Values
Maximum Power @ 0 E/A **dflt = 77.7 (1.0, 999999)**
Enter the maximum power attainable at zero extr/adm flow.
Maximum HP Flow @ 0 E/A **dflt = 28.6 (1.0, 999999)**
Enter the maximum HP Valve Flow attainable at zero extr/adm flow.

Point B Values

Minimum Power @ Maximum Extraction **dflt = 27.4 (-99999, 999999)**

Enter the minimum power attainable at maximum extraction flow.

Minimum HP Flow @ Maximum Extraction **dflt = 80.0 (-99999, 999999)**

Enter the minimum HP Valve Flow at maximum extraction flow.

Point C Values

Minimum Power @ 0 E/A **dflt = 0.0 (-99999, 999999)**

Enter the minimum power attainable at zero extr/adm flow.

Minimum HP Flow @ 0 E/A **dflt = 0.0 (-99999, 999999)**

Enter the minimum HP Valve Flow at zero extr/adm flow.

Priority On Map Limits

Select the desired control priority when the turbine is operating on a limit. Refer to the "Priority On Map Limits" description under the Extraction Steam Map Folder section of this chapter for a detailed description of each option.

Conf – Page 8 –Turbine Cascade Control

If the 5009FT is configured to use Cascade control the following configuration page will be available.

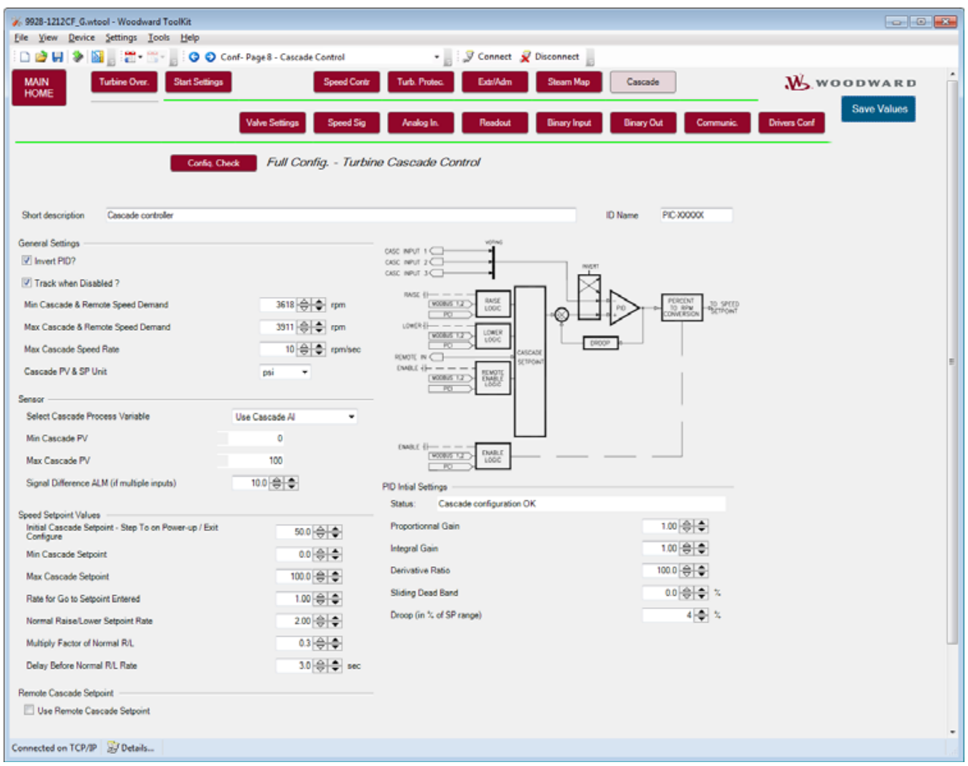


Figure 3-21. Cascade Control

Cascade Sensor settings

Invert (Cascade) PID? **dflt = Unchecked**

Check this box if the cascade control action required is reverse acting. If selected, this option will result in the HP valve (S-term) decreasing to increase the cascade input parameter. An example when the input would be inverted is when cascade PID is being used for turbine inlet pressure control.

Track when Disabled **dflt = Checked**

If checked, at power up, the setpoint will track the process value when cascade mode is disabled.
The tracking/Not tracking command can later be changed via Modbus/CCT only.
If tracking is not selected, then the operator can change the setpoint at any time.
However, to avoid any bump while cascade is enabled, an internal (hidden) setpoint of the 5009FT will take care of a smooth transfer at the "not match rate" configured in Service mode.

Minimum Cascade & Remote Speed Demand **dflt = 3600 (0.0, 25000)**

Enter the minimum speed setpoint that the Cascade controller can lower the speed setpoint to.(Must be greater than or equal to the 'Minimum Control Speed Setpt' Setting)

Maximum Cascade & Remote Speed Demand **dflt = 4000 (0.0, 25000)**

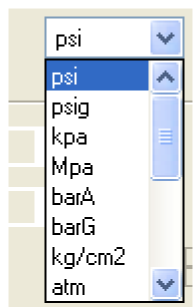
Enter the maximum speed setpoint that the Cascade controller can raise the speed setpoint to. This value is used to limit the Cascade PID from over powering the unit. (Must be less than or equal to the 'Maximum Control Speed Setpt' Setting)

Maximum Cascade Speed Rate(rpm/s) **dflt = 100 (0.01, 10000)**

Enter the maximum desired rate that the cascade setpoint will change for a large step change in the Remote cascade Setpoint signal.

Cascade PV & SP Units:

Select appropriate choice from of the pull-down list: **dflt = psi**



Sensor range:

Verify the setting of the analog input signal range of the cascade transmitters. If several transmitters (#1, #2, #3) are used, they should all have the same range.

Min Cascade PV (Value at 4 mA) **dflt = 0 (value set in AI)**
Max Cascade PV (Value at 20 mA) **dflt = 100 (value set in AI)**

Signal Difference ALM (if multiple signals used) **dflt = 10.0 (0, 10000)**

Max allowable difference between inputs

Speed Setpoint Values

Initial Cascade Setpoint **dflt = 50 (-10000, 10000)**

Enter the setpoint initialization value for the cascade setpoint, this is the value that the setpoint initializes to upon power-up or exiting the program mode.
(Must be less than or equal to the 'Max Setpt' Setting)

Minimum Cascade Setpoint **dflt = 0 (0, 1000)**

Set the minimum cascade setpoint. This value is the minimum setpoint value that the cascade setpoint can be decreased/lowered to (lower limit of cascade control).

Maximum Cascade Setpoint **dflt = 100 (0, 10000)**

Set the maximum cascade setpoint. This value is the maximum setpoint value that the cascade setpoint can be increased/raised to (upper limit of cascade control).
(Must be greater than the 'Min Setpt' Setting)

Rate for Go to Setpoint Entered **dflt = 1.0 (0.001, 20000)**

Enter the rate at which the Setpoint will ramp when Go to Setpoint is selected.

Normal Raise/Lower Setpoint Rate—(Slow) dflt = 1.0 (0.01, 10000)

Enter the cascade setpoint slow rate (in units per second) at which cascade setpoint moves when adjusted for less than 2 seconds. After 2 seconds, the rate will increase to 3 times this rate. The slow rate, fast rate time delay (defaulted to 3 seconds), and fast rate settings are all adjustable in the CCT's Service mode and below.

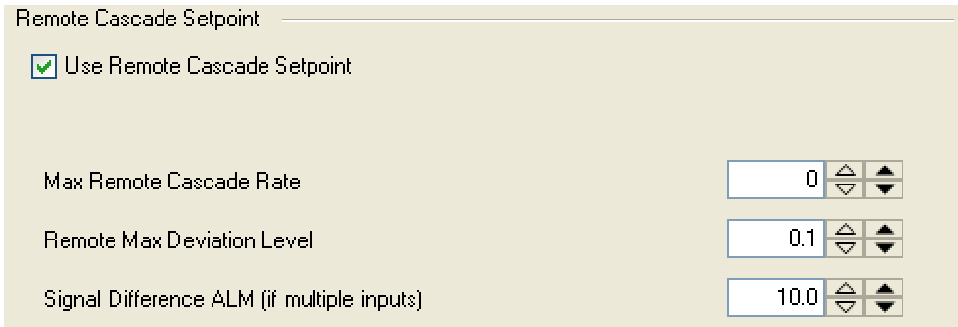
Multiply Factor of Normal R/L Rate dflt = 3 (1,10)

Set this multiply factor used for the setpoint rate when fast rate is selected

Delay Before Fast Rate (sec) dflt = 3 (1,10)

This is the time to wait when R/L command is send to use the fast rate settings.

Use Remote Cascade Setpoint (4–20 mA) dflt = Unchecked



If the box is checked, an external 4–20 mA signal can be used (configure in Analog Input page) to change the cascade setpoint. The cascade control setpoint will move to this input signal whenever the Remote cascade Setpoint is enabled.

Remote Cascade Setpoint Range

Min Remote Cascade Setpoint (Value at 4 mA) dflt=0 (value set in AI)
Max Remote Cascade Setpoint (Value at 20 mA) dflt=100 (value set in AI)

Maximum Remote Cascade Setpoint Rate dflt = 100 (0.01, 10000)

Enter the maximum desired rate that the cascade setpoint will change for a large step change in the Remote cascade Setpoint signal.

Remote Cascade Maximum Deviation Level dflt = 0.1 (0.01, 1000)

Enter the maximum deviation allowed between the Remote Cascade Setpoint and the process variable.

Signal Difference ALM (if multiple signals used) dflt = 10.0 (0, 10000)

Max allowable difference between inputs

Initial PID Settings

Proportional Gain dflt = 1.0 (0.0, 99.99)

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%.

Integral Gain dflt = 1 (0.001, 99.99)

Enter the cascade PID integral gain value, in repeats-per-second (rps). 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 rps.

Derivative Ratio dflt = 100 (0.01, 99.99)

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%.

Sliding Deadband (% of sensor range) dflt = 0 (0.0, 100)

If required, enter the deadband. typically, set between 1% and not more than 10%.

Droop (in % of Setpoint Range) **dflt = 0.0 (0.0, 100)**

Enter the droop percentage. If required, typically set between 4-6% and not more than 100%.

Settings for GENERATOR applications

Disable Cascade if GEN Breaker Opens **dflt = Checked**

If checked, when the generator breaker opens, Cascade will be disabled.

Disable Cascade if UTIL Breaker Opens **dflt = Checked**

If checked, when the utility breaker opens, Cascade will be disabled.

Conf – Page 9 –Turbine Cascade Load Sharing

For the initial release of the 5009FT, the Cascade Load Sharing Logic is currently unavailable.

Conf – Page 10 –Turbine Decoupling

If the 5009FT is configured to use Decoupling Control Modes, the following configuration page will be available.

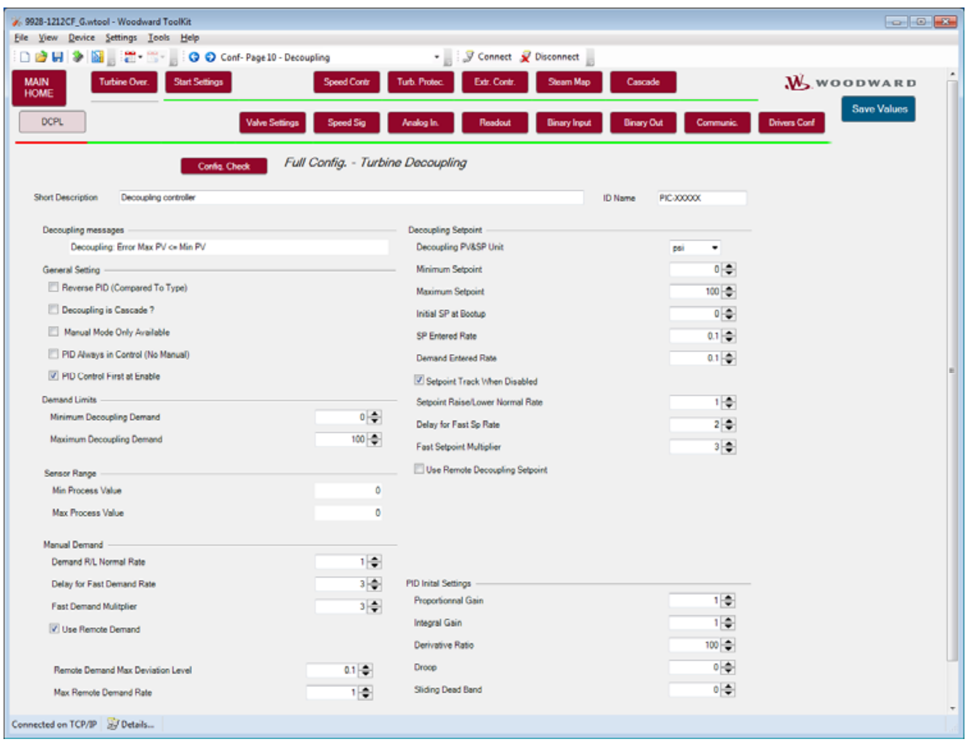


Figure 3-22. Decoupling Control

Reverse PID (Compared to Type)? **dflt = Unchecked**

Check this box if the decoupling control action required is reverse acting. If selected, this option will result in the HP valve (S-term) decreasing to increase the decoupling input parameter if inlet decoupling is used. An example when the input would be inverted is when DCPL PID is being used for turbine inlet pressure control.

Decoupling is Cascade? **dflt = Unchecked**

Check this box to use the Cascade parameter as the Decoupled process value.

Manual Mode Only Available **dflt = Unchecked**

If this box is checked, only manual decoupling will be used (automatic mode will be disabled). When Decoupling is enabled, it will initiate in manual mode.

PID Always in Control (No Manual) **dflt = Unchecked**

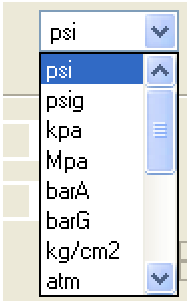
If this box is checked, automatic decoupling will be used (manual mode will be disabled). When Decoupling is enabled, it will initiate in auto mode.

PID Control First at Enable **dflt = Unchecked**

If checked, Decoupling will be in Auto mode when enabled.
If unchecked, Decoupling will be in Manual mode when enabled.

Decoupling Setpoint –
Decoupling PV & SP Units:

Select appropriate choice from of the pull-down list: **dflt = psi**



Minimum Setpoint **dflt = 0.0 (0, 1000)**

Set the minimum decoupling setpoint. This value is the minimum setpoint value that the decoupling setpoint can be decreased/lowered to (lower limit of decoupling control).

Maximum Setpoint **dflt = 0.0 (0, 10000)**

Set the maximum decoupling setpoint. This value is the maximum setpoint value that the decoupling setpoint can be increased/raised to (upper limit of decoupling control).
(Must be greater than the 'Min Setpt' Setting)

Initial Setpoint Value at Boot-up **dflt = 0.0 (-10000, 10000)**

Enter the setpoint initialization value for the decoupling setpoint, this is the value that the setpoint initializes to upon power-up or exiting the program mode.
(Must be less than or equal to the 'Max Setpt' Setting)

Setpoint Entered (Go To) Rate **dflt = 0.1 (0.01, 10000)**

Enter the desired rate at which the decoupling setpoint will move when a user entered target is given.

Demand Entered Rate **dflt = 0.1 (0.01, 10000)**

Enter the desired rate at which the decoupling demand (output) will move when a user entered demand value is given.

Setpoint Track when Disabled **dflt = Checked**

If checked, at power up, the setpoint will track the process value when decoupling mode is disabled or in manual mode.
The tracking/Not tracking command can later be changed via Modbus/CCT only.
If tracking is not selected, then the operator can change the setpoint at any time.
However, to avoid any bump while decoupling automatic mode is enabled, an internal (hidden) setpoint of the 5009FT will take care of a smooth transfer at the "not match rate" configured in Service mode.

Initial PID Settings
Proportional Gain **dflt = 1.0 (0.0, 99.99)**

Enter the DCPL PID proportional gain value. This value is used to set decoupling control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 1%.

Integral Gain **dflt = 1 (0.001, 99.99)**

Enter the DCPL PID integral gain value, in repeats-per-second (rps). This value is used to set decoupling 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 rps.

Derivative Ratio **dflt = 100 (0.01, 99.99)**

Enter the DCPL PID derivative ratio. This value is used to set decoupling control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 100%.

Deadband (% of sensor range) **dflt = 0 (0.0, 100)**

If required, enter the deadband, typically set between 1% and not more than 10%.

Droop **dflt = 0.0 (0.0, 100)**

If required, enter the droop percentage, typically set between 4–6% and not more than 100%.

Conf – Page 10A – Generator Control

This page will only exist if the unit is configured for a GENERATOR application. It will show the available options for generator load and frequency control.

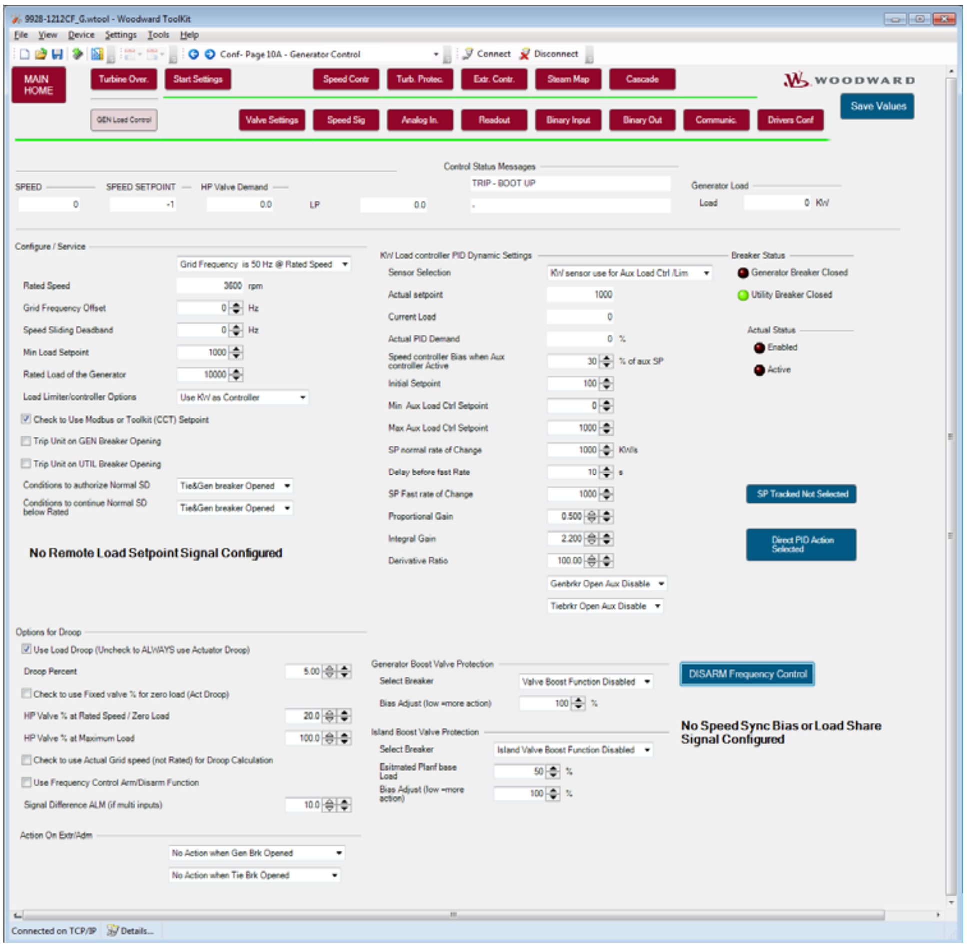


Figure 3-23. Generator Load Control Tuning

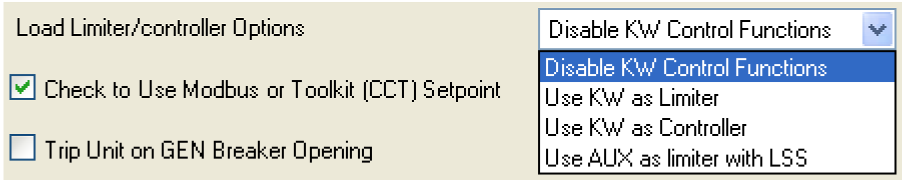
Minimum Load Setpoint **dflt = 1000 (0.0, 100000)**

Enter the minimum KW Load setpoint that the unit should step to at the instant the utility breaker is initially closed.

Rated KW Load of the Generator **dflt = 10000 (0.0, 100000)**

Enter the maximum generator load output of the turbine.

Load Limiter/controller Options **dflt = Disable KW Control Functions**



Use KW as Limiter – if configured

Gen Load Limiter

Initial Setpoint **dlft = 100.0 (-10000000.0, 10000000.0)**
Set initial setpoint for Use KW as Limiter. When the Use KW as Limiter mode selected, then Current Load Setpoint will comes up to this value.

Load Limiter ON **Status LED**
Current Load Setpoint **VIEW ONLY**

Target Load Setpoint **dflt = 10000 (50, 100000)**
User can enter a target value for the Load setpoint.

Go to Target Rate (kw/sec) **dflt = 100 (50, 10000)**
User can enter a rate at which to move to the target setpoint.

Load limiter uses E/D buttons
Use this to always enable the KW limiter – if programmed.

Enable/Disable KW Limiter buttons
Use these to enable or disable the KW limiter – if programmed.

Go to Load Target button
If KW Limiter control is ON, the Go to Target button will move the current KW setpoint to the target setpoint.

Breaker Status LED's - indicate CLOSED conditions of the Generator and Utility Breakers

Use KW as Controller – if configured

Auxiliary Load controller PID Dynamic Settings

Sensor Selection **dflt = KW sensor use for Aux Load Ctrl/Lim**
Select use KW AI or Aux AI for Aux Load Control / Limit.

Actual setpoint **VIEW ONLY**

Current Load **VIEW ONLY**

Actual PID Demand **VIEW ONLY**

Speed controller Bias when Aux controller Active **dlft = 30.0 (1, 200)**
When KW Controller enabled, then Speed setpoint will be increased to this value * (maximum speed – rated speed).

Initial Setpoint **dlft = 100.0 (-10000000.0, 10000000.0)**
Enter the setpoint initialization value for the Aux Load setpoint, this is the value that the setpoint initializes to upon power-up or exiting the program mode.

Min Aux Load Ctrl Setpoint dlft = 0.0 (-10000000.0, 10000000.0)
Enter the minimum Aux load setpoint that should be allowed for the system.

Max Aux Load Ctrl Setpoint dlft = 1000.0 (-10000000.0, 10000000.0)
Enter the maximum Aux load setpoint that should be allowed for the system.

SP normal rate of Change dlft = 1000.0 (0.0, 10000000.0)
Rate in KW/s that Aux load setpoint moves.

Delay before fast Rate dlft = 10.0 (0.0, 30.0)
Time (sec) it will use normal rate before the rate will change to Fast rate.

SP Fast rate of Change dlft = 1000.0 (0.0, 10000000.0)
Rate in KW/s that Aux load setpoint moves. When the command is held TRUE for longer than delay time the rate will switch to Fast rate.
SP Tracked Not Selected button
If SP Tracked Selected, then Actual Aux load setpoint will tracking to the Current Aux load when KW as Controller was disabled.

Proportional Gain dlft = 0.5 (0.001, 50.0)
Enter the PID proportional gain percentage. This value is used to set KW control response. This value can be changed while the turbine is operating.

Integral Gain dlft = 2.2 (0.0, 50.0)
Enter the PID integral gain in repeats-per-second (rps). This value is used to set KW control response. This value can be changed while the turbine is operating.

Derivative Ratio dlft = 100.0 (0.0, 100.0)
Enter the PID derivative ratio. This value is used to set KW control response. This value can be changed while the turbine is operating.

Conf – Page 11 –Turbine Feed Forward

If the 5009FT is configured to use Feed-Forward Control Mode, the following configuration page will be available. This is a performance enhancement feature that can be used on mechanical drive / compressor control applications.

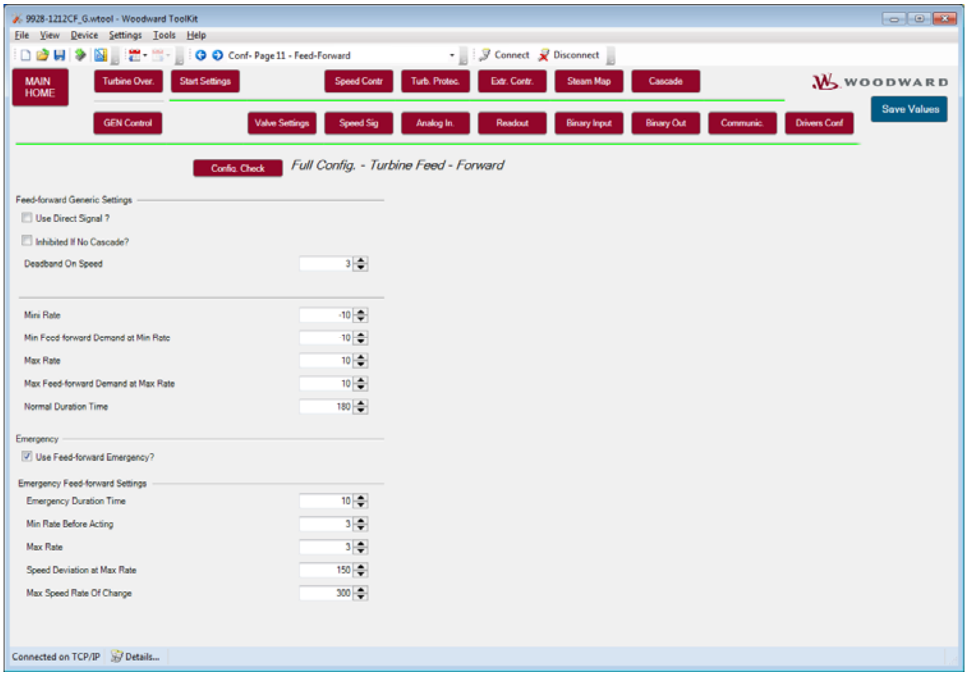


Figure 3-24. Feed-forward Performance Control

Feed-Forward Generic Settings

Used as direct speed bias only (rpm) **dflt = Unchecked**

When this option is selected, the speed bias will be directly proportional to the incoming signal. If not selected, the speed bias will be a temporary action based on the LAG times configured. Do not select this option if incoming signal is the anti-surge valve position.

If the Feed-forward loop will be direct action, i.e. bias directly the speed, the units are expressed in RPM.

If the Feed-forward loop is not direct action, i.e. surge valve position send; the units are expressed in percentage.

Inhibited if No Cascade **dflt = Unchecked**

If no speed Feed-forward is desired when cascade is disabled, then select this option.

Deadband on Speed **dflt = 3 (0, 100)**

This creates a sliding Deadband in rpm; use to avoid unnecessary small speed corrections.

Min Rate gradient (<0) **dflt = *-10 (-300, -0)**

This setting is the minimum gradient of the Feed-forward PV (antisurge valve) possible in normal operation, in % per second. Without hysteresis noticed, the absolute value should be equal to Max FW gradient.

Min FFW Demand at Min Rate (Speed bias min gradient) **dflt = -*10 (-100, -1)**

This is the speed bias requested when Feed-forward demand (valve position minus lagged valve position) reaches the min FW gradient, in rpm.

In between, Min FFW gradient and zero, speed bias will be proportional.

Without hysteresis noticed, the absolute value should be equal to speed bias at max gradient.

Max Rate gradient (>0) **dflt = *10 (0, -300)**

This setting is the maximum gradient of the Feed-forward PV (antisurge valve) possible in normal operation, in % per second.

Max FFW Demand at Max Rate (Speed bias max gradient) dflt = *10 (-100, -1)
This is the speed bias requested when Feed-forward demand (valve position minus lagged valve position) reaches the min FW gradient, in rpm.
In between, Min FFW gradient and zero, speed bias will be proportional.
Without hysteresis noticed, the absolute value should be equal to speed bias at max gradient.

Emergency
The emergency loop will be added to the actual speed setpoint. Its action is always positive. It should be activated only in case of sudden FW Process value increase.

This loop should be activated and tuned only after proper tuning of the "normal" one.

Use Feed-Forward Emergency? dflt = Unchecked
When the speed bias will be a temporary action based on the Emergency LAG times configured. The speed bias will act only in case of sudden valve change (opening) due to surge detection. During normal stroke of the valve, this mode should not act on the speed bias.

Care should be taken during calibration of this loop that the emergency bias acts only when necessary.

Emergency Action duration dflt = *10 (0, 100)
This time should be equal to the surge time loop.
When FW signal moves up and stays at its position, the speed bias will ramp back to zero in more than 10 s (valve position minus lagged valve position with time constant at 10 s).

This time should be long enough to dump speed oscillation due to surge, but not too long to avoid new instability.
Min detection rate before acting (>0) dflt = *3(0, 100)
This setting is the minimum gradient of the Feed-forward PV (antisurge valve) possible in normal operation.

This setting is used to trigger the Emergency loop. It should be high enough to avoid accidental activation. During normal anti-surge stroke, emergency loop should not be activated.
Max FFW gradient (>0) dflt = *3 (0, 100)
This setting is the max deviation/demand of the valve position minus lagged valve position.
Speed Deviation at Max Rate dflt = *150 (0, 300)
This is the speed bias requested when Feed-forward demand (valve position minus lagged valve position) reaches the max FW gradient.
In between, zero and Max FW gradient, speed bias will be proportional.
Max speed rate of change dflt = *300 (0, 1000)
This setting limits the rate of the speed bias when emergency loop is active.

Conf – Page 12 –Turbine Auxiliary Controller

If the 5009FT is configured to use Auxiliary Controller Modes the following configuration page will be available. The AUX controller can be a process controller or a limiter, but will not be available in all configurations. For compressor applications, typically the unit must be an extraction or admission unit (not a single valve turbine) to permit the use of the AUX controller.

On generator applications, a KW limiter is available without needing to configure this control option.

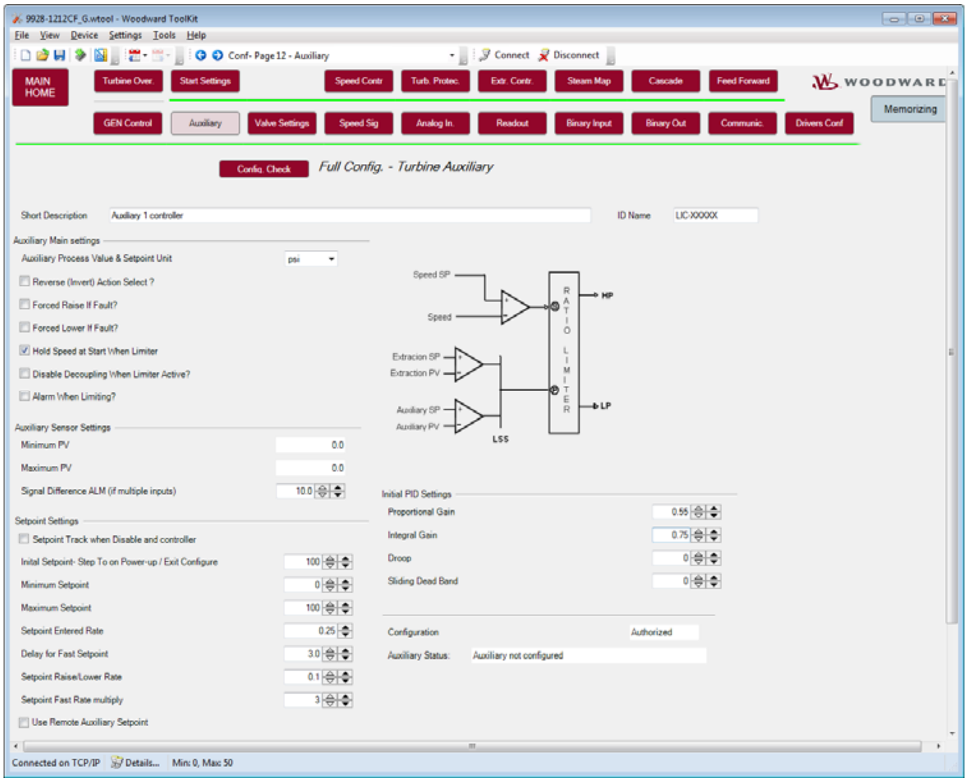


Figure 3-25. Auxiliary Control

Conf – Page 13 –Valve Settings

This page is used to configure the 5009FT for the correct type of Steam control valve arrangements present in the system.

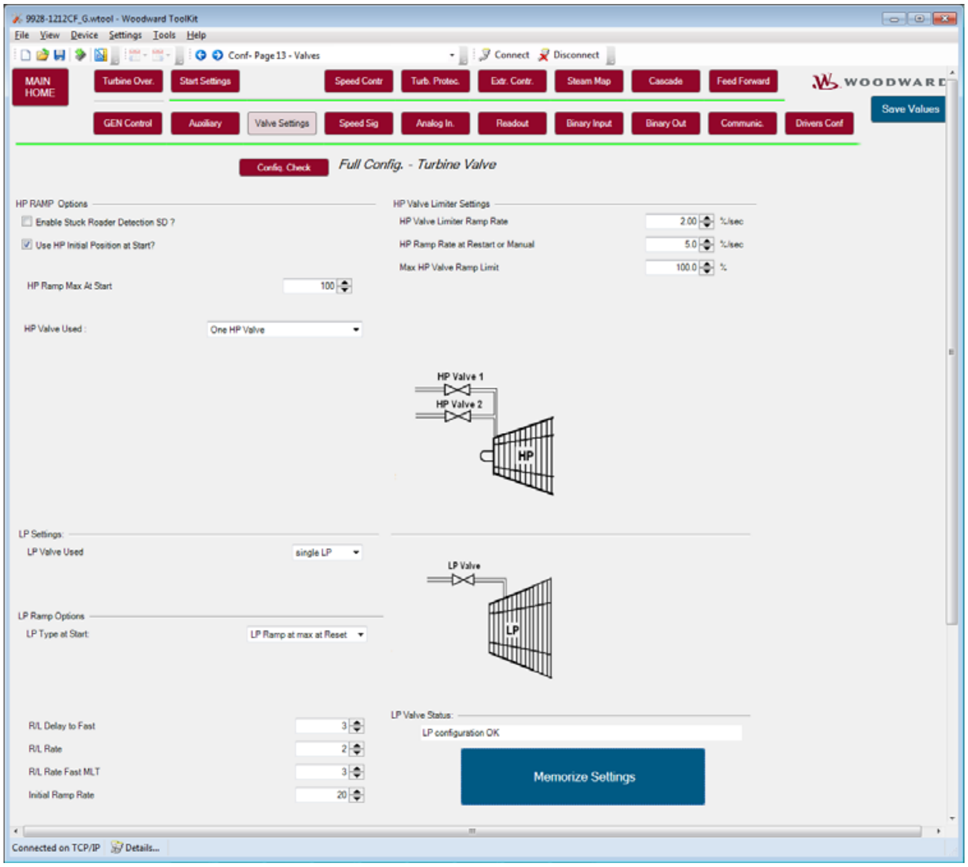


Figure 3-26. Valve Settings

Use rotor stuck SD? **dflt = Checked**
Available only when manual start is not selected.
When HP valve reached HP max at start-up, and speed is still below low idle, then, when this option is selected, the engine will trip "rotor stuck Shutdown"

HP max at start-up **dflt = 20% (0, 100)**
This value will determine what percentage the inlet control (HP) valve can be opened when speed is below Low Idle.

HP Valve Limiter Rate (Normal Modes) **dflt = 2.0 (0.0, 100)**
Enter the HP Valve Limiter Rate, in percent per second. This is the rate at which the HP valve limiter moves when a RUN command is given or when the limiter setting is changed through Raise/Lower commands. When using a semiautomatic or automatic start, this setting should be very slow—- typically less than 2%/s.

HP Valve Limiter Rate (in Restart or Manual) **dflt = 5.0 (0.0, 100)**
Enter the HP Valve Limiter Rate, in percent per second. This is the rate at which the HP valve limiter moves when a RESTART command is given or when the unit is in a Manual Start Routine. When using a manual start, this setting is less critical and can be left at the default of 5% / sec.

Max HP Valve ramp Limit **dflt = 100 (0, 100)**
Enter the maximum limit that the HP valve should be driven to (usually 100%). This value can be used if conditions exist that warrant limiting the full stroke of the HP valve to something less than 100%.

HP Valve Used **dflt = One HP Valve**
Available types include –
One HP Valve (most common)
Two HP Valves split range (% offset between them)
Two HP with HP2 as Startup Valve (usual)
Two HP Valves with HP2 boost valve (rare)

The split range allows 2 inlet valves to operate off of the same HP demand signal from the control with an offset percentage between them.

Offset When Split Valve **dflt = 0 (0, 100)**
Enter the amount of offset between the 2 valves in a split valve arrangement.

The **Startup valve** configuration allows a small startup valve to be used in tandem with a very large inlet valve. The small valve operates below 1 speed setpoint (or valve demand %) and the large valve operates above a second speed setpoint (or valve demand %). In between the two setpoints, both valves are active and the openings are interpolated.

The **Boost valve** configuration allows an admission valve to be used as a starter assisting valve.

In both of the last 2 options the curve setup and PID gains must be carefully setup to ensure stable startup operation. Typically a secondary gain equal to the Max flow on HP divided by Max flow on HP2 is used.

LP Valve Used **dflt = Single LP Valve**
Available types include –
One LP Valve (most common)
Two LP Valves split range (% offset between them)

LP Ramp Options
LP Type at Start **dflt = LP Ramp at Max at Reset/Start Ready**
Available types include –
LP Ramp at Max at Reset – LP to Max when unit is ready to Start
LP Ramp to Max at Start - LP to Max when Start initiated

LP Valve Limiter Ramp Rates

Initial Ramp Rate (going to Start Position) **dflt = 20 (1, 50)**
Normal Ramp Rate (manual raise/lower) **dflt = 2.0 (0.1, 20)**
Rate in %/s that valve limiter moves
Delay for Fast Rate **dflt = 3.0 (1, 10)**
Time (sec) it will use normal rate before the rate will change to Fast rate
Fast Demand Multiplier **dflt = 3.0 (1, 10)**
Fast rate equals the normal rate times this number

Conf – Page 14 –Turbine Speed Signals

This page is used to configure the speed sensor inputs into the control. For speed a minimum of one is mandatory. Channel #4 is reserved for a slow-speed proximity probe input – which can be used for the optional null speed detection logic, which can energize a relay that can activate the turning gear motor.

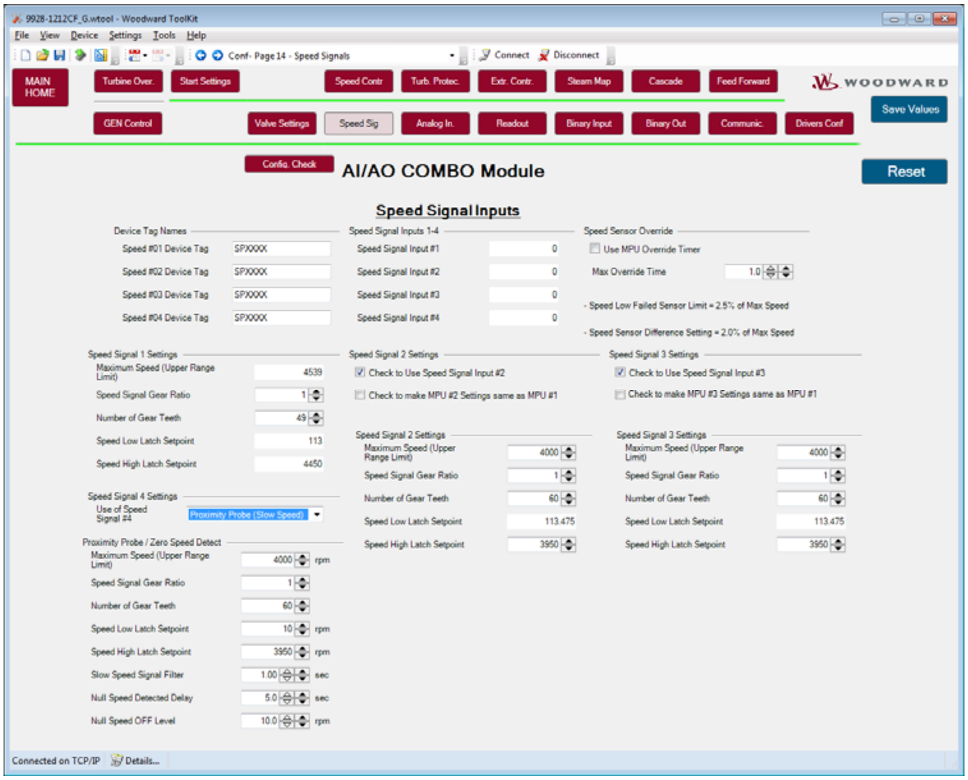


Figure 3-27. Speed Signal Settings

Maximum Speed (Upper Range Limit) **dflt = 4450 (100, 25000)**
Enter the highest speed the MPUs will receive—it should be above the max speed setpoint and the overspeed trip point, but not excessively above these limits as this number is used to setup other limiters in the control and as thus will affect resolution of other parameters. (The MPU software block will read up to 102% of this value.)

Speed Signal Gear Ratio 1 to x.x **dflt = 1.0 (0.1, 10)**
Enter the speed sensor gear ratio. This value is the ratio of the speed sensor gear to the turbine shaft. This gear ratio is the result of dividing the speed of the speed sensor gear by the speed of the turbine shaft. If speed sensor gear is mounted on the turbine shaft, the ratio is 1.

Number of Gear Teeth **dflt = 60 (1.0, 300)**
Enter the number of teeth on the gear that the speed probe is mounted on.

Speed Low Latch Setpoint **(Calculated)**
This value will equal 2.5% of the maximum speed that is entered into the MPU software block. The control value output from the MPU block will not go below 2.0% of the maximum speed.

Speed High Latch Setpoint **dflt = 4000 (100, 25000)**
This value will be set equal to the maximum speed and will act as a fault detection on this input signal.

Check to use Speed Input #2— **dflt = Checked**
Define if the speed probe #2 is used by the control.

Check to make Speed Input #2 setting same as #1 — dflt = Checked
Define if the speed probe #2 is used by the control.

Check to use Speed Input #3— dflt = Checked
Define if the speed probe #3 is used by the control.

Check to make Speed Input #3 setting same as #1 — dflt = Checked
Define if the speed probe #3 is used by the control.

Zero speed Sensor Settings
Speed input #4 is especially dedicated for zero speed detection. This channel should be connected to a proximity probe, for proper resolution.

Speed Input#4 dflt= Unchecked
Select USED if null speed detection is desired, and null speed probe used.

Maximum Speed (Upper Range Limit) dflt = 4000 (100, 25000)
Enter the highest speed the MPUs will receive—it should be above the max speed setpoint and the overspeed trip point, but not excessively above these limits as this number is used to setup other limiters in the control and as thus will affect resolution of other parameters.

Speed Signal Gear Ratio 1 to x.x dflt = 1.0 (0.1, 10)
Enter the speed sensor gear ratio. This value is the ratio of the speed sensor gear to the turbine shaft. This gear ratio is the result of dividing the speed of the speed sensor gear by the speed of the turbine shaft. If speed sensor gear is mounted on the turbine shaft, the ratio is 1.

Number of Gear Teeth dflt = 60 (1.0, 300)
Enter the number of teeth on the gear that the speed probe is mounted on.

Speed Low Latch Setpoint dflt = 10 (0.0, 200)
Set this value as a fault detection on this input signal.

Speed High Latch Setpoint dflt = 4000 (100, 25000)
Set this value as a fault detection on this input signal.

Slow Speed Signal Filter (seconds) dflt = 2.0 (0.01, 20)
Enter the desired filter lag tau of the single pole filter used on this signal.

Null speed detected delay (seconds) dflt = 5.0 (0, 120)
This setting is in conjunction with a relay output configured as “null speed relay”. When speed is at zero, the relay will wait during this delay, before it can energize.

Null speed OFF level (rpm) dflt = 10(0.1, 500)
Because the null speed detection can be used to start a turning gear, the null speed must remain detected, while turning gear is switched ON.
The OFF level is the maximum speed accepted, to hold the configured “null speed” relay switched ON.

Conf – Page 15 –Turbine Analog Inputs

This page is used to configure the analog input signals into the control. All analog inputs use a 4-20 mA current range.

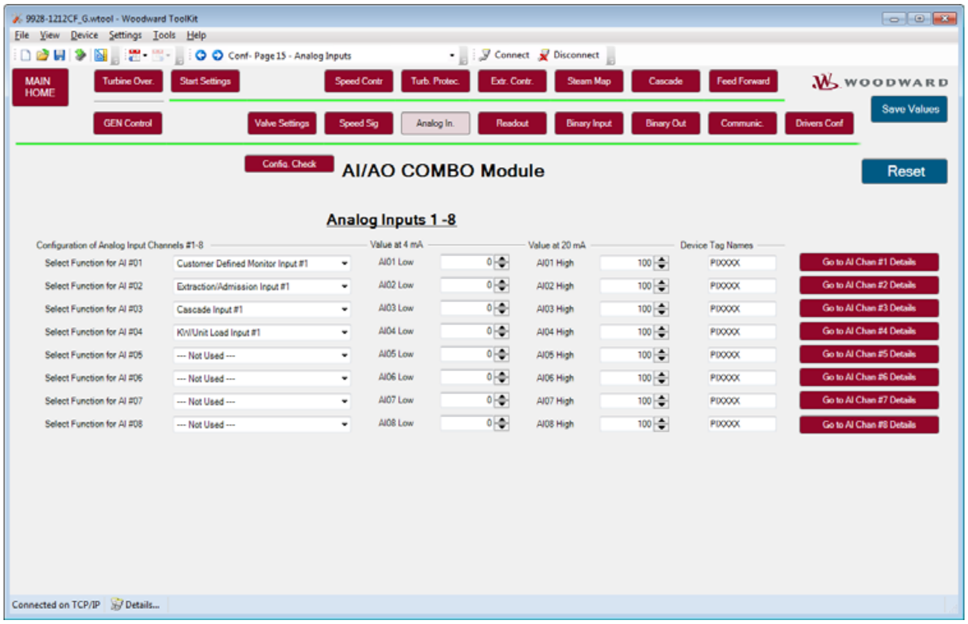


Figure 3-28. Analog Signal Settings

From this page using the pull-down menus the Analog Inputs that are used can be configured with the FUNCTION, VALUE AT 4 mA, and VALUE AT 20 mA. If desired a Device Tag text string can be entered to associate this channel information with plant wiring nomenclature.

Some notes on AI configuration:

- The Configuration check routine will attempt to correlate these choices with other settings made by the user such as turbine type, control functions used, etc. For example, if the use Remote Speed Setpoint is checked, then the control will generate a **Configuration Error** if none of these AI's are configured for this function.
- Redundant or triplicated sensors are available for most functions – if only one is present the user must configure the control for the first (#1) signal. For example **Extraction/Admission Input #1** must be used if there is only 1 signal for this function (Extraction/Admission Inputs #2 & #3 are ignored unless #1 is configured as used).
- Some optional input signals (such as compressor control signals) are not available on the first 8 AI channels, they are only available with the additional AIO module option.
- Device TAG names are optional & can be entered in any mode

Functional Selection List for 4-20 mA Analog Inputs

Table 3-2. Functional Selection List for 4-20 mA Analog Inputs

Remote Speed Reference Setpoint #1 - #3
Cascade Input #1- #3
Remote Cascade Setpoint #1- #3
Auxiliary Input #1- #3
Remote Auxiliary Setpoint #1- #3
Extraction/Admission Input #1- #3
Remote Extraction/Admission Setpoint #1- #3
Remote Manual Extraction/Admission (P) Demand #1- #3
Inlet Steam Pressure #1- #3
First Stage Pressure Input #1- #3
Exhaust Steam Pressure #1- #3
Remote Manual Decoupling Setpoint #1
4-20 mA HP Vlv Fdbk A Signal
4-20 mA HP Vlv Fdbk B Signal
Remote Manual Decoupling Demand #1
4-20 mA LP Vlv Fdbk A Signal
4-20 mA LP Vlv Fdbk B Signal
Feed Forward Input #1- #3
Sync Bias / Load Share Input #1- #3
KW/Unit Load Input #1 - #3
Curve for Hot/Cold Startup Conditions
Customer Defined Monitor Input #1
Customer Defined Monitor Input #2
Customer Defined Monitor Input #3
Customer Defined Monitor Input #4
Remote MW Setpoint
Gland Seal Process Input
Gland Seal Setpoint Input
Curve for Hot/Cold Startup Redundant

Use the "Go to Channel Details Page" navigation button to view details and status of each channel. The Channel Selection pull-down at the top will determine which channel information is displayed.

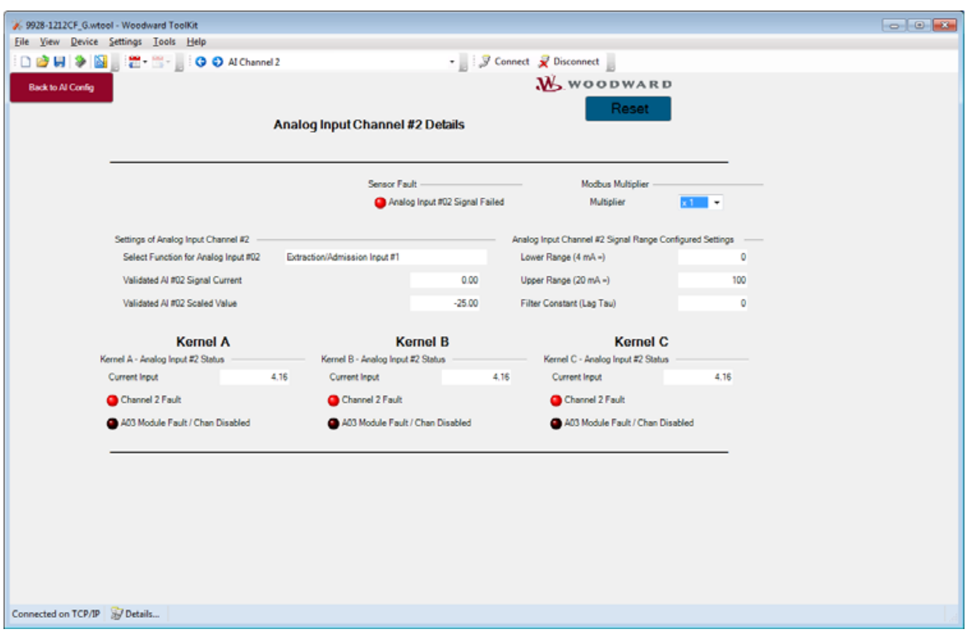


Figure 3-29. Analog Input Detailed Settings

Conf – Page 16 –Turbine Readout

This page is used to configure the analog output signals from the control. All output currents use a 4-20 mA range.

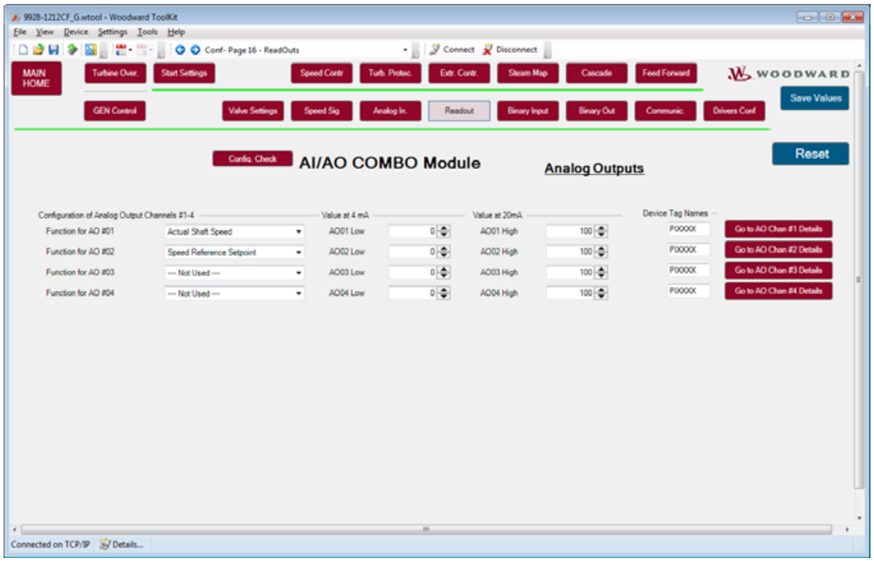


Figure 3-30. Analog Output Signal Settings

Table 3-3. Selection List for Analog Readout Outputs

Actual Shaft Speed
Speed Reference Setpoint
Remote Speed Reference Setpoint
Sync Bias / Load Share Input
Generator (MW) Load
Extraction/Admission Input
Extraction/Admission Setpoint
Remote Extraction/Admission Setpoint
Cascade Signal
Cascade Setpoint
Remote Cascade Setpoint
Auxiliary Signal
Auxiliary Setpoint
Remote Auxiliary Setpoint
Speed/Load Demand (S Demand)
Extraction / Admission Demand (P Demand)
ACT 1 (HP) Valve Limiter Setpoint
ACT 2 (LP) Valve Limiter Setpoint
ACT 1 (HP) Valve Demand
ACT 2 (LP) Valve Demand
Command from Modbus AW addresses
First Stage Pressure Input
Inlet Steam Pressure
Split HP Valve Demand (VLV2)
Split LP Valve Demand (VLV2)
Gland Seal Valve Demand
Unit Load
ACT 1 (HP) Valve Demand control
Split HP Valve Demand (VLV2) control
ACT 2 (LP) Valve Demand control
Split LP Valve Demand (VLV2) control

From this page, using the pull-down menus, the Analog Outputs that are used can be configured with the FUNCTION, VALUE AT 4 mA, and VALUE AT 20 mA. If desired a Device Tag text string can be entered to associate this channel information with plant wiring nomenclature.

Use the “Go to AO Channel #” navigation button to view details and status of each channel. In calibration mode, the output of each channel can be re-ranged, calibrated and ‘Forced’ to user specified output current from this detailed page.

This page will show the Total output current and the breakdown of the actual currents coming out of each Kernel.

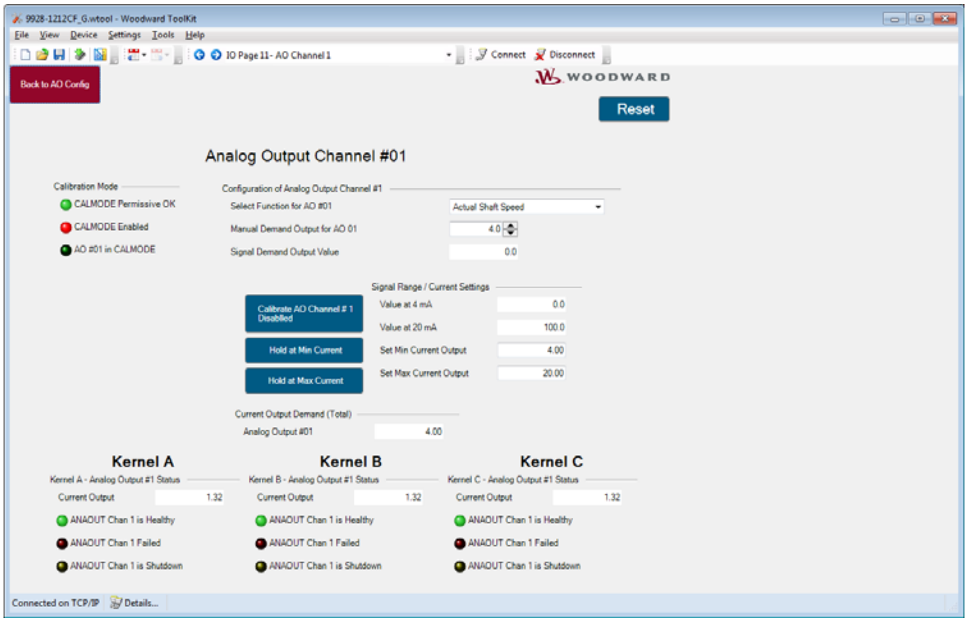


Figure 3-31. Analog Output Detailed Settings

Conf – Page 17 –Turbine Binary Inputs

This page shows the configuration of the 24 discrete inputs into the system. The first input is Fixed as an ESTOP into the 5009FT. All other channels are configurable, but the first 6 are defaulted to common signals expected to exist in all systems. Use the GO TO button to switch to the page that allows the functional assignments to be made via pull-down menus.

The present validated state of the input is shown as an LED along with the function assignment for each channel. If desired a Device Tag text string can be entered to associate each channel with plant wiring nomenclature.

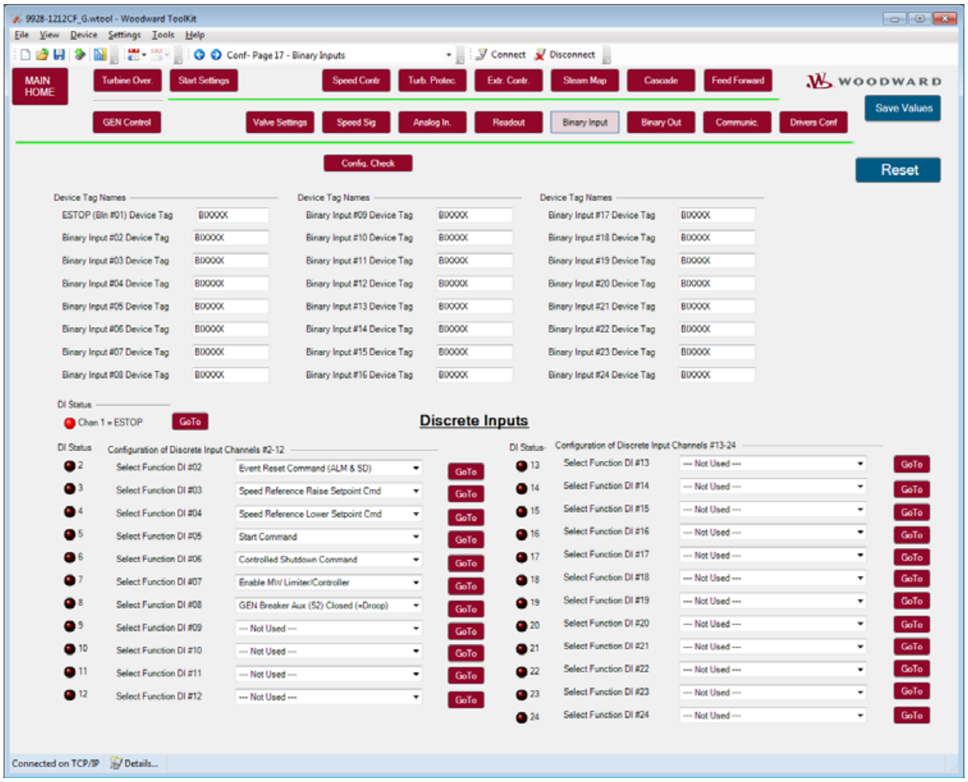


Figure 3-32. Discrete Input Settings

Table 3-4. Discrete Input Options Menu

--Reserved for Future--
Event Reset Command (ALM & SD)
Event Acknowledge Command (ALM & SD)
Speed Reference Lower Setpoint Command
Speed Reference Raise Setpoint Command
Generator Breaker Aux (52) Closed (=Droop)
Utility Tie Breaker
Select Overspeed Test
Start Command
Controlled Shutdown Command
HP Valve Limiter Raise
HP Valve Limiter Lower
Select Idle / Rated Speed Setpoints
Halt / Continue Auto Start Sequence
Override Speed Sensor Fault
Select On-Line Speed PID Dynamics
Select Local / Remote Interface Mode
Remote Speed Setpoint Enable
External Synchronizer Enabled

Enable MW Limiter/Controller
Frequency Control Arm/Disarm
Enable Cascade Control
Cascade Setpoint Raise Command
Cascade Setpoint Lower Command
Remote Cascade Setpoint Enable
Enable Auxiliary Control
Auxiliary Setpoint Raise Command
Auxiliary Setpoint Lower Command
LP Valve Limiter Raise
LP Valve Limiter Lower
Remote Auxiliary Setpoint Enable
Select Extraction/Admission Priority
Extraction/Admission Control Enable
Extraction/Admission Setpoint Raise
Extraction/Admission Setpoint Lower
Enable Remote Extraction/Admission Setpoint
Enable Manual Ext/Adm Demand
Extraction/Admission Demand Raise
Extraction/Admission Demand Lower
Enable Remote Manual Ext/Adm Demand
Enable Decoupling
Decoupling Setpoint Raise Command
Decoupling Setpoint Lower Command
Enable Remote Decoupling Setpoint
Enable Manual Decoupling
Enable Remote Manual Decoupling
DI Start Permissive #1 - #3
External Trip #2 - #10
External Alarm #1 - #10
Enable Customer PID Analog Output
Enable Remote Customer PID Setpoint
Enable Manual Customer PID Demand
Select Hot/Cold Startup Curves
Enable Feed Forward Speed Dynamics
Redundant ESTOP (Use w/ DI01)
Emergency Go to Min Gov
Redundant External TRIP#2
Redundant External TRIP#3
Redundant External TRIP#4
Stage 1 Online Auxiliary Input
Stage 1 AS Valve Fault
Stage 1 Shutdown
Stage 2 Online Auxiliary Input
Stage 2 AS Valve Fault
Stage 2 Shutdown
Seal Gas Raise SP
Seal Gas Lower SP
Seal Gas Raise Valve Dmd
Seal Gas Lower Valve Dmd
Clock SYNC Pulse via DI
Raise Aux MW Controller SP
Lower Aux MW Controller SP
Warmup @HP 100% & LP 0%

From the GO TO pages, using the pull-down menus, the Discrete/Binary Contact Inputs that are used can be configured. These pages will also show the individual Kernel inputs and faults as well as the overall validated input status.

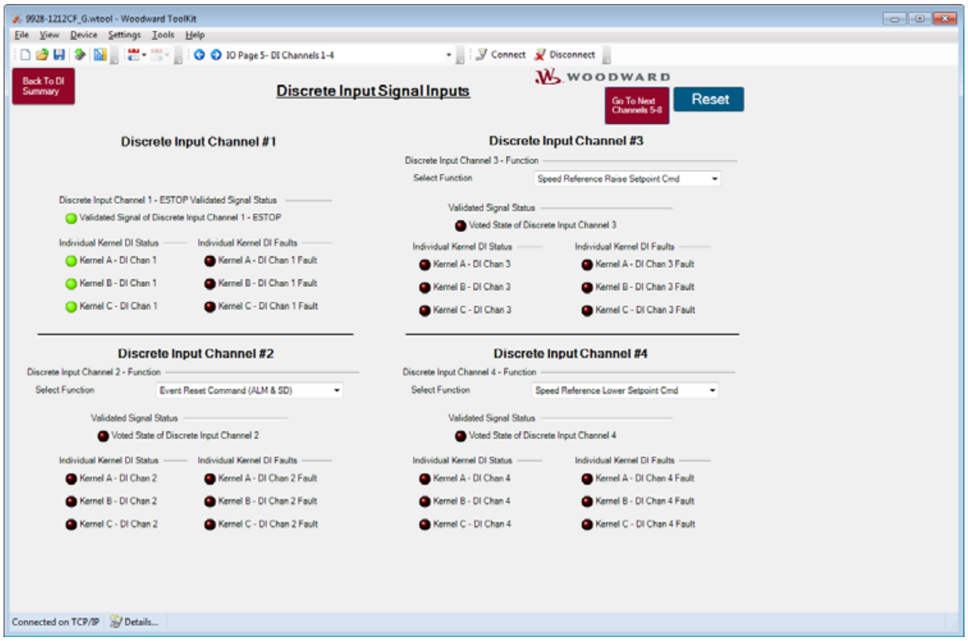


Figure 3-33. Discrete Input Details

Conf – Page 18 –Turbine Binary Output Relays

This page shows the configuration of the 12 discrete relay outputs from the system. The first output is fixed as a summary shutdown trip relay from the 5009FT with configured delay time (clears with a reset). All other channels are configurable, but the second channel is defaulted as a Summary Alarm output.

It is possible to configure an output as a Summary Shutdown signal to indicate actual status of shutdown conditions. This does not clear with a reset.

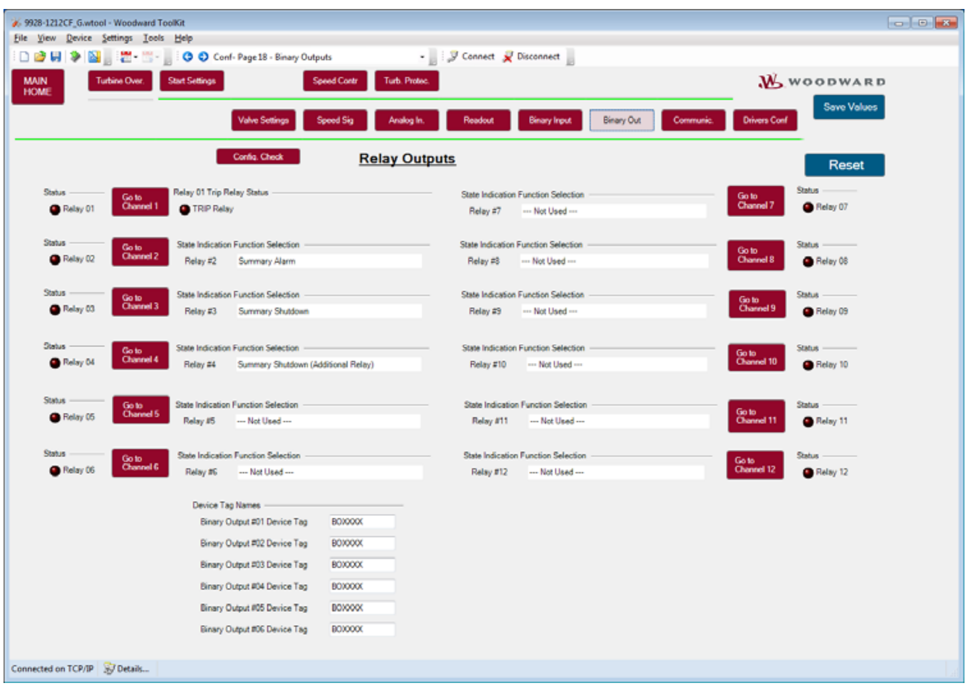


Figure 3-34. Relay Output Settings

Use the GO TO button to switch to the page that allows the functional assignments to be made via pull-down menus as well as the type of relay output desired.

The present validated state of the output, the status of each of the 6 individual relays is shown as an LED along with the function assignment for each channel. If desired a Device Tag text string can be entered to associate each channel with plant wiring nomenclature. A string output describing the complete health status of the FT Relay along with specific LED fault indications are shown for each output.

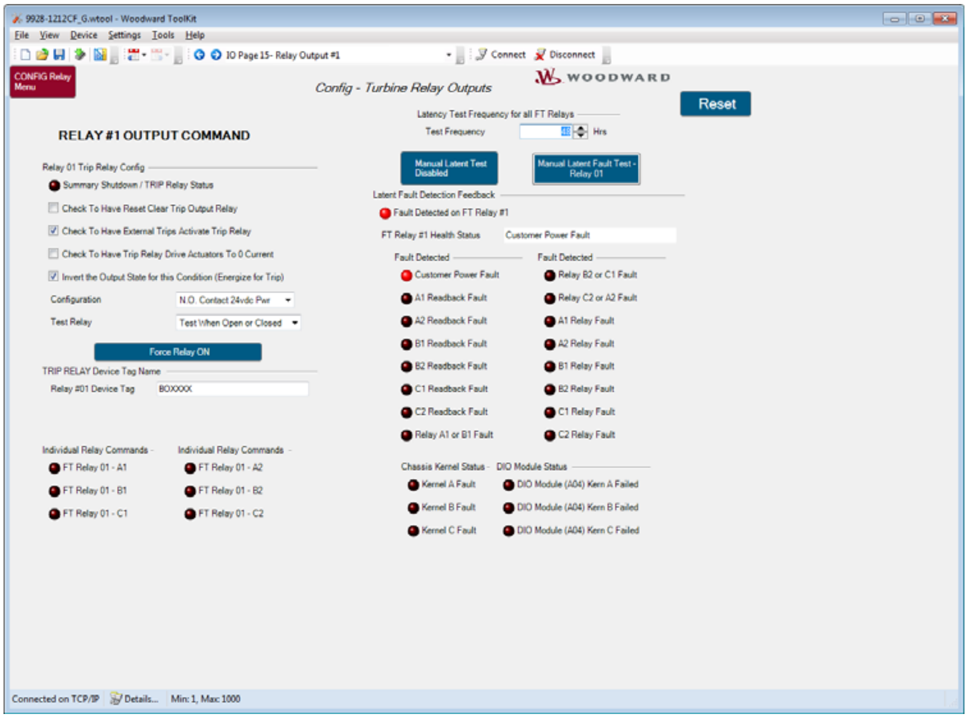


Figure 3-35. Relay Output Details

From the GO TO pages - using the pull-down menus the Relay Outputs that are used can be configured. The first output is dedicated to a Trip condition and the next 11 are fully configurable by the user.

The following configuration options apply to all 12 of the relays.

Configuration **dflt = N.O. Contact, 24 Vdc Power**
Select the configuration used for the trip relay (contacts used, power interfaced with). Normally Open (NO) and Normally Closed (NC) options are available for three different power sources (24 Vdc, 125 Vdc, 120 Vdc). This setting allows the control to correctly test the relay output, and print out the correct wiring-list terminals and jumpers. If the relay is not being tested (the relay's "Test Relay" option set for Not Used/Disabled), and a wiring list is not being utilized, this option need not be selected.

Test Relay **dflt = When Open or Closed**
The FT relay assemblies automatically test each relay in the assembly once every time period as entered above. This option allows that test to be disabled or only performed when the contacts are in a certain state. To determine if the test needs to be disabled for one or both contact settings, see Volume 1 of this manual.

Latency Test Frequency for all FT Relays

Test Frequency (Every xx hours) dflt = 48 (1, 1000)

Enter the length of time in hours between which the selected relays in each FT relay assembly are to be tested. Each relay output that is configured to be tested (its “Test Relay” option set to When Contacts are open, When Contacts are closed, or When Open or Closed) will be tested when the set time expires. With each test, all relay outputs configured for testing will have their individual relays cycled, without affecting the state of the overall relay output. The test relay timer is reset when the program mode is exited, a manual test command is given, and after each timed test.

Invert the Output State for this Condition dflt = Unchecked

The active state of the relay can be switched – the default selection is unchecked meaning that the relay will energize when the selected action occurs

Toggle buttons to enable & perform a manual latent Fault test on each channel exist on each Relay page.

NOTICE

If Latent Fault testing is desired the correct load resistance must be present so that the testing routine will not change the state of the field device during testing. The FT Relay Box must also have the correct jumpers installed to allow these tests to be performed.

The following items appear only for Relay Output #1:

Reset Clear Trip Output Relay dflt = Unchecked

When this option is checked, the trip relay will change from its shutdown state to its normal operating state when the control is shutdown and a control reset command is issued.

Check to have External Trips Activate Trip Relay dflt = Checked

When this option is selected or checked, the control’s trip relay will change to its tripped state when external trip commands (trip contact inputs) have been sensed. When this option is not selected, the control’s trip relay will only change state based on internal control shutdown conditions (i.e. Overspeed, all speed inputs failed conditions).

Drive Actuators to Zero Current with Trip Output Relay dflt = Unchecked

When this option is checked, the current to the actuators will be ‘cut’ (driven to zero current). Typically this is not used, as most actuation systems are best suited to ‘drive’ the valve to 0 % position.

Invert the Output State for this Condition (Energize for Trip) dflt = Unchecked

When selected or checked, this option reverses the conditional state of the trip relay. Instead of de-energizing on a trip condition, the Trip relay will energize on a trip condition. Care should be taken in using this option, in the event of a power loss, the Trip relay will not energize.

Each relay can be configured to function either as a **level switch** or as a **state indication**. An example of a level switch is a Speed Switch (relay changes state above a certain level) and an example of a state indication is Cascade Control Enabled (the relay energizes on the indicated state = true).

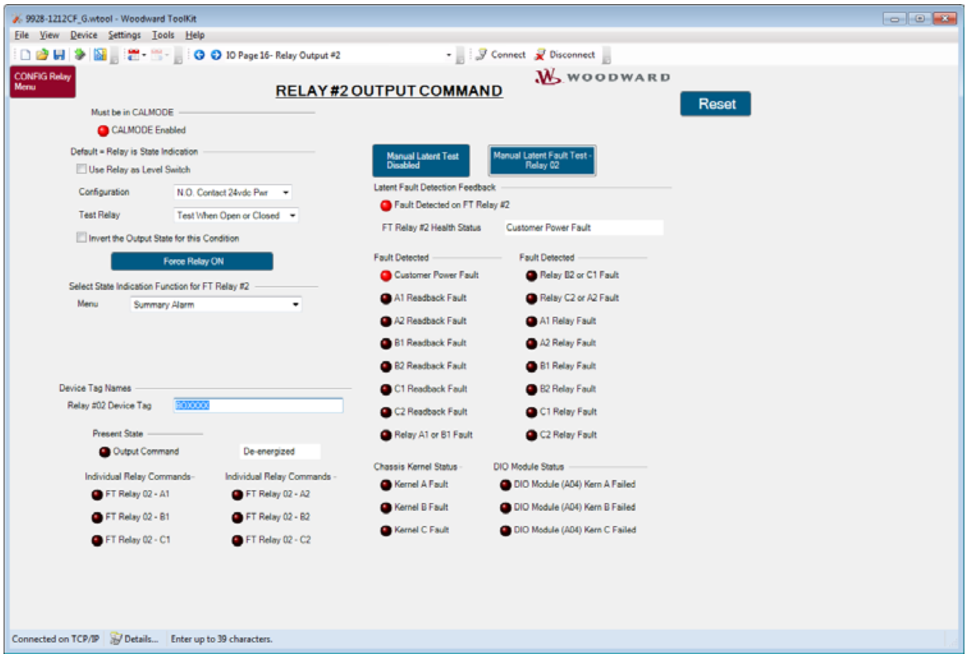


Figure 3-36. Relay Output Settings

Table 3-5. Relay Output Level Switch Options

Actual Speed Switch
Speed Setpoint Switch
GEN Input (KW)
Sync/Load Share Input
Extraction/Admission Input
Extraction/Admission Setpoint
Cascade Input
Cascade Setpoint
Auxiliary Input
Auxiliary Setpoint
Speed/Load Demand
Extraction/Admission Demand
HP Valve Limiter
LP Valve Limiter
Actuator #1 Valve Demand Output
Actuator #1 Valve Demand Output
Customer Defined Input #1-#4

Table 3-6. Relay Output State Indication Options

Summary Shutdown
Summary Shutdown (Additional Trip Relay)
Summary Alarm
Major Alarm Condition
Overspeed Trip
Overspeed Test Enabled
Speed PID in Control
Remote Speed Setpoint Enabled
Remote Speed Setpoint Active
Underspeed Switch
Auto Start Sequence in Progress
On-Line Speed PID Dynamics Mode
Local Interface Mode Selected
Frequency Control Armed
Frequency Control
Sync Input Enabled
Sync / Loadshare Input Enabled
Loadshare Mode Active
Extraction/Admission Control Enabled
Extraction/Admission Control Active
Extraction/Admission PID in Control
Remote Extraction/Admission Setpoint Enabled
Remote Extraction/Admission Setpoint Active
Cascade Control Enabled
Cascade Control Active
Remote Cascade Setpoint Enabled
Remote Cascade Setpoint Active
Auxiliary Control Enabled
Auxiliary Control Active
Auxiliary PID in Control
Remote Auxiliary Setpoint Enabled
Remote Auxiliary Setpoint Active
HP Valve Limiter in Control
LP Valve Limiter in Control
Extraction/Admission Priority Enabled
Extraction/Admission Priority Active
Extraction/Admission Input Failed
Controlling on a Steam Map Limit
Command from Modbus BW addresses
Remote Driver Reset
Horn Output
Speed Reference at Lower Limit
Stage 1 Surge Detected
Stage 1 Surge Min Pos (SMP)
Stage 1 in Auto Mode
Stage 1 in Manual w/ Backup
Stage 1 in Full Manual
Stage 2 Surge Detected
Stage 2 Surge Min Pos (SMP)
Stage 2 in Auto Mode
Stage 2 in Manual w/ Backup
Stage 2 in Full Manual
Ready to Start
Aux Load Controller Enabled
Aux Load Controller Active
Aux Load Control in Control
Cascade in Control
Zero Speed Detected
Warmup @ HP 100% & LP 0% active

Conf – Page 19 –Turbine Communications

This page shows the configuration of the Modbus blocks that are available to communicate system data to other devices. Two identical Modbus blocks are available, each with 2 ports (links) to other devices. Each Modbus block also has a third port available that is programmed that is a VIEW ONLY port with no write permissions for the control.

The reason for 2 identical blocks is to make it more flexible for the user to identify which links are going to which system. For example a user may have a redundant HMI, a serial link to a vibration system, and an Ethernet link to a DCS system. Modbus #1 can be used to communicate to the HMI and the second Modbus block can be used to link to the other secondary / simplex link devices.

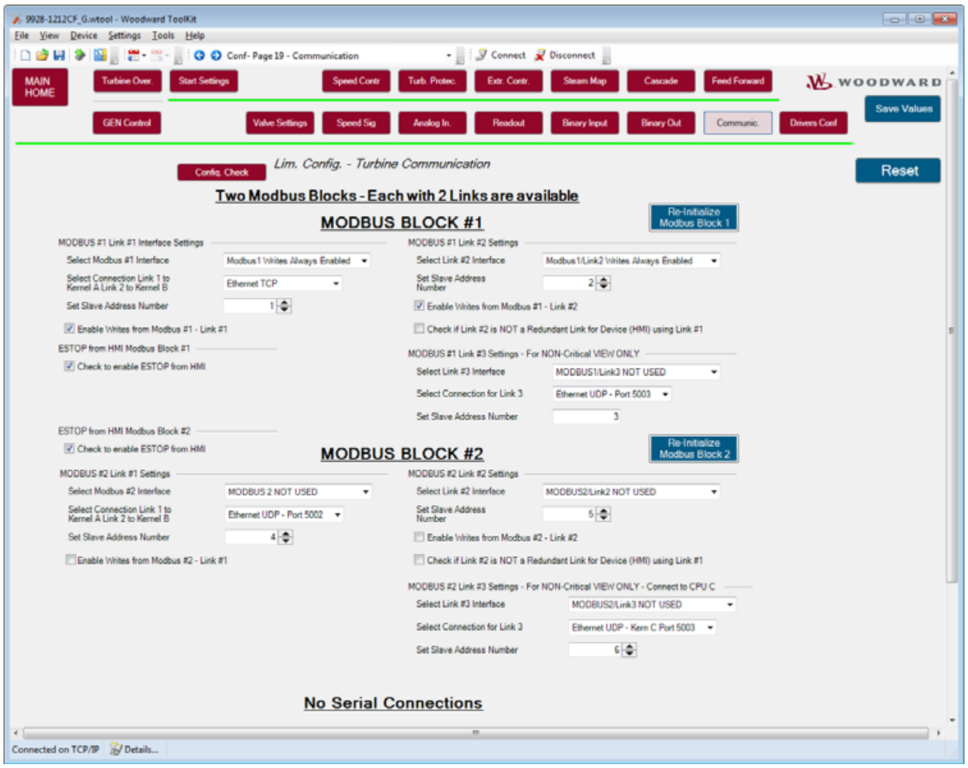


Figure 3-37. Communication (MODBUS) Settings

REDUNDANT MODBUS LINKS

If redundant links are required to a single device, connect the Primary link to Link #1 using the Kernel A CPU IP address (or serial port) and connect the Secondary link to Link #2 using Kernel B CPU IP address (or serial port). Be sure to uncheck the box that Link #2 is NOT a Redundant Link to a single device.

Select Modbus #1 / Link #1 Interface Settings

Select Modbus #1 Interface **Not Used**

Choices –

- MODBUS #1 NOT USED
- ENABLED – NO WRITES
- ENABLED – WRITES ALWAYS ENABLED
- ENABLED – WRITES WHEN SELECTED – Enable when selected with discrete input or ToolKit selected input

Set Slave Address (Device) Number **dflt = 1 (1, 246)**

Enter the integer corresponding to the Modbus device number/address required. For the HMI 1 is defaulted. In the event it is unknown, this field can be tuned in the Service mode to establish communications.

Protocol Setting **dflt = RTU**

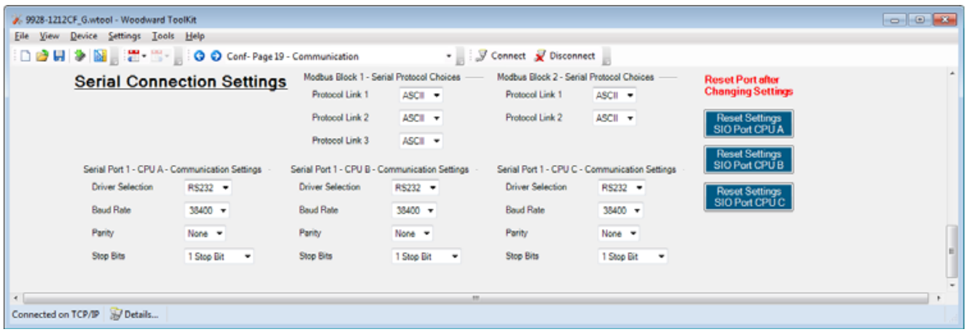
ASCII or RTU

Select between ASCII or RTU Modbus. The external device will determine which type of Modbus is necessary. For the HMI RTU is defaulted. In the event it is unknown, this field can be tuned in the Service mode to establish communications.

Enable Writes from Modbus #1 – Link #1 **dflt = Unchecked**

Select this box to allow writes to be received by the 5009FT from this device

If a Serial connection is selected from the list – a Serial Settings panel will appear at the bottom of this screen that will include these parameters settings for each of the 3 kernels.



Driver Selection **dflt = RS232**

Select the correct serial communication driver RS 232, RS-422, or RS-485.

Baud Rate **dflt = 38400**

Select the Baud Rate that the external device will be using when communicating with the 5009FT control. In the event it is unknown, this field can be tuned in the Service mode to establish communications.

Parity **dflt = None**

Select the parity setting that the external device will be using when communicating with the 5009FT control. None, Odd, or Even.

Stop Bits **dflt = 1 Stop Bit**

Select the Stop Bit setting that the external device will be using when communicating with the 5009FT control – 1, 1.5 or 2. In the event it is unknown, this field can be tuned in the Service mode to establish communications.

Scale factors for a few of the common parameters are available on this page.

Conf – Page 20 –Driver Configuration

This page shows the configuration of the actuator driver outputs that are available in the system. If the selection of “Use Module 6 Actuators” is Checked then the screen will look like the one below with 4 Navigation buttons, otherwise only the 2 Proportional buttons will be present. Navigation to the valve linearization curves for the high pressure (HP) and low pressure (LP) valves are only available through this screen.

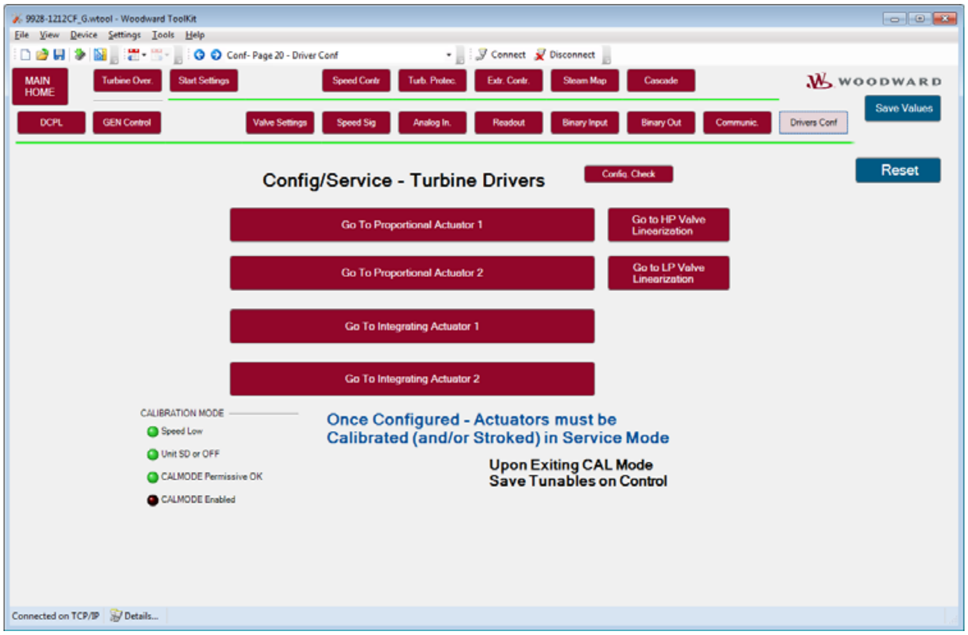


Figure 3-38. Actuator Driver Menu

Use this screen to navigate to the desired actuator detail page.

Conf – Page 21 –Proportional Actuator Channel 1

This page shows the configuration of the Proportional actuator driver output Channel #1. In other modes this page will display this information but not allow changes to be made.

Selection of the GO TO Proportional Actuator 1 will display the following page:

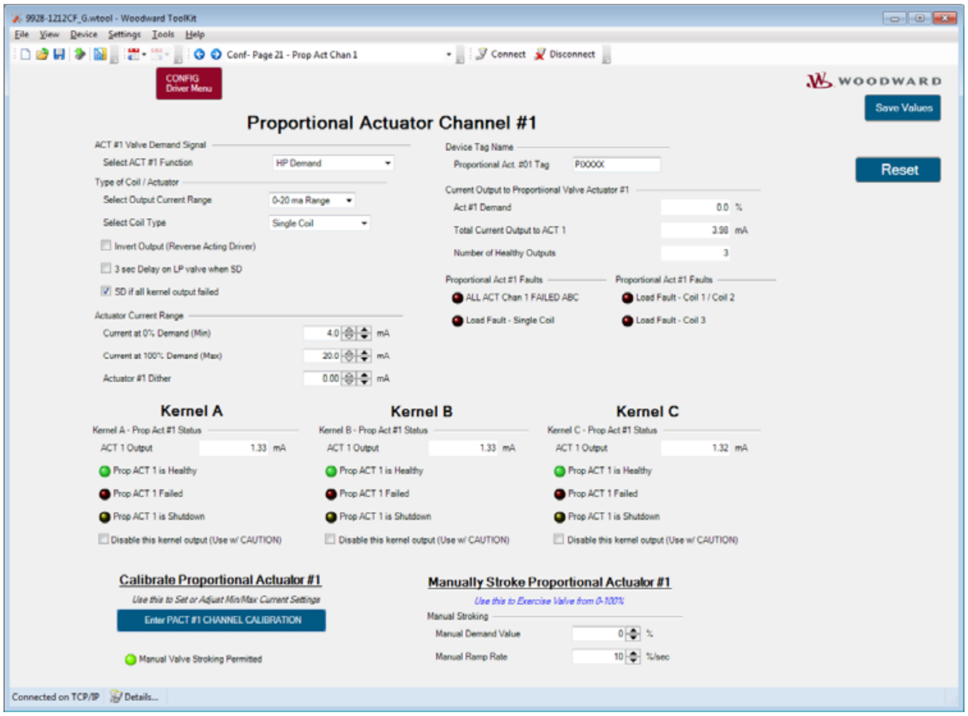


Figure 3-39. Proportional Actuator Driver Channel 1

Proportional Actuator Channel #1 Settings
From this page using the pull-down menus the ACT #1 Valve Demand Signal can be configured with the FUNCTION, Output Current Range and Coil Type can be configured. If desired a Device Tag text string can be entered to associate this channel information with plant wiring nomenclature.

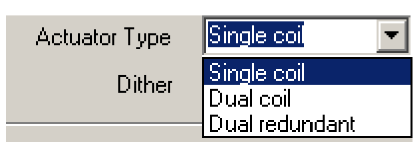
Actuator #1 Function **dflt = HP Demand**
Choices –

HP Demand (Main Inlet Governor Valve)
HP2 Demand (Split Range Valve)
LP Demand (Extraction/Admission Valve)
LP2 Demand

Actuator Range **dflt = 0-20 mA**

Select either a 0—20 mA driver range or a 0—200 mA driver range. Typically, Woodward actuators have a 20—160 mA range.

Select Coil Type **dflt= Single coil**



Select the type of actuator used.

If Single coil is selected, a jumper between Channel A&B and Channel C must be installed on the FTM.

If Dual coil is selected, the current output of HD combo cards A&B will be equal to the output of Channel C in normal operation.
No jumper must be installed in the FTM.
In case of failure of one coil, then the current output of the second coil will be doubled.

If Dual redundant is selected, the current output of HD combo cards A&B will be equal to the output of Channel C in normal operation.
No jumper must be installed in the FTM.
In case of failure of one coil, the current output of the second coil will **NOT** be doubled.
Each output can reach 20 or 200 mA if necessary in normal operation.

Dither **dflt = 0.0 (0.0, 10)**
Enter the dither, in milliamps, for the actuator. Enter 0.0 if no dither is required. Woodward TM-type actuators typically require dither. This value can be changed in the Run Mode while the turbine is operating.

Calibration Value at 0% **dflt = 4 (1.8,12) or 20 (8, 100)**
Enter the milliamp setting that corresponds to 0% flow. This number can be tuned in Service Mode but not in Operation (Run) Mode.

Calibration Value at 100% **dflt = 20 (12,24) or 160 (100, 196)**
Enter the milliamp setting that corresponds to 100% flow. This number can be tuned in Service Mode but not in Operation (Run) Mode.

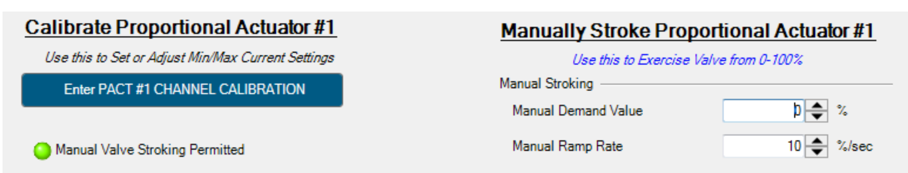
Invert Output **dflt = Unchecked**
Check this box if the actuator requires an inverted driver (opens on a decrease in current to the actuator).
Only in this case, the actuator output will maintain 20 mA(160 mA) after SD.

3 sec delay on LP valve when Shut Down **dflt = Unchecked**
Check this box to provide a 3 second delay in closing the LP valve on a shutdown. This will only add the delay if that actuator is configured for LP. This feature will allow trapped gas to escape the system in the event of a shutdown.

SD On All Failed
Check this box if the 5009FT should shutdown and go to a failed safe condition if an actuator failure has been detected. It should be noted that all three legs of the actuator drivers, both coils of a dual coil actuator, or the entire actuators field wiring would have to fail in order to cause a 'Trip on all Failed'.

Manual Stroking

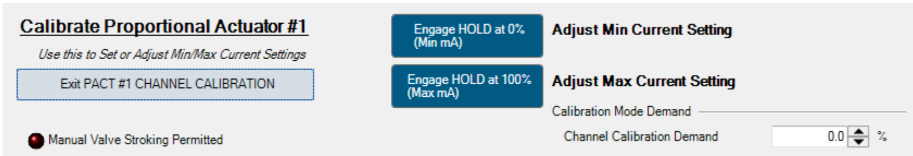
While the turbine control is in Calibration mode the actuator can be manually stroked from this screen.



Manual Demand Value **dflt = 0 (0, 100)**
Enter the desired manual valve position demand. Can tune or directly enter a value.

Manual Rate **dflt = 0 (0, 100)**
Enter the desired rate at which the valve should move to the entered manual valve position demand. Can tune or directly enter a value.

Calibration of the Actuator Current Range
To calibrate this channel – toggle the Enter Channel Calibration button.
This will place the output channels into calibrate mode and reveal toggle buttons that will drive the output to minimum current (0%) and maximum current (100%).



Engage HOLD at 0%
Click this button to drive and hold the output at 0%. At this time adjust the MIN current setting to match the current demand with the valve position actually being at 0%. It may help to move this value up and then back down to witness the valve going hard against the minimum valve stop. Release when complete.

Engage HOLD at 100%
Click this button to drive and hold the output at 100%. At this time adjust the MAX current setting to match the current demand with the valve position actually being at 100%. It may help to move this value down and then back up to witness the valve going hard against the maximum valve stop. Release when complete.

Channel Calibration Demand **dflt = 0.0 %**
Can use this to drive the channel to any demand point from 0-100% and the valve will instantly drive to this position as long as neither of the HOLD buttons is active.

Once this is complete—Exit this mode to allow a true manual stroke test. This can be done from the CCT or from an HMI. This will drive the actuator demand input, and all display values will show this as the demand to the driver.

Conf – Page 22 –Proportional Actuator Channel 2

This page shows the configuration of the Proportional actuator driver output Channel #2. In other modes this page will display this information but not allow changes to be made.

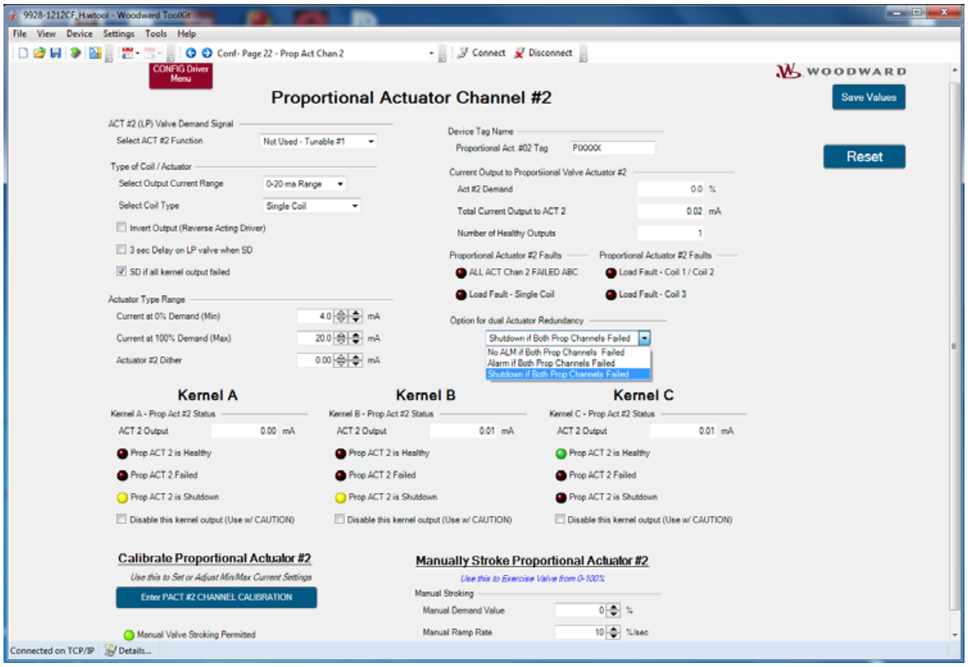


Figure 3-40. Proportional Actuator Driver Channel 2

All fields here are the same function as on Channel #1 except for the following Option.

Option for Dual Actuator Redunancy

Select the desired action in the case of both proportional actuators failed. If no alarm is selected there will still be alarms for the individual Actuator channels.

Conf – Page 23 – Actuator Controller Channel 1

This page shows the configuration of the Integrating actuator driver output Channel #1. In Configure and Service mode these parameters can be adjusted, in the Run mode this page will display this information but not allow changes to be made. **Calibration can ONLY be done in Service mode**.

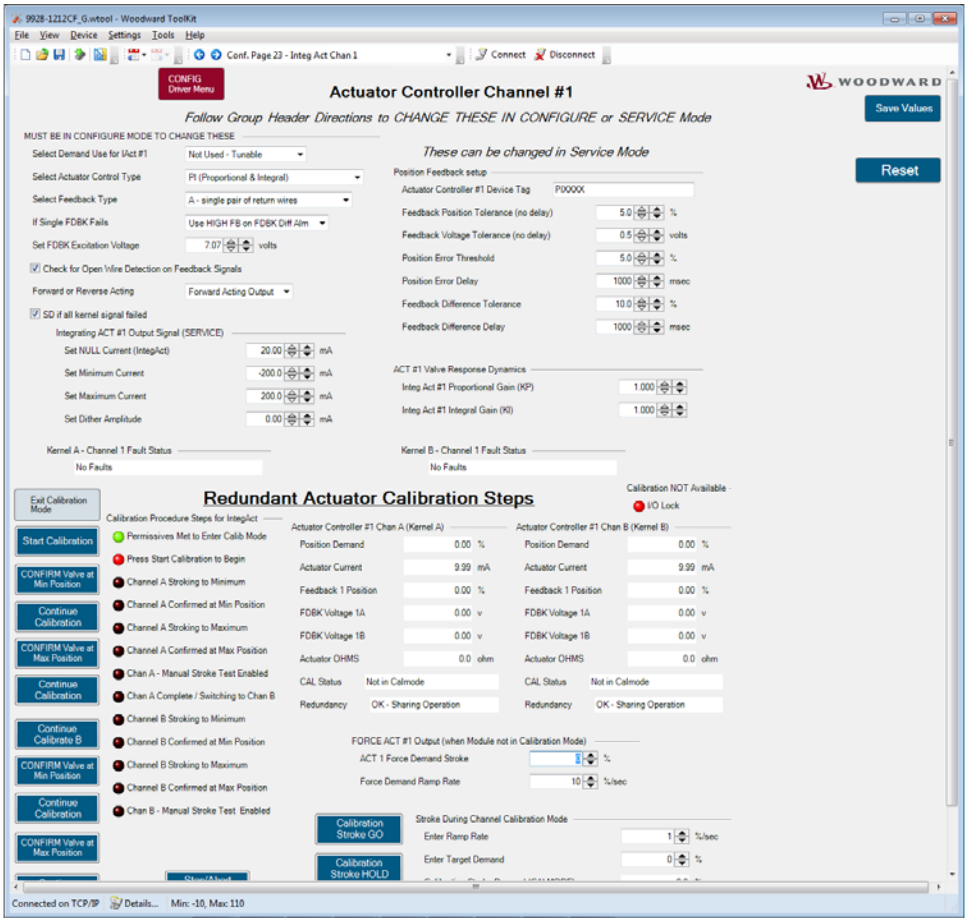
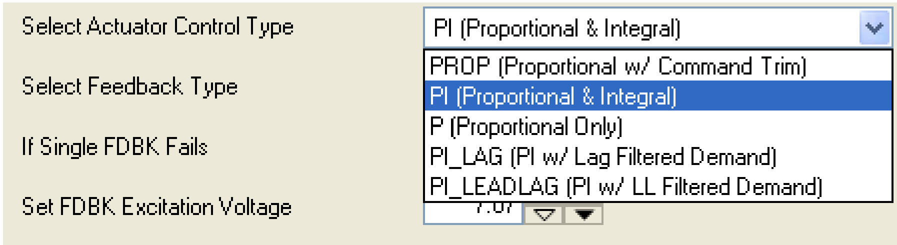


Figure 3-41. Actuator Controller Driver Channel 1

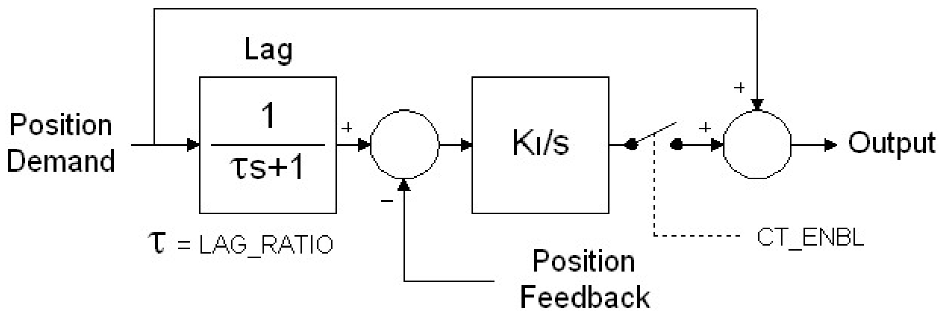
Actuator Controller Channel #1 Settings
From this page using the pull-down menus the IACT #1 Valve Demand Signal can be configured with the FUNCTION, Actuator Type and Feedback Type can be configured. If desired a Device Tag text string can be entered to associate this channel information with plant wiring nomenclature.

Actuator #1 Function **dflt = Not Used (Tunable)**
Choices –
HP Demand (Main Inlet Governor Valve)
HP2 Demand (Split Range Valve)
LP Demand (Extraction/Admission Valve)
LP2 Demand

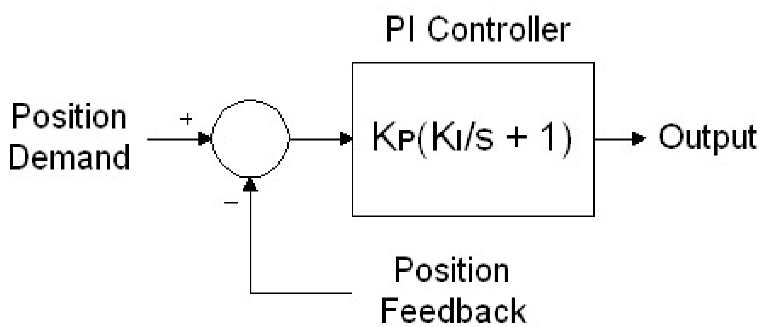
Actuator Control Type **dflt = PI (Proportional & Integral)**
Choices



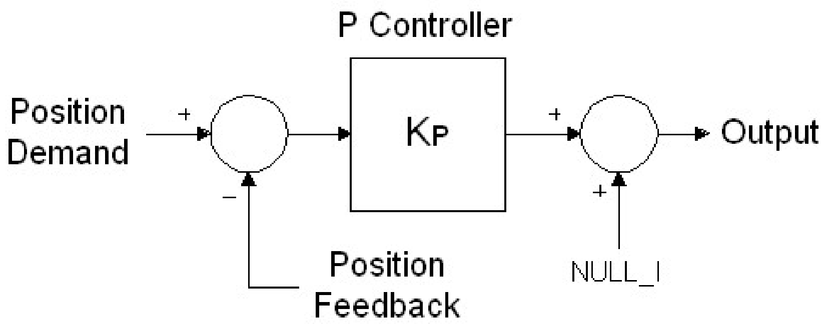
PROP
This is to interface to a proportional valve with feedback (LVDT or RVDT)
PROP selected
This selection if for proportional valve, and settings are similar of the one used for ACT combo channels.



PI
This is the **typical** configuration for interfacing to an integrating actuator and its position feedback device (LVDT or RVDT). It utilizes a proportional and integral term in its internal closed loop control of demand versus position.
PI selected

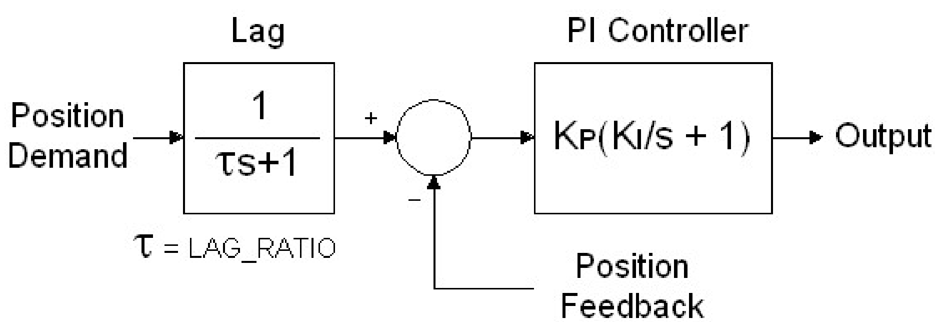


P – This interfacing is to an integrating actuator and its position feedback device, with only the proportional gain active in the demand vs. position control loop.
P selected

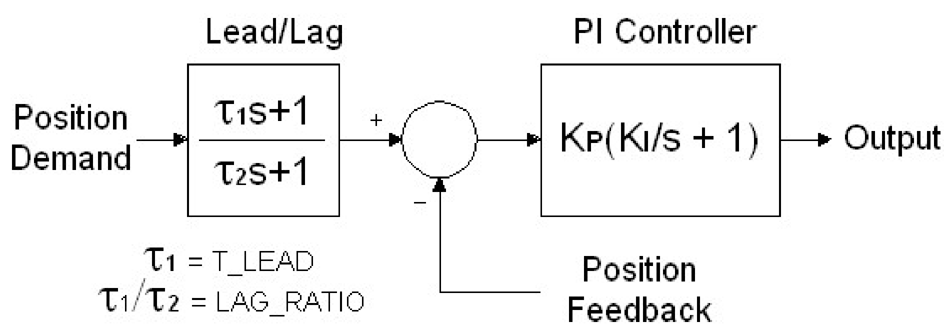


The following 2 are rarely used:
PI_LAG
Same as the PI but also adds a LAG delay filter on the demand vs. position control loop.

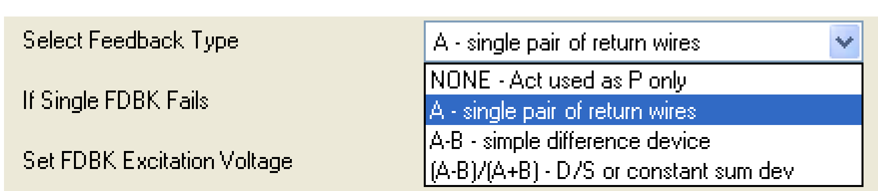
PI-LAG selected



PI_LEADLAG
Same as the PI_LAG but also adds a LEAD time constant (anticipation) filter into the demand vs. position control loop.
PI-LEAD/LAG



Select Feedback Type



A
Single pair of wires from the feedback device.

A–B
Two pair (or more) of wires from the feedback device – control will use a simple difference output voltage to determine valve position.

(A–B)/(A+B)
Two pair (or more) of wires from the feedback device – control will use a difference sum (or constant sum) output voltage to determine valve position, for some transducers this will yield a more accurate position.

For devices with two pairs of return wires, the device manufacturer's drawing should be consulted to determine if it is a difference type or difference/sum type.

<u>The type of LVDT used must be similar for each redundant channel</u>.

If Single Feedback device fails **dflt = Use HIGH FDBK**
Choose the desired signal to use if a Difference is detected between the two signals. Select to use either the HIGH or the LOW feedback signal.

Set Feedback Excitation Voltage **dflt = 7.07 volts**
Set the correct excitation voltage output from the actuator module to the feedback device(s)

Check for Open Wire Detection on Feedback Signals **dflt = Checked**
Check this to enable the open wire feedback detection on the feedback signals. This should be enabled for most systems, occasionally DC voltage feedback signals can had nuisance alarms related to this, thus in those cases this can be disabled.

Forward or Reverse Acting **dflt = Forward Acting**
Set the desired output action of the Actuator. Forward implies that current above the Null current will open the valve and current below the Null will close the valve.

Configure Integrating ACT #1 Output Signal
Set NULL Current (IntegAct) **dflt = 20.00 mA**
Set the null current of the torque motor – this is current at which the valve is held at a steady (constant) position.

Set Minimum Current **dflt = -200.0 mA**
Set the minimum current to the torque motor – this must be below the Null current setting, the minimum the control module outputs is –200 mA.

Set Maximum Current **dflt = 200.0 mA**
Set the maximum current to the torque motor – this must be above the Null current setting, the maximum the control module outputs is +200 mA.

Set Dither Amplitude **dflt = 0.0 mA**
If needed (to avoid valve sticking) a small amount of current can be entered as dither. The control will overlay this mA value, oscillation +/- over top of the current output signal. Misuse of dither can cause valves to wear pre-maturely.

Position Feedback Setup
Actuator Controller #1 Device Tag **XXXX**
Optional identifier that the user can use to relate this channel to the actual valve/actuator device.

Feedback Position Tolerance (no delay) **dflt = 5.0 %**
Sets the position out-of-range tolerance which triggers a position out of range alarm – with default value this triggers at -5% and 105%.

Feedback Voltage Tolerance (no delay) **dflt = 0.5 volts**

Sets the voltage tolerance limits for the voltage range check alarm.

Position Error Threshold **dflt = 5.0 %**
Sets threshold for the position error alarm, when the feedback exceeds the demand +/- this value for longer than the PE Delay an alarm is generated.

Position Error Delay **dflt = 1000 ms**
Sets the delay before the position error alarm will go true when feedback exceeds demand +/- PE threshold.

Feedback Difference Tolerance **dflt = 10.0 %**
Sets the amount of acceptable difference between the redundant feedback devices – when they differ by more than this amount for longer than the delay time, an alarm is generated and the actuator will only use the HIGH or the LOW (user setting from above).

ACT #1 Valve Response Dynamics
Integ Act #1 Proportional Gain (KP) **dflt = 1.000**
Sets the proportional gain factor in the demand versus position control loop, controlled within the actuator module.

Integ Act #1 Integral Gain (KI) **dflt = 1.000**
Sets the integral gain factor in the demand versus position control loop, within the actuator module.

Kernel A and Kernel B Channel 1 Fault Status
These messages show specific details of any fault that is detected. Check this if the Alarm summary annunciates an actuator fault on this channel.

Calibration of Actuator Controller (Integrating) Drivers

The navigation to the Integrating Actuator channels will take the user to screens that will be identical to the ones used in Configuration mode.

⚠WARNING **The control uses valve position (based off of actuator drive current) to determine turbine operating conditions and limits. The turbine may not function correctly if the control is not correctly calibrated to the turbine valves.**

⚠WARNING **For Actuator cards, using LVDTs, it is mandatory to calibrate each card prior to any start. Failure to do so may result in engine damage and/or injuries.**

Redundant Actuator Calibration Steps (Done in SERVICE Mode)

Calibration Procedure Steps to Integrating Actuators

The calibration of the redundant integrating actuators has been simplified by the creation of a step-by-step sequence to complete the procedure. Momentary buttons initiate control actions that are fed back to the user via LEDs. This sequence will calibrate Channel 1 on both the Kernel A and Kernel B modules.

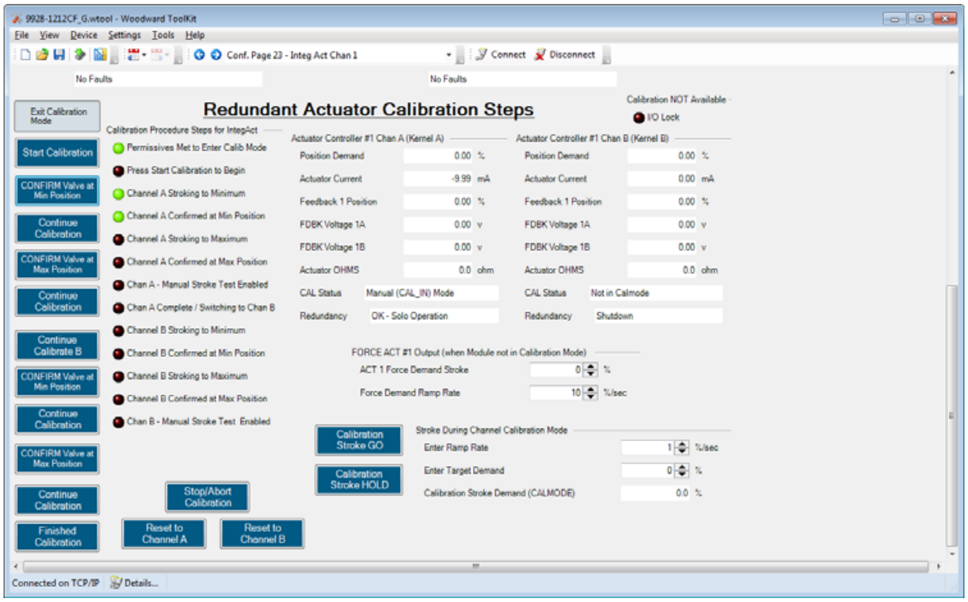


Figure 3-42. Actuator Controller Driver Channel 1 - Calibration

Step 1 – Enter Control Calibration Mode (with Turbine Shutdown)

Step 2 – Enable the Actuator channel calibration (Start Calibration)

This step will place the Kernel A channel in solo mode, shutdown Kernel B and then bias the Kernel A output current negative to drive the valve to 0% position. The CAL Status should confirm these steps as you proceed.

Step 3 – CONFIRM Valve at Min Position

While the control holds this demand the valve/actuator should be visually inspected to witness that the valve is at minimum stroke. Control will capture this feedback voltage as 0% demand position.

Step 4 – Continue Calibration

This will change the output current from below null to be above null and drive the valve to 100% position.

Step 5 – CONFIRM Valve at Max Position

While the control holds this demand, the valve/actuator should be visually inspected to witness that the valve is at maximum stroke. Control will capture this feedback voltage as 100% demand position.

Step 6 – Continue Calibration

This completes Kernel A Channel 1 calibration and allows the user to manually stroke the valve (while still in calibration mode) using only the Kernel A output.

Step 7 – Continue Calibrate B

This step will place the Kernel B channel in solo mode, shutdown Kernel A and then bias the Kernel B output current negative to drive the valve to 0% position. The CAL Status should confirm these steps as you proceed.

Step 8 – CONFIRM Valve at Min Position

While the control holds this demand, the valve/actuator should be visually inspected to witness that the valve is at minimum stroke. Control will capture this feedback voltage as 0% demand position.

Step 9 – Continue Calibration

This will change the output current from below null to be above null and drive the valve to 100% position.

Step 10 – CONFIRM Valve at Max Position

While the control holds this demand, the valve/actuator should be visually inspected to witness that the valve is at maximum stroke. Control will capture this feedback voltage as 100% demand position.

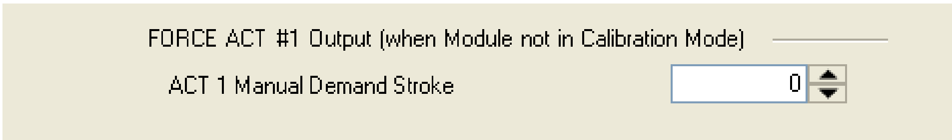
Step 11 – Continue Calibration

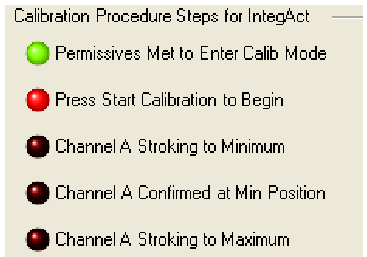
This completes Kernel B Channel 1 calibration and allows the user to manually stroke the valve (while still in calibration mode) using only the Kernel B output.

Step 12 – Finished Calibration
This completes the calibration of Channel 1 on both Kernel A and Kernel B and exits the actuator Channel 1 calibration mode. The channel status indications should both read "Not in Calmode" and "OK – Sharing Operation".

MANUALLY Stroking the Integrating Valve

To manually stroke the valve without calibrating the channels, use the following demand stroke parameter. The control must still be in Calibration mode (with turbine Shutdown) and the step-by-step channel calibration mode must not be active. The first 2 status LEDs should be the only ones lit.





Conf – Page 24 – Actuator Controller Channel 2

This page shows the configuration of the Integrating actuator driver output Channel #2. In Configure and Service mode, these parameters can be adjusted; in the Run mode, this page will display this information but not allow changes to be made. **Calibration can ONLY be done in Service mode**.

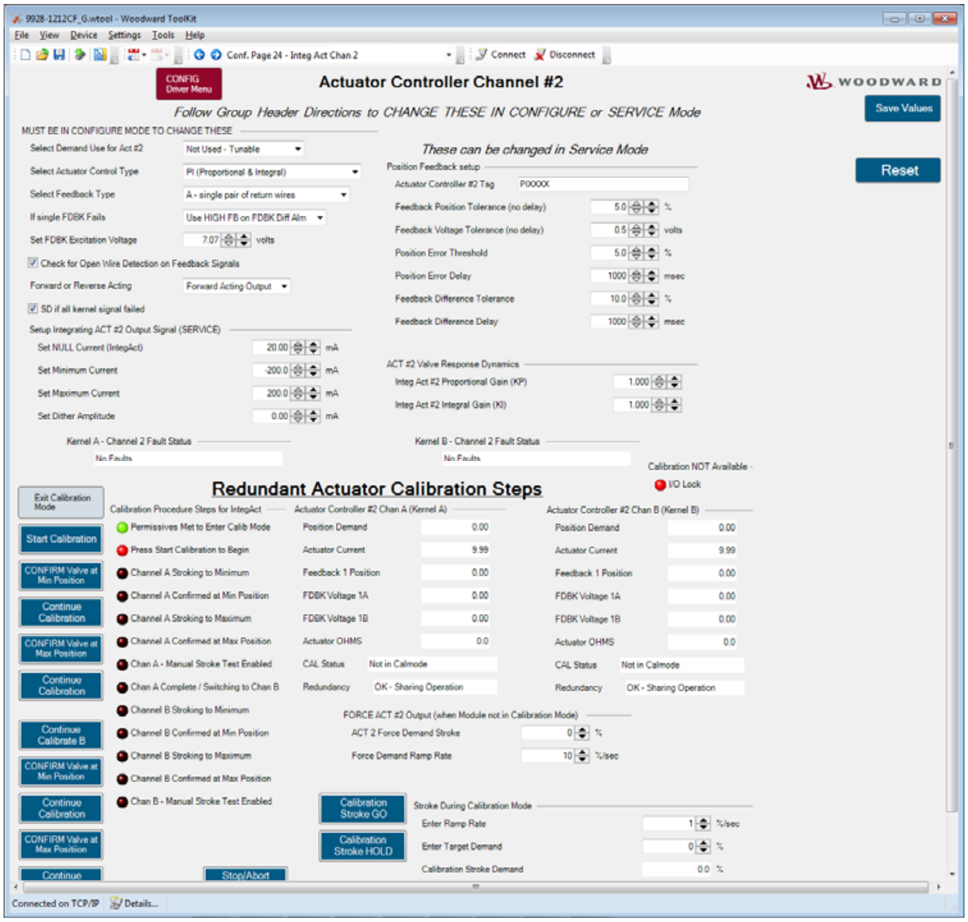


Figure 3-43. Actuator Controller Driver Channel 2

All selections on this page are identical to the Actuator Controller Channel 1 described above. Refer to that section for information as to the meaning of each setting.

Conf – Page 25 – HP Valve Linearization Curve

Navigating to the valve linearization pages will reveal the following information (HP Valve Linearization shown). This feature allows the user to adjust the valve demand output relative to the linear control demand signal. This can be used to compensate for areas of non-linearity that can exist in some multi-valve steam rack inlet or extraction valve assemblies.

The typical procedure would be to utilize flow measurement data and log flow versus valve position from 0-100%, then adjust the Y axis values in any areas of the graph that appear non-linear.

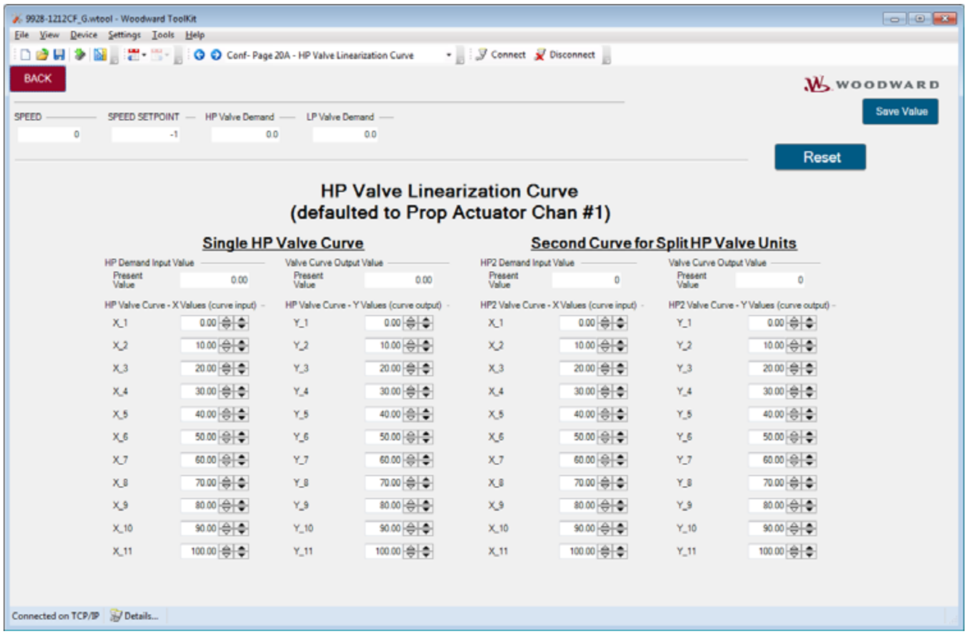


Figure 3-44. Service HP Valve Linearization Curve

The linearization of the actuators is a vital feature of the 5009FT control system. The ratio/limiting that occurs internal to the 5009FT is dependent on the valves being linear in nature. Most Woodward actuator/valves are linear in nature and do not need to be adjusted. In order to linearize the valves, a flow meter or some type of measuring device should present to measure flow through the valve. The X—Y values represent an interpolation block that sets up to 11 points on an X-Y graph.

The X values are initially set at 10 % increments but can be adjusted up or down by using the arrows to the right of the Value display box. The X values should be concentrated in areas of known non-linearity. If the valve is known to be linear from 0 to 50 %, X-1 should be 0% and X-2 should be 50%. All higher X values must have a higher %. If X-2 is moved to 50%, then X-3 must be higher and X-4 must be higher than X-3 and so forth.

Conf – Page 26 – LP Valve Linearization Curve

Page is similar to above screen – but adjusts the valve linearization curves for the LP valve.

Conf – Page 27 – Configuration Check

This page shows any configuration errors that the application detects prior to the user leaving the Configuration mode.

The screen shot below shows a configuration error identified. Unit is configured as a generator unit, but no Load input or Breaker contact inputs are programmed.

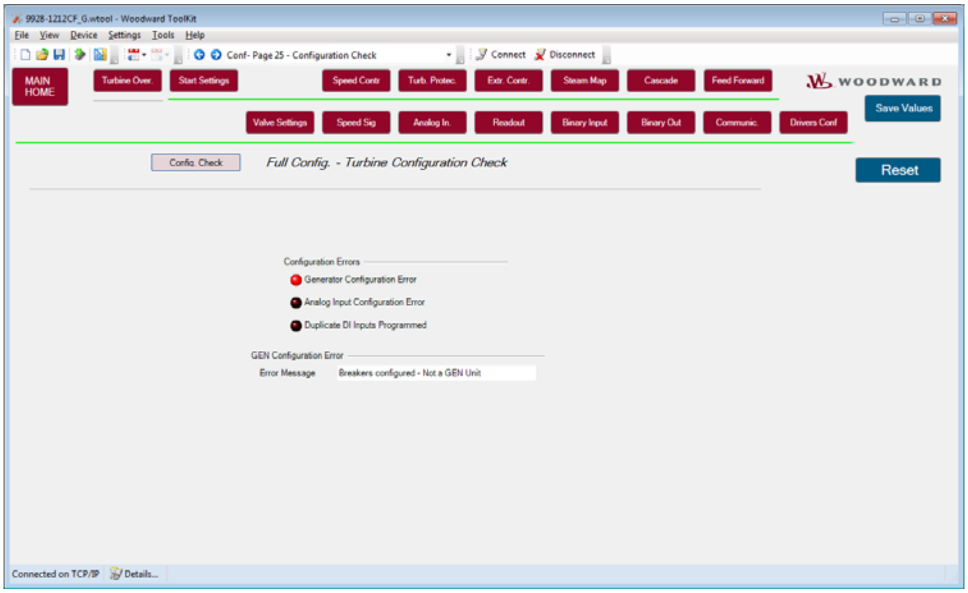


Figure 3-45. Configuration Check Page

The user will not be allowed to exit the full configuration mode until all configuration errors are corrected.

Save to Control / Exit Configuration Mode

Once all the program settings have been configured, they can be saved to the control. Click on the "**Save Values**" button to initiate the save routine. To leave configuration mode return to the **HOME** page. If any configuration errors have been detected you will not be able to exit CONFIG mode. If no errors are present you can click on the **Quit Configuration mode** button. When this command is issued, the CCT program performs a final configuration error check before any values are saved. If no configuration errors were found, a pop-up box appears and displays a message to wait while the control re-initializes and releases IO LOCK. To enter Turbine Run mode, you will need to Exit Calibration Mode.

If any configuration errors were detected by the save routine, the program will display a Configuration Error list of the errors detected on the Config Check page. By selecting the error (line), then clicking on the "Branch" button the program will step you to the page where the error was detected.

Chapter 4.
Service Mode Settings

Overview

Once the unit has been initially configured – the service mode screens give the user access to some screens and parameters as configure mode, which the exception that the 5009FT control hardware is not in IO LOCK, meaning that in Service mode the output signals from the control are active. The CCT's service mode can be accessed at any time the control is powered up.

The service mode is for qualified personnel to adjust and tune control parameters that may need to be tuned with the control & turbine in operation (such as dynamic tuning of PID controllers). The service mode can be used to change control settings, test control hardware, and calibrate control inputs/outputs while the unit is on-line (operating at any load). The parameters that are tuned in the service mode may affect system performance. Caution is advised when tuning any parameter with the turbine not shutdown. The Service Mode cannot be used to operate the turbine or to perform Run Mode functions. The Service Mode is to be used for internal adjustments only.

IMPORTANT	**Not all page parameters are referred to or explained in this chapter. This chapter provides descriptions for parameters which only exist in the Service Mode. Refer to this Volume's Program mode chapter for all other page parameter descriptions.**

Service – Page 1 – Turbine System View

This page shows the summary of the main functional configuration of the control that was setup in the configuration mode. The only function available here is to allow the user to place the control in CCT Control ONLY mode (similar to the old 5009 Local mode).

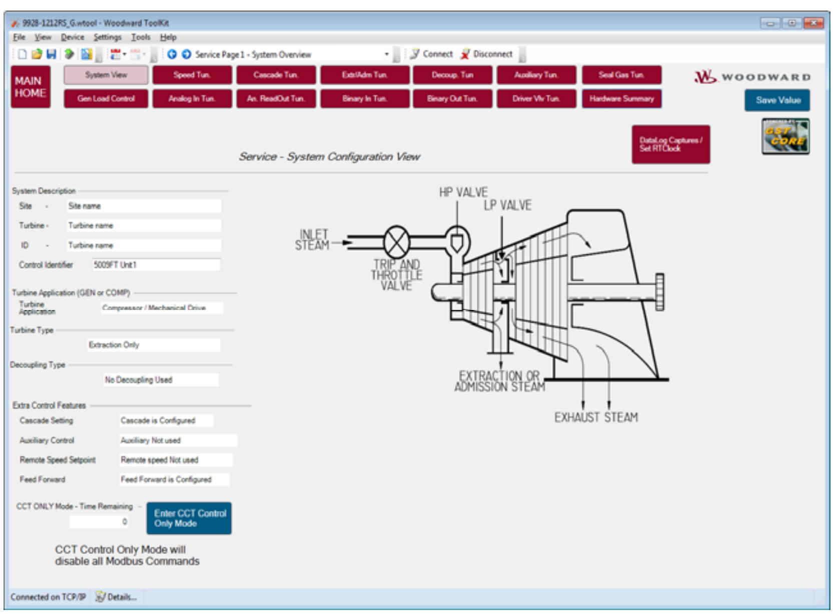


Figure 4-1. System View

Enter CCT Control Only Mode

Clicking this toggle button places the control in a mode where it will only follow CCT commands and ignore any Modbus commands. This mode will last for 10 minutes or until the button is toggled again to exit the mode. To temporarily disable the Modbus commands for longer periods (or permanently) go to the Communications page.

Service – Page 2 – Turbine Speed Tuning

This page is used to tune the dynamics of the speed control loop.

The Speed Control page allows the user to change the 5009FT control's Speed settings. The Speed input is displayed in the Speed display box at all times. The 5009FT control will attempt to control the turbine such that the Speed input matches the Speed Setpoint.

The Speed Control function is active at all times. Another control function (Decoupling Limiter) can take control of the valves, but the Speed Control function is still active and will control the speed.

The Speed Control's PID settings can be monitored and changed by selecting the control dynamics values. The Speed Control's P, I, and D terms can be adjusted with the arrow buttons to the right of each term.

In the case of the Speed Control PID, two sets of PID terms are used. One in normal speed control (Speed off-line) and one when the control is on line and handling a load. Both sets of PID terms can be adjusted independent of whether or not the control is on line. This allows two separate sets of dynamics for the two basic modes of speed control (Dual-Dynamics). Care needs to be taken that the terms changed are the correct terms for the case needed. Adjusting the PID terms for the On-Line selection while the turbine is running Off-Line will not affect turbine operation until the turbine is placed On-Line. The active state, On-Line or Off-Line, is displayed at all times in the Active Mode display box. Both sets of PID terms can be adjusted before speed control is in effect. This allows the user, during initial start-up, to adjust dynamic settings before they take effect to ensure stable operation. The control can then be fined tuned, once the turbine is up to speed. The same can be done for the Off-Line adjustments.

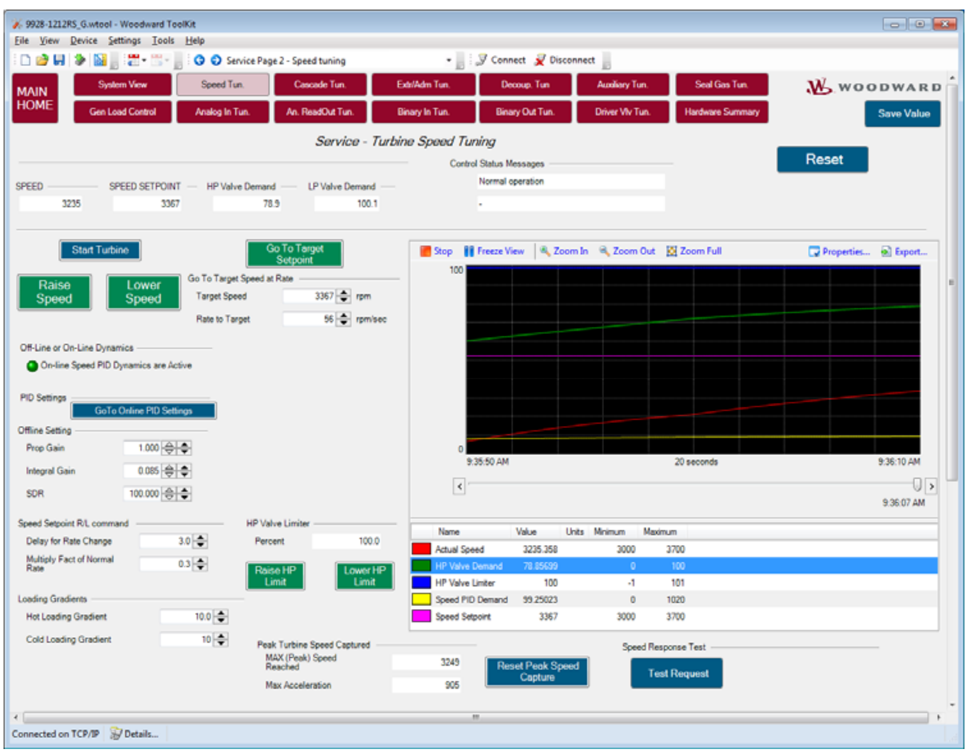


Figure 4-2. Speed Tuning

Start Turbine Button
Can be used to start the turbine; useful if tuning speed loop for the first time.

Raise/Lower Speed Buttons
Used to Raise /Lower the speed setpoint at the default ramp reference rate.

Go To Target Setpoint
The user can enter directly a **target speed** setpoint and a **rate to target** (rpm/s) at which to move. Once values are entered the control will act upon the user clicking the momentary **Go To Target Setpoint** Button and go to the target at that rate. This feature is useful for issuing small step changes to test dynamics

Off-Line or On-Line Dynamics
A Green LED will indicate that On-Line dynamics are active, if LED is off then the Off-Line dynamics are in use. The toggle button allows the user to select to view either set of dynamics. If configured to use dual dynamics – the control will switch from Off Line to On Line upon Utility Breaker closure (GEN) or Speed exceeding Min Governor speed (COMP). Alternatively the dynamics can also be switched externally by a discrete input.

Off-Line Settings or On-Line Settings
Proportional Gain **dflt = 1.0 (0.005, 100)**

Enter the PID proportional gain percentage. This value is used to set the cascade control response. This value can be changed while the turbine is operating. A recommended starting value is 1.

Integral Gain **dflt = 1.0 (.005, 50)**

Enter the PID integral gain in repeats-per-second (rps). This value is used to set cascade control response. This value can be changed while the turbine is operating. A recommended starting value is 1.0 rps.

SDR - Derivative Ratio **dflt = 100.0 (0.0, 100)**

Enter the PID derivative ratio. This value is used to set cascade control response. A recommended starting value is 100% (disabled).

Speed Setpoint R/L Commands
Delay for Slow R/L **dflt = 3.0 (0.0, 25)**
Multiply Factor of Normal Rate for Slow **dflt = 0.3 (0.01, 1)**
This is the Delay (in seconds) and the multiplier that is used in conjunction with the Loading gradient value to determine the rate at which the setpoint moves with the Raise/Lower momentary buttons.

For Example – with the loading gradient of 20 rpm/s these default settings will move the reference at 6.66 rpm/s for 3 seconds and then move at 20 rpm/s for the rest of the time the momentary button is pushed. Any duration less than the delay will always move the setpoint at the slower rate.

Loading Gradient
The loading rates that were initially entered in configuration mode are also available on this page. Depending on the configuration a single rate, or separate hot and cold rates will be shown.

HP Valve Limiter
It may be helpful while tuning the speed loop to limit the actual HP valve demand output. The valve limiter value and Raise/Lower buttons are available on this page.

Peak Turbine Speed Captured
The MAX (Peak) Speed Reached and the Maximum acceleration reached by the control are logged by the control and displayed here. A Reset button is available that will reset both of these values. This is valuable for capturing speed overshoot while tuning, or for capturing the peak speed during an overspeed trip test.

Interactive Trend Graph
The Trend graph provides a 'strip-chart' view of the speed control parameters, with Zoom features, stop/start graph and freeze view capability. Using the Properties icon the user can adjust the range of any parameter to allow the graph to be more useful for specific tuning, for example around a smaller speed window range.

The Export icon will export the data from the trend to an html document.
CAUTION - It will export all data in the buffer from the initial 'Start' command of the trend script, so the file may be come large and may take a while to create if the trend has been open and running for a long time.

Speed Response Test / Loop Quality Check tests
These are not currently available on the initial release of the product.

Service – Page 3 – Turbine Cascade Tuning

This page contains the tuning parameters for the Cascade control loop. If no Cascade control is used then this page can be skipped.

The Cascade Control's PID settings can be monitored and changed on this page.
The Controlling Parameter displayed at the top of the page will inform the user when the Cascade PID is in control. The Cascade Control's P, I, and D terms can be adjusted with the arrow buttons to the right of each term.

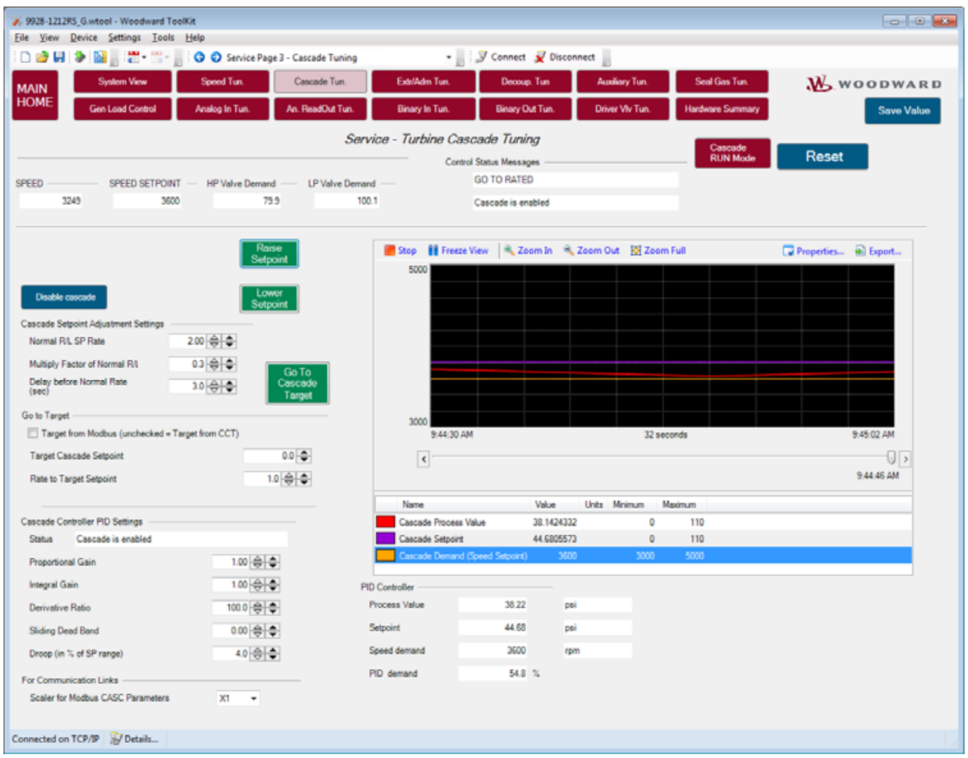


Figure 4-3. Cascade Control Tuning

Reset Button
Can be used to issue a reset if an alarm condition exists.

Raise/Lower Setpoint Buttons
Used to Raise /Lower the cascade setpoint at the normal setpoint rate.

Normal Raise/Lower Setpoint Rate dflt = 2.0 (0.01, 500)
The user can set the normal rate at which the raise/lower buttons will move after the 'slow rate' delay time has expired.

Multiply factor of Normal Raise/Lower Rate **dflt = 0.3 (0.01, 1.0)**

The slow rate will equal the normal rate times this factor in rpm/s.

Delay before Normal Rate **dflt = 3.0 (0.1, 25)**

The momentary raise/lower commands to adjust the setpoint will move at the slow rate (normal x mult factor) for any command less than this time period (seconds). When the command is held TRUE for longer than this time the rate will switch to the Normal rate (above).

Go to Cascade Target (momentary button)

When this button is pressed the unit will move the current setpoint to the Target setpoint at the rate shown. This is only active when cascade is enabled.

Target from Modbus (unchecked = Target from CCT)

If this is checked then the Go to Target feature will be available via the Modbus interface. If unchecked the go to value will come from this page on the CCT.

Target Cascade Setpoint

User can enter a target value for the setpoint.

Rate to Target Setpoint

User can enter a rate at which the unit will move to the target setpoint.

Interactive Trend Graph

The Trend graph provides a ‘strip-chart’ view of the cascade control parameters, with Zoom features, stop/start graph and freeze view capability. Using the Properties icon the user can adjust the range of any parameter to allow the graph to be more useful for specific tuning, for example around a smaller speed window range.

The Export icon will export the data from the trend to an html document.

IMPORTANT	**This will export all data in the buffer from the initial ‘Start’ command of the trend script, so the file may be come large and may take a while to create if the trend has been open and running for a long time.**

Cascade Controller PID Settings

Status

String to identify the current status activity of the cascade control loop

Proportional Gain **dflt = 1.0 (0.005, 100)**

Enter the PID proportional gain percentage. This value is used to set the cascade control response. This value can be changed while the turbine is operating. A recommended starting value is 1.

Integral Gain **dflt = 1.0 (.005, 50)**

Enter the PID integral gain in repeats-per-second (rps). This value is used to set cascade control response. This value can be changed while the turbine is operating. A recommended starting value is 1.0 rps.

Derivative Ratio **dflt = 100.0 (0.0, 100)**

Enter the PID derivative ratio. This value is used to set cascade control response. A recommended starting value is 100% (disabled).

Sliding Dead Band **dflt = 0.0 (0.0, 100)**

If desired, enter a deadband range. The control will stop actively adjusting the output demand when the process value is within +/- of this value from the setpoint. A recommended starting value is 0% (disabled).

Service – Page 4 – Turbine Extraction/Admission Tuning

This page allows for setup and control loop tuning of the Extraction Control (P) loop in an Extraction and or Admission turbine.

The Extraction/Admission Control's PID settings can be monitored and changed on this page.

The Controlling Parameter display at the top of the page will inform the user when the Extraction/Admission PID is in control. The Extraction/Admission Control's P, I, and D terms can be adjusted with the arrow buttons to the right of each term.

The Extraction/Admission PID uses the settings displayed in the Dynamics Display box to determine PID response; any change to these setting will immediately affect PID response (when the Extraction/Admission PID is in control). These values are stored in the control's RAM memory. The box's "Save Settings" button can be selected to immediately upload the new values to the control's EEPROM memory. This ensures that if all power to the control is lost the PID values will be saved. If the "Save Settings" button is not selected, the control will automatically save these values within 15 minutes. Reference Volume 1, Chapter 5 for detailed information on adjusting PID dynamic settings.

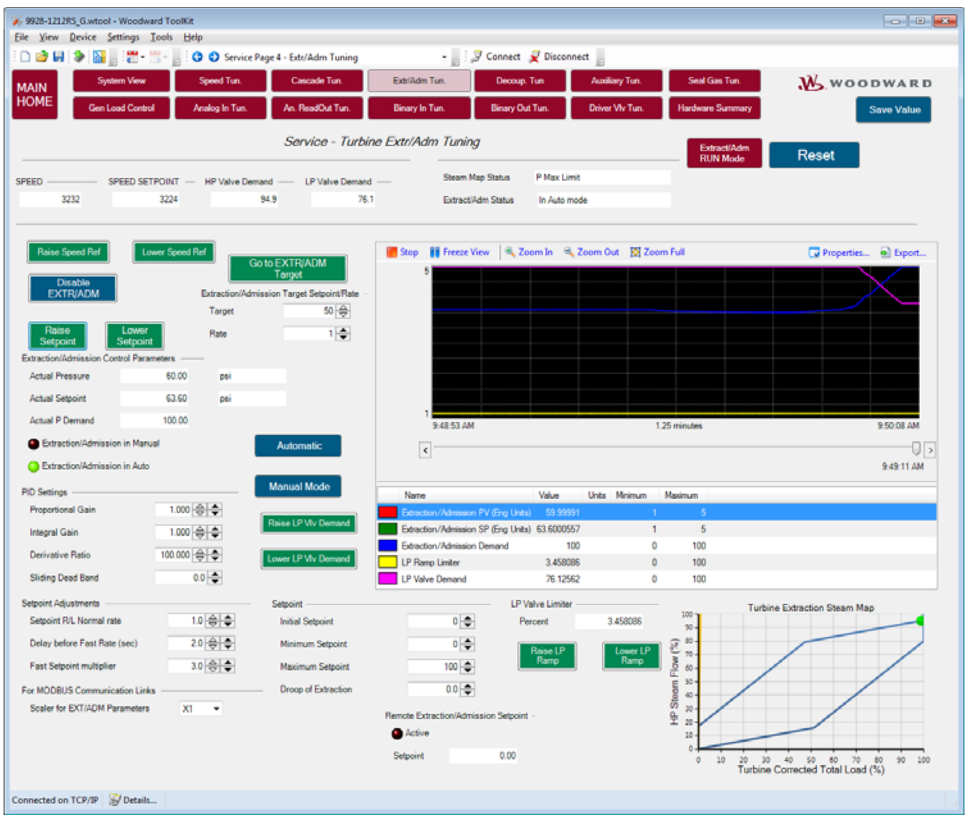


Figure 4-4. Extraction/Admission Tuning

Raise/Lower Speed Reference Buttons
Used to Raise /Lower the speed reference setpoint.

Reset Button
Can be used to issue a reset if an alarm condition exists.

Enable/Disable Extraction Button
Can be used to Enable or Disable Extraction control exists.

Raise/Lower Setpoint Buttons
Used to Raise /Lower the Extraction setpoint at the normal setpoint rate.

Go to Extraction Target (momentary button)
When this button is pressed the unit will move the current setpoint to the Target setpoint at the rate shown. This is only active when extraction is enabled and in automode.

Target Extraction Setpoint
User can enter a target value for the setpoint.

Rate to Target Setpoint
User can enter a rate at which the unit will move to the target setpoint.

Extraction Control Parameters

Actual Pressure	Extraction/admission pressure in Engineering units
Actual Setpoint	Extraction/admission pressure setpoint in Eng. units
Actual P Demand Output	PID output demand in %
Extraction in Manual	Status LED
Extraction in Automatic	Status LED

Automatic / Manual Mode Buttons
These buttons can be used to switch the control between Manual mode (User uses the Raise/Lower LP Valve Demand buttons to position the LP valve to the desired position) and Automatic mode (control Extraction PID along with the ratio limiter control determines the LP valve output position).

Raise/Lower LP Valve Demand Buttons
Used to Raise /Lower the actual LP valve demand output, once the unit is placed in Manual mode. The Extraction pressure will be affected as this valve output demand is changed. These buttons have no effect if the control is in Auto mode.

Interactive Trend Graph
The Trend graph provides a 'strip-chart' view of the extraction/admission control parameters, with Zoom features, stop/start graph and freeze view capability. Using the Properties icon the user can adjust the range of any parameter to allow the graph to be more useful for specific tuning, for example around a smaller speed window range.

The Export icon will export the data from the trend to an html document.

IMPORTANT	**This will export all data in the buffer from the initial 'Start' command of the trend script, so the file may be come large and may take a while to create if the trend has been open and running for a long time.**

Extraction PID Settings

Proportional Gain **dflt = 1.0 (0.0, 99.99)**
Enter the Extraction/admission PID proportional gain value. This value is used to set extraction/admission control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 1%.

Integral Gain **dflt = 0.5 (0.001, 50)**
Enter the Extraction/admission PID integral gain value, in repeats-per- second (rps). This value is used to set extraction/admission 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 rps.

Derivative Ratio **dflt = 100 (0.01, 100)**
Enter the Extraction/Admission PID derivative ratio. This value is used to set extraction/admission control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 99.99%.

Sliding Deadband **dflt = 0 (0.0, 100)**
If required, enter the deadband percentage. Typically, set between 1-5% and not more than 10%.

Normal Raise/Lower Setpoint Rate **dflt = 1.0 (0.01, 500)**
The user can set the normal rate at which the raise/lower buttons will move up until the delay time has been reached.

Delay before Fast Rate (sec) **dflt = 3.0 (0.1, 25)**
The momentary raise/lower commands to adjust the setpoint will move at the normal rate for any command less than this time period (seconds). When the command is held TRUE for longer than this time the rate will switch to the Fast rate (Normal x factor below).

Fast Setpoint Multiplier **dflt = 3.0 (0.01, 100)**
The fast rate will equal the normal rate times this factor in rpm/s.

Initial Setpoint Value **dflt = 0.0 (-10000, 10000)**
Enter the setpoint initialization value for the extraction/admission setpoint, this is the value that the setpoint initializes to upon power-up or exiting the program mode.
(Must be less than or equal to the 'Max admission Setpt' Setting)

Minimum Setpoint **dflt = 0.0 (0.0, 10000)**
Enter the minimum extraction/admission setpoint that should be allowed for the system.

Maximum Setpoint **dflt = 100 (0.0, 10000)**
Enter the maximum extraction/admission setpoint that should be allowed for the system.

Droop of Extraction **dflt = 0.0 (0.0, 10)**
Enter the droop percentage. Typically not required, this will allow an offset between setpoint and process.

LP Valve Limiter
It may be helpful while tuning the extraction loop to limit the actual LP valve demand output. The valve limiter value and Raise/Lower buttons are available on this page.

Service – Page 5 – Turbine Decoupling Tuning

This page allows for tuning of the Decoupling PID if decoupling is used. It has a trend graph to aid in PID tuning

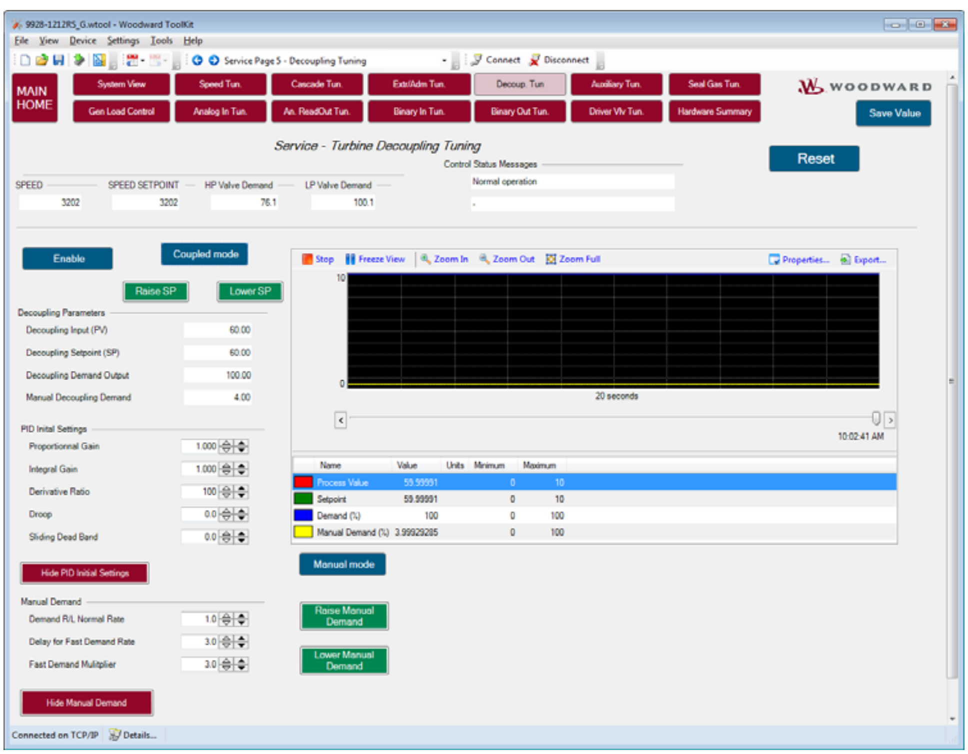


Figure 4-5. Decoupling Tuning

Decoupling Control Features

The Decoupling folder is visible only when any Decoupling Control is configured into the 5009FT control.

The Decoupling Controller will take control of HP or LP the valves any time it is enabled and in control.

To enable it, the Extr/Adm control must first be enabled and in control of LP and switched into manual mode (if in automatic).

When configured for Inlet & speed, the decoupling PID will control directly the HP valve, and in conjunction with the speed PID, the LP valve.

In this mode, when disabled, the PID will track the HP position as shown in the header above.

When configured for Exhaust & speed, the decoupling PID will control directly the LP valve, and in conjunction with the speed PID, the HP valve.

In this mode, when disabled, the PID will track the LP valve position.

The Decoupling input is constantly displayed in the Decoupling Input (PV) display box. Once Decoupling Control is enabled, the 5009FT will be attempting to match the input to the setpoint.

The Decoupling Control function can be enabled and disabled by manually selecting the Enable/Disable buttons to the right of the Decoupling Status display box. The status box will display what mode the Decoupling Control function is in at all times. As linked to the extraction status, extraction status is also indicated.

Disabling (Quit) the decoupling will not disable extraction.

Extraction PID control will be re-activated and take control of the pressure/Flow demand (automatic or manual).

The Decoupling Setpoint can be manually changed by pressing the arrow keys to the right of the DCPL Setpt display box. The status of the Decoupling controller does not affect whether the setpoint can be adjusted or not. The setpoint will determine what level the Decoupling controller will maintain the turbine to once enabled. The rate at which the setpoint can change is set in the Program mode as Setpoint Rate.

When the Decoupling Controller is disabled, the setpoint will remain at the last valid setpoint and will control at that setpoint when the Decoupling controller is again enabled. If the Setpoint Tracking feature is active the setpoint will track the input whenever the Decoupling Controller is disabled.

The output of the DCPL PID controller will be displayed in the PID display box. This output can be used to determine if the PID is in control or if there are stability problems. For the DCPL Limiter, the PID will ramp out of the way until the input matches the setpoint.

Like the extraction PID, the Decoupling PID can be put in manual mode.

This will allow an easy transfer from letdown station control to Decoupling control. In case of strong process instabilities, manual mode may also be needed.

The Decoupling setpoint can also be varied by a 4–20 mA Remote Decoupling Setpoint signal. The 4–20 mA Remote Decoupling Setpoint information is only visible if the function is configured in the Program mode. The Enable/Disable buttons to the right of the Remote Setpoint Status display gauge are used to enable and disable the remote setpoint function. If configured, the status of the 4–20 mA Remote Decoupling function is continually displayed in the Remote Status display gauge.

Decoupling Control Dynamics

The Decoupling Control's PID settings can be monitored and changed by selecting the Dynamics button. If the RUN mode's Security logic is locked, the PID's settings can only be monitored. If the RUN mode's Security logic is unlocked, the PID's settings can be monitored and changed. Reference the Security Button section of this chapter for instructions on locking and unlocking the Run Mode's Security logic.

Selecting the "Dynamics button on the Decoupling Control folder will allow access to the Dynamics display box. This Decoupling Control Dynamics display box displays the Decoupling PID dynamic settings. The Controlling Parameter display at the bottom of the folder will inform the user when the Decoupling PID is in control. The Decoupling Control's P, I, and D terms can be adjusted with the arrow buttons to the right of each term.

Service – Page 6 – Turbine Auxiliary Tuning

This page is available if auxiliary control has been configured, to tune the dynamic response of the AUX controller.

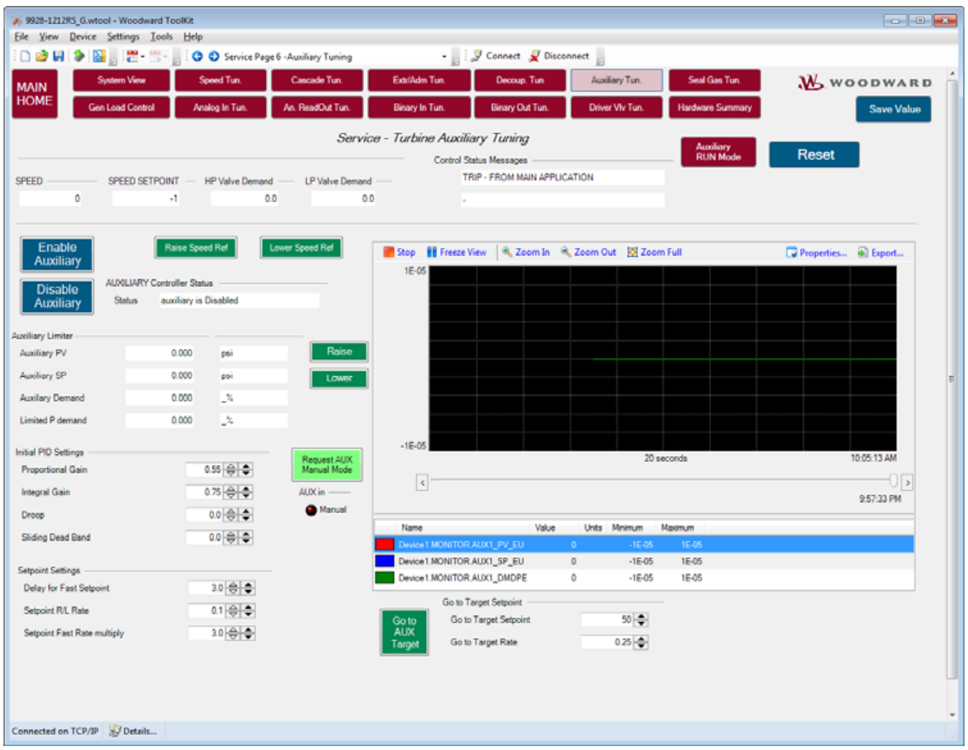


Figure 4-6. Auxiliary Control Tuning

AUX as Speed Reference Limiter Always Enabled

If the application is a single valve turbine (no extraction or admission) then the Auxiliary controller can only be used as a Limiter on the Speed Reference setpoint. If the application is a two valve turbine (HP & LP) then the AUX limiter can be configured as a Reference limiter or a Process controller. For each condition a switchable panel will display either the Text or Enable/Disable buttons.

AUX as Speed
Ref Limiter
Always Enabled

Auxiliary Limiter

Auxiliary PV - Actual Process Value of Auxiliary parameter in Engineering units
Auxiliary SP - Setpoint for Auxiliary process in Engineering units
Auxiliary Demand - PID output demand Value of Auxiliary controller
Limited P Demand – AUX PID output limited by steam map or ratio limiter

Interactive Trend Graph
The Trend graph provides a 'strip-chart' view of the AUX control parameters, with Zoom features, stop/start graph and freeze view capability. Using the Properties icon the user can adjust the range of any parameter to allow the graph to be more useful for specific tuning, for example around a smaller speed window range.

The Export icon will export the data from the trend to an html document.

IMPORTANT	**This will export all data in the buffer from the initial 'Start' command of the trend script, so the file may be come large and may take a while to create if the trend has been open and running for a long time.**

Auxiliary PID Settings

Proportional Gain **dflt = 0.5 (0.0, 99.99)**
Enter the Auxiliary PID proportional gain value. This value is used to set Auxiliary control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 0.5%.

Integral Gain **dflt = 0.75 (0.001, 50)**
Enter the Auxiliary PID integral gain value, in repeats-per- second (rps). This value is used to set Auxiliary control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 0.75 rps.

Derivative Ratio **dflt = 100 (0.01, 100)**
Enter the Auxiliary PID derivative ratio. This value is used to set Auxiliary control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 100%.

Droop **dflt = 0 (0.0, 100)**
If required, enter a droop percentage. If needed it is typically, set between 1-5% and not more than 10%.

Sliding Deadband **dflt = 0 (0.0, 100)**
If required, enter the deadband percentage. Typically, set between 1-5% and not more than 10%.

Delay before Fast Rate (sec) **dflt = 3.0 (0.1, 25)**
The momentary raise/lower commands to adjust the setpoint will move at the normal rate for any command less than this time period (seconds). When the command is held TRUE for longer than this time the rate will switch to the Fast rate (Normal x factor below).

Normal Setpoint Raise/Lower Rate **dflt = 0.1 (0.01, 500)**
The user can set the normal rate at which the raise/lower buttons will move up until the delay time has been reached.

Fast Setpoint Multiplier **dflt = 3.0 (0.01, 100)**
The fast rate will equal the normal rate times this factor in rpm/s.

Items below are only available if AUX is a Process Controller

Request AUX Manual Mode Button –
User can request (if Process controller) to switch to manual mode to control the LP valve position via Raise/Lower buttons which become visible.

Manual Mode LED – displays the status of AUX manual mode

Go to Target Setpoint **dflt = 50 (0, 100)**
User can enter a target setpoint

Setpoint Entered Rate **dflt = 0.25 (0.01, 100)**
User can enter a rate at which to move to the target setpoint

Go to AUX Target button
User button to trigger moving to the target setpoint

Service – Page 7 – Seal Gas / Gland Seal Control Tuning

This page will appear when seal gas PID is selected in the configuration section.

The seal gas PID is a PID controller independent from Speed controller and extraction/Admission controller. Its purpose is to control the seal gas pressure or any other type of process which needs to be controlled.

To be active, an analog output must be configured for this usage. The 5009FT won't generate an error message if an AO is configured for Seal gas PID demand or not, but it will need an analog output signal for this function to control a process.

The Seal PID function can be put in manual/automatic selecting the Manual/Auto buttons to the right of the Seal PID Status display box. The status box will display what mode the Control function is in at all times.

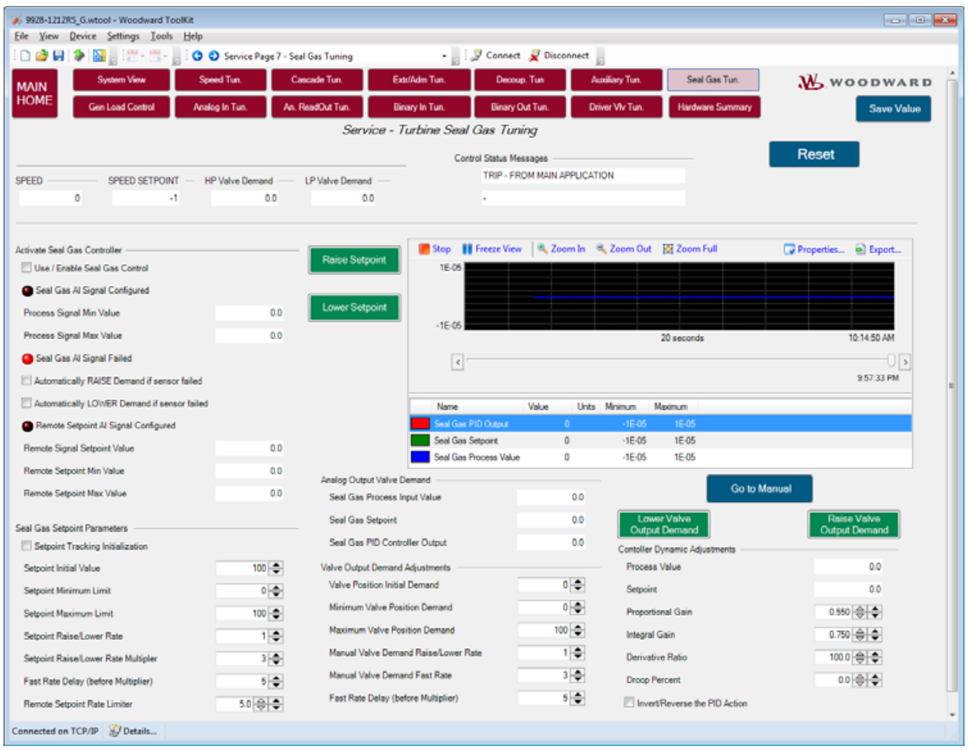


Figure 4-7. Seal Gas Control Tuning

Use / Enable Gland Seal/Seal Gas Control **dflt = Unchecked**
If unchecked this function is not available or disabled, if checked then the Seal Gas control PID will be active.

Gland Seal/Seal Gas AI signal configured LED
Status to indicate if an AI signal has been configured for this function.

Process Signal Min Value display only config in AI section
Process Signal Max Value display only config in AI section

Gland Seal/Seal Gas AI Signal Failed LED
Status to indicate if an AI signal has been configured for this function.

Automatically RAISE Demand if sensor failed **dflt = Unchecked**
Automatically LOWER Demand if sensor failed **dflt = Unchecked**
If both of these boxes are selected, by accident, then lower has priority. If neither automatic Raise or Lower is selected, the PID automatically goes into manual mode and holds the PID output at the position it had 160 ms before the failure, lagged at maximum 3 seconds (Process value Lag time multiplied by Prop gain). It is then possible to manually adjust the demand output at any time.

Remote AI Setpoint signal configured LED
Status to indicate if an AI signal has been configured for this function. If it has been configured, then Enable/Disable buttons will appear to activate or deactivate the use of this signal.

Remote Setpoint Signal Value display current value
Remote Setpoint Signal Min Value display only config in AI section
Remote Setpoint Signal Max Value display only config in AI section

Seal Gas Setpoint Values
Setpoint Tracking Initialization **dflt = Unchecked**
Check this to track the setpoint to the process value when control is disabled.
Initial Setpoint Value **dflt = 0.0 (-100000, 100000)**
Enter the setpoint initialization value for the Seal gas PID setpoint. This is the value that the setpoint initializes to upon power-up or exiting the program mode.
Setpoint Minimum Limit **dflt = 0.0 (-100000, 100000)**
Set the minimum Seal PID setpoint. This value is the minimum setpoint value to which the Seal PID setpoint can be set.

Setpoint Maximum Limit **dflt = 100.0 (-100000, 100000)**
Set the maximum Seal PID setpoint. This value is the maximum setpoint value that the Seal PID setpoint can be increased/raised to.

Setpoint Raise/Lower Rate—(Normal) **dflt = 1.0 (0.01, 10000)**
Enter the Seal PID setpoint slow rate (in units per second) at which Seal PID setpoint moves when adjusted for less than 3 seconds. After 3 seconds, the rate will increase to x times this rate. The slow rate, fast rate time delay (defaulted to 3 seconds), and fast rate settings are all adjustable in the CCT's Service mode and below.
Setpoint R/L (fast) Rate Multiplier: **dflt =*3 (1,10)**
Set this multiply factor used for the setpoint rate when fast rate is selected.
Fast rate delay (sec) before multiplier **dflt = *5 (1,10)**
This is the time to wait when R/L command is send to use the fast rate settings.
Remote Setpoint Rate Limiter: **dflt =*5.0 (1,100)**
Rate limiter for following the remote setpoint signal.

Analog Output Valve Demand
Seal Gas Process Input Value **display current value**
Seal Gas Setpoint **display current value**
Seal Gas PID Controller Output **display current value**

Valve Output Demand Adjustments
Valve Output Demand at initialization **dflt =*0(0,100)**
This is the demand at boot-up.

Min Valve Position Demand (PID) Output **dflt =*0(0,100)**
This is the minimum possible demand for the Seal gas PID.

Max Valve Position Demand (PID) Output **dflt = *100 (0, 100)**
This is the maximum possible demand for the Seal gas PID.

Manual Valve Demand R/L rate: **dflt = *1 (0, 100)%/s**
This is the normal rate used to raise/lower the PID output when in manual mode.

Manual Valve Demand Fast Demand Rate **dflt = *3 (1, 10)**
This multiplier factor will apply on the Demand R/L rate when the R/L delay is passed.

Fast Rate Delay **dflt = *5 (1, 30)**
This is the delay when R/L demand is pressed, before the fast rate is activated.

Raise/Lower Valve Demand buttons
These buttons can be used to raise or lower the valve output demand from its present value.

Controller Dynamic Adjustments
The interactive trend graph can help in making tunable adjustments to the Seal Gas control loop.

Interactive Trend Graph
The Trend graph provides a 'strip-chart' view of the Seal Gas control parameters, with Zoom features, stop/start graph and freeze view capability. Using the Properties icon, the user can adjust the range of any parameter to allow the graph to be more useful for specific tuning—for example, around a smaller speed window range.
The Export icon will export the data from the trend to an html document.
CAUTION - It will export all data in the buffer from the initial 'Start' command of the trend script, so the file may be come large and may take a while to create if the trend has been open and running for a long time.

Proportional Gain **dflt = 0.55 (0.0, 99.99)**
Enter the Seal PID proportional gain value. This value is used to set Seal PID control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 1%.

Integral Gain **dflt = 0.75 (0.001, 99.99)**
Enter the Seal PID integral gain value, in repeats-per-second (rps). This value is used to set Seal PID 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 rps.

Derivative Ratio **dflt = 100 (0.01, 99.99)**
Enter the Seal PID derivative ratio. This value is used to set Seal PID control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 100%.

Droop **dflt = 0.0 (0.0, 100)**
Enter the droop percentage. If required, typically set between 4-6% and not more than 100%. If not needed, set it at zero.

Invert Seal PID input **dflt = Unchecked**
Check this box if the Seal PID control action required is reverse acting. If selected, this option will result in the PID output decrease decreasing to increase the Seal PID input parameter.

Service – Page 8 – GEN Load Control

This page will only exist if the unit is configured for a GENERATOR application. It will show the available options for generator load and frequency control.

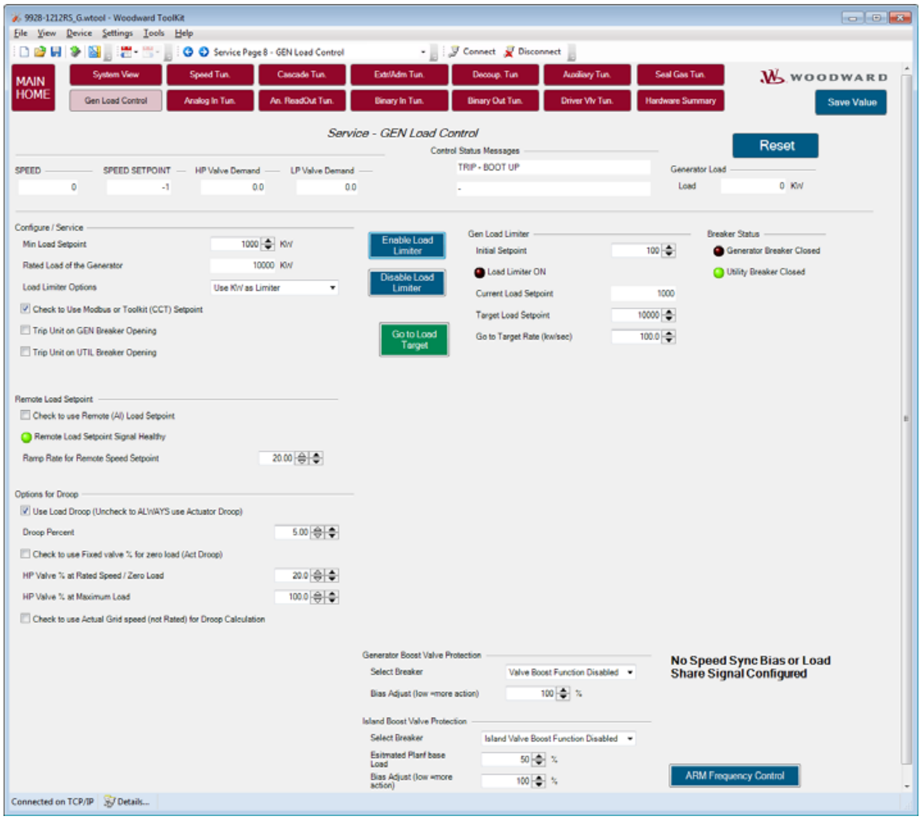


Figure 4-8. Generator Load Control Tuning

Minimum Load Setpoint **dflt = 1000 (0.0, 100000)**

Enter the minimum KW Load setpoint that the unit should step to at the instant the utility breaker is initially closed.

Rated KW Load of the Generator **dflt = 10000 (0.0, 100000)**

Enter the maximum generator load output of the turbine.

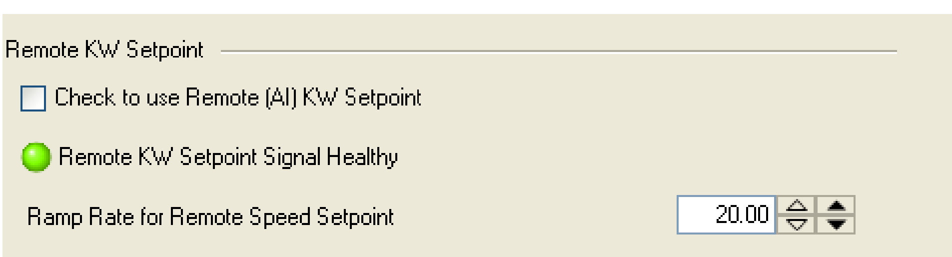
KW Limiter Options **dflt = Disabled**

If desired a separate PID is available to act as a KW limiter on the unit. It will limit the generator output to the user entered setpoint. It will not ‘control’ to this setting, but merely limit the overall power output of the machine.

Check to use Modbus or ToolKit Setpoint (Target) **dflt = Checked**

Check this to use a target setpoint that is entered from the CCT or from Modbus. If this is not checked the unit will look for a remote KW setpoint and always use that signal.

If a remote KW setpoint is programmed in the AI section then the following options will appear.



Check to use Remote AI KW Setpoint
This should be checked to use the remote signal, it can be temporarily unchecked to force the control to use the Modbus or CCT value.
Remote KW Setpoint Signal Healthy (Status LED)
Ramp Rate for Remote Speed Setpoint dflt = 20.0 (0.0, 1000.0)
This is the kW/s rate at which the setpoint will follow the remote signal.

Options for Droop

Use KW Droop (Uncheck to ALWAYS use Act Droop) dflt = Checked
The unit is defaulted to use KW Droop on generator applications, and switch to Actuator droop upon a failure of this signal. By unchecking this box the user can force the turbine to always be in actuator droop
Droop Percentage (Determines MAX GOV setting) dflt = 5.0 (0.0, 10.0)
Enter the desired droop setting for the system. This value will determine the maximum governor reference (setpoint) setting for the system. For example a typical 60 Hz system with a rated speed of 3600 rpm at 5% droop will have a maximum speed reference setting of 3780 rpm
Check to use Fixed valve % for zero load (Act Droop) dflt = Unchecked
The default action for the control is to use the valve percentage at the time of 'breaker closure' as the 'zero load' point and load in a linear fashion from this point up to 100% valve. If desired, the user can check this box, to override those settings and use the min and max valve percentage load points entered below. This can be useful in some systems, such as when the inlet pressure changes dramatically after the unit's breaker is closed and the unit is on-line.
HP Valve % at Rated Speed/Zero Load dflt = 20.0 (0.0, 100)
Enter the zero load valve setpoint that should be used for actuator droop.
HP Valve % at Maximum Load dflt = 100 (0.0, 100)
Enter the maximum load valve setpoint that should be used for actuator droop.
Check to use actual Grid speed (no Rated) for Droop Calc dflt = Unchecked
The default for the control is to use Rated speed in the droop calculation rather than the actual grid speed at the time of synchronization.
Check to use Frequency Control Arm/Disarm Function dflt = Unchecked
Check this box if Frequency arm/disarm function is desired, a discrete input is required to command which unit on the bus will be the Isoch unit (Armed) that will hold frequency (sometimes called the swing machine). When this is checked and the input is false (Disarmed) the unit will just droop against the local Isoch unit.
Arm Frequency Control toggle button
Use this to Arm or Disarm the Frequency control function (if programmed).

Enable/Disable KW Limiter buttons
Use these to enable or disable the KW limiter – if programmed.
Breaker Status LED's - indicate CLOSED conditions of the Generator and Utility Breakers
If KW Limiter control is ON, the Go to Target button will move the current KW setpoint to the target setpoint.

KW Limiter PID Dynamic Settings
Current KW Load
KW Load Limiter PID Output
Proportional Gain dflt = 0.5 (0.0, 99.99)
Enter the PID proportional gain value. This value is used to set KW limiter control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 0.5%.
Integral Gain dflt = 2.2 (0.001, 50)
Enter the PID integral gain value, in repeats-per- second (rps). This value is used to set KW Limiter control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 2.2 rps.

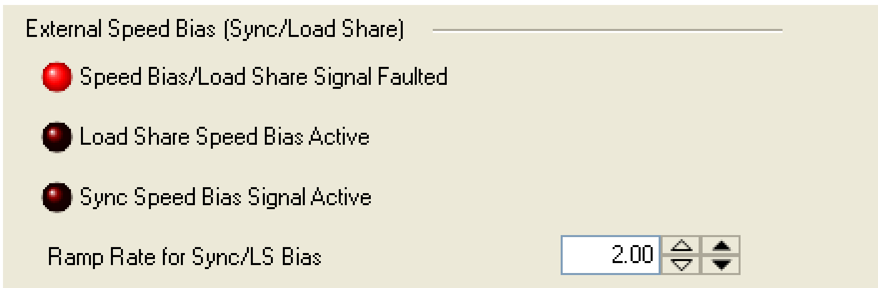
Derivative Ratio **dflt = 5.0 (0.01, 100)**

Enter the PID derivative ratio. This value is used to set KW Limiter control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 5%.

Threshold Value **dflt = 10 (0.0, 100)**

If a threshold value is entered, the PID will remain completely out of the way of the valve demand (-1 or 101%) until the KW signal gets within the setpoint plus this value – for this control the input to the PID is normalized, thus 10 equals a value 10% away from the setpoint.

If an external speed bias (for sync and also load sharing) is programmed then the following options will appear.



Status LEDs — of the Signal fault status, and whether or not the signal is actively being used for synchronization or load sharing.

Ramp Rate for Sync/LS Bias **dflt = 2 (0.0, 10)**

This is the rpm/s rate at which the speed reference setpoint will adjust at when the speed bias input is actively being used to synchronize the turbine.

Service – Page 9 – Turbine Analog Inputs

This page provides a summary status of the validated Analog Input Channels 1–8. It shows the configured usage, fault status and validated current input (in mA) of each channel. A tunable string is available for each input for the user to enter a device name label. A navigation button to take the user to details of each channel is available on this page.

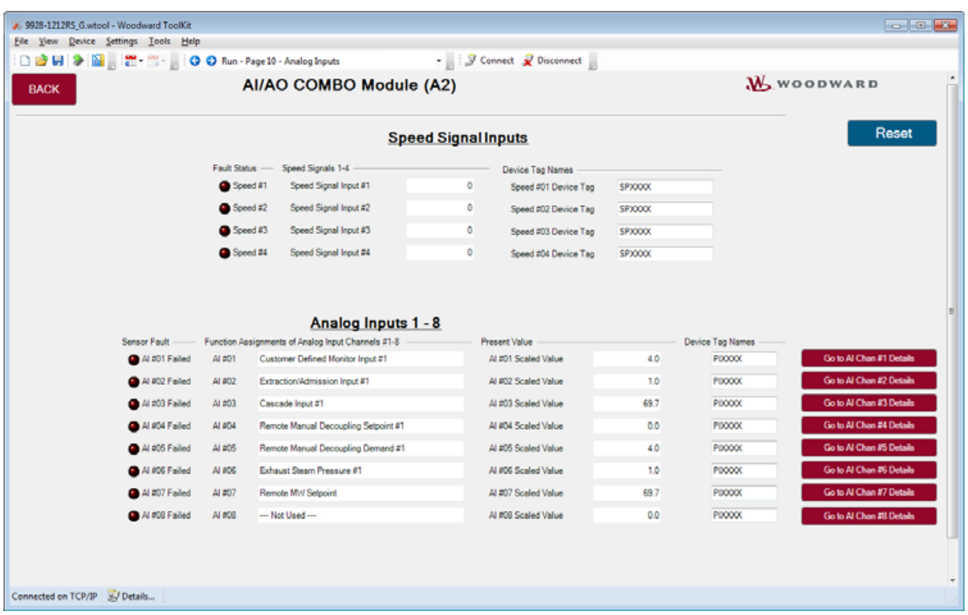


Figure 4-9. Service Analog Summary

On the AI details page the user selects the desired channel from the pull-down selection box at the top.

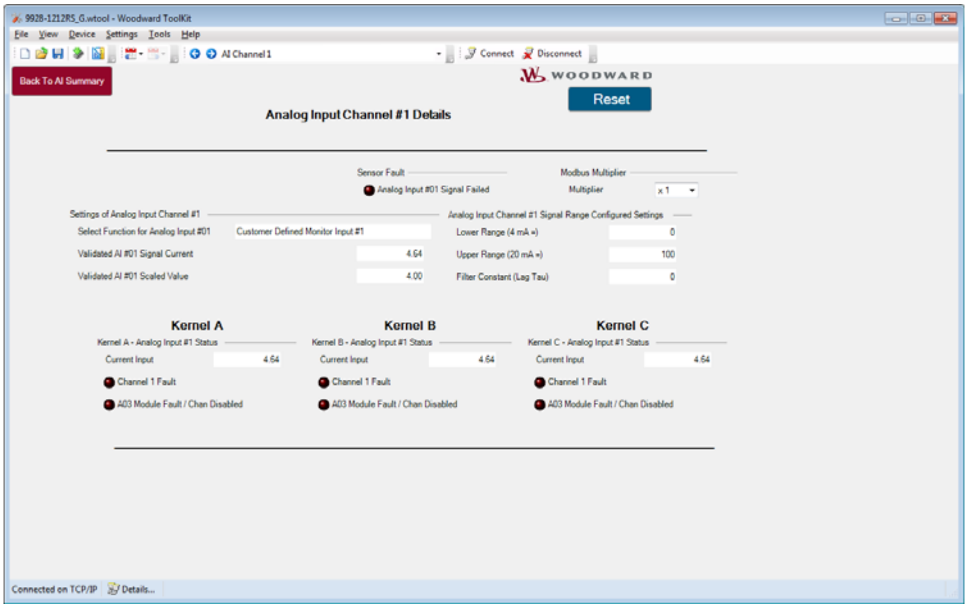


Figure 4-10. Service Analog Input Details

From this page the individual kernel signals and faults can be seen.

The navigation blocks at the top can take the user back to the desired AI summary page – each one slightly different depending on the mode selected.

Service – Page 10 – Analog Outputs

This page provides a summary status of the validated Analog Output Channels 1–4. It shows the configured usage, fault status and validated current output (in mA) of each channel. A tunable string is available for each input for the user to enter a device name label. A navigation button to take the user to details of each channel is available on this page.

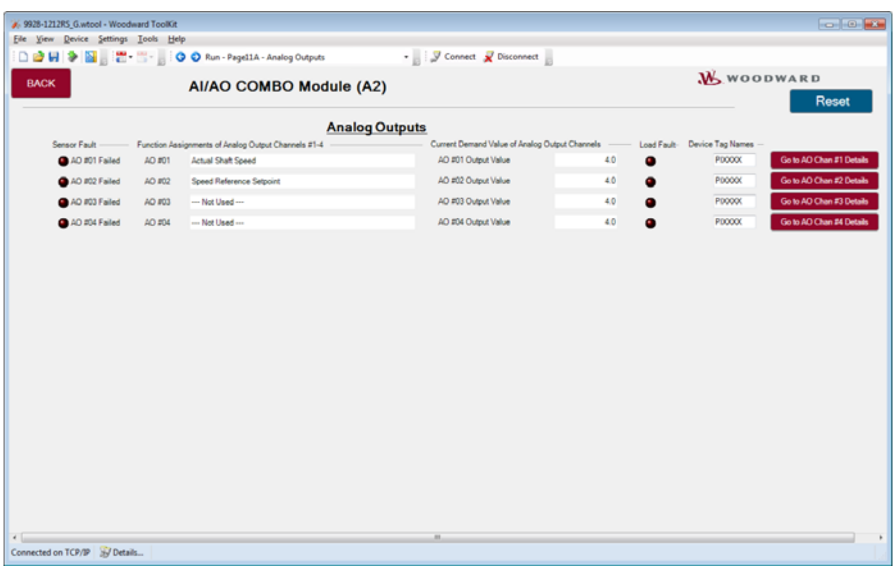


Figure 4-11. Service Analog Output Summary

On the details page, each channel can be calibrated to set the min/max currents equal to the desired engineering units range for the selected signal.

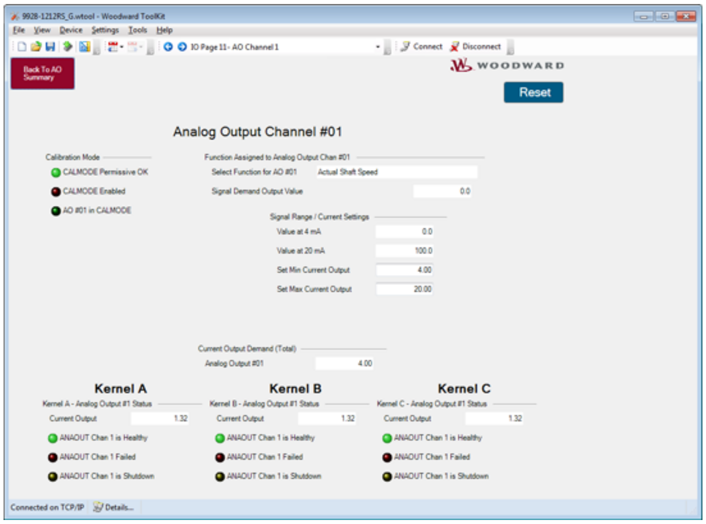


Figure 4-12. Service Analog Output Details

To calibrate the output channel:

1) Place the control into Calibration mode.
2) Click on the button to place the AO channel in calibrate mode
3) Set the desired range of the output with the Value at 4 mA and Value at 20 mA settings.
4) The Hold buttons will hold the output of the control at the Min/Max currents which will correspond with the tunable values shown.
5) If needed the min and max current output can be adjusted.

Service – Page 11 – Turbine Binary Inputs

This page provides a summary status of the validated Binary (Contact) Input Channels. It shows the configured usage and validated input status of each channel.

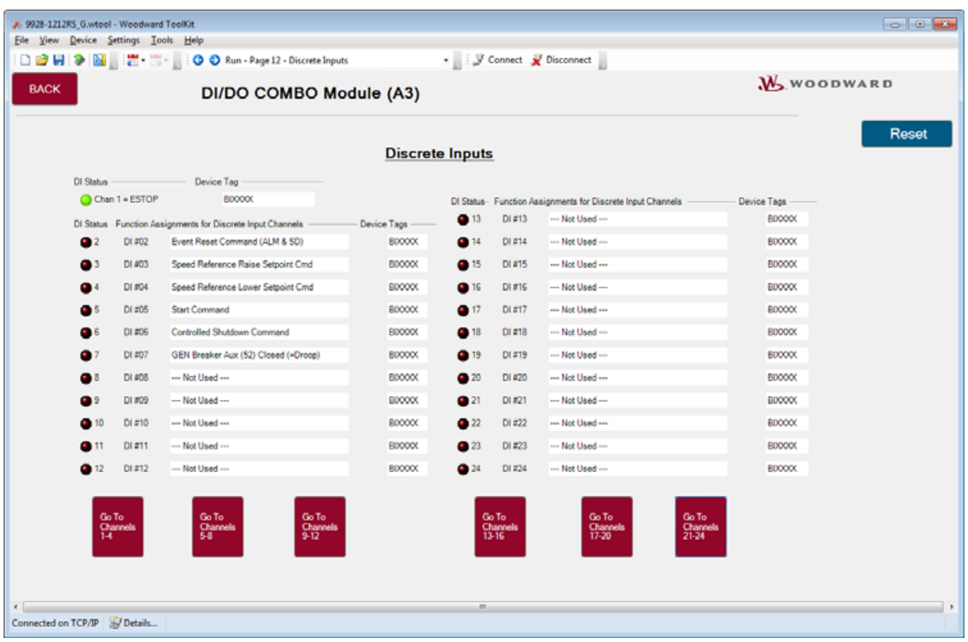


Figure 4-13. Service Discrete Input Summary

Service – Page 12 – Turbine Binary (Relay) Outputs

This page provides a summary status of the 12 relay output channels.
It shows the configured usage and validated output status of each relay channel. Navigation buttons exist to take the user to the details of each channel.

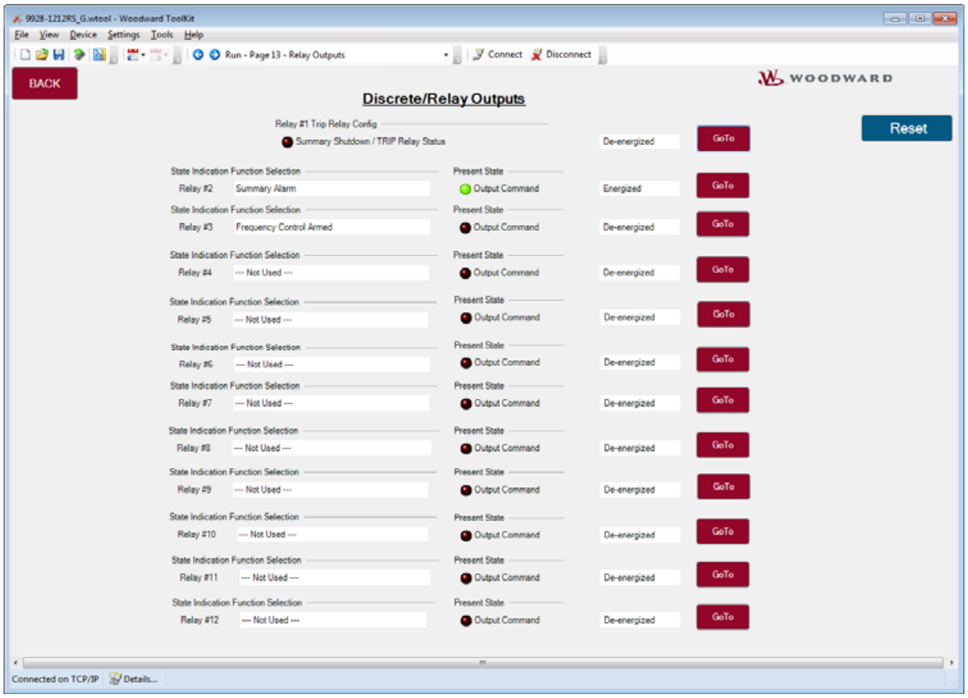


Figure 4-14. Service Relay Output Summary

This page is identical to the Configuration Mode view of the Relay Outputs. For information on options available on the channel details pages, refer to the Configuration mode section.

This page also allows the user to navigate to a Channel details page, where details on the signal from each kernel can be monitored. It also gives a health status message of the fault tolerant relay with LEDs to identify all possible faults. If this channel has sufficient load resistance and the jumpers on this channel are configured for latent fault detection, then faults can be detected while the fault tolerant relay maintains the correct output command. From this page, it can be activated by buttons to enable or disable this function and to manually perform a fault test.

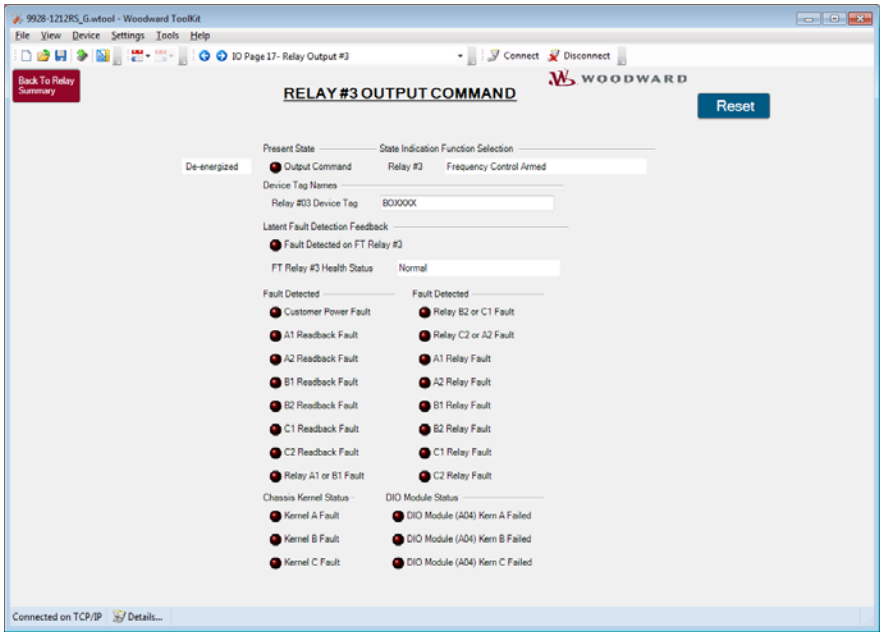


Figure 4-15. Discrete Relay Output Channel Detail

On relay Channel #1, there is also a user option for setting the Test Frequency for the control to check each relay, if latent fault detection is available. It is defaulted to 48 hours. NOTE: During this test you will hear each of the 6 relays for a single FT relay output change state as the control executes its test.

Service – Page 13 – Turbine Drivers & Valves

This page provides service access to the actuator outputs available in the system. If the actuator controller module is not included in the system, then the Integrating Actuator output info will not be shown.

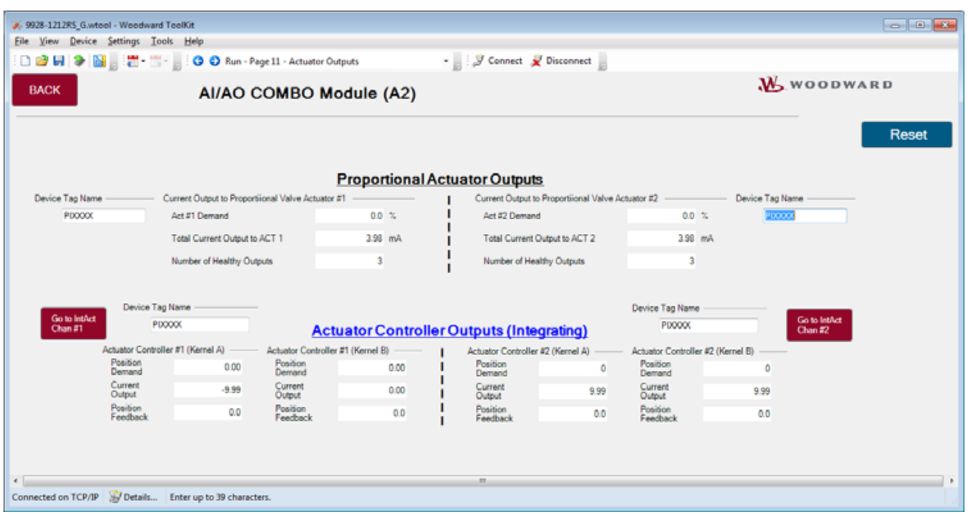


Figure 4-16. Service Actuator Outputs Summary

Using the navigation buttons the user can go to each individual integrating actuator channel if configured.

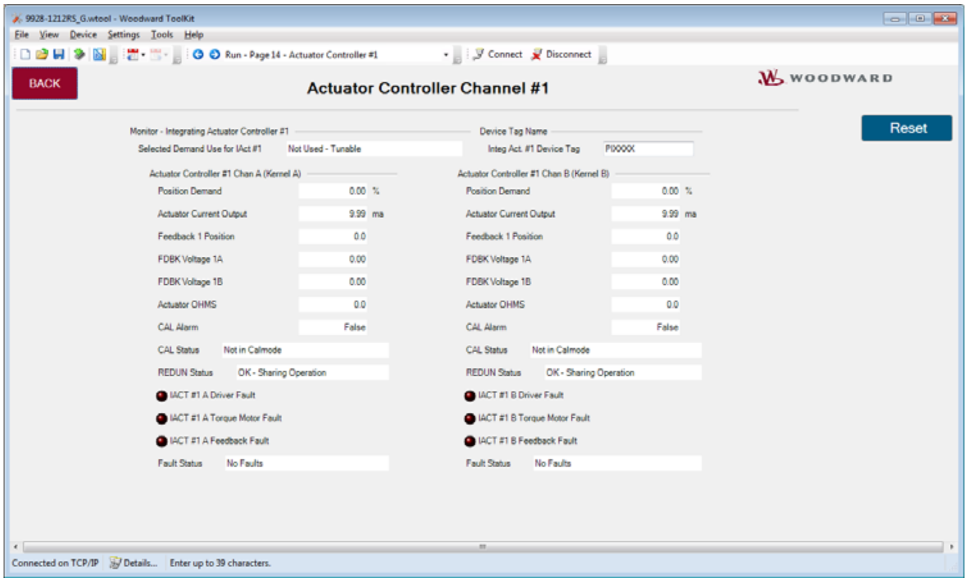


Figure 4-17. Service Integrating Actuator Channel 1

Chapter 5.
RUN Mode Settings

Overview

Once the unit has been configured – the run mode screens give the user access to operational run screens. The run mode is for qualified personnel to start/stop the turbine, enable/disable functions, raise/lower setpoints, view hardware signals, and access alarm & shutdown information. These pages are useful in the initial commissioning of the unit, but can also be used at any time to operate the turbine, thus providing a backup to any HMI device that may be used as the primary operational interface.

The run mode starts with a MAIN Menu screen that allows simple navigation to the various functional based pages. It is recommended to use the navigation buttons (rather than the pull-down or forward/back buttons on the toolkit task bar) to move around through the run mode. The HOME Menu button will always return you to this screen.

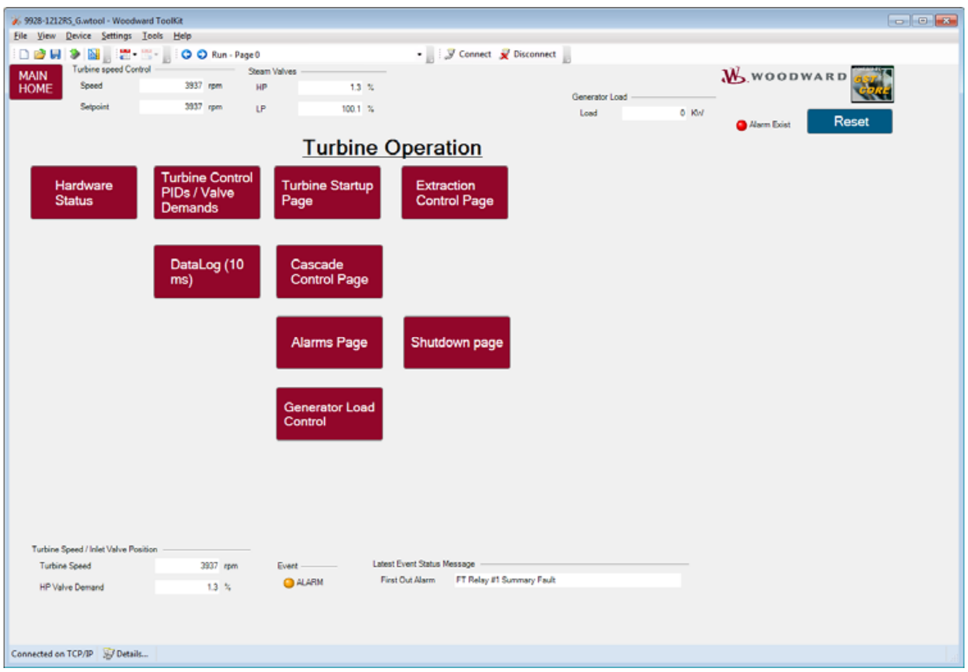


Figure 5-1. RUN Main Menu

Run – Hardware Status

This page shows the current value of each channel of the first 2 I/O modules, which includes speed, analog inputs & outputs (in mA), and discrete input and output states. It also shows the status of the CPUs and power supplies.

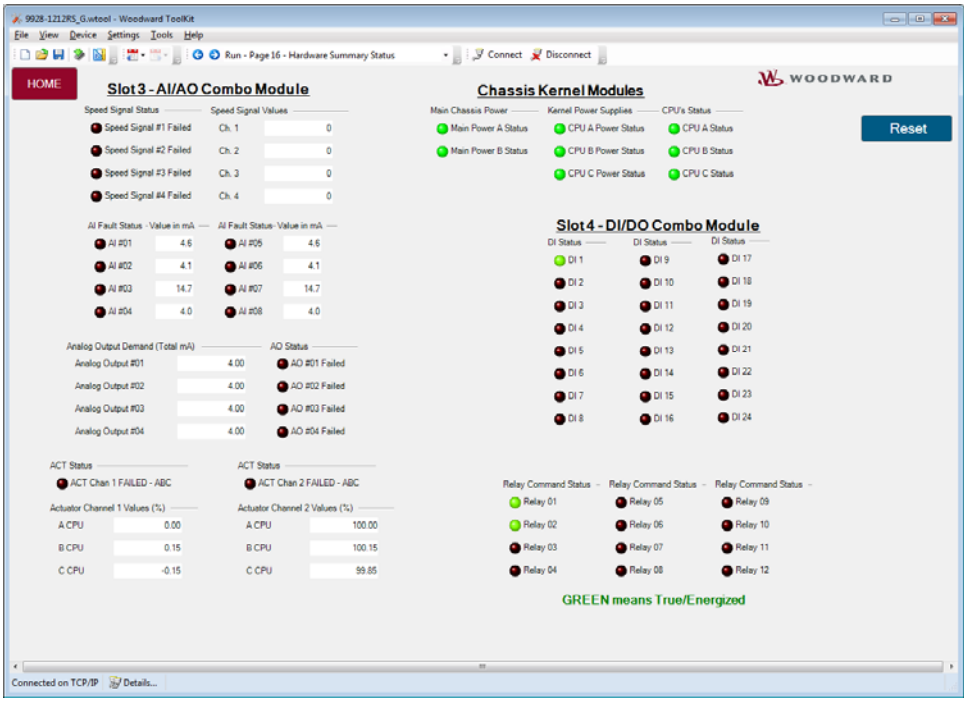


Figure 5-2. Hardware Status

Run – General Overview Turbine Startup Page

This page is intended to be the primary operator interface screen for turbine operation. Once the unit has been configured and tuned and is ready for plant operation, this screen will provide a good overview of turbine operation. The view of this page changes based upon configuration options and where the turbine is in the start-up sequence.

Example—Unit Shutdown Condition

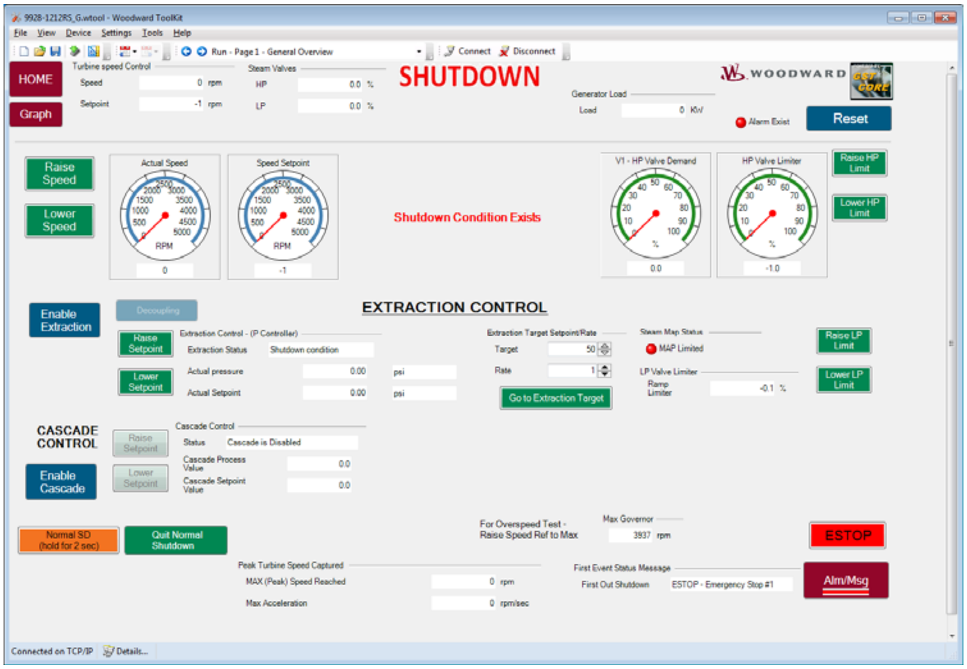


Figure 5-3. Start/Run Shutdown State

Reset Button

Clicking on, or selecting, the Reset button issues a reset command to the 5009FT control. This is identical to the Contact closure or the Modbus run command. This command will reset both alarms and trips, and if all start permissives are met, ready the turbine for the configured start procedure. This command will not start the turbine.

Example—Unit Ready to Start

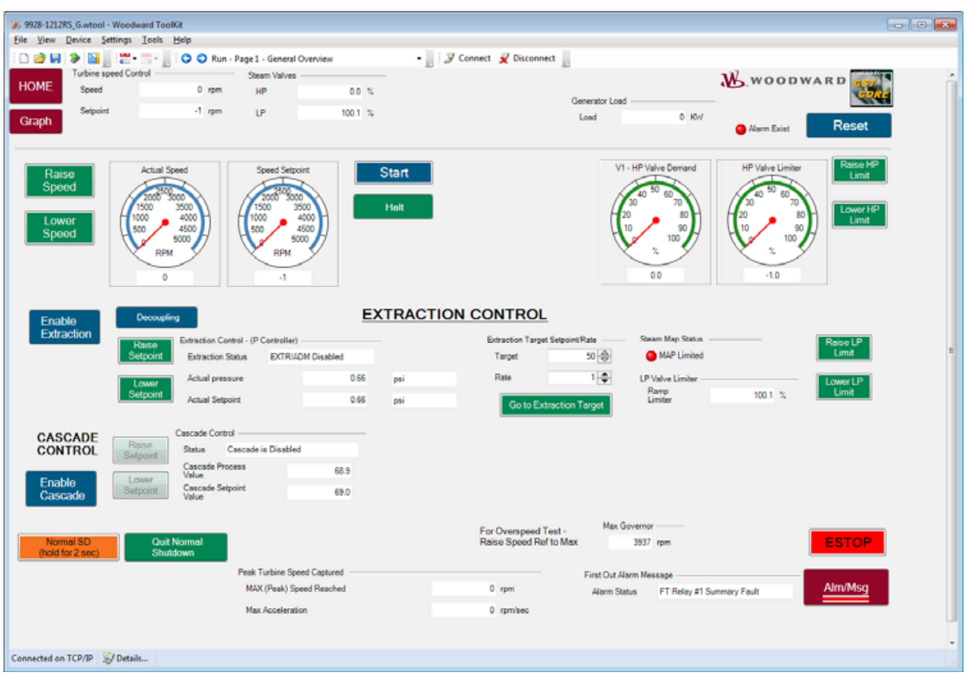


Figure 5-4. Start/Run Ready to Start

Start /Run Turbine Features

The Start Turbine tab is used primarily to bring the turbine up to rated speed. The Speed input, Speed setpoint and HP (and LP if used) Valve position demands are always displayed in the top banner of each Run page. At the bottom of each RUN page are Status messages, and ESTOP button (with a second required user confirmation) and a navigation button to the Alarm summary page. Graph button allows to show dynamic startup curve.

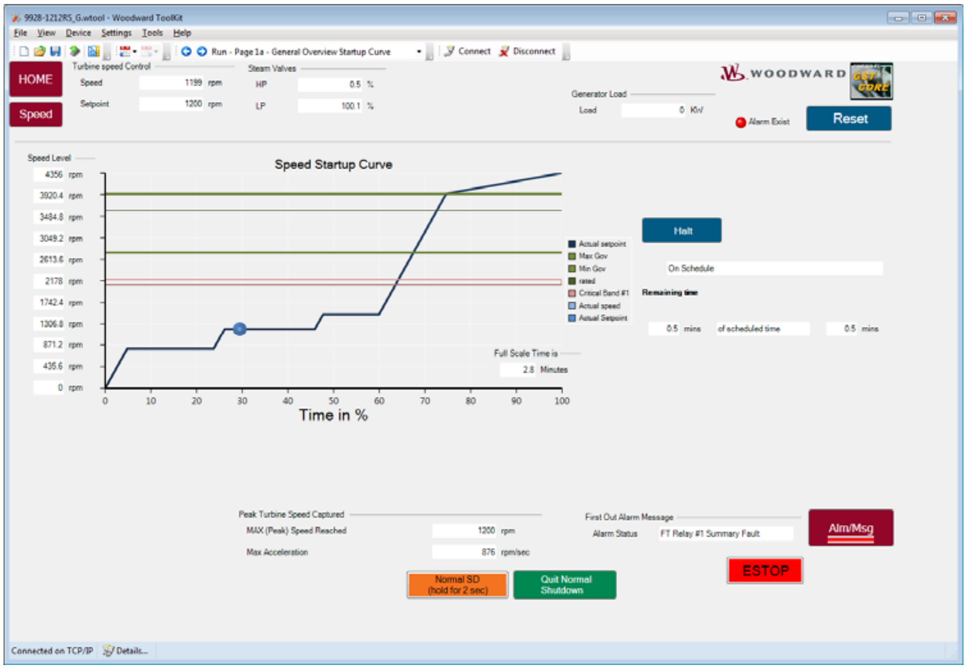


Figure 5-5. Dynamic Startup Curve

Start Button

Clicking, or selecting, the Start button is used to issue a start command to the 5009FT control. This command is identical to the Contact input or the Modbus RUN commands. This command will initiate the configured start procedure. All start permissives must be met before the start command is accepted.

The start Push button can also be used, when the HP ramp has been manually moved, using R/L HP ramp commands.

If the engine is configured for automatic start, then pressing the start push button, while engine is running, will automatically initiate an automatic raise of the HP ramp limiter.

The 5009FT control will attempt to control the turbine such that the Speed input matches the Speed Setpoint. The Speed Setpoint can be manually changed by pressing the arrow keys to the right of the Setpoint display box. The status of the Speed controller does not affect whether the setpoint can be adjusted or not.

The rate at which the setpoint can change is set in the Program mode as Loading gradient. The HP Valve Limiter can be manipulated from this screen. The HP Limiter can be raised and lowered by pushing the arrows to the right of the HP Valve Limiter display.

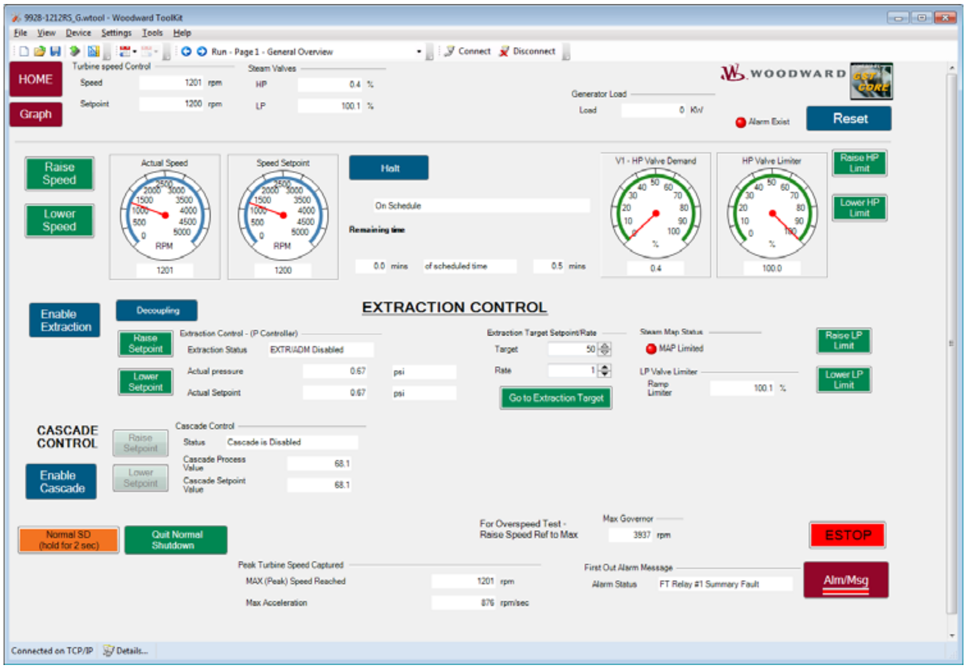


Figure 5-6. Start/Run at High Idle Speed

Continue/Halt Button

Clicking or selecting the Halt button is used to issue a halt command to the 5009FT control. This command is identical to the Contact input or Modbus Continue/Halt commands. This is used to stop the auto start procedure at any moment and to keep the turbine at that place in the start procedure. The Continue button is used in the same way, to reinitiate the auto start procedure from the place that it was halted. The status of the Start Sequence is continually displayed in the Start Seq Status display box in this folder.

After Shutdown, the autostart sequence is automatically disabled.

The operator can only request Continue if the engine is not Tripped.

Raise/Lower HP Valve Limiter Buttons

The Raise/Lower Limiter buttons are used to open the HP Limiter at the HP Valve Limiter in semiautomatic mode, or to limit the HP valve opening.

Rate as configured in the Program Mode of the Start Turbine folder

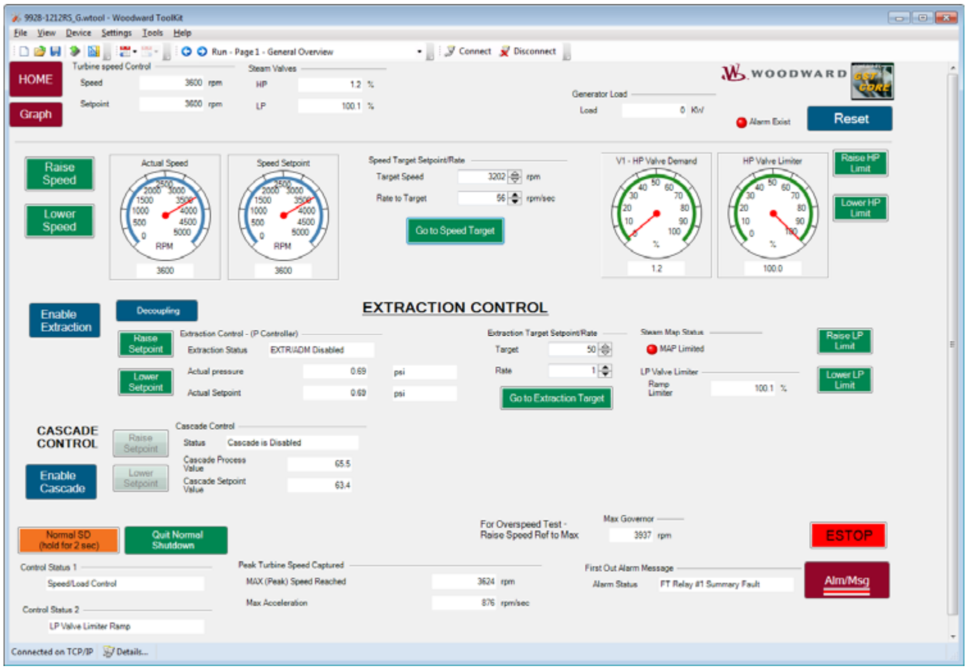


Figure 5-7. Start/Run at Rated Speed (Extraction and Cascade configured)

Speed Target Buttons

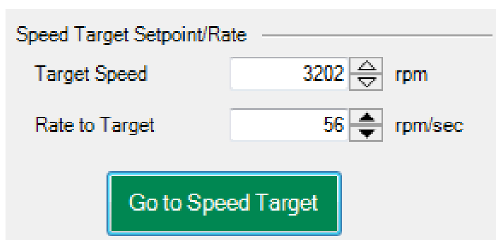


Figure 5-8. Go to Target Speed

It is possible to enter a speed Setpoint via Modbus or CCT software. To be accepted, this target must not set be inside a critical band.

For Modbus and CCT, the target will be accepted only when a “Go to target” is sent. Any new target will also have to receive a “Go to target”. The Target in control is the latest one send from either Modbus#1 or Modbus#2 or CCT.

When a target is sent, the autostart sequence is automatically halted.

If ”continue” is re-selected via contact input, Modbus, or CCT, then the Target is disabled. The rate at which the target will move the setpoint will be the value entered by the user in the ‘Rate to Target’ field.

Other options, such as Extraction Control, Remote Speed Setpoint, Cascade control, and Auxiliary control will appear on this run screen if they are configured to be used.

Features available on Turbine Start/Run Page:

Normal (Controlled) Shutdown

The Normal SD button allows a user to stop the turbine in a controlled manner. The 5009FT control can be configured to ramp all controlling parameters down to a controlled turbine stop. The CCT command to the 5009FT control requires a 2 second momentary signal to initiate the controlled shutdown. This will ensure that the operator truly wants to shutdown and avoid any brief signal from the touch screen. This delay is NOT included from the Modbus or discrete input commands that also initiate a normal shutdown. If at any time during the controlled shutdown the operator wishes to discontinue the shutdown, the Quit Normal Shutdown button will return the turbine to a run mode.

Depending on the configuration, the normal SD, when completed, will

- Trip the turbine
- Let the turbine reset (ready to start), and
- Bring the setpoint at low Idle, and switch the control to manual commands.

Overspeed Test Functionality

The control's Overspeed Test function allows an operator to periodically increase turbine speed above its rated operating range to test the turbine's electrical and/or mechanical overspeed protection devices, logic, and circuitry.

An internal or external overspeed test can be performed from this page. The turbine must be in speed control, and all decoupling control functions must be disabled.

Clicking the Quit Test button at any time will cause the speed set point to ramp down to the maximum controllable setpoint. Changing the speed setpoint is done by pushing the arrow buttons to the right of the speed and speed setpoint or by a contact input.

Clicking the Enable 5009 Test button will allow the speed setpoint to be raised to the Overspeed Trip Level as configured in the 5009FT control. Once the speed reaches the electrical overspeed setpoint, the 5009FT will trip the turbine.

Clicking the Enable External Test button will allow the speed setpoint to be raised to the Overspeed Test Limit as configured in the 5009FT control. The mechanical or external overspeed protection of the turbine should trip during this test. The speed of the turbine cannot be increased past the Overspeed Test Limit.

If the speed setpoint is not changed within 60 seconds during either of the tests, the control automatically discontinues the overspeed test. At that time, if the speed of the turbine is above the electrical overspeed setpoint, the turbine will trip. If it is below the electrical trip setpoint, it will ramp down to the maximum controllable setpoint.

A Peak Speed is shown that displays the highest speed the turbine has attained since the Clear Peak Speed button has been selected. While not in a test mode these values can be viewed on the Service Speed Tuning page.

If the turbine is ramped up to Maximum Governor Speed Setpoint, the overspeed test options will appear in the lower left of the page. On Generator applications, the breakers must be in the OPEN position.

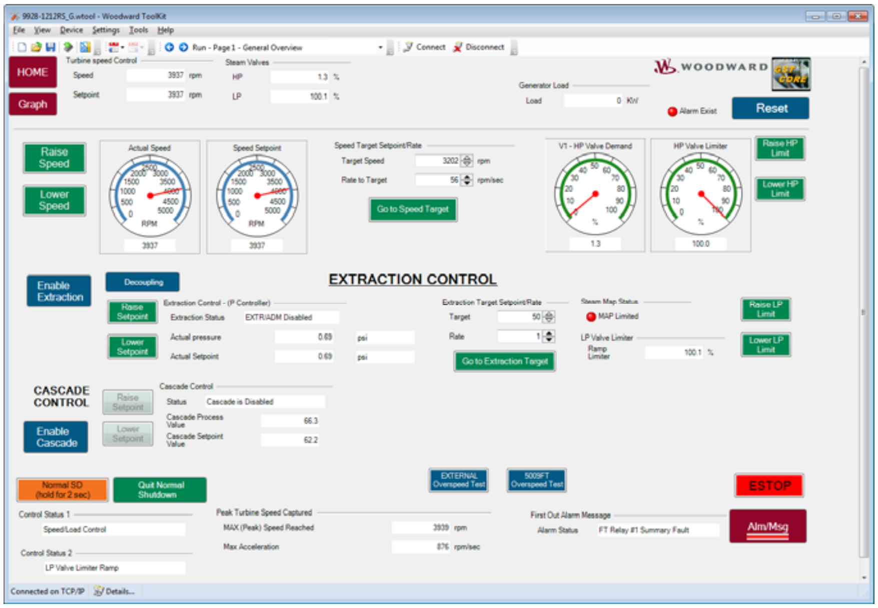


Figure 5-9. At Max Governor Speed

The following screen will appear. The Text will indicate which Overspeed is being tested (Internal or External). In both cases the test will be aborted (& the speed setpoint returned to Max Gov speed) if no raise or lower command is received by the control for 60 seconds. This is to ensure that the control is never left in this state unattended.

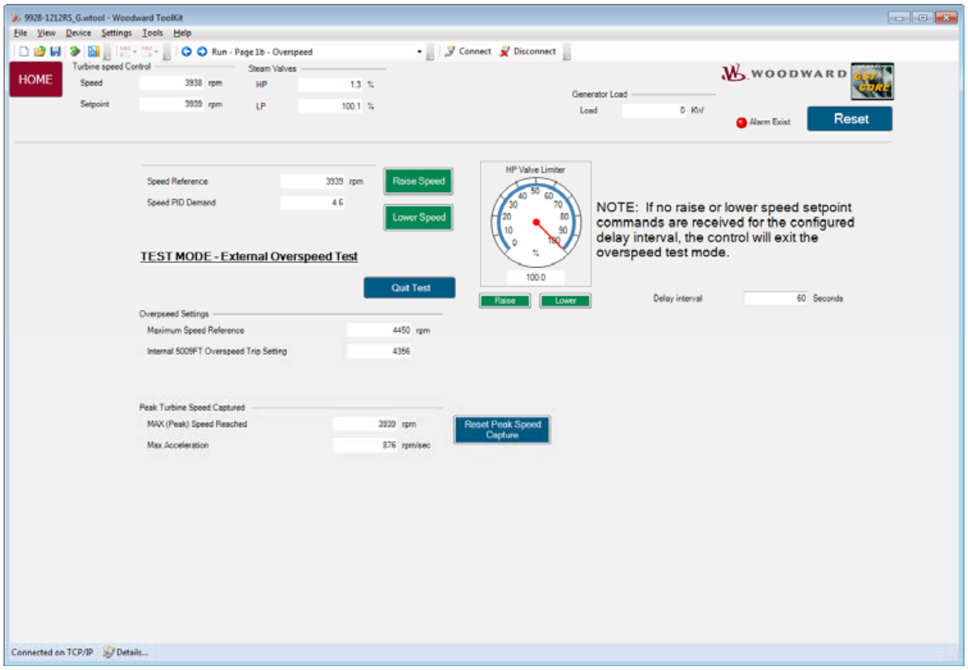


Figure 5-10. External Overspeed test

If the Internal 5009FT overspeed test is being done – the control will trip at the overspeed setpoint shown. If an External Overspeed trip is being tested – then the 5009FT will initiate an alarm at this point, but not a shutdown. If the turbine speed reaches the Maximum Speed Reference setpoint, the 5009FT will initiate a Trip.

Note: the box "OSPD level active" indicates if the internal overspeed level is used or not.

Run – Turbine Control PIDs / Valve Demands

This page is intended to help explain the calculation of the HP and LP Valve demands based upon the PID's steam map constants and the valve limiters. It is helpful for troubleshooting and understanding the components that determine output valve demands.

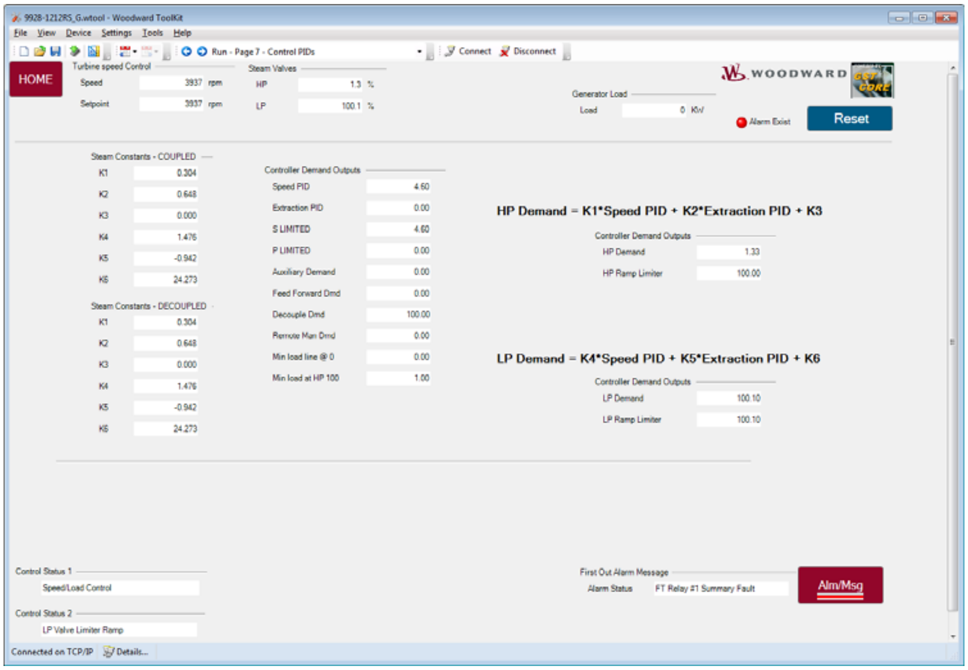


Figure 5-11. PID/Valve Demand Calculations

Run – Extraction/Admission Control

This page is designed to give a more detailed view of the Extraction control. It allows enabling/disabling of extraction, raise/lowering of the setpoint or LP valve limiter ramp, a "Go to Target" setpoint adjustment and the ability to place the LP valve in Manual mode. Manual mode will allow the user to manually raise and lower the LP valve position.

Views of your page may differ slightly from what is shown below due to options and configuration items used.

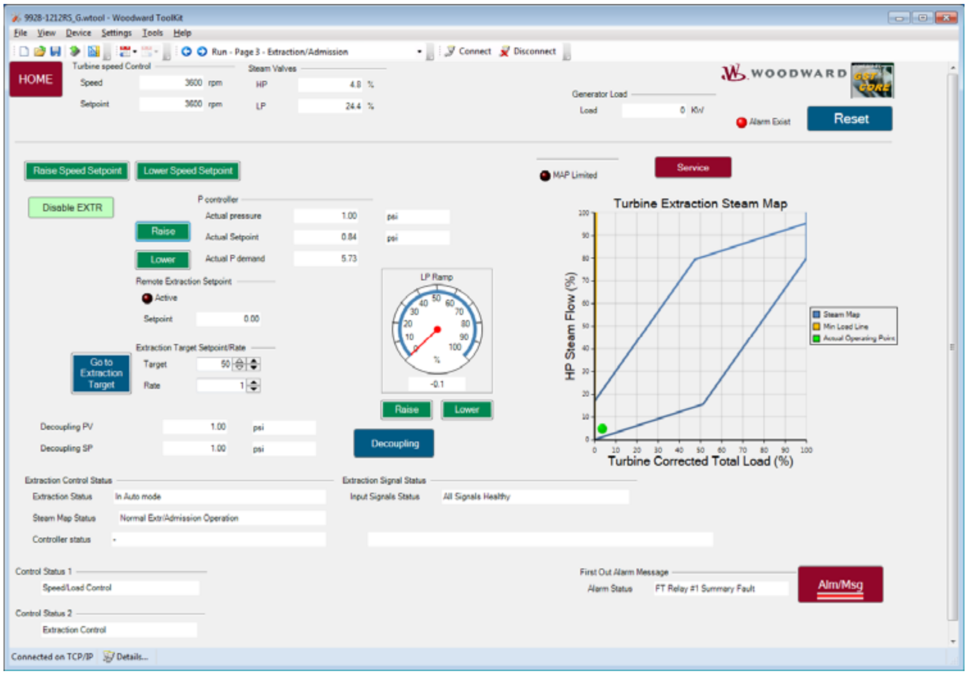


Figure 5-12. Extraction/Admission Control

Run – Cascade Control

If cascade is configured for use, this page is designed to give a more detailed view of the controller and all operational options available.
Cascade control can be enabled/disabled, the setpoint can be raised or lowered or the user can enter a Target Setpoint (this is an integer number so it can be directing entered into the field) and press Go to Target. The cascade will move the setpoint to the target at the user defined rate.

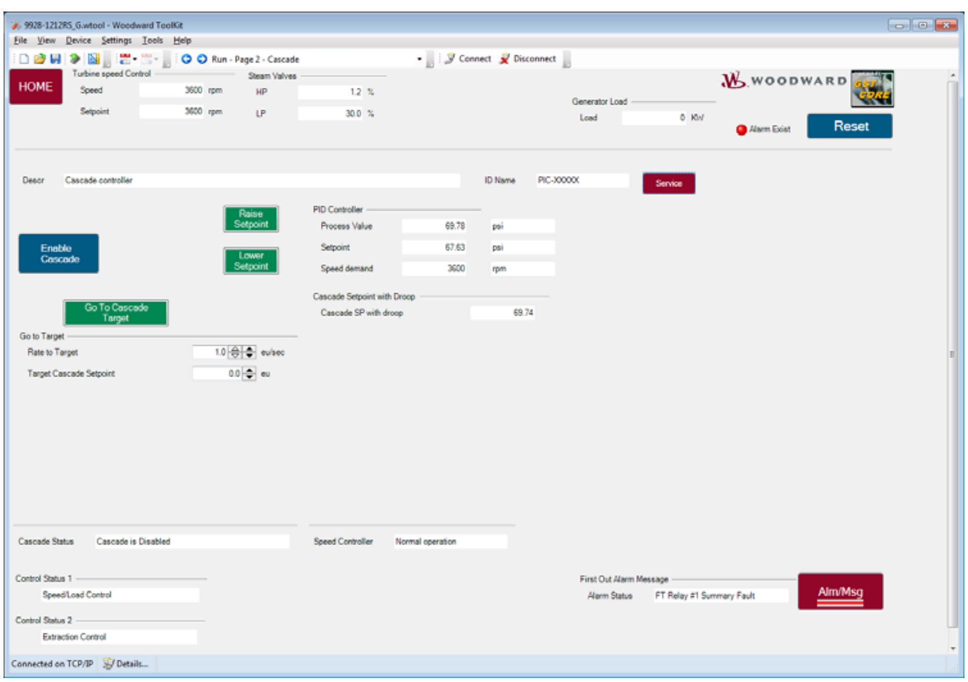


Figure 5-13. RUN Cascade Control

Run – Auxiliary Control

If Auxiliary control is configured for use, this page is designed to give a more detailed view of the controller and all operational options available.
This function can be configured as a process controller or a limiter. Auxiliary control can be enabled/disabled while if it is configured as a limiter it is always active. The setpoint can be raised or lowered or the user can enter a Target Setpoint (this is an integer number so it can be directing entered into the field) and press Go to Target.

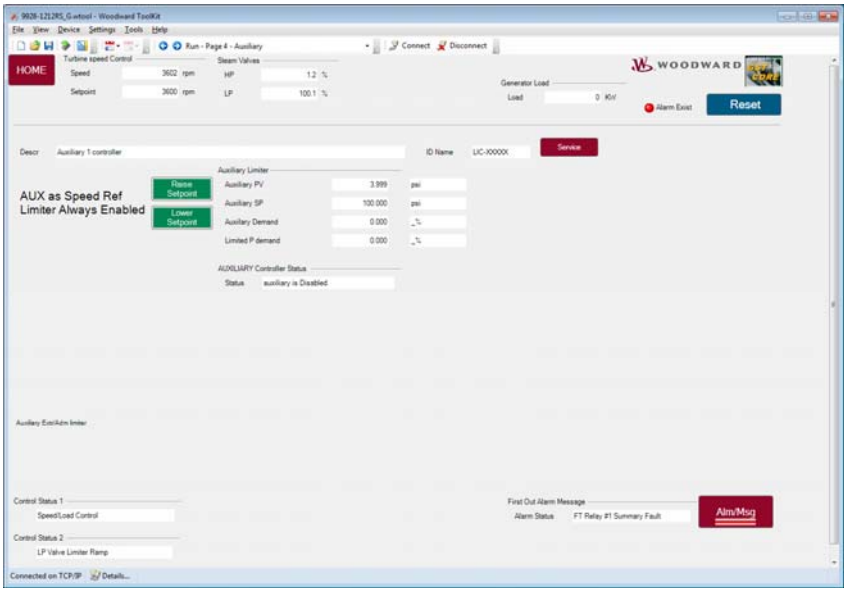


Figure 5-14. RUN Auxiliary Limiter Control

If it is configured as a controller.

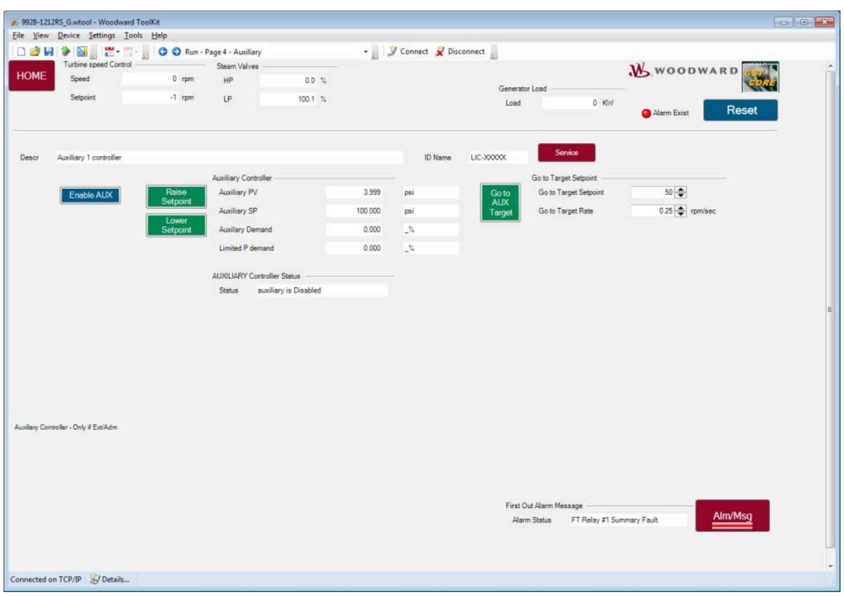


Figure 5-15. RUN Auxiliary Controller Control

Run – Generator Load Control

This page is intended to be the primary operator interface screen for turbine operation of generator drive units. Once the unit has been configured and tuned and is ready for plant operation, this screen will provide a good overview of turbine operation. The view of this page changes based upon configuration options and where the turbine is in the start-up sequence.

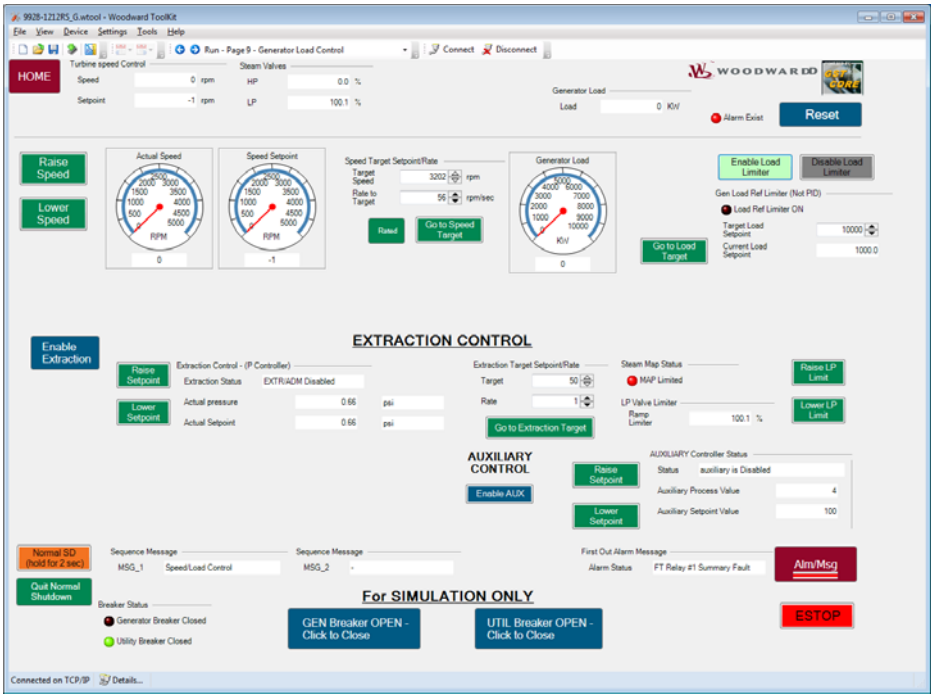


Figure 5-16. Extraction Turbine w/ AUX limiter (Generator)

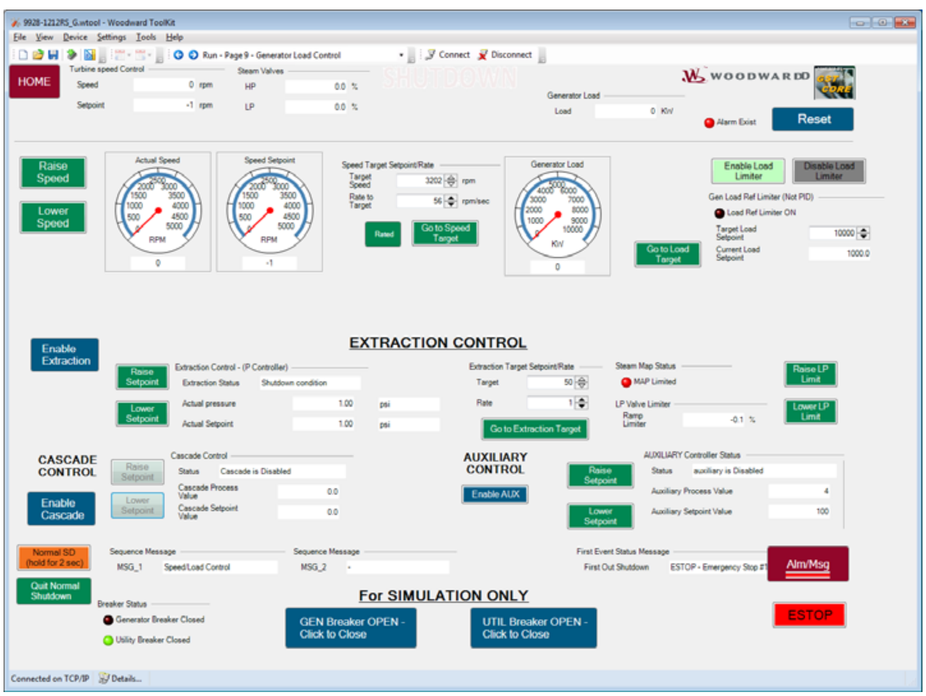


Figure 5-17. Extraction Turbine w/ CASC Controller (Generator)

Run – Seal Gas Control

If the optional Seal Gas control is configured for use, a navigate button to this page will be available. It will take the user to the Service page for the Seal Gas Control.

Run – Alarm Event Summary & Shutdown Event Summary

These pages show the time-stamped alarm and shutdown events that are present in the system. The time-stamp is from the 5009FT real time clock for all events, except those triggered by discrete inputs. All external alarm and trip inputs receive a 1 ms time-stamp from the discrete input module, which is carried through to these Event lists (meaning that 1 ms resolution of these events can be seen by the user).

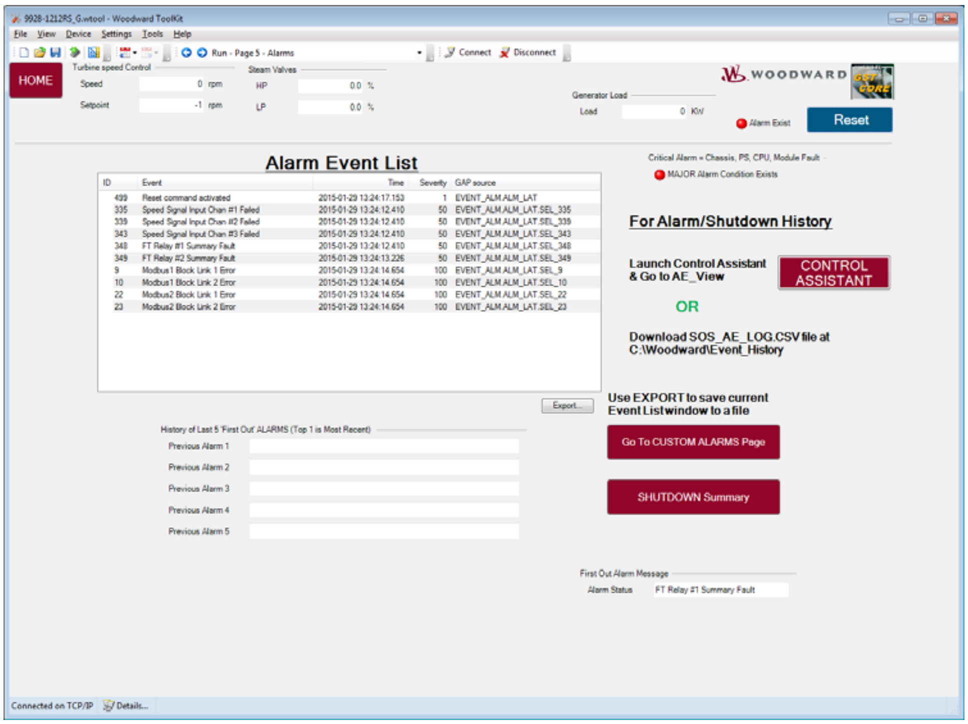


Figure 5-18. Alarm Summary Page

This page also contains the last 5 ‘First Out’ alarms and trips. For example if 3 alarms came in over a short period of time, they would all be listed in order in the Event List box with their respective time-stamps. When a reset is given and all events clear, then the event that was first will drop down into the ‘Previous Alarm/Trip 1’ message. The other 2 alarms will not appear below. If, however, when a reset was given only 2 of the 3 clear and one remained in the active list, that one will not drop down as a previous event.

IMPORTANT	**This Alarm History logic expects the unit to typically run without any existing alarms. If the unit runs for long periods of time with existing alarms in this list, the First Out Previous Alarms will not give the user very useful information. Use the HMI alarm History or the procedures below to obtain a complete list of events.**

EXPORT Button

An export button exists on the event list block that will save the current information in an HTML / web page formatted file. It will open a dialog box and allow the user to name the file and location. If this feature is used, a suggested location is to place it in **C:\Woodward\Event_History** and give the file a name to describe the event (Trip_during_Startup).

Alarm/Shutdown History

For viewing alarm & shutdown history (all events that came in), there are 2 options.

View via Control Assistant

Launch Control Assistant from ToolKit and open New AE View under the 'File' pull-down menu or click on the AE_View icon in the toolbar.
A dialog window such as the one below will show all triggered events in both the alarm and shutdown event latch stacks (Latch_AE block).

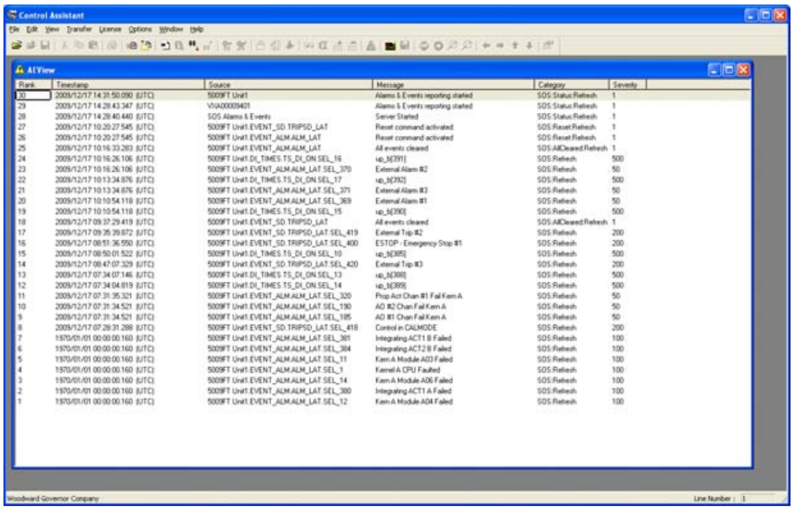


Figure 5-19. AE Event Viewer in Control Assistant

Download a File

The Servlink-to-OPC Server (SOS) program continually writes the annunciation of all events to a .CSV file on the CCT. This file is named SOS_AE_LOG.CSV and is located at **C:\Woodward\Event_History**. This file can be copied at anytime to a USB memory device and opened in Microsoft Excel.

Run – Datalog Captures / Set Real-Time Clock

The control is defaulted to continually log specific variables into a memory file once a Turbine Start/Run command is issued. Upon a Trip the control will create a file of this data on the CPU hard-drive. This data is logged at 10 ms intervals and will retain about four minutes worth of run-time, thus it is intended for high resolution views of specific events (such as a breaker trip, load transient, PID tuning……). It is not intended to be a historical trend of parameters.

This page gives the user the ability to trigger the starting & stopping of Datalogs so that log files of events that do not trip the turbine can be acquired.

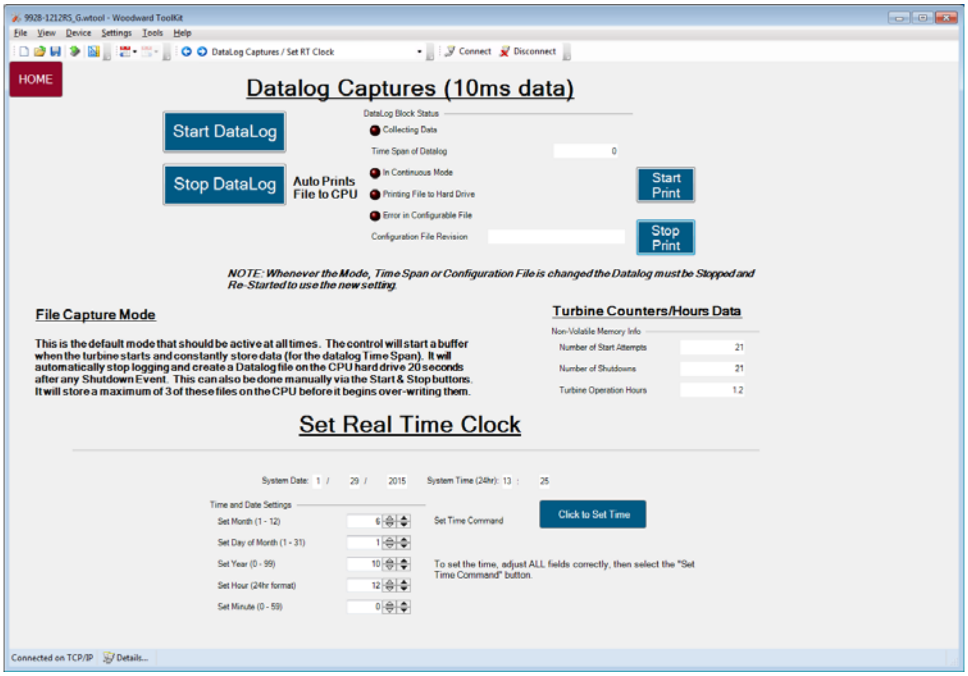


Figure 5-20. Datalog & Real Time Clock Setting

The page also allows the user to set the correct time for the real time clock.

Control Time Synchronization

If time needs to be accurately synchronized with other devices in the plant – the control supports using SNTP (Simple Network Time Protocol) via a LAN network. Refer to the AppManager program help in enabling this feature. It must be done with the turbine shutdown and the 5009FT control application needs to be stopped, since the control CPUs will need to initially synchronize with the network signal. The 5009FT will need to be configured with IP addresses on your local network, and you will also need the IP address of the SNTP server.

Chapter 6.
Troubleshooting

Lost CCT Servlink Communications with Control

If upon leaving the configuration mode, the control does not re-establish communications with the CPU (or if a kernel fault is detected when communications do re-establish), do the following.

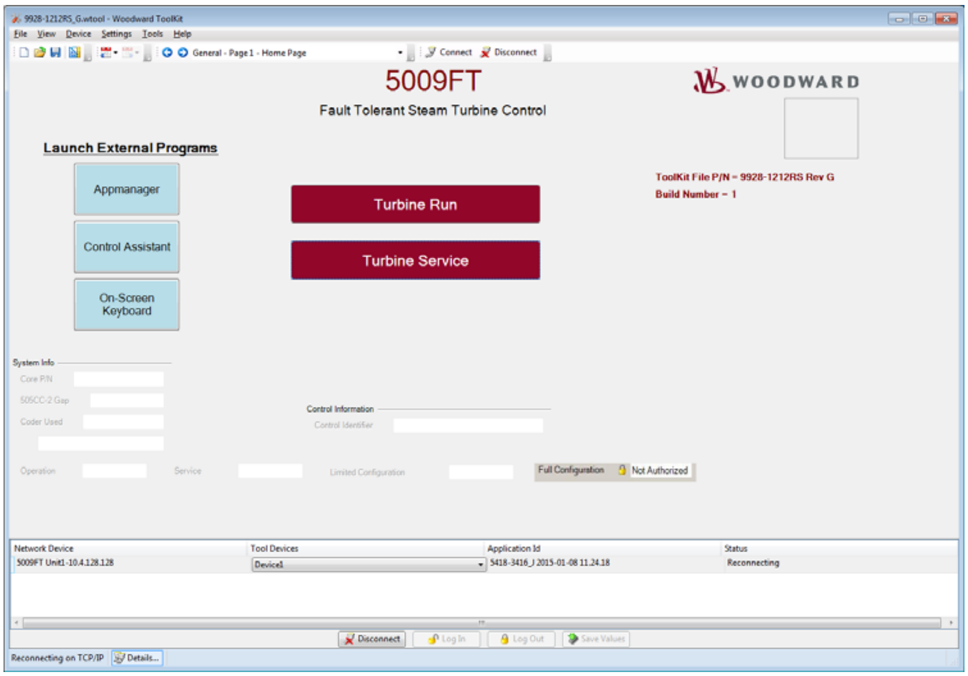


Figure 6-1. Connect/Disconnect to Control

Launch AppManager – and view the CPUs under the 5009FT grouping.

Highlighting the group should show the application as Inactive. This means that as the 3 CPUs rebooted and initialized upon releasing IO Lock, 1 of them did not correctly synchronize with the other 2.

Select each CPU to view whether the application is RUNNING or INACTIVE. Find the 1 that is INACTIVE – select the application and click on Stop Application. Once its status is STOPPED then it can be selected and the Start Application button pressed.

The kernel will re-initialize and will synchronize with the other 2 kernels. If this was the kernel communicating to Toolkit – go to the toolkit main page and click on DISCONNECT – then click on CONNECT to re-establish communications.

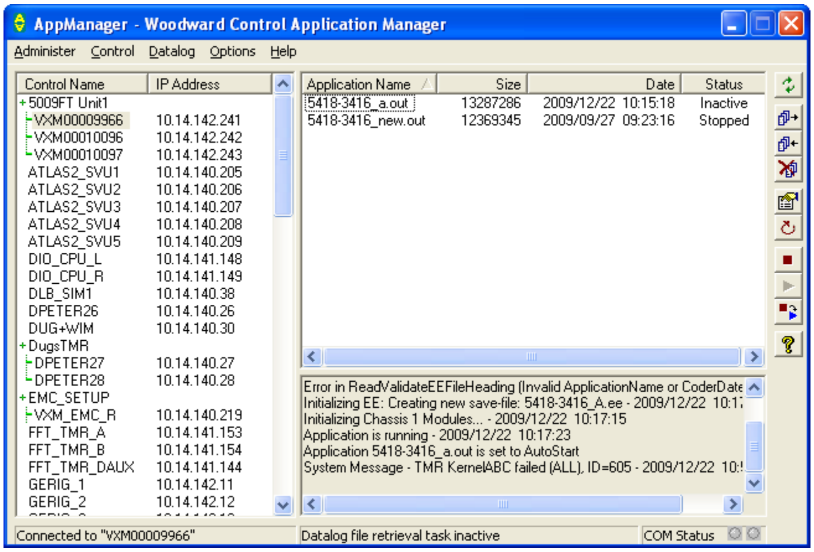


Figure 6-2. AppManager

Saving the Control's Configuration to a File

At any time the ToolKit program is open and communicating with the control, the control's configuration can be saved to a configuration file on the CCT computer.
To save the control's configuration settings to a file:

1. Select the "**Save from device to file**" option from the screen's "**Settings**" menu.

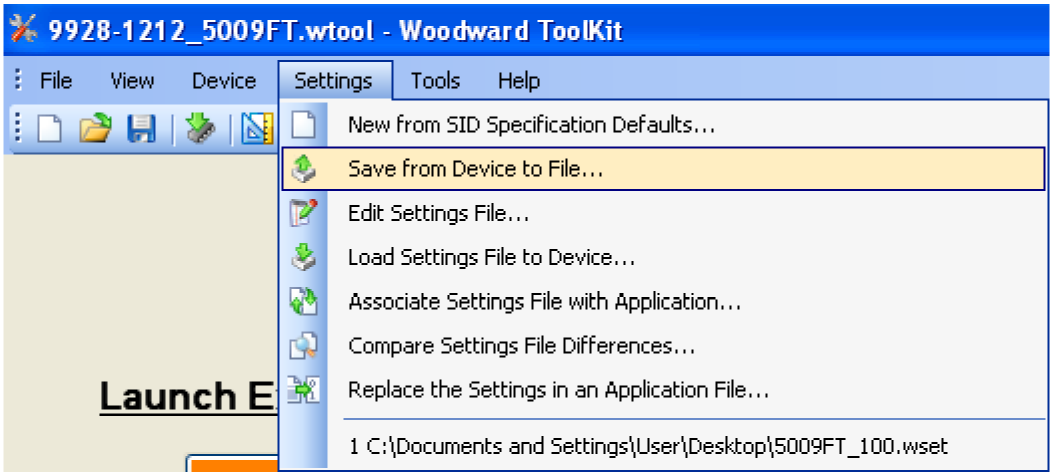


Figure 6-3. Save Settings to File

The following dialog box should appear:

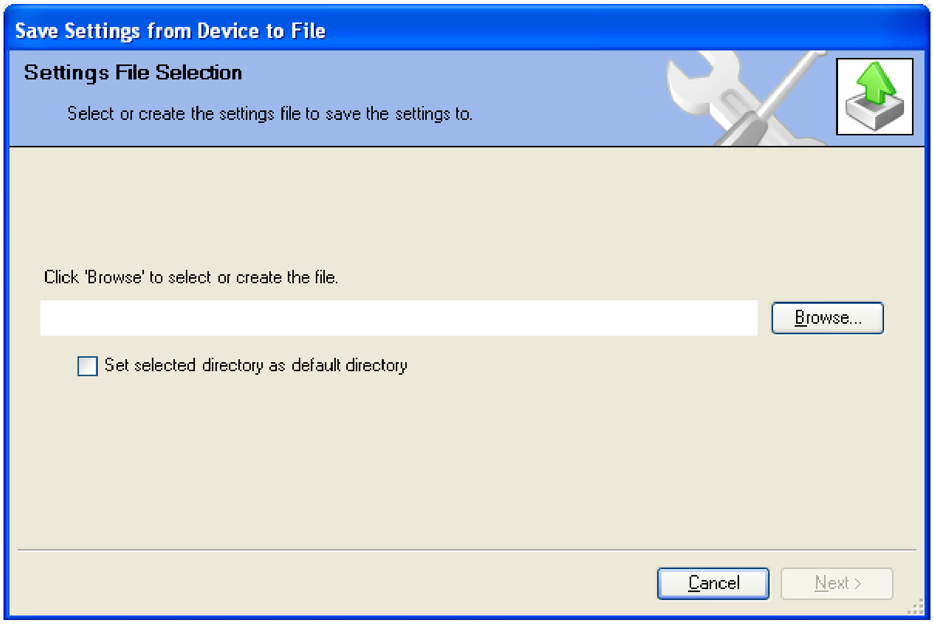


Figure 6-4. Save Settings Folder

2. Clicking “Browse…” will take the user to a screen in which to name the ‘toolkit settings’ file and the folder location in which to save the file. For the “Save in:” folder location, go the “c:\Woodward\ToolKit” folder. For the “File name:”, enter a useful name such as **UnitA_as_commissioned** or **UnitA_as_01Jan2010.** Once completed, select “Save”.

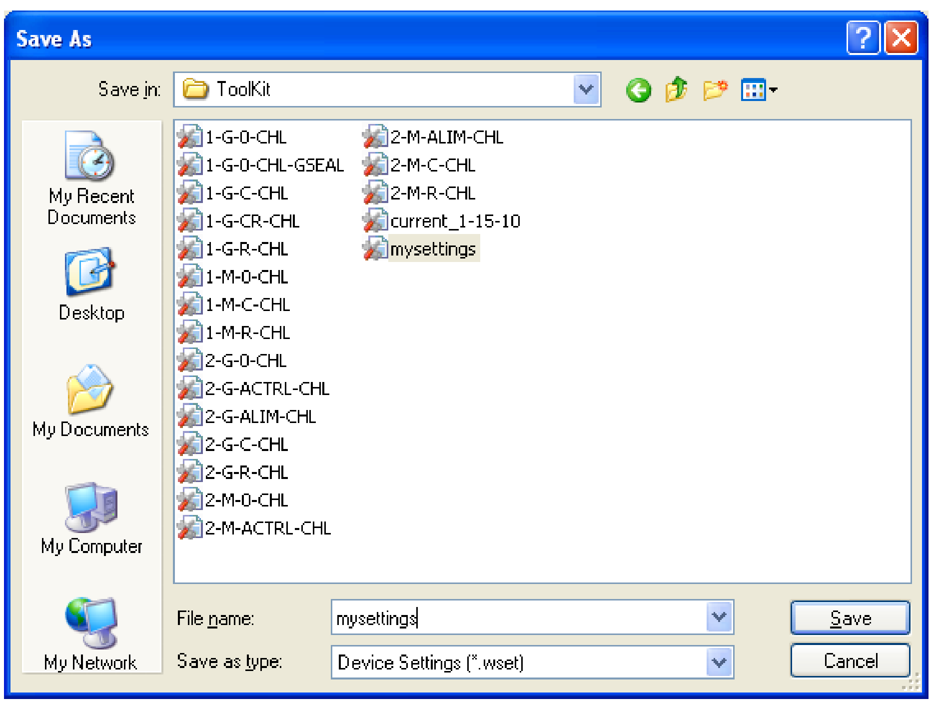


Figure 6-5. Settings File Name

3. In the “Save Settings Selection” dialog box, select the check box for setting the selected directory as the default directory. This will make it easier to find this folder location in the future. Select the Next button when complete.

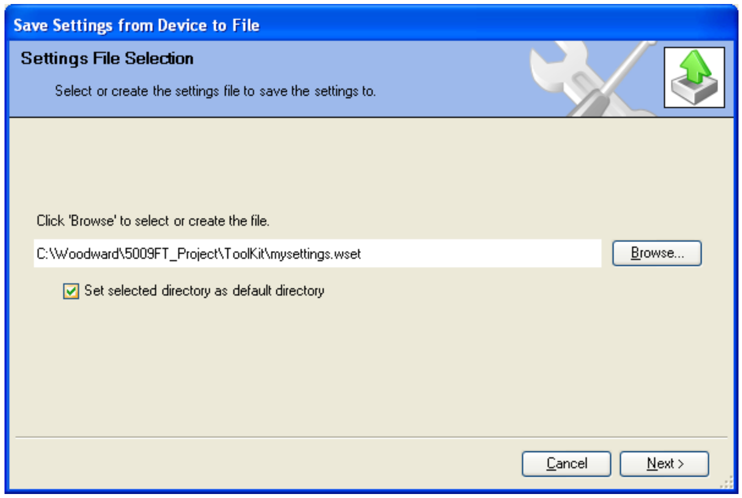


Figure 6-6. Save Settings to File Default Directory

4. The next screen will allow the user to confirm which device to get the settings from. In the case of the 5009FT, it should show only **Dflt Control ID<ip address>** click on Next.

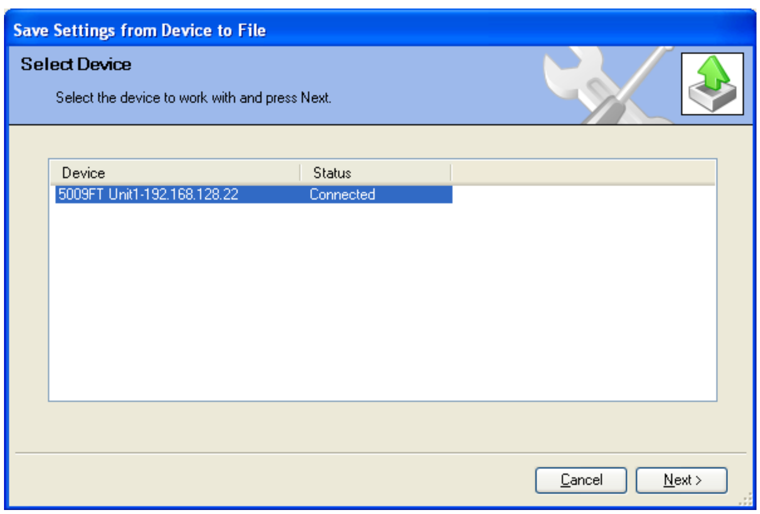


Figure 6-7. Select Device

5. Toolkit will create the file and then open a notes text file that can be used to add information about these settings. Click on Next to get to the Finished screen that will confirm the process is complete.

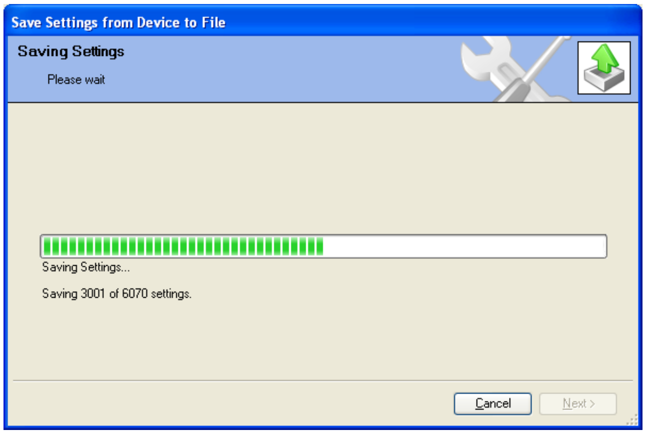


Figure 6-8. Saving to File Progress Bar

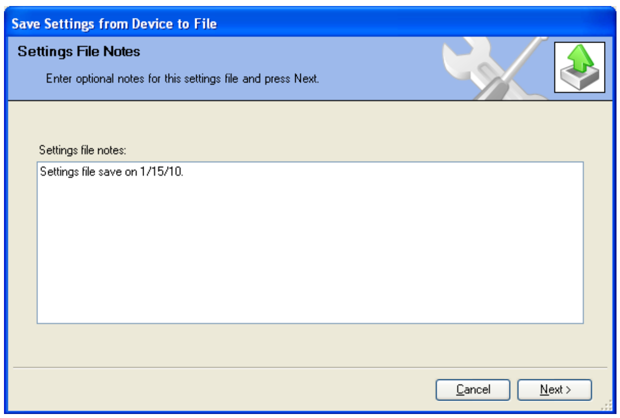


Figure 6-9. Notes for settings file

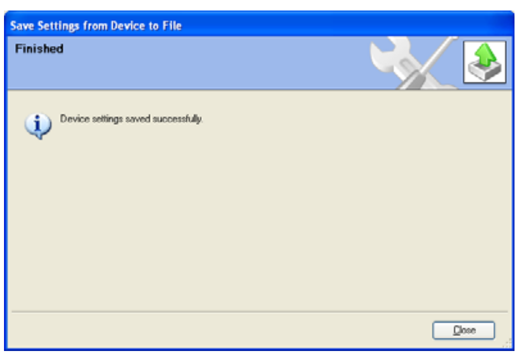


Figure 6-10. Process complete

IMPORTANT	**Once the unit has been commissioned and is placed in operation, this file should be copied to another computer (via a USB memory stick) as a backup. It is the user/site responsibility to retain this file, as it contains control specific settings for this turbine.**

Uploading a Configuration File to the Control

Uploading a configuration file to a control can only be performed if a configuration file has already been created and saved. This procedure may be useful when installing multiple 5009FT units in a plant, to verify that they each have the same configuration. This procedure is not required when replacing any one CPU. If a single CPU is replaced, it will be automatically configured to the settings used by the other two CPUs during its initialization procedure.

IMPORTANT	**Uploading settings from a File to the control can only be done while the turbine is shutdown. The Control will need to enter IO LOCK to complete this request, which means all Outputs from the control will go to False/Zero state.**

To upload a saved configuration settings file to the control:

1. Select the "**Load Settings File to Device**" option from the screen's "**Settings**" menu.

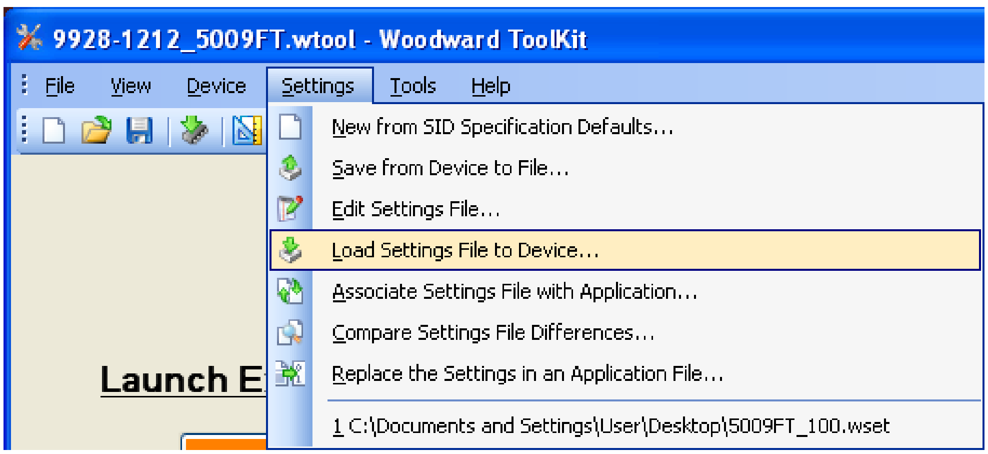


Figure 6-11. Load Settings into Control

The following dialog box should appear:

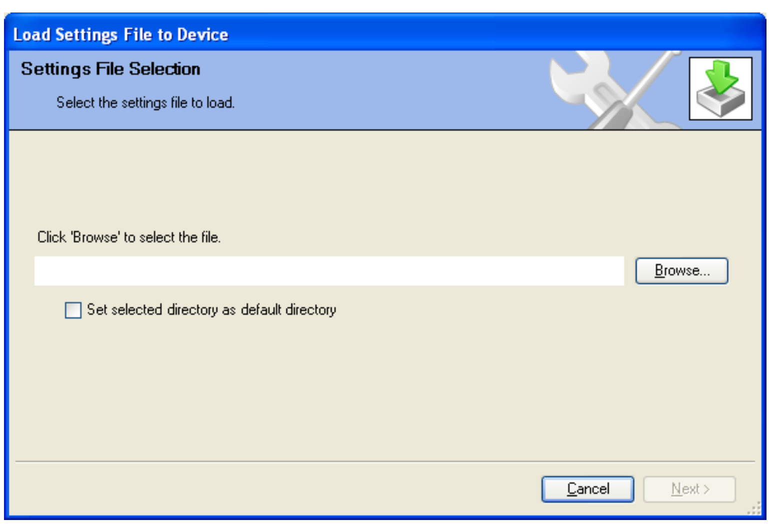


Figure 6-12. Locate Directory

2. Clicking “Browse…” will take the user to a screen in which to select the desired ‘toolkit settings’ file. Once completed, select “Open”.

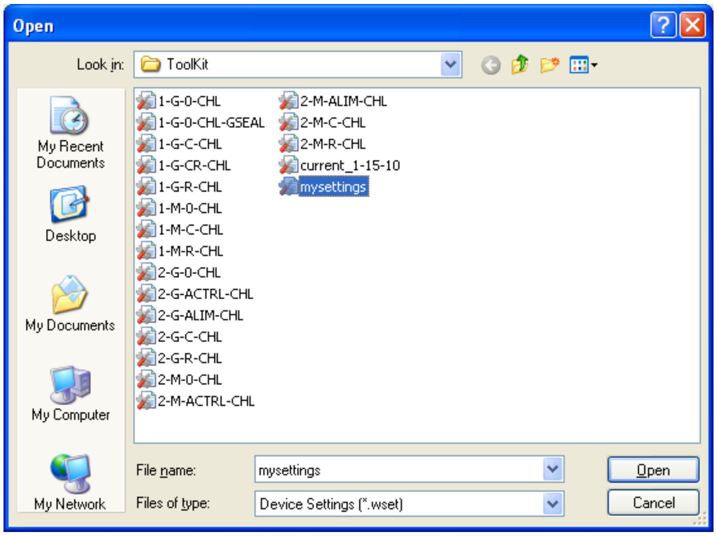


Figure 6-13. Select Settings File

3. In the “Settings File Selection” dialog box, select the check box for setting the selected directory as the default directory. This will make it easier to find this folder location in the future. Select the Next button when complete.

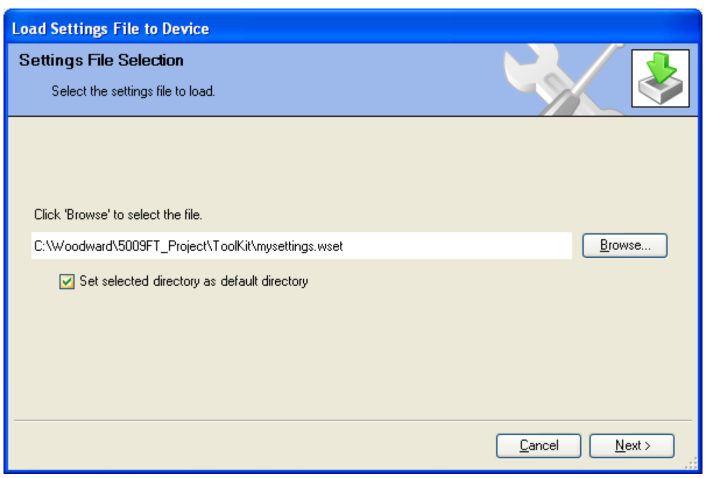


Figure 6-14. Make default directory

4. The next screen will allow the user to confirm which device to load the settings onto. In the case of the 5009FT, it should show only **Dflt Control ID<ip address>** click on Next.

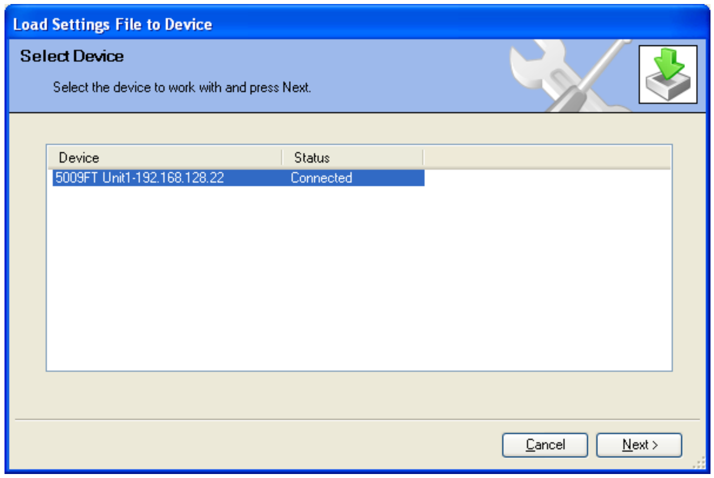


Figure 6-15. Select Target device

5. The next screen warns the user that the control will be shutdown while the settings are loaded. When the necessary precautions are taken, select the Next button.

> **IMPORTANT**
>
> **The control will be shutdown during the settings file loading process. Verify the engine is shutdown and in a safe state prior to loading any settings.**
>
> **Failure to do so may result in personal injury or damage to equipment.**

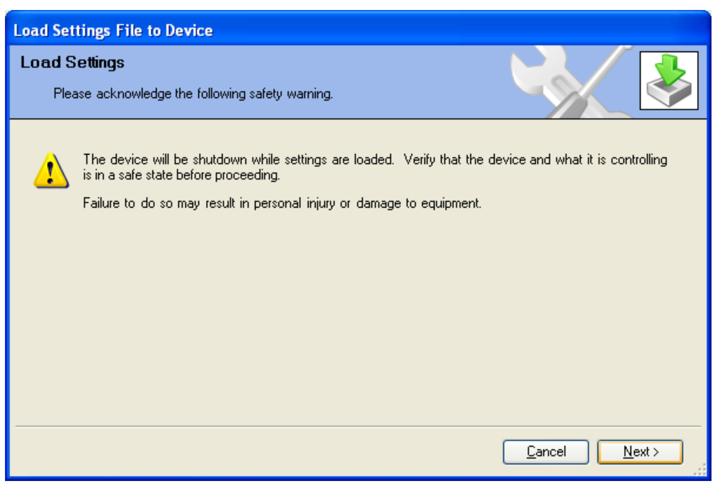


Figure 6-16. WARNING Turbine must be Shutdown

6. Toolkit will then load the settings file to the control. A progress bar will show the status of the upload.

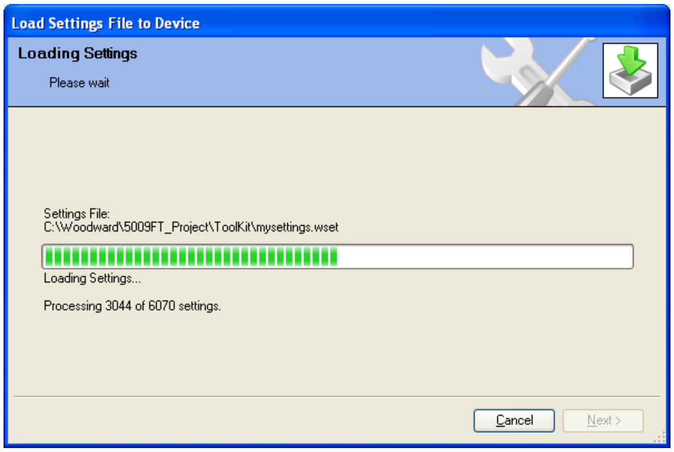


Figure 6-17. Loading File into Control Progress Bar

7. When the settings file upload is completed, the next window will be displayed. Upon upload completion, the control will reset.

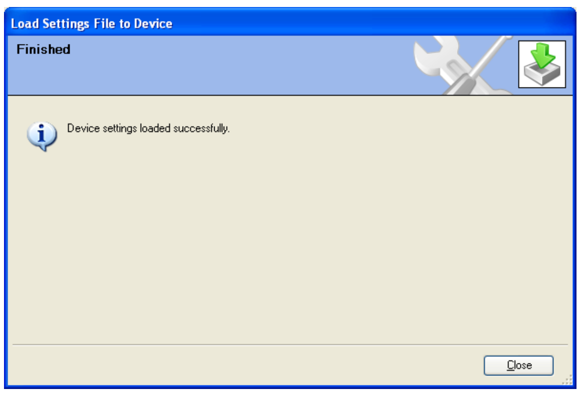


Figure 6-18. Process Complete

Note: For users familiar with Control Assistant, the DOWNLOAD or UPLOAD tunables function works the same on the 5009FT as it does on other Woodward controls.

Chapter 7
Alarms/Tips

General

The table below gives the complete list of all Events programmed in the 5009FT application. The numerical event ID and descriptions are shown and each of this events are programmed sequentially in the Modbus list with Event001 starting at Boolean Read address 401 (1:0401) and ending at 898 (1:0898).

The 5009FT Control System monitors all alarms and trips and sends them to the Modbus. This chapter includes a list of all alarms and shutdowns and possible causes of the alarm/trip.

Table 7-1. Trips (10 ms Scan Time)

EVENT400	ESTOP - Emergency Stop #1
EVENT401	Overspeed Trip SD
EVENT402	Max Overspeed Reached
EVENT403	Predictive Overspeed SD
EVENT404	Normal SD Completed
EVENT405	Underspeed Shutdown
EVENT406	Speed Control Lost
EVENT407	Stuck in Critical Speed Band
EVENT408	Rotor Stuck SD
EVENT409	Speed Sig Lost / Fail to Start
EVENT410	Configuration Error (CORE)
EVENT411	Extraction Sensor Fault
EVENT412	Spare CORE SD14
EVENT413	Spare CORE SD15
EVENT414	Spare CORE SD16
EVENT415	Spare SD – Currently NOT Used
EVENT416	Spare SD – Currently NOT Used
EVENT417	Spare SD – Currently NOT Used
EVENT418	Control in CALMODE
EVENT419	External Trip #2
EVENT420	External Trip #3
EVENT421	External Trip #4
EVENT422	External Trip #5
EVENT423	External Trip #6
EVENT424	External Trip #7
EVENT425	External Trip #8
EVENT426	External Trip #9
EVENT427	External Trip #10
EVENT428	Spare SD – Currently NOT Used
EVENT429	Spare SD – Currently NOT Used
EVENT430	Integrating ACT1 A&B Failed

EVENT431	Integrating ACT2 A&B Failed
EVENT432	Input/Output Configuration Error
EVENT433	Breaker Opened Trip
EVENT434	Spare SD – Currently NOT Used
EVENT435	Spare SD – Currently NOT Used

Table 7-2. Alarm Events (40 ms Scan Time)

EVENT Number	**Description**
EVENT001	Kernel A CPU Faulted
EVENT002	Kernel B CPU Faulted
EVENT003	Kernel C CPU Faulted
EVENT004	Kernel A High Temp Alarm
EVENT005	Kernel B High Temp Alarm
EVENT006	Kernel C High Temp Alarm
EVENT007	Power Supply #1 Fault
EVENT008	Power Supply #2 Fault
EVENT009	Modbus1 Block Link 1 Error
EVENT010	Modbus1 Block Link 2 Error
EVENT011	Kern A Module A03 Failed
EVENT012	Kern A Module A04 Failed
EVENT013	Kern A Module A05 Failed
EVENT014	Kern A Module A06 Failed
EVENT015	Kern B Module A03 Failed
EVENT016	Kern B Module A04 Failed
EVENT017	Kern B Module A05 Failed
EVENT018	Kern B Module A06 Failed
EVENT019	Kern C Module A03 Failed
EVENT020	Kern C Module A04 Failed
EVENT021	Kern C Module A05 Failed
EVENT022	Modbus2 Block Link 1 Error
EVENT023	Modbus2 Block Link 2 Error
EVENT024	Redundant DI ESTOP Alarm
EVENT025	AI #01 Chan Fail Kern A Mod A03
EVENT026	AI #01 Chan Fail Kern B Mod A03
EVENT027	AI #01 Chan Fail Kern C Mod A03
EVENT028	AI #01 Chan Diff between Kernels
EVENT029	AI #01 Input Signal Failure
EVENT030	AI #02 Chan Fail Kern A Mod A03
EVENT031	AI #02 Chan Fail Kern B Mod A03
EVENT032	AI #02 Chan Fail Kern C Mod A03
EVENT033	AI #02 Chan Diff between Kernels
EVENT034	AI #02 Input Signal Failure
EVENT035	AI #03 Chan Fail Kern A Mod A03

EVENT036	AI #03 Chan Fail Kern B Mod A03
EVENT037	AI #03 Chan Fail Kern C Mod A03
EVENT038	AI #03 Chan Diff between Kernels
EVENT039	AI #03 Input Signal Failure
EVENT040	AI #04 Chan Fail Kern A Mod A03
EVENT041	AI #04 Chan Fail Kern B Mod A03
EVENT042	AI #04 Chan Fail Kern C Mod A03
EVENT043	AI #04 Chan Diff between Kernels
EVENT044	AI #04 Input Signal Failure
EVENT045	AI #05 Chan Fail Kern A Mod A03
EVENT046	AI #05 Chan Fail Kern B Mod A03
EVENT047	AI #05 Chan Fail Kern C Mod A03
EVENT048	AI #05 Chan Diff between Kernels
EVENT049	AI #05 Input Signal Failure
EVENT050	AI #06 Chan Fail Kern A Mod A03
EVENT051	AI #06 Chan Fail Kern B Mod A03
EVENT052	AI #06 Chan Fail Kern C Mod A03
EVENT053	AI #06 Chan Diff between Kernels
EVENT054	AI #06 Input Signal Failure
EVENT055	AI #07 Chan Fail Kern A Mod A03
EVENT056	AI #07 Chan Fail Kern B Mod A03
EVENT057	AI #07 Chan Fail Kern C Mod A03
EVENT058	AI #07 Chan Diff between Kernels
EVENT059	AI #07 Input Signal Failure
EVENT060	AI #08 Chan Fail Kern A Mod A03
EVENT061	AI #08 Chan Fail Kern B Mod A03
EVENT062	AI #08 Chan Fail Kern C Mod A03
EVENT063	AI #08 Chan Diff between Kernels
EVENT064	AI #08 Input Signal Failure
EVENT065	AI #09 Chan Fail Kern A Mod A03
EVENT066	AI #09 Chan Fail Kern B Mod A03
EVENT067	AI #09 Chan Fail Kern C Mod A03
EVENT068	AI #09 Chan Diff between Kernels
EVENT069	AI #09 Input Signal Failure
EVENT070	AI #10 Chan Fail Kern A Mod A03
EVENT071	AI #10 Chan Fail Kern B Mod A03
EVENT072	AI #10 Chan Fail Kern C Mod A03
EVENT073	AI #10 Chan Diff between Kernels
EVENT074	AI #10 Input Signal Failure
EVENT075	AI #11 Chan Fail Kern A Mod A03
EVENT076	AI #11 Chan Fail Kern B Mod A03
EVENT077	AI #11 Chan Fail Kern C Mod A03
EVENT078	AI #11 Chan Diff between Kernels
EVENT079	AI #11 Input Signal Failure

EVENT080	AI #12 Chan Fail Kern A Mod A03
EVENT081	AI #12 Chan Fail Kern B Mod A03
EVENT082	AI #12 Chan Fail Kern C Mod A03
EVENT083	AI #12 Chan Diff between Kernels
EVENT084	AI #12 Input Signal Failure
EVENT085	AI #13 Chan Fail Kern A Mod A05
EVENT086	AI #13 Chan Fail Kern B Mod A05
EVENT087	AI #13 Chan Fail Kern C Mod A05
EVENT088	AI #13 Chan Diff between Kernels
EVENT089	AI #13 Input Signal Failure
EVENT090	AI #14 Chan Fail Kern A Mod A05
EVENT091	AI #14 Chan Fail Kern B Mod A05
EVENT092	AI #14 Chan Fail Kern C Mod A05
EVENT093	AI #14 Chan Diff between Kernels
EVENT094	AI #14 Input Signal Failure
EVENT095	AI #15 Chan Fail Kern A Mod A05
EVENT096	AI #15 Chan Fail Kern B Mod A05
EVENT097	AI #15 Chan Fail Kern C Mod A05
EVENT098	AI #15 Chan Diff between Kernels
EVENT099	AI #15 Input Signal Failure
EVENT100	AI #16 Chan Fail Kern A Mod A05
EVENT101	AI #16 Chan Fail Kern B Mod A05
EVENT102	AI #16 Chan Fail Kern C Mod A05
EVENT103	AI #16 Chan Diff between Kernels
EVENT104	AI #16 Input Signal Failure
EVENT105	AI #17 Chan Fail Kern A Mod A05
EVENT106	AI #17 Chan Fail Kern B Mod A05
EVENT107	AI #17 Chan Fail Kern C Mod A05
EVENT108	AI #17 Chan Diff between Kernels
EVENT109	AI #17 Input Signal Failure
EVENT110	AI #18 Chan Fail Kern A Mod A05
EVENT111	AI #18 Chan Fail Kern B Mod A05
EVENT112	AI #18 Chan Fail Kern C Mod A05
EVENT113	AI #18 Chan Diff between Kernels
EVENT114	AI #18 Input Signal Failure
EVENT115	AI #19 Chan Fail Kern A Mod A05
EVENT116	AI #19 Chan Fail Kern B Mod A05
EVENT117	AI #19 Chan Fail Kern C Mod A05
EVENT118	AI #19 Chan Diff between Kernels
EVENT119	AI #19 Input Signal Failure
EVENT120	AI #20 Chan Fail Kern A Mod A05
EVENT121	AI #20 Chan Fail Kern B Mod A05
EVENT122	AI #20 Chan Fail Kern C Mod A05
EVENT123	AI #20 Chan Diff between Kernels

EVENT124	AI #20 Input Signal Failure
EVENT125	AI #21 Chan Fail Kern A Mod A05
EVENT126	AI #21 Chan Fail Kern B Mod A05
EVENT127	AI #21 Chan Fail Kern C Mod A05
EVENT128	AI #21 Chan Diff between Kernels
EVENT129	AI #21 Input Signal Failure
EVENT130	AI #22 Chan Fail Kern A Mod A05
EVENT131	AI #22 Chan Fail Kern B Mod A05
EVENT132	AI #22 Chan Fail Kern C Mod A05
EVENT133	AI #22 Chan Diff between Kernels
EVENT134	AI #22 Input Signal Failure
EVENT135	AI #23 Chan Fail Kern A Mod A05
EVENT136	AI #23 Chan Fail Kern B Mod A05
EVENT137	AI #23 Chan Fail Kern C Mod A05
EVENT138	AI #23 Chan Diff between Kernels
EVENT139	AI #23 Input Signal Failure
EVENT140	AI #24 Chan Fail Kern A Mod A05
EVENT141	AI #24 Chan Fail Kern B Mod A05
EVENT142	AI #24 Chan Fail Kern C Mod A05
EVENT143	AI #24 Chan Diff between Kernels
EVENT144	AI #24 Input Signal Failure
EVENT145	AI #25 Chan Fail Kern A Mod A05
EVENT146	AI #25 Chan Fail Kern B Mod A05
EVENT147	AI #25 Chan Fail Kern C Mod A05
EVENT148	AI #25 Chan Diff between Kernels
EVENT149	AI #25 Input Signal Failure
EVENT150	AI #26 Chan Fail Kern A Mod A05
EVENT151	AI #26 Chan Fail Kern B Mod A05
EVENT152	AI #26 Chan Fail Kern C Mod A05
EVENT153	AI #26 Chan Diff between Kernels
EVENT154	AI #26 Input Signal Failure
EVENT155	AI #27 Chan Fail Kern A Mod A05
EVENT156	AI #27 Chan Fail Kern B Mod A05
EVENT157	AI #27 Chan Fail Kern C Mod A05
EVENT158	AI #27 Chan Diff between Kernels
EVENT159	AI #27 Input Signal Failure
EVENT160	AI #28 Chan Fail Kern A Mod A05
EVENT161	AI #28 Chan Fail Kern B Mod A05
EVENT162	AI #28 Chan Fail Kern C Mod A05
EVENT163	AI #28 Chan Diff between Kernels
EVENT164	AI #28 Input Signal Failure
EVENT165	AI #29 Chan Fail Kern A Mod A05
EVENT166	AI #29 Chan Fail Kern B Mod A05
EVENT167	AI #29 Chan Fail Kern C Mod A05

EVENT168	AI #29 Chan Diff between Kernels
EVENT169	AI #29 Input Signal Failure
EVENT170	AI #30 Chan Fail Kern A Mod A05
EVENT171	AI #30 Chan Fail Kern B Mod A05
EVENT172	AI #30 Chan Fail Kern C Mod A05
EVENT173	AI #30 Chan Diff between Kernels
EVENT174	AI #30 Input Signal Failure
EVENT175	AI #31 Chan Fail Kern A Mod A05
EVENT176	AI #31 Chan Fail Kern B Mod A05
EVENT177	AI #31 Chan Fail Kern C Mod A05
EVENT178	AI #31 Chan Diff between Kernels
EVENT179	AI #31 Input Signal Failure
EVENT180	AI #32 Chan Fail Kern A Mod A05
EVENT181	AI #32 Chan Fail Kern B Mod A05
EVENT182	AI #32 Chan Fail Kern C Mod A05
EVENT183	AI #32 Chan Diff between Kernels
EVENT184	AI #32 Input Signal Failure
EVENT185	AO #1 Chan Fail Kern A
EVENT186	AO #1 Chan Fail Kern B
EVENT187	AO #1 Chan Fail Kern C
EVENT188	AO #1 No Load Detected
EVENT189	AO #1 Chan Fail All Kernels
EVENT190	AO #2 Chan Fail Kern A
EVENT191	AO #2 Chan Fail Kern B
EVENT192	AO #2 Chan Fail Kern C
EVENT193	AO #2 No Load Detected
EVENT194	AO #2 Chan Fail All Kernels
EVENT195	AO #3 Chan Fail Kern A
EVENT196	AO #3 Chan Fail Kern B
EVENT197	AO #3 Chan Fail Kern C
EVENT198	AO #3 No Load Detected
EVENT199	AO #3 Chan Fail All Kernels
EVENT200	AO #4 Chan Fail Kern A
EVENT201	AO #4 Chan Fail Kern B
EVENT202	AO #4 Chan Fail Kern C
EVENT203	AO #4 No Load Detected
EVENT204	AO #4 Chan Fail All Kernels
EVENT205	AO #5 Chan Fail Kern A
EVENT206	AO #5 Chan Fail Kern B
EVENT207	AO #5 Chan Fail Kern C
EVENT208	AO #5 No Load Detected
EVENT209	AO #5 Chan Fail All Kernels
EVENT210	AO #6 Chan Fail Kern A
EVENT211	AO #6 Chan Fail Kern B

EVENT212	AO #6 Chan Fail Kern C
EVENT213	AO #6 No Load Detected
EVENT214	AO #6 Chan Fail All Kernels
EVENT215	AO #7 Chan Fail Kern A
EVENT216	AO #7 Chan Fail Kern B
EVENT217	AO #7 Chan Fail Kern C
EVENT218	AO #7 No Load Detected
EVENT219	AO #7 Chan Fail All Kernels
EVENT220	AO #8 Chan Fail Kern A
EVENT221	AO #8 Chan Fail Kern B
EVENT222	AO #8 Chan Fail Kern C
EVENT223	AO #8 No Load Detected
EVENT224	AO #8 Chan Fail All Kernels
EVENT225	AO #9 Chan Fail Kern A
EVENT226	AO #9 Chan Fail Kern B
EVENT227	AO #9 Chan Fail Kern C
EVENT228	AO #9 No Load Detected
EVENT229	AO #9 Chan Fail All Kernels
EVENT230	AO #10 Chan Fail Kern A
EVENT231	AO #10 Chan Fail Kern B
EVENT232	AO #10 Chan Fail Kern C
EVENT233	AO #10 No Load Detected
EVENT234	AO #10 Chan Fail All Kernels
EVENT235	AO #11 Chan Fail Kern A
EVENT236	AO #11 Chan Fail Kern B
EVENT237	AO #11 Chan Fail Kern C
EVENT238	AO #11 No Load Detected
EVENT239	AO #11 Chan Fail All Kernels
EVENT240	AO #12 Chan Fail Kern A
EVENT241	AO #12 Chan Fail Kern B
EVENT242	AO #12 Chan Fail Kern C
EVENT243	AO #12 No Load Detected
EVENT244	AO #12 Chan Fail All Kernels
EVENT245	DI #1 Chan Fail Kern A
EVENT246	DI #1 Chan Fail Kern B
EVENT247	DI #1 Chan Fail Kern C
EVENT248	DI #2 Chan Fail Kern A
EVENT249	DI #2 Chan Fail Kern B
EVENT250	DI #2 Chan Fail Kern C
EVENT251	DI #3 Chan Fail Kern A
EVENT252	DI #3 Chan Fail Kern B
EVENT253	DI #3 Chan Fail Kern C
EVENT254	DI #4 Chan Fail Kern A
EVENT255	DI #4 Chan Fail Kern B

EVENT256	DI #4 Chan Fail Kern C
EVENT257	DI #5 Chan Fail Kern A
EVENT258	DI #5 Chan Fail Kern B
EVENT259	DI #5 Chan Fail Kern C
EVENT260	DI #6 Chan Fail Kern A
EVENT261	DI #6 Chan Fail Kern B
EVENT262	DI #6 Chan Fail Kern C
EVENT263	DI #7 Chan Fail Kern A
EVENT264	DI #7 Chan Fail Kern B
EVENT265	DI #7 Chan Fail Kern C
EVENT266	DI #8 Chan Fail Kern A
EVENT267	DI #8 Chan Fail Kern B
EVENT268	DI #8 Chan Fail Kern C
EVENT269	DI #9 Chan Fail Kern A
EVENT270	DI #9 Chan Fail Kern B
EVENT271	DI #9 Chan Fail Kern C
EVENT272	DI #10 Chan Fail Kern A
EVENT273	DI #10 Chan Fail Kern B
EVENT274	DI #10 Chan Fail Kern C
EVENT275	DI #11 Chan Fail Kern A
EVENT276	DI #11 Chan Fail Kern B
EVENT277	DI #11 Chan Fail Kern C
EVENT278	DI #12 Chan Fail Kern A
EVENT279	DI #12 Chan Fail Kern B
EVENT280	DI #12 Chan Fail Kern C
EVENT281	DI #13 Chan Fail Kern A
EVENT282	DI #13 Chan Fail Kern B
EVENT283	DI #13 Chan Fail Kern C
EVENT284	DI #14 Chan Fail Kern A
EVENT285	DI #14 Chan Fail Kern B
EVENT286	DI #14 Chan Fail Kern C
EVENT287	DI #15 Chan Fail Kern A
EVENT288	DI #15 Chan Fail Kern B
EVENT289	DI #15 Chan Fail Kern C
EVENT290	DI #16 Chan Fail Kern A
EVENT291	DI #16 Chan Fail Kern B
EVENT292	DI #16 Chan Fail Kern C
EVENT293	DI #17 Chan Fail Kern A
EVENT294	DI #17 Chan Fail Kern B
EVENT295	DI #17 Chan Fail Kern C
EVENT296	DI #18 Chan Fail Kern A
EVENT297	DI #18 Chan Fail Kern B
EVENT298	DI #18 Chan Fail Kern C
EVENT299	DI #19 Chan Fail Kern A

EVENT300	DI #19 Chan Fail Kern B
EVENT301	DI #19 Chan Fail Kern C
EVENT302	DI #20 Chan Fail Kern A
EVENT303	DI #20 Chan Fail Kern B
EVENT304	DI #20 Chan Fail Kern C
EVENT305	DI #21 Chan Fail Kern A
EVENT306	DI #21 Chan Fail Kern B
EVENT307	DI #21 Chan Fail Kern C
EVENT308	DI #22 Chan Fail Kern A
EVENT309	DI #22 Chan Fail Kern B
EVENT310	DI #22 Chan Fail Kern C
EVENT311	DI #23 Chan Fail Kern A
EVENT312	DI #23 Chan Fail Kern B
EVENT313	DI #23 Chan Fail Kern C
EVENT314	DI #24 Chan Fail Kern A
EVENT315	DI #24 Chan Fail Kern B
EVENT316	DI #24 Chan Fail Kern C
EVENT317	Speed Signal #1 Difference ALM
EVENT318	Speed Signal #2 Difference ALM
EVENT319	Speed Signal #3 Difference ALM
EVENT320	Spare
EVENT321	Spare
EVENT322	Spare
EVENT323	Spare
EVENT324	Spare
EVENT325	Spare
EVENT326	Spare
EVENT327	Spare
EVENT328	Spare
EVENT329	Spare
EVENT330	Spare
EVENT331	Spare
EVENT332	Speed Chan #1 Fail Kern A
EVENT333	Speed Chan #1 Fail Kern B
EVENT334	Speed Chan #1 Fail Kern C
EVENT335	Speed Signal Input Chan #1 Failed
EVENT336	Speed Chan #2 Fail Kern A
EVENT337	Speed Chan #2 Fail Kern B
EVENT338	Speed Chan #2 Fail Kern C
EVENT339	Speed Signal Input Chan #2 Failed
EVENT340	Speed Chan #3 Fail Kern A
EVENT341	Speed Chan #3 Fail Kern B
EVENT342	Speed Chan #3 Fail Kern C
EVENT343	Speed Signal Input Chan #3 Failed

EVENT344	Speed Chan #4 Fail Kern A
EVENT345	Speed Chan #4 Fail Kern B
EVENT346	Speed Chan #4 Fail Kern C
EVENT347	Speed Signal Input Chan #4 Failed
EVENT348	FT Relay #1 Summary Fault
EVENT349	FT Relay #2 Summary Fault
EVENT350	FT Relay #3 Summary Fault
EVENT351	FT Relay #4 Summary Fault
EVENT352	FT Relay #5 Summary Fault
EVENT353	FT Relay #6 Summary Fault
EVENT354	FT Relay #7 Summary Fault
EVENT355	FT Relay #8 Summary Fault
EVENT356	FT Relay #9 Summary Fault
EVENT357	FT Relay #10 Summary Fault
EVENT358	FT Relay #11 Summary Fault
EVENT359	FT Relay #12 Summary Fault
EVENT360	Underspeed Alarm
EVENT361	Speed Control Lost
EVENT362	Stuck in Critical Band
EVENT363	Rotor Stuck Alarm
EVENT364	Configuration Error while Running
EVENT365	Cascade Ext Override Active
EVENT366	Cascade Emergency Activated
EVENT367	Aux Limiter in Control
EVENT368	Aux Limiter Active / No Speed Raise
EVENT369	External Alarm #1
EVENT370	External Alarm #2
EVENT371	External Alarm #3
EVENT372	External Alarm #4
EVENT373	External Alarm #5
EVENT374	External Alarm #6
EVENT375	External Alarm #7
EVENT376	External Alarm #8
EVENT377	External Alarm #9
EVENT378	External Alarm #10
EVENT379	Kernel Fault/CPU Voting Error
EVENT380	Integrating ACT1 A Failed
EVENT381	Integrating ACT1 B Failed
EVENT382	Spare
EVENT383	Integrating ACT2 A Failed
EVENT384	Integrating ACT2 B Failed
EVENT385	Overspeed Alarm Level
EVENT386	Spare CORE ALM11
EVENT387	Spare CORE ALM12

EVENT388	Spare CORE ALM13
EVENT389	Spare CORE ALM14
EVENT390	Spare CORE ALM15
EVENT391	Spare CORE ALM16
EVENT392	OVERSPEED Test Mode Active
EVENT393	Spare
EVENT394	Spare
EVENT395	Spare
EVENT396	Spare
EVENT397	Spare
EVENT398	Spare
EVENT399	Spare
EVENTS_400 thru 435	** Reserved for TRIPS **
EVENT436	Spare
EVENT437	Spare
EVENT438	Spare
EVENT439	Spare
EVENT440	ALL REM Speed Setpoints Failed
EVENT441	REM Speed Setpoint Sig Diff
EVENT442	ALL Cascade Inputs Failed
EVENT443	Cascade Signal Difference
EVENT444	ALL REM Casc Setpoints Failed
EVENT445	REM Casc Setpoints Sig Diff
EVENT446	ALL Auxiliary Inputs Failed
EVENT447	Auxiliary Input Signal Difference
EVENT448	ALL REM Auxiliary Setpoints Failed
EVENT449	REM Auxiliary Setpoints Sig Diff
EVENT450	ALL Extraction/Admission Inputs Failed
EVENT451	Ext/Adm Inputs Signal Difference
EVENT452	Remote E/A Setpoint Failed
EVENT453	Remote E/A Setpoints Sig Diff
EVENT454	Manual Remote E/A Setpoint Failed
EVENT455	Manual Remote E/A Setpoints Sig Diff
EVENT456	Inlet Steam Press Input Signals Failed
EVENT457	Inlet Steam Press Input Signals Sig Di
EVENT458	First Stage Pressure Input Signals Fai
EVENT459	First Stage Pressure Input Signals Sig
EVENT460	ALL Exhaust Pressure Signals Failed
EVENT461	Exhaust Pressure Signal Difference
EVENT462	Remote Decoupling Inputs Failed
EVENT463	Remote Decoupling Inputs Sig Diff

EVENT464	ALL Manual Remote Decoupling Sigs Fail
EVENT465	Manual Remote Decoupling Sig Diff
EVENT466	ALL Feed Forward Input Signals Failed
EVENT467	Feed Forward Signals Diff
EVENT468	All Sync/Speed Bias Signals Failed
EVENT469	Sync/Speed Bias Signal Difference
EVENT470	ALL Load Signals Failed
EVENT471	Load Signal Difference
EVENT472	ALL Comp Flow 1 Signals Failed
EVENT473	Comp Flow 1 Signal Difference
EVENT474	ALL Suction Pressure Signals Failed
EVENT475	Suction Pressure Signal Difference
EVENT476	ALL Discharge Pressure Failed
EVENT477	Discharge Press Signal Diff
EVENT478	ALL Suction Temp 1 Signals Failed
EVENT479	Suction Temp 1 Signal Difference
EVENT480	ALL Discharge Temp Signals Failed
EVENT481	Discharge Temp Signals Diff
EVENT482	Spare
EVENT483	Spare
EVENT484	Spare
EVENT485	Spare

EVENT Description Details

The information below may be helpful in further understanding the alarm messages above. In most cases it is assumed the message above should be adequate.

Chassis/Operating System Alarms

Alarm—Kernel x Anlg I/O Module Flt
Explanation—Failure of the Analog I/O module in Kernel x (A, B, C). Verify that the module is inserted and the Fault light is off.

Alarm—Kernel x Discrete I/O Mod Flt
Explanation—Failure of the Discrete I/O module in Kernel x (A, B, C). Verify that the module is inserted and the Fault light is off.

Alarm—Kernel x Fault
Explanation—Kernel x CPU fault. Verify that the CPU is inserted and reset.

Alarm—Kernel x Overtemperature Alarm
Explanation—Kernel overtemperature detected x (A, B, C).

Alarm—Power Supply #x Fault
Explanation—Power supply #x (1, 2) fault detected. Check input and output voltages of the supply.

Alarm—Operating System Fault
Explanation—Operating system alarm detected.

Application Alarms

Alarm—Kernel x Comm Link Failed
Explanation—Kernel x (A, B, C) communications link was detected as failed.

Alarm—Turbine Trip
Explanation—Turbine has tripped.
.

Alarm—Overspeed
Explanation—Turbine speed is above trip level.

Alarm—Stuck in Critical Band
Explanation—Turbine speed was stuck or forced into a critical band too long.

Alarm—External Alarm #x
Explanation—External Alarm #x (1-10) contact input was opened.

Alarm—Configuration Error
Explanation—Invalid configuration.

Speed Probe Alarms

Alarm—Spd Probe #x Input Fld
Explanation—All Speed probe #x (1-4) inputs failed.

Alarm—Spd Probe #1 Deviation Alm
Explanation—Speed probe input is out of tolerance with other speed probes.

Alarm—Spd Probe #1 Ospd Alm
Explanation—Speed probe input is above overspeed alarm setting.

Alarm—Spd Probe #x Kernel y Fault
Explanation—Input failure or input is out of tolerance from speed probe x (1, 4) in kernel y (A,B,C).

Alarm- Null speed function not armed
Explanation—Input#4 failure or input is out of tolerance from speed probe 1, 2, or/and 3. Null speed won't be detected until function re-armed.

Analog Input Alarm

Alarm—Anlg Input #x Kernel y Fault
Explanation—Input failure or input is out of tolerance from analog input #x (1-8) in kernel y (A, B, C).

Alarm—Discrete In #x Kernel y Fault
Explanation—Input mismatch from other kernels from input #x (1-24) in kernel y (A, B, C).

Cascade Alarms

Alarm—All Cascade Inputs Failed
Explanation—All Cascade analog inputs failed.

Alarm—Casc Input #x Failed
Explanation—Cascade input #x (1, 2, 3) failure detected.

Alarm—Casc Input #x Deviation Alm
Explanation—Cascade input #x (1, 2, 3) is out of tolerance, but not failed.

Alarm—Rmt Casc Setpt Input Failed
Explanation—Remote Cascade Setpoint analog input failed.

Extraction Alarms

Alarm—All Extraction Inputs Failed
Explanation—All Extraction analog inputs failed.

Alarm—Extraction Input #x Failed
Explanation—Extraction input #x (1, 2, 3) failure detected.

Alarm—Extraction Input #x Deviation Alm
Explanation—Extraction input #x (1, 2, 3) is out of tolerance, but not failed.

Alarm—Rmt Extr Setpt Input Failed
Explanation—Remote Extraction Setpoint analog input failed.

Decoupling Alarms

Alarm—All DCPL Inputs Failed
Explanation—All DCPL analog inputs failed.

Alarm—DCPL Input #x Failed
Explanation—DCPL input #x (1, 2, 3) failure detected.

Alarm—DCPL Input #x Deviation Alm
Explanation—DCPL input #x (1, 2, 3) is out of tolerance, but not failed.

Alarm—Rmt DCPL Setpt Input Failed
Explanation—Remote Decoupling Setpoint analog input failed.

Speed Setpoint Alarms

Alarm—Rmt Spd Setpt Input Failed
Explanation—Remote Speed Setpoint input failure detected.

Feed forward Alarms

Alarm—All feed forward Inputs Failed
Explanation—All Load Share Setpoint analog inputs failed.
Time Stamp—5 ms resolution.

Alarm—feed-Forward Input #x Deviation Alm
Explanation—Load Share Setpoint input #x (1, 2, 3) is out of tolerance, but not failed.

Monitor Input#(1-4) Alarms

Alarm—Monitor Input#x Failed
Explanation—Monitor input failure detected.

Driver Alarms

Alarm—Act #1 combo Failed
Explanation—All Actuator #1 (open circuit detected).

Alarm—Act #1 combo Load Fault
Explanation—HP (Actuator #1) Load/Coil Fault detected (single coil/load).

Alarm—Act #1 combo Load 'A/B' Fault
Explanation—HP (Act #1) Load/Coil from Kernel A/B Fault detected (dual coil/load).

Alarm—Act #1 combo Load 'C' Fault
Explanation—HP (Act #1) Load/Coil from Kernel C Fault detected (dual coil/load).

Alarm—Act #2 combo Failed
Explanation—All LP (Actuator #2) (open circuit detected).

Alarm—Act #2 Driver x Fault
Explanation—LP (Actuator #2) Kernel x (A, B, C) fault detected.

Alarm—Act #2 combo Load Fault
Explanation—LP (Actuator #2) Load/Coil Fault detected (single coil/load).

Alarm—Act #2 (LP) Load 'A/B' Fault
Explanation—LP (Act #2) Load/Coil from Kernel A/B Fault detected (dual coil/load).

Alarm—Act #2 (LP) Load 'C' Fault
Explanation—LP (Act #2) Load/Coil from Kernel C Fault detected (dual coil/load).

Alarm-All act 06 channel 1 Fault
Explanation—Channel 1 output of A106 and C106 are fault. Line might be opened.

Alarm-Calibration A106 channel 1 not completed.
Explanation—Channel 1 output of A106 calibration is not completed. Calibration is requested.

Alarm— ACT_A106 ch1 fault
Explanation—Channel 1 output of A106 is fault. Line might be opened

Alarm—Position MAX DIFF A106-Ch1.
Explanation—Channel 1 LVDT feedback of A106 is fault is too different from the one on C106. Check LVDT/wiring.

Alarm—LVDT1 A106 ch1 fault
Explanation—LVDT of A106 is fault.

Alarm-Calibration C106 channel 1 not completed.
Explanation—Channel 1 output of C106 calibration is not completed. Calibration is requested.

Alarm— ACT_C106 ch1 fault
Explanation—Channel 1 output of C106 is fault. Line might be opened.

Alarm—Position deviation-Ch1.
Explanation—Channel 1 LVDT feedback different is too big. Check LVDT/wiring or linearize the LVDT.

Alarm—LVDT1 C106 ch1 fault
Explanation—LVDT of C106 is fault.

Alarm-All act 06 channel 2 fault
Explanation—Channel 2 output of A106 and C106 are fault. Line might be opened.

Alarm-Calibration A106 channel 2 not completed.
Explanation—Channel 2 output of A106 calibration is not completed. Calibration is requested.

Alarm— ACT_A106 ch2 fault
Explanation—Channel 2 output of A106 is fault. Line might be opened.

Alarm—Position MAX DIFF-Ch2.
Explanation—Channel 2 LVDT feedback different is too big. Check LVDT/wiring or linearize valve.

Alarm—LVDT1 A106 ch2 fault
Explanation—LVDT of A106 is fault.

Alarm-Calibration C106 channel 2 not completed.
Explanation—Channel 2 output of C106 calibration is not completed. Calibration is requested.

Alarm— ACT_C106 ch2 fault
Explanation—Channel 2 output of C106 is fault. Line might be opened.

Alarm—Position MAX DIFF C106-Ch2.
Explanation—Channel 2 LVDT feedback of C106 is fault is too different from the one on A106. Check LVDT/wiring.

Alarm—LVDT1 C106 ch2 fault
Explanation—LVDT of C106 channel 2 is fault.

Pilot Alarms

Alarm—HP pilot feedback Signal failure A106
Explanation—LVDT Pilot signal used for HP A106 fault.

Alarm—HP pilot feedback Signal failure C106
Explanation—LVDT Pilot signal used for HP C106 fault.

Alarm—HP pilot feedback HP pilot DF fault
Explanation—LVDT Pilot signal used for HP A106 difference.

Alarm—LP pilot feedback Signal failure A106
Explanation—LVDT Pilot used for LP signal on A106 fault.

Alarm—LP pilot feedback Signal failure C106
Explanation—LVDT Pilot used for LP signal on C106 fault.

Alarm—LP pilot feedback LP pilot DF fault
Explanation—LVDT Pilot used for LP signal difference.

Alarm—HP degraded mode activated
Explanation—All LVDT Pilot used for HP signal fault- degraded mode is activated.

Alarm—LP degraded mode activated
Explanation—All LVDT Pilot used for LP signal fault- degraded mode is activated.

Alarm—HP demand -LVDT too big
Explanation—HP Demand-LVDT feedback is too big. Calibration required.

Alarm—LP Demand -LVDT too big
Explanation—LP Demand-LVDT feedback is too big. Calibration required.

Alarm—HP pilot degraded fault
Explanation— Degraded mode cannot correctly drive the HP valve. Tuning is required.

Alarm—LP pilot degraded fault
Explanation— Degraded mode cannot correctly drive the HP valve. Tuning is required.

Relay Alarms

IMPORTANT

Relays 1-3 are in FTM #104-1A, 4-6 in FTM #104-1B, 7-9 in FTM #104-2A, and 10-12 in FTM #104-2B.

Alarm—Relay #x y1 Driver Fault
Explanation—Fault in the y (A, B, C) 1 driver of Relay #x (1-12).

Alarm—Relay #x y2 Driver Fault
Explanation—- Fault in the y (A, B, C) 2 driver of Relay #x (1-12).

Alarm—Relay #x y1 Fault
Explanation—Fault in the y (A, B, C) 1 relay of Relay #x (1-12).

Alarm—Relay #x y2 Fault
Explanation—Fault in the y2 relay of Relay #x (1-12).

Alarm—Relay #x A1 or B1 Fault
Explanation—Fault in either A1 or B1 relays of Relay #x (1-12).

Alarm—Relay #x C2 or A2 Fault
Explanation—Fault in either C2 or A2 relays of Relay #x (1-12).

Alarm—Relay #x B2 or C1 Fault
Explanation—Fault in either B2 or C1 relays of Relay #x (1-12).

Analog Output Alarms

Alarm—Analog Out #x Failed
Explanation—All Analog Output #x (1-4) drivers or load has failed.

Alarm—Anlg Out #x Driver y Fault
Explanation—Analog Output #x (1-4) Kernel y (A, B, C) fault detected.

Alarm—Anlg Out #x Load Fault
Explanation—Analog Output #x (1-4) Load Fault detected.

Major Alarm Indication

A Major Alarm indication is available to the Modbus communication devices and as a programmable relay option. This major alarm feature highlights control system related events that should be corrected as soon as possible.

Table 7-3. Major Alarm Indication

	MAJOR ALARM
MAL_001	Kernel A CPU Faulted
MAL_002	Kernel B CPU Faulted
MAL_003	Kernel C CPU Faulted
MAL_004	Kernel A High Temp Alarm
MAL_005	Kernel B High Temp Alarm
MAL_006	Kernel C High Temp Alarm
MAL_007	Power Supply #1 Fault
MAL_008	Power Supply #2 Fault
MAL_009	spare009
MAL_010	spare010
MAL_011	Kern A Module A03 Failed
MAL_012	Kern A Module A04 Failed
MAL_013	Kern A Module A05 Failed
MAL_014	Kern A Module A06 Failed
MAL_015	Kern B Module A03 Failed
MAL_016	Kern B Module A04 Failed
MAL_017	Kern B Module A05 Failed
MAL_018	Kern B Module A06 Failed
MAL_019	Kern C Module A03 Failed
MAL_020	Kern C Module A04 Failed
MAL_021	Kern C Module A05 Failed
MAL_022	spare022
MAL_023	spare023
MAL_024	spare024

Table 7-4.Dedicated/Fixed Major Alarms

Kernel x Analog I/O Module Flt	Failure of the Analog I/O module in Kernel x (A, B, C).
Kernel x Discrete I/O Module Flt	Failure of the Discrete I/O module in Kernel x (A, B, C).
Kernel x Fault	Kernel x (A, B, C) CPU Failure.
Power Supply #x Fault	Power Supply #x (1, 2) Fault Detected.

Chapter 8.
Modbus

Modbus® Communications

This control can communicate with plant distributed control systems and/or CRT based operator control panels through up to four Modbus communication ports. These ports support ASCII or RTU MODBUS transmission protocols. The 5009FT supports Ethernet UDP, TCP, or serial (RS-232, RS-422, or RS-485) communications. 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 5009FT control is always the slave device, the DCS or operator interface will act as the master and initiate communication transactions.

Monitor Only

The Modbus communication ports, are defaulted from the factory, to communicate with any device that communicates through Modbus and has the same port settings. Alternatively, each port can be configured to only output data and ignore any input commands. This allows the control to be monitored but not controlled from an external device. By simply connecting a monitoring device, configured to communicate through Modbus, this device can be used to monitor all control parameters, modes, etc. without effecting control of the turbine. To use a Modbus port for monitoring only (Boolean and analog write commands are ignored), program the 'Use Modbus Port' setting to 'Not Used'.

Monitor and Control

Once a Modbus port is configured for Modbus communications, the control will accept Run mode commands from an external network master device (DCS, HMI, etc.). This allows a Modbus compatible device to monitor and perform all 5009FT Control Run mode parameters and commands. Modbus ports are independent of each other, and can be used simultaneously. The last command given between the ports has priority. To use a 5009FT Modbus port to monitor and operate the 5009FT Control, program the desired port(s) 'Use Modbus Port' setting to 'Modbus'.

Modbus Communication

The 5009FT Control supports two Modbus transmission modes (ASCII & RTU). A mode defines the individual units of information within a message and the numbering system used to transmit the data. Only one mode per Modbus network is allowed. The supported modes are ASCII (American Standard Code for Information Interchange), and RTU (Remote Terminal Unit). These modes are defined in the following table.

Table 8-1. ASCII vs. RTU Modbus

CHARACTERISTIC	ASCII	RTU
Coding System	hexadecimal (uses	8-bit binary
	ASCII printable binary	
	characters: 0-9, A-F)	
Start Bits	1	1
Data Bits per Char	7	8
Parity	even, odd,	even, odd,
	or none	or none
Stop Bits	1, 1.5, or 2	1, 1.5, or 2
Baud Rate	110, 300, 600, 1200,	110,300, 600, 1200,
	1800,2400, 4800, 9600,	1800, 2400, 4800, 9600,
	19200, 38400, or 57600	19200, or 38400
Error Checking	LRC (Longitudinal	CRC (Cyclical
	Redundancy Check)	Redundancy Check)

In the RTU mode, data is sent in 8-bit binary characters and transmitted in a continuous stream. In the ASCII mode, each binary character is divided into two 4-bit parts (high order and low order), changed to be represented by a hexadecimal equivalent, then transmitted, with breaks of up to 1 second possible. Because of these differences, data transmission with the ASCII mode is typically slower (see Figure 7-1 below).

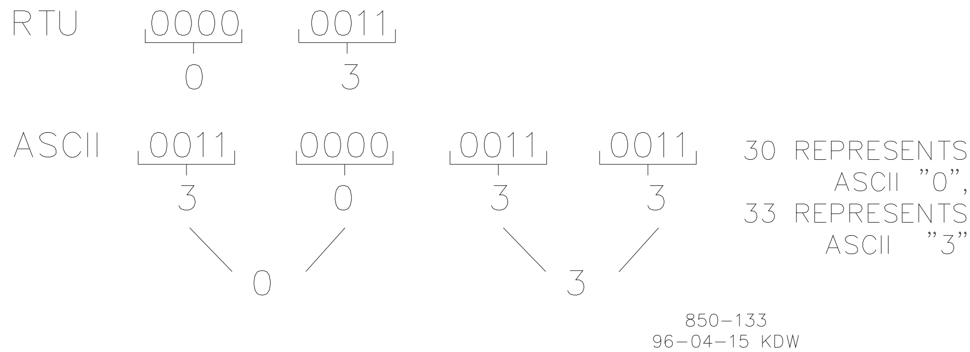


Figure 8-1. ASCII/RTU Representation of 3

The Modbus protocol allows one master and up to 247 slaves on a common network. Each slave is assigned a fixed, unique device address in the range of 1 to 247. With the Modbus protocol, only the network master can initiate a transaction. A transaction consists of a request from the master to a slave unit and the slave's response. The protocol and Modbus device number are set in the Program Mode and can be adjusted in the Service Mode, if required.

The control's CPU module serial communication ports are defaulted for RS-232 communications. RS-232 communications is limited to a distance of 15.24 meters (50 feet). Volume 2 shows the required RS-232 communication connections. 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 in at least one location.

In cases where a device which is being interfaced to is located a distance of greater than 15.24 meters (50 feet) from the control, it is recommended that RS-422 or RS-485 be used. With the use of RS-422 or RS-485 communications, the control can interface with a device through serial communications up to 1219.2 meters (4000 feet) from the control.

This control functions as a slave unit only. As a slave unit, the control will only respond to a transaction request by a master device. The control can directly communicate with a DCS or other Modbus supporting device on a single communications link. If multi-dropping is used (via RS-422 or RS-485 communications), up to 246 devices (5009FT units or other customer devices) can be connected to one Master device on a single network. The device number for each port can be set in the Program or Service modes.

Each message to or from a master has a defined structure called the message "frame". A frame consists of the slave device address, a code defining the requested data, and error checking information. See Figure 7-2.

	BEGINNING OF FRAME	SLAVE ADDRESS	FUNCTION CODE	DATA	ERROR CHECK CODE	END OF FRAME
ASCII	:	2 CHARS 8 BITS	2 CHARS 8 BITS	4 BITS DATA PER CHAR	2 CHAR 8 BITS	CR LF
RTU	3–CHAR DEAD TIME	1 CHAR 8 BITS	1 CHAR 8 BITS	8 BITS DATA PER CHAR	2 CHAR 16 BITS	3 CHAR DEAD TIME

855–382
93–09–27 DAR

Figure 8-2. Modbus Frame Definition

The Modbus function code tells the addressed slaves what function to perform. The following table lists the function codes supported by this control.

Modbus Function Codes

Table 8-2. Modbus Function Codes

CODE	DEFINITION	REFERENCE ADDRESS
01	Read Digital Outputs (Raise/Lower and Enable/Disable Commands)	0XXXX
02	Read Digital Inputs (Status Indications / Alarms and Trips)	1XXXX
03	Read Analog Outputs	4XXXX
04	Read Analog Inputs (Speed, Setpt, etc.)	3XXXX
5	Write Single Discrete Output (Raise/Lower and Enable/Disable Commands)	0XXXX
6	Write Single Register (Enter Setpt Directly)	4XXXX
8	Loopback Diagnostic Test (supports subfunction 0 only)	N/A
5	Write Digital Outputs	0XXXX
16	Write Analog Outputs	4XXXX

When a Modbus message is received, it is checked for any errors or invalid data. If there is invalid data in the message, an error code is sent back to the master and the control issues an alarm message. The error codes are defined in the following table. The exception error status and respective error codes can be viewed in the Service Mode under PORT # SETTINGS, where # is the number of the port (1 or 2).

If the control has not received a message for the configured time-out period, the control will alarm with an error message, but no message is sent to the master. This time-out is defaulted to 2 seconds and only applies to units using both monitor and control (adjustable in the Service Mode).

Table 8-3. Modbus Slave Error Codes

CODE	ERROR MESSAGE	TO MASTER	DESCRIPTION
0	No Error	0	No Error
1	Bad Modbus function	1	The specified function is not supported for this control
2	Bad Modbus data address	2	The Modbus value addressee is not valid for this control
3	Bad Modbus data value	3	Too many values requested or the on/off indicator in function code 5 is invalid.
9	Bad Modbus checksum	None	Message checksum did not match.
10	Bad Modbus message	None	Message could not be decoded.
n/a	Lost Modbus link	None	No messages received for the configured time- out period.

Port Adjustments

Before the 5009FT Control will communicate with the master device, the communication parameters must be verified. These values are set in the Program Mode and can be adjusted, if required, from the Service Mode.

Modbus Communication Port Adjustments

PARAMETER	ADJUSTMENT RANGE
Baud Rate	110 TO 38400
Parity	NONE, ODD, or EVEN
Stop Bits	1 TO 2

Control Modbus Addresses

The Modbus communication ports in the 5009FT Control are programmed for unique Modbus addresses. A complete listing of these addresses for your application is located at the end of this section. The Modbus address listing consists of Boolean Writes, Boolean Reads, Analog Reads, and Analog Writes. The Boolean reads and writes are also referred to as input and holding coils. The analog reads and writes are referred to as input registers and holding registers.

All values that can be addressed by Modbus are considered to be discrete and numeric. The discretes are a 1 bit binary, on or off value, and the numerics are 16 bit values. Discretes are sometimes referred to as coils or digitals and numerics are referred to as registers or analogs. All read/write registers are interpreted by the 5009FT Control as signed 16 bit integer values. Since Modbus can only handle integers, values that require a decimal point in the Modbus Master Device are multiplied by a scaling constant before being sent by the 5009FT Control. See Tables 8-7 and 8-8 (Analog Reads and Analog Writes) under the MULTIPLIER column for defaulted communication constants and ranges.

The maximum number of discretes and registers that can be transmitted in one packet is dependent on each implementation of Modbus. The following table defines these limits.

Table 8-4. Maximum Modbus Discrete and Analog Values

MODE OF TRANSMISSION	MAX DISCRETES	MAX REGISTERS
ASCII	944	59
RTU	1188	118

Boolean Writes (Holding Coils)

Holding coils are logical signals that are both readable from and writable to the 5009FT Control. An example of a Boolean write value would be raise or lower commands. 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 0:0010 and this corresponded to a speed raise command, the speed setpoint will increase until a 0 is written to address 0:0010. The 5009FT 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. The holding coils available are listed in Table 8-5, under Boolean Writes.

Boolean Reads (Input Coils)

Input coils are logical signals that are readable from, but not writable to, the 5009FT Control. An example of a Boolean read value would be a turbine trip status indication. 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 5009FT Control supports Modbus function code 2, which involves reading selected input coils. The input coils available are listed in Table 8-6, under Boolean Reads.

Analog Reads (Input Registers)

Input registers are analog values that are readable from, but not writable to, the 5009FT Control. An example of an analog read value would be turbine speed. The values of the input registers are stored internal to the control as floating point numbers representing engineering units (i.e. kPa or RPM). The values that are transmitted are integer values ranging from -32767 to +32767. Since Modbus can only handle integers, values that require a decimal point must be multiplied by a scaling constant in the 5009FT Control before being sent across the Modbus link. For example, these input registers may be listed as the Modbus value 'x100' or 'cascade scale factor' under the description heading to denote the value is multiplied by a scaling constant (refer to Modbus Scale Factors later in this section). This will allow transmission of decimal parts of a unit if this is necessary for better resolution.

See the 5009FT Control Service Mode for defaulted communication constants and ranges. The control supports Modbus function code 4, which involves reading selected input registers. The input registers available are listed in Table 7-7, under Analog Reads.

Analog Writes (Holding Registers)

Holding registers are analog values that are writable to the 5009FT Control. These values can also be read from a device performing error checking. An example of an analog write value would be a direct speed setpoint value as opposed to raise and lower setpoint commands. The value of the holding registers is also stored in the control as numbers representing engineering units (i.e. PSI (kPa) or RPM). Once again, if decimal points are required, a scaling factor must be used (refer to Modbus Scale Factors later in this section). The 5009FT Control supports Modbus function codes 3, 6, and 16. These correspond to reading selected holding registers, writing to a single holding register, and writing to multiple holding registers, respectively. The holding registers available are listed in Table 8-8, under Analog Writes. The following tables give the address and description of all Boolean and analog, reads and writes.

Table 8-5. Boolean Writes

Boolean Writes (RPTbw)

Addr	Description	Addr	Description
0:0001	Modbus Shutdowns	0:0121	Raise D1
0:0002	Modbus Shutdowns acknowledge	0:0122	Lower DB
0:0003	Normal SD	0:0123	Raise DB
0:0004	Quit normal SD	0:0124	Lower Droop
0:0005	Start permissive	0:0125	Raise Droop
0:0006	RESET	0:0126	Fast action for PID adjust
0:0007	START	0:0127	Extraction SP track
0:0008	HP ramp limiter UP	0:0128	Extraction SP no track
0:0009	HP ramp limiter down	0:0129	Update EEPROM
0:0010	Lower speed	0:0130	Request calibration
0:0011	Raise speed	0:0131	Quit calibration
0:0012	Halt sequence	0:0132	Start calibration procedure
0:0013	Continue autostart	0:0133	Valve At min
0:0014	Remote speed enable	0:0134	Valve at max
0:0015	Remote speed disable	0:0135	Stroke completed
0:0016	reset max speed	0:0136	Raise manual actuator stroke
0:0017	External overspeed test	0:0137	Lower manual actuator stroke
0:0018	Internal Overspeed request	0:0138	Go to Speed Setpoint Target

0:0019	Quit overspeed test
0:0020	HP gain enabled
0:0021	HP gain disabled
0:0022	Feed Forward enable
0:0023	Feed Forward disable
0:0024	Cascade enable
0:0025	Cascade disable
0:0026	Cascade lower SP
0:0027	Cascade raise SP
0:0028	Enable remote cascade
0:0029	Disable remote cascade
0:0030	Enable decoupling
0:0031	Disable decoupling
0:0032	Lower decoupling SP
0:0033	Raise decoupling SP
0:0034	Enable remote decoupling
0:0035	Disable remote decoupling
0:0036	Manual control demand
0:0037	Decoupling auto demand
0:0038	Remote
0:0039	Local
0:0040	Alarm Acknowledge
0:0041	*Spare*
0:0042	Activate Relay #02
0:0043	Activate Relay #03
0:0044	Activate Relay #04
0:0045	Activate Relay #05
0:0046	Activate Relay #06
0:0047	Activate Relay #07
0:0048	Activate Relay #08
0:0049	Activate Relay #09
0:0050	Activate Relay #10
0:0051	Activate Relay #11
0:0052	Activate Relay #12
0:0053	*Spare*
0:0054	*Spare*
0:0055	*Spare*
0:0056	*Spare*
0:0057	*Spare*

0:0139	Go to AUX Setpoint Target
0:0140	Go to CASC Setpoint Target
0:0141	Select On-Line Speed Dynamics
0:0142	Emergency Go to Min Gov
0:0143	Go to KW Setpoint Target
0:0144	Frequency control Arm (Enable)
0:0145	Frequency control Disarm (Disable)
0:0146	*Spare*
0:0147	*Spare*
0:0148	Temporary activate relay#1
0:0149	Temporary activate relay#2
0:0150	Temporary activate relay#3
0:0151	Temporary activate relay#4
0:0152	Temporary activate relay#05
0:0153	Temporary activate relay#06
0:0154	Temporary activate relay#07
0:0155	Temporary activate relay#08
0:0156	Temporary activate relay#09
0:0157	Temporary activate relay#10
0:0158	Temporary activate relay#11
0:0159	Temporary activate relay#12
0:0160	Binary signal Xfer through Modbus
0:0161	Binary signal Xfer through Modbus
0:0162	Binary signal Xfer through Modbus
0:0163	Binary signal Xfer through Modbus
0:0164	Binary signal Xfer through Modbus
0:0165	Binary signal Xfer through Modbus
0:0166	Binary signal Xfer through Modbus
0:0167	Binary signal Xfer through Modbus
0:0168	Binary signal Xfer through Modbus
0:0169	Binary signal Xfer through Modbus
0:0170	Binary signal Xfer through Modbus
0:0171	Binary signal Xfer through Modbus
0:0172	Binary signal Xfer through Modbus
0:0173	Binary signal Xfer through Modbus
0:0174	Binary signal Xfer through Modbus
0:0175	Binary signal Xfer through Modbus
0:0176	Binary signal Xfer through Modbus
0:0177	Binary signal Xfer through Modbus

0:0058	Set time
0:0059	LP gain enabled
0:0060	LP gain disable
0:0061	Enable extraction
0:0062	Disable extraction
0:0063	E/A lower SP
0:0064	E/A raise SP
0:0065	Enable remote extraction
0:0066	Disable remote extraction
0:0067	Raise LP ramp
0:0068	Lower LP ramp
0:0069	Lower Extraction Demand (vlv out)
0:0070	Raise Extraction Demand (vlv out)
0:0071	Extraction manual demand
0:0072	Extraction auto demand
0:0073	Lower Prop Gain off-line
0:0074	Raise Prop Gain off-line
0:0075	Lower Prop Gain on-line
0:0076	Raise Prop Gain on-line
0:0077	Lower Int Gain off-line
0:0078	Raise Int Gain off-line
0:0079	Lower Int Gain on-line
0:0080	Raise Int Gain on-line
0:0081	Lower deriv Gain off-line
0:0082	Raise deriv Gain off-line
0:0083	Lower deriv Gain on-line
0:0084	Raise deriv Gain on-line
0:0085	Lower Deadband online
0:0086	Raise Deadband online
0:0087	fast action for PID adjust
0:0088	Go to EXTR Setpoint Target
0:0089	Go to EXTR Demand Target
0:0090	Go to Idle
0:0091	Go to Rated
0:0092	Emergency Stop from HMI
0:0093	Select Cold Start Curve
0:0094	Select Hot Start Curve
0:0095	Auxiliary Control Enable
0:0096	Auxiliary Control Disable
0:0097	Raise Auxiliary Setpoint
0:0098	Lower Auxiliary Setpoint
0:0099	AUX Control Manual Request
0:0100	Fast action for PID adjust
0:0101	Cascade SP track
0:0102	Cascade SP no track
0:0103	Raise Aux Demand
0:0104	Lower Aux Demand
0:0105	Remote Aux Setpoint Enable

0:0178	Binary signal Xfer through Modbus
0:0179	Binary signal Xfer through Modbus
0:0180	Binary signal Xfer through Modbus
0:0181	Binary signal Xfer through Modbus
0:0182	Binary signal Xfer through Modbus
0:0183	Binary signal Xfer through Modbus
0:0184	Binary signal Xfer through Modbus
0:0185	Modbus#1 select RED1-B request
0:0186	Modbus#1 select RED1-A request
0:0187	Modbus#1 select RED2-B request
0:0188	Modbus#1 select RED2-A request
0:0189	Memorize calibration data.(online)
0:0190	Manual start request
0:0191	Quit Manual start request
0:0192	Raise Seal Gas Setpt
0:0193	Lower Seal Gas Setpt
0:0194	Raise Seal Gas VLV Dmd
0:0195	Lower Seal Gas VLV Dmd
0:0196	Enable Seal Gas Rem SP
0:0197	Disable Seal Gas Rem SP
0:0198	Seal Gas SP Tracking ON
0:0199	Seal Gas SP Tracking OFF
0:0200	Spare
0:0201	Enable Rem Manul Ext Dmd
0:0202	Disable Rem Manul Ext Dmd
0:0203	Enable CASC Swing mode
0:0204	Enable CASC Droop
0:0205	Select Ext/Adm Priority
0:0206	Enable Manual Vlv Dmd
0:0207	Disable Manual Vlv Dmd
0:0208	Raise aux MW Control SP
0:0209	Lower aux MW Control SP
0:0210	Spare
0:0211	Spare
0:0212	Enable Warmup function
0:0213	Disable Warmup function
0:0214	*Spare 214 through 250*

0:0106	Remote Aux Setpoint Disable
0:0107	Enable External Synchronizer
0:0108	Disable External Synchronizer
0:0109	Enable KW Limiter/Controller
0:0110	Disable KW Limiter/Controller
0:0111	Go to DCPL Setpoint Target
0:0112	Go to DCPL Demand Target
0:0113	Fast PID tuning
0:0114	DCPL SP track
0:0115	DCPL SP no track
0:0116	Lower P1
0:0117	Raise P1
0:0118	Lower I1
0:0119	Raise I1
0:0120	Lower D1

Table 8-6. Boolean Reads

Boolean Reads (RPTbr)

Addr	GAP Block Name	Description
1:0001	T1__AUX1.TRACK_ST.B_NAME	AUX SP track if disabled
1:0002	T1__AUX1.Z00_ST.B_NAME	AUX is Disabled
1:0003	T1__AUX1.A00_ST.B_NAME	AUX In Control Active
1:0004	T1__AUX1.A02_ST.B_NAME	AUX in Manual
1:0005	T1__AUX1.A01_ST.B_NAME	AUX Control Limiting
1:0006	T1__CASC.CASC_RSPAC.B_NAME	Remote Cascade SP enabled
1:0007	T1__CASC.Z02_ST.B_NAME	Remote Speed / CASC Enabled
1:0008	T1__CASC.CAS_ENBLD.B_NAME	Cascade is Enabled
1:0009	T1__CASC.Z00_ST.B_NAME	Cascade is Disabled
1:0010	T1__CASC.RSPD_ENBLD.B_NAME	Remote Speed Enabled
1:0011	T1__CASC.RSPD_ACTV.B_NAME	Remote Speed Active
1:0012	T1__CASC.LDSH_ENBLD.B_NAME	load sharing enabled
1:0013	T1__AUX1.AUX_ENA.NOT	AUX is Enabled
1:0014	T1__CASC.CASC_OVLSS.B_NAME	LSS Cascade Override active
1:0015	T1__CASC.CASC_OVHSS.B_NAME	HSS Cascade Override active
1:0016	T1__CASC.CASC_EMER.B_NAME	Emergency activated
1:0017	T1__CASC.CASC_ACTV.B_NAME	Cascade In-Control Active
1:0018	T1__CASC.B03_ST.B_NAME	CASC/ Load Sharing
1:0019	T1__CASC.B02_ST.B_NAME	Swing mode selected
1:0020	T1__CASC.B01_ST.B_NAME	Droop mode selected
1:0021	T1__CASC.B00_ST.B_NAME	Remote speed active
1:0022	T1__CASC.EMRG_CTRL.B_NAME	Emergency in control
1:0023	T1__CE__.ALM09.B_NAME	Aux in control/ No speed Raise
1:0024	T1__CE__.ALM01.B_NAME	Underspeed alarm
1:0025	T1__CE__.ALM03.B_NAME	Stuck in critical Band
1:0026	T1__CE__.TRIP09.B_NAME	SD for rotor stuck
1:0027	T1__CE__.ALM05.B_NAME	Configuration Error while running
1:0028	T1__CE__.ALM06.B_NAME	Cascade Override Activated
1:0029	T1__CE__.TRIP02.B_NAME	Overspeed
1:0030	T1__CE__.TRIP10.B_NAME	Speed lost or fail to start
1:0031	T1__CE__.TRIP11.B_NAME	Boot up
1:0032	T1__CE__.TRIP12.B_NAME	Configuration Error&starting
1:0033	T1__CE__.TRIP13.B_NAME	*Spare*
1:0034	T1__CE__.TRIP14.B_NAME	*Spare*
1:0035	T1__CE__.TRIP15.B_NAME	*Spare*

1:0036	T1__CE__.TRIP16.B_NAME	*Spare*
1:0037	T1__CE__.TRIP08.B_NAME	Stuck in critical Band SD
1:0038	T1__CE__.TRIP07.B_NAME	Speed control lost
1:0039	T1__CE__.TRIP06.B_NAME	Underspeed Shutdown
1:0040	T1__CE__.TRIP05.B_NAME	Normal SD completed
1:0041	T1__CE__.ALM07.B_NAME	Emergency cascade activated
1:0042	T1__CE__.TRIP03.B_NAME	Max Overspeed reached
1:0043	T1__CE__.ALM08.B_NAME	Auxiliary Limiter Active
1:0044	T1__CE__.TRIP01.B_NAME	Trip From Main application
1:0045	EVENT_SD.SD_TRIP.B_NAME	Shutdown General
1:0046	CONFIG_ERR.SUMMARY.OR	any configuration error
1:0047	EVENT_ALM.ALM_OUT.B_NAME	Alarm Active
1:0048	T1__CE__.ALM16.B_NAME	*Spare*
1:0049	T1__CE__.ALM15.B_NAME	*Spare*
1:0050	T1__CE__.ALM14.B_NAME	*Spare*
1:0051	T1__CE__.ALM13.B_NAME	*Spare*
1:0052	T1__CE__.ALM12.B_NAME	*Spare*
1:0053	T1__CE__.ALM11.B_NAME	*Spare*
1:0054	T1__CE__.ALM10.B_NAME	*Spare*
1:0055	T1__CE__.ALM02.B_NAME	Speed control lost
1:0056	T1__CE__.TRIP04.B_NAME	Predictive Overspeed SD
1:0057	T1__CE__.ALM04.B_NAME	Rotor stuck
1:0058	T1__DCPL.TRACK_ST.B_NAME	DCPL/ Setpoint tracking
1:0059	T1__EXTC.EXTC_NOCON.B_NAME	Extraction NOT Configured
1:0060	T1__EXTC.A00_ST.B_NAME	Extraction Control is Disabled
1:0061	*Spare*	*Spare*
1:0062	T1__EXTC.Z01_ST.B_NAME	EXT Control Ramp LP
1:0063	T1__EXTC.TRACK_ST.B_NAME	EXT Control Setpoint is tracking
1:0064	T1__EXTC.EXTC_ENABL.B_NAME	Extraction Control Enabled
1:0065	T1__EXTC.EXTC_ACTIV.B_NAME	Extraction Control Active
1:0066	T1__EXTC.B04_ST.B_NAME	EXT/RemSP Decoupling
1:0067	T1__EXTC.A02_ST.B_NAME	Extraction In Manual
1:0068	T1__EXTC.B02_ST.B_NAME	EXT Decoupling in Manual
1:0069	T1__EXTC.B02R_ST.B_NAME	EXT Rem Manual Decoupling
1:0070	T1__EXTC.A0A_ST.B_NAME	Extraction Auto enabling
1:0071	T1__EXTC.A01_ST.B_NAME	Extraction Manual Enabling
1:0072	T1__EXTC.A05_ST.B_NAME	Extraction is Disabling
1:0073	T1__EXTC.A04_ST.B_NAME	EXT In Rem SP extraction
1:0074	T1__EXTC.A03_ST.B_NAME	Extraction In Auto
1:0075	T1__EXTC.A02R_ST.B_NAME	EXT Remote Manual flow
1:0076	T1__EXTC.B03_ST.B_NAME	EXT Decoupling Auto
1:0077	T1__EXTC.Z00_ST.B_NAME	EXT Shutdown condition
1:0078	T1__FW__.FW_ENABLED.B_NAME	Feed forward enabled
1:0079	T1__FW__.FW_ACTIVE.B_NAME	Feed forward active
1:0080	T1__MAP_.DECOUP_IND.B_NAME	DECOUPLING INHIBITED
1:0081	T1__MAP_.HPMAX_LMT.B_NAME	HP Max Limited
1:0082	T1__MAP_.HPMIN_LMT.B_NAME	HP Min Limited
1:0083	T1__MAP_.LPMAX_LMT.B_NAME	LP Max Limited
1:0084	T1__MAP_.LPMIN_LMT.B_NAME	LP MIN Limited
1:0085	T1__MAP_.MAP_LIMITD.B_NAME	STEAMMAP LIMIT ACTIVE
1:0086	T1__MAP_.DECOUP_ACT.B_NAME	DECOUPLING ACTIVE
1:0087	T1__MAP_.MAX_S_LMT.B_NAME	Max S Limited
1:0088	T1__MAP_.MIN_P_LMT.B_NAME	MinP limited
1:0089	T1__MAP_.K_ILLEGAL.B_NAME	Error K-VALUES
1:0090	T1__MAP_.MN_FLW_LMT.B_NAME	MIn Flow Limited
1:0091	T1__MAP_.RECOUP_IND.B_NAME	RECOUPLING INHIBITED
1:0092	T1__MAP_.MAX_P_LMT.B_NAME	Max P limited

1:0093	T1__SPDC.CAN_OSPD.B_NAME	Ospd test permissive
1:0094	T1__SPDC.SRT_ACTV.B_NAME	Speed Response Test Active
1:0095	T1__SPDC.SRTE_ACT.B_NAME	Synchro Rate active
1:0096	T1__SPDC.SPDC_HOT.B_NAME	Hot curve Selected
1:0097	T1__SPDC.PID_ONLINE.B_NAME	PID Online used
1:0098	T1__SPDC.OVERRIDE.B_NAME	Override speed fault
1:0099	T1__SPDC.SRT_ENBL.B_NAME	Speed Response Test enabled
1:0100	T1__SPDC.NOT_COMPLT.B_NAME	Startup not completed
1:0101	T1__SPDC.Z00_ST.B_NAME	Shutdown Step
1:0102	T1__SPDC.A10_ST.B_NAME	Abort overspeed Step
1:0103	T1__SPDC.A07_ST.B_NAME	Startup to Rated Step
1:0104	T1__SPDC.A09_ST.B_NAME	Test overspeed Step
1:0105	T1__SPDC.AUTO_SEL.B_NAME	Automatic start selected
1:0106	T1__SPDC.NSDCPLTE.B_NAME	Normal SD completed
1:0107	T1__SPDC.STARTING.B_NAME	Engine started (running)
1:0108	T1__SPDC.WARN_SCHED.B_NAME	Warning/of schedule
1:0109	T1__SPDC.Z01_ST.B_NAME	Normal SD Step
1:0110	T1__SPDC.A06_ST.B_NAME	At auto level 3
1:0111	T1__SPDC.A05_ST.B_NAME	Startup to auto level 3 Step
1:0112	T1__SPDC.A04_ST.B_NAME	At auto level 2
1:0113	T1__SPDC.A03_ST.B_NAME	Startup to auto level 2 Step
1:0114	T1__SPDC.A02_ST.B_NAME	At idle 1 Step
1:0115	T1__SPDC.A02AST.B_NAME	Manual Step
1:0116	T1__SPDC.A01_ST.B_NAME	Startup to level 1 Step
1:0117	T1__SPDC.A00_ST.B_NAME	RESET Step
1:0118	T1__SPDC.A00AST.B_NAME	Restart Step
1:0119	T1__SPDC.A08_ST.B_NAME	Startup completed
1:0120	T1__SPDC.START_ACT.B_NAME	Turbine Started
1:0121	T1__VLV_.HPSTRTVLEN.B_NAME	Startup valve enabled
1:0122	T1__VLV_.HPSTR_ACT.B_NAME	Startup valve opened
1:0123	T1__VLV_.HP_BST_OPR.B_NAME	HP2 boost valve operating
1:0124	T2__AUX1.RAISE_DMD.B_NAME	Raise Demand
1:0125	T2__AUX1.DISABLE.B_NAME	disable AUX1
1:0126	T2__AUX1.LOWER_DMD.B_NAME	Lower Demand
1:0127	T2__AUX1.SENSOR_FLT.B_NAME	fault detected
1:0128	T2__AUX1.QUIT_AUX1.B_NAME	Quit AUX1 request
1:0129	T2__AUX1.RAISE_SP.B_NAME	Raise SP
1:0130	T2__AUX1.RQ_AUTO.B_NAME	AUX1 auto request
1:0131	T2__AUX1.RQ_MAN.B_NAME	AUX1 manual request
1:0132	T2__AUX1.LOWER_SP.B_NAME	Lower SP
1:0133	T2__CASC.LDSH_DIS.B_NAME	LD share disable
1:0134	T2__CASC.CASC_DIS.B_NAME	Cascade mode is disabled
1:0135	T2__CASC.CASC_IH.B_NAME	Cascade Inhibited
1:0136	T2__CASC.GOTO_CAS.B_NAME	Enable cascade
1:0137	T2__CASC.GOTO_LDSH.B_NAME	Go to load share command/remote
1:0138	T2__CASC.GOTO_REM.B_NAME	Go to remote speed
1:0139	T2__CASC.GOT_DCAS.B_NAME	Disable cascade
1:0140	T2__CASC.DIS_RCAS.B_NAME	Remote Cascade disable
1:0141	T2__CASC.LOWER_SP.B_NAME	Lower SP
1:0142	T2__CASC.OTHER_SD.B_NAME	Other Unit SD
1:0143	T2__CASC.OTHER_SW.B_NAME	Other Unit swing or LDSH
1:0144	T2__CASC.PROCESS_FL.B_NAME	Cascade PV fault
1:0145	T2__CASC.QUIT_RCAS.B_NAME	Quit Remote cascade
1:0146	T2__CASC.QUIT_REM.B_NAME	Quit remote speed
1:0147	T2__CASC.RAISE_SP.B_NAME	Raise SP
1:0148	T2__CASC.REM_DIS.B_NAME	Remote speed disable
1:0149	T2__CASC.RQ_REMCAS.B_NAME	Remote Cascade Enable

1:0150	T2__CASC.SWING_DIS.B_NAME	Swing mode Disable
1:0151	T2__CASC.GOTO_SWG.B_NAME	Go to Swing command
1:0152	T2__CASC.GOTO_DRPD.B_NAME	Go to droop demand
1:0153	T2__CE__.EXT_CF_ERR.B_NAME	External Configuration Error
1:0154	T2__CE__.GOTO_IH.B_NAME	Go to commands inhibited
1:0155	T2__CE__.RESET_ALM.B_NAME	Reset Alarm
1:0156	T2__CE__.RESET_SD.B_NAME	Reset Shutdown
1:0157	T2__CE__.START_IH.B_NAME	Start Inhibited
1:0158	T2__CE__.TRIP.B_NAME	Shutdown command
1:0159	T2__CE__.CONFIG_SEL.B_NAME	In configure mode
1:0160	T2__DCPL.EXTRDCDI.B_NAME	Disable auto decoupling
1:0161	T2__DCPL.EXTRDCRQ.B_NAME	Decoupling requested
1:0162	T2__DCPL.DCPL_DIS.B_NAME	Decoupling disabled
1:0163	T2__DCPL.DIS_RMDCL.B_NAME	Disable Rem Manual Decoupling
1:0164	T2__DCPL.EXTRDCIH.B_NAME	Inhibit decoupling
1:0165	T2__DCPL.EXTRDCQ.B_NAME	Remote decoupling quit
1:0166	T2__DCPL.SQ__DCRS.B_NAME	Raise DCPL SP
1:0167	T2__DCPL.SQ__DCLS.B_NAME	Lower DCPL SP
1:0168	T2__DCPL.SQ__ADCL.B_NAME	Semi auto decoupling requested
1:0169	T2__DCPL.EXTRDCR.B_NAME	Remote decoupling request
1:0170	T2__DCPL.EXTR_QDC.B_NAME	Quit decoupling requested
1:0171	T2__DCPL.EXTRDCRI.B_NAME	Remote decoupling disabled
1:0172	T2__DCPL.EXTRRMDCL.B_NAME	Rem Man decoupling requested
1:0173	T2__DCPL.EXTRMDCL.B_NAME	Manual decoupling requested
1:0174	T2__DCPL.DCPL_FLT.B_NAME	Decoupling PV Fault
1:0175	T2__EXTC.RQ_QUIT.B_NAME	Extraction quit
1:0176	T2__EXTC.INHIBITED.B_NAME	Extraction inhibit
1:0177	T2__EXTC.RQ_MAN.B_NAME	E/A MANUAL request
1:0178	T2__EXTC.RQ_REM.B_NAME	Remote extraction request
1:0179	T2__EXTC.DISABLE.B_NAME	Extraction disable
1:0180	T2__EXTC.DIS_AUTO.B_NAME	Extraction auto disable BUS
1:0181	T2__EXTC.DIS_RMAN.B_NAME	Disable Remote E/A Manual demand
1:0182	T2__EXTC.REM_DIS.B_NAME	Remote disable
1:0183	T2__EXTC.EXTR_RQ.B_NAME	Extraction requested
1:0184	T2__EXTC.RQ_RMAN.B_NAME	E/A remote MANUAL request
1:0185	T2__EXTC.LOWER_DMD.B_NAME	Lower extraction demand (valve output)
1:0186	T2__EXTC.LOWER_SP.B_NAME	Lower extraction setpoint
1:0187	T2__EXTC.QUIT_REM.B_NAME	Extraction quit remote
1:0188	T2__EXTC.RAISE_DMD.B_NAME	Raise extraction demand (valve output)
1:0189	T2__EXTC.RAISE_SP.B_NAME	Raise extraction setpoint
1:0190	T2__EXTC.RQ_AUTO.B_NAME	Extraction/Admission SEMI-AUTO
1:0191	T2__EXTC.EXTR_FLT.B_NAME	Extraction fault
1:0192	T2__FW__.FW__QUIT.B_NAME	Quit FW
1:0193	T2__FW__.AI_FLT.B_NAME	Disable Bus from HWR
1:0194	T2__FW__.FW__CMD.B_NAME	FW request
1:0195	T2__SPDC.SL_GOTO_L1.B_NAME	Go to low idle1 slow rate select
1:0196	T2__SPDC.LOWER.B_NAME	Lower Speed command
1:0197	T2__SPDC.SEL_PID_O.B_NAME	Select speed PID online
1:0198	T2__SPDC.RTIM_FLT.B_NAME	Remote timer Fault
1:0199	T2__SPDC.RST_MAX.B_NAME	Reset max speed detected
1:0200	T2__SPDC.RAISE.B_NAME	Raise Speed command
1:0201	T2__SPDC.SRT_QUIT.B_NAME	Quit SRT test
1:0202	T2__SPDC.QUIT_OSPD.B_NAME	Quit overspeed test command
1:0203	T2__SPDC.QUIT_NSD.B_NAME	Quit NSD request command
1:0204	T2__SPDC.SPD_GOTO.B_NAME	Go To speed Target
1:0205	T2__SPDC.NSD_TO_LOW.B_NAME	Permissive for NSD < min gov
1:0206	T2__SPDC.SRT_START.B_NAME	Start SRT TEST

1:0207	T2__SPDC.HOT_SELTED.B_NAME	HOT curve selection command
1:0208	T2__SPDC.HALT.B_NAME	Halt sequence command
1:0209	T2__SPDC.FRC_LOWER.B_NAME	Lower speed forced
1:0210	T2__SPDC.ENBL_OSPD.B_NAME	Overspeed test request command
1:0211	T2__SPDC.ENBL_NSD.B_NAME	Normal SD request command
1:0212	T2__SPDC.EMER_MNGOV.B_NAME	Emergency min gov Request
1:0213	T2__SPDC.CONTINUE.B_NAME	Continue sequence command
1:0214	T2__SPDC.COLD_SELTD.B_NAME	COLD curve selection command
1:0215	T2__SPDC.OVER_BI.B_NAME	Speed override contact
1:0216	T2__SPDC.SRT_TOGGLE.B_NAME	SRT Toggle
1:0217	T2__SPDC.START.B_NAME	Start command
1:0218	T2__VLV_.LP_RAMPDW.B_NAME	Lower LP ramp
1:0219	T2__VLV_.DIS_HP2.B_NAME	Disable HP2 usage
1:0220	T2__VLV_.HPR_LOWER.B_NAME	Lower HP ramp
1:0221	T2__VLV_.HPR_RAISE.B_NAME	Raise HP ramp
1:0222	T2__VLV_.LP_RAMPUP.B_NAME	Raise LP ramp
1:0223	T2__VLV_.IH_HP2.B_NAME	Inhibit HP2 usage
1:0224	T2C_AUX1.REVERSE.B_NAME	Reverse Action select
1:0225	T2C_AUX1.AUX_LIM_AL.B_NAME	Alarm when Limiting?
1:0226	T2C_AUX1.HOLD_SPD.B_NAME	hold speed at start when limiter
1:0227	T2C_AUX1.PID_FRLOW.B_NAME	Forced Lower if fault?
1:0228	T2C_AUX1.PID_FRRAIS.B_NAME	Forced raise if fault?
1:0229	T2C_AUX1.PID_TR_I.B_NAME	Initial SP tracking (1=track)
1:0230	T2C_AUX1.DIS_DCPL.B_NAME	disable decoupling when limiter active
1:0231	T2C_CASC.USE_RCASC.B_NAME	Use Remote Cascade Setpoint
1:0232	T2C_CASC.INVERT.B_NAME	Invert PID?
1:0233	T2C_CASC.SWG_DROOP.B_NAME	SW & Droop?
1:0234	T2C_CASC.USE_EMGR.B_NAME	Use emergency recov
1:0235	T2C_CASC.WSPV_ENAB.B_NAME	Use WSPV correction?
1:0236	T2C_CASC.TRACK_EN.B_NAME	Track when disabled
1:0237	T2C_CE__.NON_LATCH.B_NAME	Use non latching alarm reset?
1:0238	T2C_DCPL.USE_RMDCPL.B_NAME	Use Remote man Decoupling
1:0239	T2C_DCPL.CONFDCLI.B_NAME	Decoupled mode is limiter (reserve)
1:0240	T2C_DCPL.CONFNODC.B_NAME	Decoupling Control Bypassed
1:0241	T2C_DCPL.CONFSMDC.B_NAME	Semiautomatic/Remote Only
1:0242	T2C_DCPL.IS_CASC.B_NAME	Cascade is decoupling
1:0243	T2C_DCPL.PID_REV.B_NAME	Reverse Action select
1:0244	T2C_DCPL.SEMIDPRIOR.B_NAME	Semiautomatic First at Enable
1:0245	T2C_DCPL.USE_RDCP.B_NAME	Use Remote Decoupling
1:0246	T2C_DCPL.SP_TRACK.B_NAME	SP Track
1:0247	T2C_EXTC.CONFSMPR.B_NAME	Semiautomatic/Remote Only
1:0248	T2C_EXTC.DCPL_EXTA.B_NAME	Semiautomatic First from Decoupling
1:0249	T2C_EXTC.PID_REV.B_NAME	Reverse Action select
1:0250	T2C_EXTC.REXTR_US.B_NAME	Use Remote Extraction
1:0251	T2C_EXTC.SEMI_PRIOR.B_NAME	Semiautomatic First at Enable
1:0252	T2C_EXTC.TRACK.B_NAME	Extraction SP Track when Disabled
1:0253	T2C_EXTC.USE_RMEXTC.B_NAME	Use Remote man Extraction
1:0254	T2C_EXTC.CONFMAN.B_NAME	Manual Enabling
1:0255	T2C_EXTC.CONFNOEX.B_NAME	Extraction Pressure Control Bypassed
1:0256	T2C_FW__.DIRECT_SEL.B_NAME	Use direct signal
1:0257	T2C_FW__.EMERGENCY.B_NAME	Use emergency?
1:0258	T2C_FW__.IH_CAS.B_NAME	Inhibited if no cascade?
1:0259	T2C_MAP_.P_MX_PRIO.B_NAME	Priority If P at MAX. TRUE MEANS SPEED
1:0260	T2C_MAP_.S_MX_PRIO.B_NAME	Priority If S at MAX. TRUE MEANS: SEE
1:0261	T2C_MAP_.P_MN_PRIO.B_NAME	Priority If Pressure at MIN. TRUE MEAN

1:0262	T2C_MAP_.HP_MX_PRIO.B_NAME	Priority If HP at MAX. TRUE MEANS SPEE
1:0263	T2C_MAP_.LP_MX_PRIO.B_NAME	Priority If LP at MAX. TRUE MEANS SPEE
1:0264	T2C_MAP_.ENB_MINFLW.B_NAME	ENABLE MIN FLOW LIMITER
1:0265	T2C_MAP_.HP_MN_PRIO.B_NAME	Priority If HP at MIN. TRUE MEANS SPEE
1:0266	T2C_MAP_.LP_MN_PRIO.B_NAME	Priority If LP at MIN. TRUE MEANS SPEE
1:0267	T2C_SPDC.USE_BST.B_NAME	Use Boost action?
1:0268	T2C_SPDC.USE_ACC_ON.B_NAME	Use Acceleration protection online?
1:0269	T2C_SPDC.USE_ACC_OF.B_NAME	Use Acceleration protection offline?
1:0270	T2C_SPDC.UNDER_SD.B_NAME	Use underspeed SD?
1:0271	T2C_SPDC.CRIT2FX_RT.B_NAME	Critical speed 2 rate fixed?
1:0272	T2C_SPDC.USE_PRED_O.B_NAME	Use Predictive overspeed Protection?
1:0273	T2C_SPDC.LOSS_SD.B_NAME	SD if control lost?
1:0274	T2C_SPDC.SD_STUCK.B_NAME	SD if stuck?
1:0275	T2C_SPDC.NSD_PERM.B_NAME	Use NSD permissive< min gov
1:0276	T2C_SPDC.NSD_NO_SD.B_NAME	No SD at the end
1:0277	T2C_SPDC.NSD_IDLE.B_NAME	NSD to low idle only?
1:0278	T2C_SPDC.LOWER_CR_E.B_NAME	Enable speed lower in critical?
1:0279	T2C_SPDC.UNDER_ENBL.B_NAME	Use underspeed?
1:0280	T2C_SPDC.LEVEL2E.B_NAME	Startup level 2 active
1:0281	T2C_SPDC.CR_IS_MIN.B_NAME	Min speed is High critical?
1:0282	T2C_SPDC.EN_PID_SW.B_NAME	Use Online/Offline PID Switch
1:0283	T2C_SPDC.FRC_UNLD.B_NAME	Force unload if stuck?
1:0284	T2C_SPDC.CRIT3FX_RT.B_NAME	Critical speed 3 rate fixed?
1:0285	T2C_SPDC.IDLE_PRIOR.B_NAME	*Spare*
1:0286	T2C_SPDC.AN_CRV_SEL.B_NAME	Curve selected via analog value
1:0287	T2C_SPDC.LEVEL3E.B_NAME	Startup level 3 active
1:0288	T2C_SPDC.BY_PASS_OV.B_NAME	Speed override by-passed
1:0289	T2C_SPDC.CRIT1E.B_NAME	Critical range 1 active
1:0290	T2C_SPDC.CRIT1FX_RT.B_NAME	Critical speed 1 rate fixed?
1:0291	T2C_SPDC.CRIT2E.B_NAME	Critical range 2 active
1:0292	T2C_SPDC.CRIT3E.B_NAME	Critical range 3 active
1:0293	T2C_SPDC.IDLE_HOLD.B_NAME	Hold speed at idle
1:0294	T2C_VLV_.HP_STR_VLV.B_NAME	Use valve demand for xfer
1:0295	T2C_VLV_.HP_V1INI.B_NAME	Use V1 INI?
1:0296	T2C_VLV_.SD_IFSTUCK.B_NAME	SD if stuck
1:0297	T2__SPDC.ONLINEDYN.OR	Using On-Line Spd PID Dyn
1:0298	T2C_AUX1.USE_RAUX1.B_NAME	Remote AUX1 Setpt is Used
1:0299	T1__AUX1.RAUX_ENBLD.B_NAME	Remote AUX1 Setpt is Enabled
1:0300		** H/W Status Starts at 301 **
1:0301	CNFG_DI01.DI01_VAL.B_NAME	DI 1 = Emergency Stop
1:0302	CNFG_DI02.DI02_VAL.B_NAME	DI 2 Status
1:0303	CNFG_DI03.DI03_VAL.B_NAME	DI 3 Status
1:0304	CNFG_DI04.DI04_VAL.B_NAME	DI 4 Status
1:0305	CNFG_DI05.DI05_VAL.B_NAME	DI 5 Status
1:0306	CNFG_DI06.DI06_VAL.B_NAME	DI 6 Status
1:0307	CNFG_DI07.DI07_VAL.B_NAME	DI 7 Status
1:0308	CNFG_DI08.DI08_VAL.B_NAME	DI 8 Status
1:0309	CNFG_DI09.DI09_VAL.B_NAME	DI 9 Status
1:0310	CNFG_DI10.DI10_VAL.B_NAME	DI 10 Status
1:0311	CNFG_DI11.DI11_VAL.B_NAME	DI 11 Status
1:0312	CNFG_DI12.DI12_VAL.B_NAME	DI 12 Status
1:0313	CNFG_DI13.DI13_VAL.B_NAME	DI 13 Status
1:0314	CNFG_DI14.DI14_VAL.B_NAME	DI 14 Status

1:0315	CNFG_DI15.DI15_VAL.B_NAME	DI 15 Status
1:0316	CNFG_DI16.DI16_VAL.B_NAME	DI 16 Status
1:0317	CNFG_DI17.DI17_VAL.B_NAME	DI 17 Status
1:0318	CNFG_DI18.DI18_VAL.B_NAME	DI 18 Status
1:0319	CNFG_DI19.DI19_VAL.B_NAME	DI 19 Status
1:0320	CNFG_DI20.DI20_VAL.B_NAME	DI 20 Status
1:0321	CNFG_DI21.DI21_VAL.B_NAME	DI 21 Status
1:0322	CNFG_DI22.DI22_VAL.B_NAME	DI 22 Status
1:0323	CNFG_DI23.DI23_VAL.B_NAME	DI 23 Status
1:0324	CNFG_DI24.DI24_VAL.B_NAME	DI 24 Status
1:0325	CNFG_BO_01.BO_01.B_SW	Relay Output #1 Status
1:0326	CNFG_BO_02.BO_02.B_SW	Relay Output #2 Status
1:0327	CNFG_BO_03.BO_03.B_SW	Relay Output #3 Status
1:0328	CNFG_BO_04.BO_04.B_SW	Relay Output #4 Status
1:0329	CNFG_BO_05.BO_05.B_SW	Relay Output #5 Status
1:0330	CNFG_BO_06.BO_06.B_SW	Relay Output #6 Status
1:0331	CNFG_BO_07.BO_07.B_SW	Relay Output #7 Status
1:0332	CNFG_BO_08.BO_08.B_SW	Relay Output #8 Status
1:0333	CNFG_BO_09.BO_09.B_SW	Relay Output #9 Status
1:0334	CNFG_BO_10.BO_10.B_SW	Relay Output #10 Status
1:0335	CNFG_BO_11.BO_11.B_SW	Relay Output #11 Status
1:0336	CNFG_BO_12.BO_12.B_SW	Relay Output #12 Status
1:0337	CNFG_BO_02.USE_AS_LS.B_NAME	Relay #2 Used as Level Switch
1:0338	CNFG_BO_03.USE_AS_LS.B_NAME	Relay #3 Used as Level Switch
1:0339	CNFG_BO_04.USE_AS_LS.B_NAME	Relay #4 Used as Level Switch
1:0340	CNFG_BO_05.USE_AS_LS.B_NAME	Relay #5 Used as Level Switch
1:0341	CNFG_BO_06.USE_AS_LS.B_NAME	Relay #6 Used as Level Switch
1:0342	CNFG_BO_07.USE_AS_LS.B_NAME	Relay #7 Used as Level Switch
1:0343	CNFG_BO_08.USE_AS_LS.B_NAME	Relay #8 Used as Level Switch
1:0344	CNFG_BO_09.USE_AS_LS.B_NAME	Relay #9 Used as Level Switch
1:0345	CNFG_BO_10.USE_AS_LS.B_NAME	Relay #10 Used as Level Switch
1:0346	CNFG_BO_11.USE_AS_LS.B_NAME	Relay #11 Used as Level Switch
1:0347	CNFG_BO_12.USE_AS_LS.B_NAME	Relay #12 Used as Level Switch
1:0348	CHASS_CNFG.USE_MOD05.B_NAME	True = Module A5 Included
1:0349	CHASS_CNFG.USE_MOD06.B_NAME	True = Module A6 Included
1:0350	CALMODE.CALPERM.B_NAME	True = Calibration Mode Permitted
1:0351	CALMODE.CALMODE.B_NAME	True = Unit in Calibration Mode
1:0352	CALMODE.ENA_MODFRC.B_NAME	Output Forcing from HMI Active
1:0353	SEAL.USED.B_NAME	Seal Gas Control Used
1:0354	SEAL.M2PID_SPTK.B_NAME	Seal Gas Setpoint Tracking ON
1:0355	SEAL.MAN_VLVDMD.OR	Seal Gas Manual Vlv Dmd ON
1:0356	SEAL.REMOT_SP.B_ACTION	Rem Seal Gas Setpt Enabled
1:0357	Spare through 1:0373	
1:0374		
1:0375	TOOLKIT.CAS_CF.EQ	Cascade is not Used
1:0376	AI_ERR.TYPE_AUX1.EQ	Auxiliary Control is not Used
1:0377	AI_ERR.TYPE_EXTR.EQ	Extraction Not Used
1:0378	T2__EXTC.INHIBITED.B_NAME	Extraction is Inhibited
1:0379	T2C_SPDC.USE_HOTCD.B_NAME	True if Internal Curves Used
1:0380	T2C_CASC.USE_REM_SP.B_MUX_N_1	Remote Spd Setpt is Configured
1:0381	T2_GEN.GENBRKCLOS.B_NAME	Generator Breaker CLOSED
1:0382	T2_GEN.UTILB_CLOS.B_NAME	Utility Breaker CLOSED
1:0383	T2_GEN.GEN_UNIT.B_NAME	Unit is configured as GEN Unit
1:0384	T2_GEN.FREQCACTIV.AND	Frequency Control Active
1:0385	T2_GEN_O.SYNC_CNTRL.B_NAME	Synchronizer/LS Spd Bias Active
1:0386	*Spare*	*Spare*
1:0387	T2_GEN.USEKWLIM.B_NAME	KW Limiter is Configured

1:0388	T2_GEN.KWLIM_ENA.B_NAME	KW Limiter is Active
1:0389	T2_GEN.USE_FREQC.B_NAME	Frequency Arm/Disarm Configured
1:0390	*Spare*	*Spare*
1:0391	*Spare*	*Spare*
1:0392	*Spare*	*Spare*
1:0393	*Spare*	*Spare*
1:0394	*Spare*	*Spare*
1:0395	*Spare*	*Spare*
1:0396	*Spare*	*Spare*
1:0397	*Spare*	*Spare*
1:0398	*Spare*	
1:0399	*Spare*	
1:0400		Events (ALM and SD) start at 401
1:0401	ALM_MASTR.EVENT001.B_ALARM	Kernel A CPU Faulted
1:0402	ALM_MASTR.EVENT002.B_ALARM	Kernel B CPU Faulted
1:0403	ALM_MASTR.EVENT003.B_ALARM	Kernel C CPU Faulted
1:0404	ALM_MASTR.EVENT004.B_ALARM	Kernel A High Temp Alarm
1:0405	ALM_MASTR.EVENT005.B_ALARM	Kernel B High Temp Alarm
1:0406	ALM_MASTR.EVENT006.B_ALARM	Kernel C High Temp Alarm
1:0407	ALM_MASTR.EVENT007.B_ALARM	Power Supply #1 Fault
1:0408	ALM_MASTR.EVENT008.B_ALARM	Power Supply #2 Fault
1:0409	ALM_MASTR.EVENT009.B_ALARM	Modbus1 Block Link 1 Error
1:0410	ALM_MASTR.EVENT010.B_ALARM	Modbus1 Block Link 2 Error
1:0411	ALM_MASTR.EVENT011.B_ALARM	Kern A Module A03 Failed
1:0412	ALM_MASTR.EVENT012.B_ALARM	Kern A Module A04 Failed
1:0413	ALM_MASTR.EVENT013.B_ALARM	Kern A Module A05 Failed
1:0414	ALM_MASTR.EVENT014.B_ALARM	Kern A Module A06 Failed
1:0415	ALM_MASTR.EVENT015.B_ALARM	Kern B Module A03 Failed
1:0416	ALM_MASTR.EVENT016.B_ALARM	Kern B Module A04 Failed
1:0417	ALM_MASTR.EVENT017.B_ALARM	Kern B Module A05 Failed
1:0418	ALM_MASTR.EVENT018.B_ALARM	Kern B Module A06 Failed
1:0419	ALM_MASTR.EVENT019.B_ALARM	Kern C Module A03 Failed
1:0420	ALM_MASTR.EVENT020.B_ALARM	Kern C Module A04 Failed
1:0421	ALM_MASTR.EVENT021.B_ALARM	Kern C Module A05 Failed
1:0422	ALM_MASTR.EVENT022.B_ALARM	Modbus2 Block Link 1 Error
1:0423	ALM_MASTR.EVENT023.B_ALARM	Modbus2 Block Link 2 Error
1:0424	ALM_MASTR.EVENT024.B_ALARM	Redundant DI ESTOP Alarm
1:0425	ALM_MASTR.EVENT025.B_ALARM	AI #01 Chan Fail Kern A Mod A03
1:0426	ALM_MASTR.EVENT026.B_ALARM	AI #01 Chan Fail Kern B Mod A03
1:0427	ALM_MASTR.EVENT027.B_ALARM	AI #01 Chan Fail Kern C Mod A03
1:0428	ALM_MASTR.EVENT028.B_ALARM	AI #01 Chan Diff between Kernels
1:0429	ALM_MASTR.EVENT029.B_ALARM	AI #01 Input Signal Failure
1:0430	ALM_MASTR.EVENT030.B_ALARM	AI #02 Chan Fail Kern A Mod A03
1:0431	ALM_MASTR.EVENT031.B_ALARM	AI #02 Chan Fail Kern B Mod A03
1:0432	ALM_MASTR.EVENT032.B_ALARM	AI #02 Chan Fail Kern C Mod A03
1:0433	ALM_MASTR.EVENT033.B_ALARM	AI #02 Chan Diff between Kernels
1:0434	ALM_MASTR.EVENT034.B_ALARM	AI #02 Input Signal Failure
1:0435	ALM_MASTR.EVENT035.B_ALARM	AI #03 Chan Fail Kern A Mod A03
1:0436	ALM_MASTR.EVENT036.B_ALARM	AI #03 Chan Fail Kern B Mod A03
1:0437	ALM_MASTR.EVENT037.B_ALARM	AI #03 Chan Fail Kern C Mod A03
1:0438	ALM_MASTR.EVENT038.B_ALARM	AI #03 Chan Diff between Kernels
1:0439	ALM_MASTR.EVENT039.B_ALARM	AI #03 Input Signal Failure
1:0440	ALM_MASTR.EVENT040.B_ALARM	AI #04 Chan Fail Kern A Mod A03
1:0441	ALM_MASTR.EVENT041.B_ALARM	AI #04 Chan Fail Kern B Mod A03
1:0442	ALM_MASTR.EVENT042.B_ALARM	AI #04 Chan Fail Kern C Mod A03
1:0443	ALM_MASTR.EVENT043.B_ALARM	AI #04 Chan Diff between Kernels
1:0444	ALM_MASTR.EVENT044.B_ALARM	AI #04 Input Signal Failure

1:0445	ALM_MASTR.EVENT045.B_ALARM	AI #05 Chan Fail Kern A Mod A03
1:0446	ALM_MASTR.EVENT046.B_ALARM	AI #05 Chan Fail Kern B Mod A03
1:0447	ALM_MASTR.EVENT047.B_ALARM	AI #05 Chan Fail Kern C Mod A03
1:0448	ALM_MASTR.EVENT048.B_ALARM	AI #05 Chan Diff between Kernels
1:0449	ALM_MASTR.EVENT049.B_ALARM	AI #05 Input Signal Failure
1:0450	ALM_MASTR.EVENT050.B_ALARM	AI #06 Chan Fail Kern A Mod A03
1:0451	ALM_MASTR.EVENT051.B_ALARM	AI #06 Chan Fail Kern B Mod A03
1:0452	ALM_MASTR.EVENT052.B_ALARM	AI #06 Chan Fail Kern C Mod A03
1:0453	ALM_MASTR.EVENT053.B_ALARM	AI #06 Chan Diff between Kernels
1:0454	ALM_MASTR.EVENT054.B_ALARM	AI #06 Input Signal Failure
1:0455	ALM_MASTR.EVENT055.B_ALARM	AI #07 Chan Fail Kern A Mod A03
1:0456	ALM_MASTR.EVENT056.B_ALARM	AI #07 Chan Fail Kern B Mod A03
1:0457	ALM_MASTR.EVENT057.B_ALARM	AI #07 Chan Fail Kern C Mod A03
1:0458	ALM_MASTR.EVENT058.B_ALARM	AI #07 Chan Diff between Kernels
1:0459	ALM_MASTR.EVENT059.B_ALARM	AI #07 Input Signal Failure
1:0460	ALM_MASTR.EVENT060.B_ALARM	AI #08 Chan Fail Kern A Mod A03
1:0461	ALM_MASTR.EVENT061.B_ALARM	AI #08 Chan Fail Kern B Mod A03
1:0462	ALM_MASTR.EVENT062.B_ALARM	AI #08 Chan Fail Kern C Mod A03
1:0463	ALM_MASTR.EVENT063.B_ALARM	AI #08 Chan Diff between Kernels
1:0464	ALM_MASTR.EVENT064.B_ALARM	AI #08 Input Signal Failure
1:0465	ALM_MASTR.EVENT065.B_ALARM	AI #09 Chan Fail Kern A Mod A03
1:0466	ALM_MASTR.EVENT066.B_ALARM	AI #09 Chan Fail Kern B Mod A03
1:0467	ALM_MASTR.EVENT067.B_ALARM	AI #09 Chan Fail Kern C Mod A03
1:0468	ALM_MASTR.EVENT068.B_ALARM	AI #09 Chan Diff between Kernels
1:0469	ALM_MASTR.EVENT069.B_ALARM	AI #09 Input Signal Failure
1:0470	ALM_MASTR.EVENT070.B_ALARM	AI #10 Chan Fail Kern A Mod A03
1:0471	ALM_MASTR.EVENT071.B_ALARM	AI #10 Chan Fail Kern B Mod A03
1:0472	ALM_MASTR.EVENT072.B_ALARM	AI #10 Chan Fail Kern C Mod A03
1:0473	ALM_MASTR.EVENT073.B_ALARM	AI #10 Chan Diff between Kernels
1:0474	ALM_MASTR.EVENT074.B_ALARM	AI #10 Input Signal Failure
1:0475	ALM_MASTR.EVENT075.B_ALARM	AI #11 Chan Fail Kern A Mod A03
1:0476	ALM_MASTR.EVENT076.B_ALARM	AI #11 Chan Fail Kern B Mod A03
1:0477	ALM_MASTR.EVENT077.B_ALARM	AI #11 Chan Fail Kern C Mod A03
1:0478	ALM_MASTR.EVENT078.B_ALARM	AI #11 Chan Diff between Kernels
1:0479	ALM_MASTR.EVENT079.B_ALARM	AI #11 Input Signal Failure
1:0480	ALM_MASTR.EVENT080.B_ALARM	AI #12 Chan Fail Kern A Mod A03
1:0481	ALM_MASTR.EVENT081.B_ALARM	AI #12 Chan Fail Kern B Mod A03
1:0482	ALM_MASTR.EVENT082.B_ALARM	AI #12 Chan Fail Kern C Mod A03
1:0483	ALM_MASTR.EVENT083.B_ALARM	AI #12 Chan Diff between Kernels
1:0484	ALM_MASTR.EVENT084.B_ALARM	AI #12 Input Signal Failure
1:0485	ALM_MASTR.EVENT085.B_ALARM	AI #13 Chan Fail Kern A Mod A05
1:0486	ALM_MASTR.EVENT086.B_ALARM	AI #13 Chan Fail Kern B Mod A05
1:0487	ALM_MASTR.EVENT087.B_ALARM	AI #13 Chan Fail Kern C Mod A05
1:0488	ALM_MASTR.EVENT088.B_ALARM	AI #13 Chan Diff between Kernels
1:0489	ALM_MASTR.EVENT089.B_ALARM	AI #13 Input Signal Failure
1:0490	ALM_MASTR.EVENT090.B_ALARM	AI #14 Chan Fail Kern A Mod A05
1:0491	ALM_MASTR.EVENT091.B_ALARM	AI #14 Chan Fail Kern B Mod A05
1:0492	ALM_MASTR.EVENT092.B_ALARM	AI #14 Chan Fail Kern C Mod A05
1:0493	ALM_MASTR.EVENT093.B_ALARM	AI #14 Chan Diff between Kernels
1:0494	ALM_MASTR.EVENT094.B_ALARM	AI #14 Input Signal Failure
1:0495	ALM_MASTR.EVENT095.B_ALARM	AI #15 Chan Fail Kern A Mod A05
1:0496	ALM_MASTR.EVENT096.B_ALARM	AI #15 Chan Fail Kern B Mod A05
1:0497	ALM_MASTR.EVENT097.B_ALARM	AI #15 Chan Fail Kern C Mod A05
1:0498	ALM_MASTR.EVENT098.B_ALARM	AI #15 Chan Diff between Kernels
1:0499	ALM_MASTR.EVENT099.B_ALARM	AI #15 Input Signal Failure
1:0500	ALM_MASTR.EVENT100.B_ALARM	AI #16 Chan Fail Kern A Mod A05
1:0501	ALM_MASTR.EVENT101.B_ALARM	AI #16 Chan Fail Kern B Mod A05

1:0502	ALM_MASTR.EVENT102.B_ALARM	AI #16 Chan Fail Kern C Mod A05
1:0503	ALM_MASTR.EVENT103.B_ALARM	AI #16 Chan Diff between Kernels
1:0504	ALM_MASTR.EVENT104.B_ALARM	AI #16 Input Signal Failure
1:0505	ALM_MASTR.EVENT105.B_ALARM	AI #17 Chan Fail Kern A Mod A05
1:0506	ALM_MASTR.EVENT106.B_ALARM	AI #17 Chan Fail Kern B Mod A05
1:0507	ALM_MASTR.EVENT107.B_ALARM	AI #17 Chan Fail Kern C Mod A05
1:0508	ALM_MASTR.EVENT108.B_ALARM	AI #17 Chan Diff between Kernels
1:0509	ALM_MASTR.EVENT109.B_ALARM	AI #17 Input Signal Failure
1:0510	ALM_MASTR.EVENT110.B_ALARM	AI #18 Chan Fail Kern A Mod A05
1:0511	ALM_MASTR.EVENT111.B_ALARM	AI #18 Chan Fail Kern B Mod A05
1:0512	ALM_MASTR.EVENT112.B_ALARM	AI #18 Chan Fail Kern C Mod A05
1:0513	ALM_MASTR.EVENT113.B_ALARM	AI #18 Chan Diff between Kernels
1:0514	ALM_MASTR.EVENT114.B_ALARM	AI #18 Input Signal Failure
1:0515	ALM_MASTR.EVENT115.B_ALARM	AI #19 Chan Fail Kern A Mod A05
1:0516	ALM_MASTR.EVENT116.B_ALARM	AI #19 Chan Fail Kern B Mod A05
1:0517	ALM_MASTR.EVENT117.B_ALARM	AI #19 Chan Fail Kern C Mod A05
1:0518	ALM_MASTR.EVENT118.B_ALARM	AI #19 Chan Diff between Kernels
1:0519	ALM_MASTR.EVENT119.B_ALARM	AI #19 Input Signal Failure
1:0520	ALM_MASTR.EVENT120.B_ALARM	AI #20 Chan Fail Kern A Mod A05
1:0521	ALM_MASTR.EVENT121.B_ALARM	AI #20 Chan Fail Kern B Mod A05
1:0522	ALM_MASTR.EVENT122.B_ALARM	AI #20 Chan Fail Kern C Mod A05
1:0523	ALM_MASTR.EVENT123.B_ALARM	AI #20 Chan Diff between Kernels
1:0524	ALM_MASTR.EVENT124.B_ALARM	AI #20 Input Signal Failure
1:0525	ALM_MASTR.EVENT125.B_ALARM	AI #21 Chan Fail Kern A Mod A05
1:0526	ALM_MASTR.EVENT126.B_ALARM	AI #21 Chan Fail Kern B Mod A05
1:0527	ALM_MASTR.EVENT127.B_ALARM	AI #21 Chan Fail Kern C Mod A05
1:0528	ALM_MASTR.EVENT128.B_ALARM	AI #21 Chan Diff between Kernels
1:0529	ALM_MASTR.EVENT129.B_ALARM	AI #21 Input Signal Failure
1:0530	ALM_MASTR.EVENT130.B_ALARM	AI #22 Chan Fail Kern A Mod A05
1:0531	ALM_MASTR.EVENT131.B_ALARM	AI #22 Chan Fail Kern B Mod A05
1:0532	ALM_MASTR.EVENT132.B_ALARM	AI #22 Chan Fail Kern C Mod A05
1:0533	ALM_MASTR.EVENT133.B_ALARM	AI #22 Chan Diff between Kernels
1:0534	ALM_MASTR.EVENT134.B_ALARM	AI #22 Input Signal Failure
1:0535	ALM_MASTR.EVENT135.B_ALARM	AI #23 Chan Fail Kern A Mod A05
1:0536	ALM_MASTR.EVENT136.B_ALARM	AI #23 Chan Fail Kern B Mod A05
1:0537	ALM_MASTR.EVENT137.B_ALARM	AI #23 Chan Fail Kern C Mod A05
1:0538	ALM_MASTR.EVENT138.B_ALARM	AI #23 Chan Diff between Kernels
1:0539	ALM_MASTR.EVENT139.B_ALARM	AI #23 Input Signal Failure
1:0540	ALM_MASTR.EVENT140.B_ALARM	AI #24 Chan Fail Kern A Mod A05
1:0541	ALM_MASTR.EVENT141.B_ALARM	AI #24 Chan Fail Kern B Mod A05
1:0542	ALM_MASTR.EVENT142.B_ALARM	AI #24 Chan Fail Kern C Mod A05
1:0543	ALM_MASTR.EVENT143.B_ALARM	AI #24 Chan Diff between Kernels
1:0544	ALM_MASTR.EVENT144.B_ALARM	AI #24 Input Signal Failure
1:0545	ALM_MASTR.EVENT145.B_ALARM	AI #25 Chan Fail Kern A Mod A05
1:0546	ALM_MASTR.EVENT146.B_ALARM	AI #25 Chan Fail Kern B Mod A05
1:0547	ALM_MASTR.EVENT147.B_ALARM	AI #25 Chan Fail Kern C Mod A05
1:0548	ALM_MASTR.EVENT148.B_ALARM	AI #25 Chan Diff between Kernels
1:0549	ALM_MASTR.EVENT149.B_ALARM	AI #25 Input Signal Failure
1:0550	ALM_MASTR.EVENT150.B_ALARM	AI #26 Chan Fail Kern A Mod A05
1:0551	ALM_MASTR.EVENT151.B_ALARM	AI #26 Chan Fail Kern B Mod A05
1:0552	ALM_MASTR.EVENT152.B_ALARM	AI #26 Chan Fail Kern C Mod A05
1:0553	ALM_MASTR.EVENT153.B_ALARM	AI #26 Chan Diff between Kernels
1:0554	ALM_MASTR.EVENT154.B_ALARM	AI #26 Input Signal Failure
1:0555	ALM_MASTR.EVENT155.B_ALARM	AI #27 Chan Fail Kern A Mod A05
1:0556	ALM_MASTR.EVENT156.B_ALARM	AI #27 Chan Fail Kern B Mod A05
1:0557	ALM_MASTR.EVENT157.B_ALARM	AI #27 Chan Fail Kern C Mod A05
1:0558	ALM_MASTR.EVENT158.B_ALARM	AI #27 Chan Diff between Kernels

1:0559	ALM_MASTR.EVENT159.B_ALARM	AI #27 Input Signal Failure
1:0560	ALM_MASTR.EVENT160.B_ALARM	AI #28 Chan Fail Kern A Mod A05
1:0561	ALM_MASTR.EVENT161.B_ALARM	AI #28 Chan Fail Kern B Mod A05
1:0562	ALM_MASTR.EVENT162.B_ALARM	AI #28 Chan Fail Kern C Mod A05
1:0563	ALM_MASTR.EVENT163.B_ALARM	AI #28 Chan Diff between Kernels
1:0564	ALM_MASTR.EVENT164.B_ALARM	AI #28 Input Signal Failure
1:0565	ALM_MASTR.EVENT165.B_ALARM	AI #29 Chan Fail Kern A Mod A05
1:0566	ALM_MASTR.EVENT166.B_ALARM	AI #29 Chan Fail Kern B Mod A05
1:0567	ALM_MASTR.EVENT167.B_ALARM	AI #29 Chan Fail Kern C Mod A05
1:0568	ALM_MASTR.EVENT168.B_ALARM	AI #29 Chan Diff between Kernels
1:0569	ALM_MASTR.EVENT169.B_ALARM	AI #29 Input Signal Failure
1:0570	ALM_MASTR.EVENT170.B_ALARM	AI #30 Chan Fail Kern A Mod A05
1:0571	ALM_MASTR.EVENT171.B_ALARM	AI #30 Chan Fail Kern B Mod A05
1:0572	ALM_MASTR.EVENT172.B_ALARM	AI #30 Chan Fail Kern C Mod A05
1:0573	ALM_MASTR.EVENT173.B_ALARM	AI #30 Chan Diff between Kernels
1:0574	ALM_MASTR.EVENT174.B_ALARM	AI #30 Input Signal Failure
1:0575	ALM_MASTR.EVENT175.B_ALARM	AI #31 Chan Fail Kern A Mod A05
1:0576	ALM_MASTR.EVENT176.B_ALARM	AI #31 Chan Fail Kern B Mod A05
1:0577	ALM_MASTR.EVENT177.B_ALARM	AI #31 Chan Fail Kern C Mod A05
1:0578	ALM_MASTR.EVENT178.B_ALARM	AI #31 Chan Diff between Kernels
1:0579	ALM_MASTR.EVENT179.B_ALARM	AI #31 Input Signal Failure
1:0580	ALM_MASTR.EVENT180.B_ALARM	AI #32 Chan Fail Kern A Mod A05
1:0581	ALM_MASTR.EVENT181.B_ALARM	AI #32 Chan Fail Kern B Mod A05
1:0582	ALM_MASTR.EVENT182.B_ALARM	AI #32 Chan Fail Kern C Mod A05
1:0583	ALM_MASTR.EVENT183.B_ALARM	AI #32 Chan Diff between Kernels
1:0584	ALM_MASTR.EVENT184.B_ALARM	AI #32 Input Signal Failure
1:0585	ALM_MASTR.EVENT185.B_ALARM	AO #1 Chan Fail Kern A
1:0586	ALM_MASTR.EVENT186.B_ALARM	AO #1 Chan Fail Kern B
1:0587	ALM_MASTR.EVENT187.B_ALARM	AO #1 Chan Fail Kern C
1:0588	ALM_MASTR.EVENT188.B_ALARM	AO #1 No Load Detected
1:0589	ALM_MASTR.EVENT189.B_ALARM	AO #1 Chan Fail All Kernels
1:0590	ALM_MASTR.EVENT190.B_ALARM	AO #2 Chan Fail Kern A
1:0591	ALM_MASTR.EVENT191.B_ALARM	AO #2 Chan Fail Kern B
1:0592	ALM_MASTR.EVENT192.B_ALARM	AO #2 Chan Fail Kern C
1:0593	ALM_MASTR.EVENT193.B_ALARM	AO #2 No Load Detected
1:0594	ALM_MASTR.EVENT194.B_ALARM	AO #2 Chan Fail All Kernels
1:0595	ALM_MASTR.EVENT195.B_ALARM	AO #3 Chan Fail Kern A
1:0596	ALM_MASTR.EVENT196.B_ALARM	AO #3 Chan Fail Kern B
1:0597	ALM_MASTR.EVENT197.B_ALARM	AO #3 Chan Fail Kern C
1:0598	ALM_MASTR.EVENT198.B_ALARM	AO #3 No Load Detected
1:0599	ALM_MASTR.EVENT199.B_ALARM	AO #3 Chan Fail All Kernels
1:0600	ALM_MASTR.EVENT200.B_ALARM	AO #4 Chan Fail Kern A
1:0601	ALM_MASTR.EVENT201.B_ALARM	AO #4 Chan Fail Kern B
1:0602	ALM_MASTR.EVENT202.B_ALARM	AO #4 Chan Fail Kern C
1:0603	ALM_MASTR.EVENT203.B_ALARM	AO #4 No Load Detected
1:0604	ALM_MASTR.EVENT204.B_ALARM	AO #4 Chan Fail All Kernels
1:0605	ALM_MASTR.EVENT205.B_ALARM	AO #5 Chan Fail Kern A
1:0606	ALM_MASTR.EVENT206.B_ALARM	AO #5 Chan Fail Kern B
1:0607	ALM_MASTR.EVENT207.B_ALARM	AO #5 Chan Fail Kern C
1:0608	ALM_MASTR.EVENT208.B_ALARM	AO #5 No Load Detected
1:0609	ALM_MASTR.EVENT209.B_ALARM	AO #5 Chan Fail All Kernels
1:0610	ALM_MASTR.EVENT210.B_ALARM	AO #6 Chan Fail Kern A
1:0611	ALM_MASTR.EVENT211.B_ALARM	AO #6 Chan Fail Kern B
1:0612	ALM_MASTR.EVENT212.B_ALARM	AO #6 Chan Fail Kern C
1:0613	ALM_MASTR.EVENT213.B_ALARM	AO #6 No Load Detected
1:0614	ALM_MASTR.EVENT214.B_ALARM	AO #6 Chan Fail All Kernels
1:0615	ALM_MASTR.EVENT215.B_ALARM	AO #7 Chan Fail Kern A

1:0616	ALM_MASTR.EVENT216.B_ALARM	AO #7 Chan Fail Kern B
1:0617	ALM_MASTR.EVENT217.B_ALARM	AO #7 Chan Fail Kern C
1:0618	ALM_MASTR.EVENT218.B_ALARM	AO #7 No Load Detected
1:0619	ALM_MASTR.EVENT219.B_ALARM	AO #7 Chan Fail All Kernels
1:0620	ALM_MASTR.EVENT220.B_ALARM	AO #8 Chan Fail Kern A
1:0621	ALM_MASTR.EVENT221.B_ALARM	AO #8 Chan Fail Kern B
1:0622	ALM_MASTR.EVENT222.B_ALARM	AO #8 Chan Fail Kern C
1:0623	ALM_MASTR.EVENT223.B_ALARM	AO #8 No Load Detected
1:0624	ALM_MASTR.EVENT224.B_ALARM	AO #8 Chan Fail All Kernels
1:0625	ALM_MASTR.EVENT225.B_ALARM	AO #9 Chan Fail Kern A
1:0626	ALM_MASTR.EVENT226.B_ALARM	AO #9 Chan Fail Kern B
1:0627	ALM_MASTR.EVENT227.B_ALARM	AO #9 Chan Fail Kern C
1:0628	ALM_MASTR.EVENT228.B_ALARM	AO #9 No Load Detected
1:0629	ALM_MASTR.EVENT229.B_ALARM	AO #9 Chan Fail All Kernels
1:0630	ALM_MASTR.EVENT230.B_ALARM	AO #10 Chan Fail Kern A
1:0631	ALM_MASTR.EVENT231.B_ALARM	AO #10 Chan Fail Kern B
1:0632	ALM_MASTR.EVENT232.B_ALARM	AO #10 Chan Fail Kern C
1:0633	ALM_MASTR.EVENT233.B_ALARM	AO #10 No Load Detected
1:0634	ALM_MASTR.EVENT234.B_ALARM	AO #10 Chan Fail All Kernels
1:0635	ALM_MASTR.EVENT235.B_ALARM	AO #11 Chan Fail Kern A
1:0636	ALM_MASTR.EVENT236.B_ALARM	AO #11 Chan Fail Kern B
1:0637	ALM_MASTR.EVENT237.B_ALARM	AO #11 Chan Fail Kern C
1:0638	ALM_MASTR.EVENT238.B_ALARM	AO #11 No Load Detected
1:0639	ALM_MASTR.EVENT239.B_ALARM	AO #11 Chan Fail All Kernels
1:0640	ALM_MASTR.EVENT240.B_ALARM	AO #12 Chan Fail Kern A
1:0641	ALM_MASTR.EVENT241.B_ALARM	AO #12 Chan Fail Kern B
1:0642	ALM_MASTR.EVENT242.B_ALARM	AO #12 Chan Fail Kern C
1:0643	ALM_MASTR.EVENT243.B_ALARM	AO #12 No Load Detected
1:0644	ALM_MASTR.EVENT244.B_ALARM	AO #12 Chan Fail All Kernels
1:0645	ALM_MASTR.EVENT245.B_ALARM	DI #1 Chan Fail Kern A
1:0646	ALM_MASTR.EVENT246.B_ALARM	DI #1 Chan Fail Kern B
1:0647	ALM_MASTR.EVENT247.B_ALARM	DI #1 Chan Fail Kern C
1:0648	ALM_MASTR.EVENT248.B_ALARM	DI #2 Chan Fail Kern A
1:0649	ALM_MASTR.EVENT249.B_ALARM	DI #2 Chan Fail Kern B
1:0650	ALM_MASTR.EVENT250.B_ALARM	DI #2 Chan Fail Kern C
1:0651	ALM_MASTR.EVENT251.B_ALARM	DI #3 Chan Fail Kern A
1:0652	ALM_MASTR.EVENT252.B_ALARM	DI #3 Chan Fail Kern B
1:0653	ALM_MASTR.EVENT253.B_ALARM	DI #3 Chan Fail Kern C
1:0654	ALM_MASTR.EVENT254.B_ALARM	DI #4 Chan Fail Kern A
1:0655	ALM_MASTR.EVENT255.B_ALARM	DI #4 Chan Fail Kern B
1:0656	ALM_MASTR.EVENT256.B_ALARM	DI #4 Chan Fail Kern C
1:0657	ALM_MASTR.EVENT257.B_ALARM	DI #5 Chan Fail Kern A
1:0658	ALM_MASTR.EVENT258.B_ALARM	DI #5 Chan Fail Kern B
1:0659	ALM_MASTR.EVENT259.B_ALARM	DI #5 Chan Fail Kern C
1:0660	ALM_MASTR.EVENT260.B_ALARM	DI #6 Chan Fail Kern A
1:0661	ALM_MASTR.EVENT261.B_ALARM	DI #6 Chan Fail Kern B
1:0662	ALM_MASTR.EVENT262.B_ALARM	DI #6 Chan Fail Kern C
1:0663	ALM_MASTR.EVENT263.B_ALARM	DI #7 Chan Fail Kern A
1:0664	ALM_MASTR.EVENT264.B_ALARM	DI #7 Chan Fail Kern B
1:0665	ALM_MASTR.EVENT265.B_ALARM	DI #7 Chan Fail Kern C
1:0666	ALM_MASTR.EVENT266.B_ALARM	DI #8 Chan Fail Kern A
1:0667	ALM_MASTR.EVENT267.B_ALARM	DI #8 Chan Fail Kern B
1:0668	ALM_MASTR.EVENT268.B_ALARM	DI #8 Chan Fail Kern C
1:0669	ALM_MASTR.EVENT269.B_ALARM	DI #9 Chan Fail Kern A
1:0670	ALM_MASTR.EVENT270.B_ALARM	DI #9 Chan Fail Kern B
1:0671	ALM_MASTR.EVENT271.B_ALARM	DI #9 Chan Fail Kern C
1:0672	ALM_MASTR.EVENT272.B_ALARM	DI #10 Chan Fail Kern A

1:0673	ALM_MASTR.EVENT273.B_ALARM	DI #10 Chan Fail Kern B
1:0674	ALM_MASTR.EVENT274.B_ALARM	DI #10 Chan Fail Kern C
1:0675	ALM_MASTR.EVENT275.B_ALARM	DI #11 Chan Fail Kern A
1:0676	ALM_MASTR.EVENT276.B_ALARM	DI #11 Chan Fail Kern B
1:0677	ALM_MASTR.EVENT277.B_ALARM	DI #11 Chan Fail Kern C
1:0678	ALM_MASTR.EVENT278.B_ALARM	DI #12 Chan Fail Kern A
1:0679	ALM_MASTR.EVENT279.B_ALARM	DI #12 Chan Fail Kern B
1:0680	ALM_MASTR.EVENT280.B_ALARM	DI #12 Chan Fail Kern C
1:0681	ALM_MASTR.EVENT281.B_ALARM	DI #13 Chan Fail Kern A
1:0682	ALM_MASTR.EVENT282.B_ALARM	DI #13 Chan Fail Kern B
1:0683	ALM_MASTR.EVENT283.B_ALARM	DI #13 Chan Fail Kern C
1:0684	ALM_MASTR.EVENT284.B_ALARM	DI #14 Chan Fail Kern A
1:0685	ALM_MASTR.EVENT285.B_ALARM	DI #14 Chan Fail Kern B
1:0686	ALM_MASTR.EVENT286.B_ALARM	DI #14 Chan Fail Kern C
1:0687	ALM_MASTR.EVENT287.B_ALARM	DI #15 Chan Fail Kern A
1:0688	ALM_MASTR.EVENT288.B_ALARM	DI #15 Chan Fail Kern B
1:0689	ALM_MASTR.EVENT289.B_ALARM	DI #15 Chan Fail Kern C
1:0690	ALM_MASTR.EVENT290.B_ALARM	DI #16 Chan Fail Kern A
1:0691	ALM_MASTR.EVENT291.B_ALARM	DI #16 Chan Fail Kern B
1:0692	ALM_MASTR.EVENT292.B_ALARM	DI #16 Chan Fail Kern C
1:0693	ALM_MASTR.EVENT293.B_ALARM	DI #17 Chan Fail Kern A
1:0694	ALM_MASTR.EVENT294.B_ALARM	DI #17 Chan Fail Kern B
1:0695	ALM_MASTR.EVENT295.B_ALARM	DI #17 Chan Fail Kern C
1:0696	ALM_MASTR.EVENT296.B_ALARM	DI #18 Chan Fail Kern A
1:0697	ALM_MASTR.EVENT297.B_ALARM	DI #18 Chan Fail Kern B
1:0698	ALM_MASTR.EVENT298.B_ALARM	DI #18 Chan Fail Kern C
1:0699	ALM_MASTR.EVENT299.B_ALARM	DI #19 Chan Fail Kern A
1:0700	ALM_MASTR.EVENT300.B_ALARM	DI #19 Chan Fail Kern B
1:0701	ALM_MASTR.EVENT301.B_ALARM	DI #19 Chan Fail Kern C
1:0702	ALM_MASTR.EVENT302.B_ALARM	DI #20 Chan Fail Kern A
1:0703	ALM_MASTR.EVENT303.B_ALARM	DI #20 Chan Fail Kern B
1:0704	ALM_MASTR.EVENT304.B_ALARM	DI #20 Chan Fail Kern C
1:0705	ALM_MASTR.EVENT305.B_ALARM	DI #21 Chan Fail Kern A
1:0706	ALM_MASTR.EVENT306.B_ALARM	DI #21 Chan Fail Kern B
1:0707	ALM_MASTR.EVENT307.B_ALARM	DI #21 Chan Fail Kern C
1:0708	ALM_MASTR.EVENT308.B_ALARM	DI #22 Chan Fail Kern A
1:0709	ALM_MASTR.EVENT309.B_ALARM	DI #22 Chan Fail Kern B
1:0710	ALM_MASTR.EVENT310.B_ALARM	DI #22 Chan Fail Kern C
1:0711	ALM_MASTR.EVENT311.B_ALARM	DI #23 Chan Fail Kern A
1:0712	ALM_MASTR.EVENT312.B_ALARM	DI #23 Chan Fail Kern B
1:0713	ALM_MASTR.EVENT313.B_ALARM	DI #23 Chan Fail Kern C
1:0714	ALM_MASTR.EVENT314.B_ALARM	DI #24 Chan Fail Kern A
1:0715	ALM_MASTR.EVENT315.B_ALARM	DI #24 Chan Fail Kern B
1:0716	ALM_MASTR.EVENT316.B_ALARM	DI #24 Chan Fail Kern C
1:0717	ALM_MASTR.EVENT317.B_ALARM	Speed Signal #1 Difference ALM
1:0718	ALM_MASTR.EVENT318.B_ALARM	Speed Signal #2 Difference ALM
1:0719	ALM_MASTR.EVENT319.B_ALARM	Speed Signal #3 Difference ALM
1:0720	ALM_MASTR.EVENT320.B_ALARM	Spare
1:0721	ALM_MASTR.EVENT321.B_ALARM	Spare
1:0722	ALM_MASTR.EVENT322.B_ALARM	Spare
1:0723	ALM_MASTR.EVENT323.B_ALARM	Spare
1:0724	ALM_MASTR.EVENT324.B_ALARM	Spare
1:0725	ALM_MASTR.EVENT325.B_ALARM	Spare
1:0726	ALM_MASTR.EVENT326.B_ALARM	Spare
1:0727	ALM_MASTR.EVENT327.B_ALARM	Spare
1:0728	ALM_MASTR.EVENT328.B_ALARM	Spare
1:0729	ALM_MASTR.EVENT329.B_ALARM	Spare

1:0730	ALM_MASTR.EVENT330.B_ALARM	Spare
1:0731	ALM_MASTR.EVENT331.B_ALARM	Spare
1:0732	ALM_MASTR.EVENT332.B_ALARM	Speed Chan #1 Fail Kern A
1:0733	ALM_MASTR.EVENT333.B_ALARM	Speed Chan #1 Fail Kern B
1:0734	ALM_MASTR.EVENT334.B_ALARM	Speed Chan #1 Fail Kern C
1:0735	ALM_MASTR.EVENT335.B_ALARM	Speed Signal Input Chan #1 Failed
1:0736	ALM_MASTR.EVENT336.B_ALARM	Speed Chan #2 Fail Kern A
1:0737	ALM_MASTR.EVENT337.B_ALARM	Speed Chan #2 Fail Kern B
1:0738	ALM_MASTR.EVENT338.B_ALARM	Speed Chan #2 Fail Kern C
1:0739	ALM_MASTR.EVENT339.B_ALARM	Speed Signal Input Chan #2 Failed
1:0740	ALM_MASTR.EVENT340.B_ALARM	Speed Chan #3 Fail Kern A
1:0741	ALM_MASTR.EVENT341.B_ALARM	Speed Chan #3 Fail Kern B
1:0742	ALM_MASTR.EVENT342.B_ALARM	Speed Chan #3 Fail Kern C
1:0743	ALM_MASTR.EVENT343.B_ALARM	Speed Signal Input Chan #3 Failed
1:0744	ALM_MASTR.EVENT344.B_ALARM	Speed Chan #4 Fail Kern A
1:0745	ALM_MASTR.EVENT345.B_ALARM	Speed Chan #4 Fail Kern B
1:0746	ALM_MASTR.EVENT346.B_ALARM	Speed Chan #4 Fail Kern C
1:0747	ALM_MASTR.EVENT347.B_ALARM	Speed Signal Input Chan #4 Failed
1:0748	ALM_MASTR.EVENT348.B_ALARM	FT Relay #1 Summary Fault
1:0749	ALM_MASTR.EVENT349.B_ALARM	FT Relay #2 Summary Fault
1:0750	ALM_MASTR.EVENT350.B_ALARM	FT Relay #3 Summary Fault
1:0751	ALM_MASTR.EVENT351.B_ALARM	FT Relay #4 Summary Fault
1:0752	ALM_MASTR.EVENT352.B_ALARM	FT Relay #5 Summary Fault
1:0753	ALM_MASTR.EVENT353.B_ALARM	FT Relay #6 Summary Fault
1:0754	ALM_MASTR.EVENT354.B_ALARM	FT Relay #7 Summary Fault
1:0755	ALM_MASTR.EVENT355.B_ALARM	FT Relay #8 Summary Fault
1:0756	ALM_MASTR.EVENT356.B_ALARM	FT Relay #9 Summary Fault
1:0757	ALM_MASTR.EVENT357.B_ALARM	FT Relay #10 Summary Fault
1:0758	ALM_MASTR.EVENT358.B_ALARM	FT Relay #11 Summary Fault
1:0759	ALM_MASTR.EVENT359.B_ALARM	FT Relay #12 Summary Fault
1:0760	ALM_MASTR.EVENT360.B_ALARM	Underspeed Alarm
1:0761	ALM_MASTR.EVENT361.B_ALARM	Speed Control Lost
1:0762	ALM_MASTR.EVENT362.B_ALARM	Stuck in Critical Band
1:0763	ALM_MASTR.EVENT363.B_ALARM	Rotor Stuck Alarm
1:0764	ALM_MASTR.EVENT364.B_ALARM	Configuration Error while Running
1:0765	ALM_MASTR.EVENT365.B_ALARM	Cascade Ext Override Active
1:0766	ALM_MASTR.EVENT366.B_ALARM	Cascade Emergency Activated
1:0767	ALM_MASTR.EVENT367.B_ALARM	Aux Limiter in Control
1:0768	ALM_MASTR.EVENT368.B_ALARM	Aux Limiter Active / No Speed Raise
1:0769	ALM_MASTR.EVENT369.B_ALARM	External Alarm #1
1:0770	ALM_MASTR.EVENT370.B_ALARM	External Alarm #2
1:0771	ALM_MASTR.EVENT371.B_ALARM	External Alarm #3
1:0772	ALM_MASTR.EVENT372.B_ALARM	External Alarm #4
1:0773	ALM_MASTR.EVENT373.B_ALARM	External Alarm #5
1:0774	ALM_MASTR.EVENT374.B_ALARM	External Alarm #6
1:0775	ALM_MASTR.EVENT375.B_ALARM	External Alarm #7
1:0776	ALM_MASTR.EVENT376.B_ALARM	External Alarm #8
1:0777	ALM_MASTR.EVENT377.B_ALARM	External Alarm #9
1:0778	ALM_MASTR.EVENT378.B_ALARM	External Alarm #10
1:0779	ALM_MASTR.EVENT379.B_ALARM	Kernel Fault/CPU Voting Error
1:0780	ALM_MASTR.EVENT380.B_ALARM	Integrating ACT1 A Failed
1:0781	ALM_MASTR.EVENT381.B_ALARM	Integrating ACT1 B Failed
1:0782	ALM_MASTR.EVENT382.B_ALARM	*Spare*
1:0783	ALM_MASTR.EVENT383.B_ALARM	Integrating ACT2 A Failed
1:0784	ALM_MASTR.EVENT384.B_ALARM	Integrating ACT2 B Failed
1:0785	ALM_MASTR.EVENT385.B_ALARM	Overspeed Alarm Level
1:0786	ALM_MASTR.EVENT386.B_ALARM	*Spare CORE ALM11*

1:0787	ALM_MASTR.EVENT387.B_ALARM	*Spare CORE ALM12*
1:0788	ALM_MASTR.EVENT388.B_ALARM	*Spare CORE ALM13*
1:0789	ALM_MASTR.EVENT389.B_ALARM	*Spare CORE ALM14*
1:0790	ALM_MASTR.EVENT390.B_ALARM	*Spare CORE ALM15*
1:0791	ALM_MASTR.EVENT391.B_ALARM	*Spare CORE ALM16*
1:0792	ALM_MASTR.EVENT392.B_ALARM	Overspeed Test Mode Active
1:0793	ALM_MASTR.EVENT393.B_ALARM	
1:0794	ALM_MASTR.EVENT394.B_ALARM	
1:0795	ALM_MASTR.EVENT395.B_ALARM	
1:0796	ALM_MASTR.EVENT396.B_ALARM	
1:0797	ALM_MASTR.EVENT397.B_ALARM	
1:0798	ALM_MASTR.EVENT398.B_ALARM	
1:0799	ALM_MASTR.EVENT399.B_ALARM	** CORE ALM/SD Start at 401 **
1:0800	ALM_MASTR.EVENT400.B_ALARM	ESTOP - Emergency Stop #1
1:0801	ALM_MASTR.EVENT401.B_ALARM	Overspeed Trip SD
1:0802	ALM_MASTR.EVENT402.B_ALARM	Max Overspeed Reached
1:0803	ALM_MASTR.EVENT403.B_ALARM	Predictive Overspeed SD
1:0804	ALM_MASTR.EVENT404.B_ALARM	Normal SD Completed
1:0805	ALM_MASTR.EVENT405.B_ALARM	Underspeed Shutdown
1:0806	ALM_MASTR.EVENT406.B_ALARM	Speed Control Lost
1:0807	ALM_MASTR.EVENT407.B_ALARM	Stuck in Critical Speed Band
1:0808	ALM_MASTR.EVENT408.B_ALARM	Rotor Stuck SD
1:0809	ALM_MASTR.EVENT409.B_ALARM	Speed Sig Lost / Fail to Start
1:0810	ALM_MASTR.EVENT410.B_ALARM	Configuration Error (CORE)
1:0811	ALM_MASTR.EVENT411.B_ALARM	Extraction Sensor Fault
1:0812	ALM_MASTR.EVENT412.B_ALARM	*Spare CORE SD14*
1:0813	ALM_MASTR.EVENT413.B_ALARM	*Spare CORE SD15*
1:0814	ALM_MASTR.EVENT414.B_ALARM	*Spare CORE SD16*
1:0815	ALM_MASTR.EVENT415.B_ALARM	*Spare*
1:0816	ALM_MASTR.EVENT416.B_ALARM	*Spare*
1:0817	ALM_MASTR.EVENT417.B_ALARM	*Spare*
1:0818	ALM_MASTR.EVENT418.B_ALARM	Control in CALMODE
1:0819	ALM_MASTR.EVENT419.B_ALARM	External Trip #2
1:0820	ALM_MASTR.EVENT420.B_ALARM	External Trip #3
1:0821	ALM_MASTR.EVENT421.B_ALARM	External Trip #4
1:0822	ALM_MASTR.EVENT422.B_ALARM	External Trip #5
1:0823	ALM_MASTR.EVENT423.B_ALARM	External Trip #6
1:0824	ALM_MASTR.EVENT424.B_ALARM	External Trip #7
1:0825	ALM_MASTR.EVENT425.B_ALARM	External Trip #8
1:0826	ALM_MASTR.EVENT426.B_ALARM	External Trip #9
1:0827	ALM_MASTR.EVENT427.B_ALARM	External Trip #10
1:0828	ALM_MASTR.EVENT428.B_ALARM	Spare
1:0829	ALM_MASTR.EVENT429.B_ALARM	Spare
1:0830	ALM_MASTR.EVENT430.B_ALARM	Integrating ACT1 A&B Failed
1:0831	ALM_MASTR.EVENT431.B_ALARM	Integrating ACT2 A&B Failed
1:0832	ALM_MASTR.EVENT432.B_ALARM	Input/Output Configuration Error
1:0833	ALM_MASTR.EVENT433.B_ALARM	Breaker Opened Trip
1:0834	ALM_MASTR.EVENT434.B_ALARM	*Spare*
1:0835	ALM_MASTR.EVENT435.B_ALARM	*Spare*
1:0836	ALM_MASTR.EVENT436.B_ALARM	*Spare*
1:0837	ALM_MASTR.EVENT437.B_ALARM	*Spare*
1:0838	ALM_MASTR.EVENT438.B_ALARM	*Spare*
1:0839	ALM_MASTR.EVENT439.B_ALARM	*Spare*
1:0840	ALM_MASTR.EVENT440.B_ALARM	ALL REM Speed Setpoints Failed
1:0841	ALM_MASTR.EVENT441.B_ALARM	REM Speed Setpoint Sig Diff
1:0842	ALM_MASTR.EVENT442.B_ALARM	ALL Cascade Inputs Failed
1:0843	ALM_MASTR.EVENT443.B_ALARM	Cascade Signal Difference

1:0844	ALM_MASTR.EVENT444.B_ALARM	ALL REM Casc Setpoints Failed
1:0845	ALM_MASTR.EVENT445.B_ALARM	REM Casc Setpoints Sig Diff
1:0846	ALM_MASTR.EVENT446.B_ALARM	ALL Auxiliary Inputs Failed
1:0847	ALM_MASTR.EVENT447.B_ALARM	Auxiliary Input Signal Difference
1:0848	ALM_MASTR.EVENT448.B_ALARM	ALL REM Auxiliary Setpoints Failed
1:0849	ALM_MASTR.EVENT449.B_ALARM	REM Auxiliary Setpoints Sig Diff
1:0850	ALM_MASTR.EVENT450.B_ALARM	ALL Extraction/Admission Inputs Failed
1:0851	ALM_MASTR.EVENT451.B_ALARM	Ext/Adm Inputs Signal Difference
1:0852	ALM_MASTR.EVENT452.B_ALARM	Remote E/A Setpoint Failed
1:0853	ALM_MASTR.EVENT453.B_ALARM	Remote E/A Setpoints Sig Diff
1:0854	ALM_MASTR.EVENT454.B_ALARM	Manual Remote E/A Setpoint Failed
1:0855	ALM_MASTR.EVENT455.B_ALARM	Manual Remote E/A Setpoints Sig Diff
1:0856	ALM_MASTR.EVENT456.B_ALARM	Inlet Steam Press Input Signals Failed
1:0857	ALM_MASTR.EVENT457.B_ALARM	Inlet Steam Press Input Signals Sig Di
1:0858	ALM_MASTR.EVENT458.B_ALARM	First Stage Pressure Input Signals Fai
1:0859	ALM_MASTR.EVENT459.B_ALARM	First Stage Pressure Input Signals Sig
1:0860	ALM_MASTR.EVENT460.B_ALARM	ALL Exhaust Pressure Signals Failed
1:0861	ALM_MASTR.EVENT461.B_ALARM	Exhaust Pressure Signal Difference
1:0862	ALM_MASTR.EVENT462.B_ALARM	Remote Decoupling Inputs Failed
1:0863	ALM_MASTR.EVENT463.B_ALARM	Remote Decoupling Inputs Sig Diff
1:0864	ALM_MASTR.EVENT464.B_ALARM	ALL Manual Remote Decoupling Sigs Fail
1:0865	ALM_MASTR.EVENT465.B_ALARM	Manual Remote Decoupling Sig Diff
1:0866	ALM_MASTR.EVENT466.B_ALARM	ALL Feed Forward Input Signals Failed
1:0867	ALM_MASTR.EVENT467.B_ALARM	Feed Forward Signals Diff
1:0868	ALM_MASTR.EVENT468.B_ALARM	All Sync/Speed Bias Signals Failed
1:0869	ALM_MASTR.EVENT469.B_ALARM	Sync/Speed Bias Signal Difference
1:0870	ALM_MASTR.EVENT470.B_ALARM	ALL Load Signals Failed
1:0871	ALM_MASTR.EVENT471.B_ALARM	Load Signal Difference
1:0872	ALM_MASTR.EVENT472.B_ALARM	ALL Comp Flow 1 Signals Failed
1:0873	ALM_MASTR.EVENT473.B_ALARM	Comp Flow 1 Signal Difference
1:0874	ALM_MASTR.EVENT474.B_ALARM	ALL Suction Pressure Signals Failed
1:0875	ALM_MASTR.EVENT475.B_ALARM	Suction Pressure Signal Difference
1:0876	ALM_MASTR.EVENT476.B_ALARM	ALL Discharge Pressure Failed
1:0877	ALM_MASTR.EVENT477.B_ALARM	Discharge Press Signal Diff
1:0878	ALM_MASTR.EVENT478.B_ALARM	ALL Suction Temp 1 Signals Failed
1:0879	ALM_MASTR.EVENT479.B_ALARM	Suction Temp 1 Signal Difference
1:0880	ALM_MASTR.EVENT480.B_ALARM	ALL Discharge Temp Signals Failed
1:0881	ALM_MASTR.EVENT481.B_ALARM	Discharge Temp Signals Diff
1:0882	ALM_MASTR.EVENT482.B_ALARM	*Spare*
1:0883	ALM_MASTR.EVENT483.B_ALARM	*Spare*
1:0884	ALM_MASTR.EVENT484.B_ALARM	*Spare*
1:0885	ALM_MASTR.EVENT485.B_ALARM	*Spare*
1:0886	ALM_MASTR.EVENT486.B_ALARM	*Spare*
1:0887	ALM_MASTR.EVENT487.B_ALARM	*Spare*
1:0888	ALM_MASTR.EVENT488.B_ALARM	*Spare*
1:0889	ALM_MASTR.EVENT489.B_ALARM	*Spare*
1:0890	ALM_MASTR.EVENT490.B_ALARM	*Spare*
1:0891	ALM_MASTR.EVENT491.B_ALARM	*Spare*
1:0892	ALM_MASTR.EVENT492.B_ALARM	*Spare*
1:0893	ALM_MASTR.EVENT493.B_ALARM	*Spare*
1:0894	ALM_MASTR.EVENT494.B_ALARM	*Spare*
1:0895	ALM_MASTR.EVENT495.B_ALARM	*Spare*
1:0896	ALM_MASTR.EVENT496.B_ALARM	*Spare*
1:0897	ALM_MASTR.EVENT497.B_ALARM	*Spare*
1:0898	ALM_MASTR.EVENT498.B_ALARM	*Spare*
1:0899		

1:0900		
1:0901	SEAL.PV_FLT.AND	Seal Gas PV fault
1:0902	SEAL.REMSP_FLT.AND	Seal Gas remote SP fault
1:0903	SEAL.USE_RMTSP.B_NAME	Remote Seal Gas SP Configured
1:0904	X1__VLV_.HP_OR_MX.B_NAME	HP Valve Limiter at MAX
1:0905	X1__VLV_.HP_OR_ZERO.B_NAME	HP Valve Limiter at MIN
1:0906	X1__VLV_.LP_ATMAX.B_NAME	LP Valve Limiter at MAX
1:0907	X1__SPDC.SR__CRIT.B_NAME	Speed (Ref) in Critical Band
1:0908	X1__CASC.RCAS_ACTIV.B_NAME	Remote CASC Setpt active
1:0909	LOAD_CTRL.OR_ALWAYS.OR	MW aux controller Enabled
1:0910	LOAD_CTRL.AUX_ACTIVE.B_NAME	MW aux controller Active
1:0911	LOAD_CTRL.TRACK.AND	MW aux controller Tracking
1:0912	T2_GEN.AUX_CTRL_E.B_NAME	MW aux controller Used
1:0913	PT_CNTRL.LSS_AUX.SEL_2	Aux load ctlr in control
1:0914	WARMUP.WARM_ACT.B_NAME	Warmup function Active
1:0915	WARMUP.USE_WRUP.B_NAME	Warmup function used
1:0916		
1:0917		
1:0918		
1:0919		
1:0920		
1:0921		
1:0922	ALM_MASTR.EVENT501.B_ALARM	AI #33 Chan Fail Kern A Mod A05
1:0923	ALM_MASTR.EVENT502.B_ALARM	AI #33 Chan Fail Kern B Mod A05
1:0924	ALM_MASTR.EVENT503.B_ALARM	AI #33 Chan Fail Kern C Mod A05
1:0925	ALM_MASTR.EVENT504.B_ALARM	AI #33 Chan Diff between Kernels
1:0926	ALM_MASTR.EVENT505.B_ALARM	AI #33 Input Signal Failure
1:0927	ALM_MASTR.EVENT506.B_ALARM	AI #34 Chan Fail Kern A Mod A05
1:0928	ALM_MASTR.EVENT507.B_ALARM	AI #34 Chan Fail Kern B Mod A05
1:0929	ALM_MASTR.EVENT508.B_ALARM	AI #34 Chan Fail Kern C Mod A05
1:0930	ALM_MASTR.EVENT509.B_ALARM	AI #34 Chan Diff between Kernels
1:0931	ALM_MASTR.EVENT510.B_ALARM	AI #34 Input Signal Failure
1:0932	ALM_MASTR.EVENT511.B_ALARM	AI #35 Chan Fail Kern A Mod A05
1:0933	ALM_MASTR.EVENT512.B_ALARM	AI #35 Chan Fail Kern B Mod A05
1:0934	ALM_MASTR.EVENT513.B_ALARM	AI #35 Chan Fail Kern C Mod A05
1:0935	ALM_MASTR.EVENT514.B_ALARM	AI #35 Chan Diff between Kernels
1:0936	ALM_MASTR.EVENT515.B_ALARM	AI #35 Input Signal Failure
1:0937	ALM_MASTR.EVENT516.B_ALARM	AI #36 Chan Fail Kern A Mod A05
1:0938	ALM_MASTR.EVENT517.B_ALARM	AI #36 Chan Fail Kern B Mod A05
1:0939	ALM_MASTR.EVENT518.B_ALARM	AI #36 Chan Fail Kern C Mod A05
1:0940	ALM_MASTR.EVENT519.B_ALARM	AI #36 Chan Diff between Kernels
1:0941	ALM_MASTR.EVENT520.B_ALARM	AI #36 Input Signal Failure
1:0942 thru 1:0950		Spare
1:0951	ALM_MASTR.AL_188.OUT_3	AO #1 No Load Detected trip
1:0952	ALM_MASTR.AL_189.OUT_3	AO #1 Chan Fail All Kernels trip
1:0953	ALM_MASTR.AL_193.OUT_3	AO #2 No Load Detected trip
1:0954	ALM_MASTR.AL_194.OUT_3	AO #2 Chan Fail All Kernels trip
1:0955	ALM_MASTR.AL_198.OUT_3	AO #3 No Load Detected trip
1:0956	ALM_MASTR.AL_199.OUT_3	AO #3 Chan Fail All Kernels trip
1:0957	ALM_MASTR.AL_203.OUT_3	AO #4 No Load Detected trip
1:0958	ALM_MASTR.AL_204.OUT_3	AO #4 Chan Fail All Kernels trip

Table 8-7. Analog Reads

Analog Reads (RPTar)			
Addr	GAP Block Name	Description	Mult
3:0001	T1__AUX1.A00_TM.A_NAME	AUX1/Step active time	1
3:0002	T1__AUX1.A02_TM.A_NAME	AUX1/Step active time	1
3:0003	T1__AUX1.DMD_EU.A_NAME	AUX1 dmd in RPM (on spd REF)	1
3:0004	T1__AUX1.DMD_PERC.A_NAME	AUX1 demand in %	100
3:0005	T1__AUX1.PV_PERC.A_NAME	AUX1 Process Value in %	1
3:0006	T1__AUX1.PV_UNIT.A_NAME	AUX1 Process Value in EU	
3:0007	T1__AUX1.SETPOINT.A_NAME	AUX1 setpoint in EU	USER DEFINED IN CCT
3:0008	T1__AUX1.SETP_PERC.A_NAME	AUX1 setpoint in %	100
3:0009	T1__AUX1.Z00_TM.A_NAME	AUX1/ Step active time	1
3:0010	T1__AUX1.A01_TM.A_NAME	AUX1/ Step active time	1
3:0011	T1__CASC.CASC_PV.A_NAME	Cascade PV in %	100
3:0012	T1__CASC.B02_TM.A_NAME	CASC/ Step active time	1
3:0013	T1__CASC.B01_TM.A_NAME	CASC/ Step active time	1
3:0014	T1__CASC.CASC_PV2.A_NAME	Cascade PV in EU	USER DEFINED IN CCT
3:0015	T1__CASC.CASC_SP.A_NAME	Cascade setpoint in %	100
3:0016	T1__CASC.CASC_SP2.A_NAME	Cascade setpoint in EU	USER DEFINED IN CCT
3:0017	T1__CASC.CASC_SP3.A_NAME	Casc setpoint with droop in EU	USER DEFINED IN CCT
3:0018	T1__CASC.Z02_TM.A_NAME	CASC/ Step active time	1
3:0019	T1__CASC.Z01_TM.A_NAME	CASC/ Step active time	1
3:0020	T1__CASC.Z00_TM.A_NAME	CASC/ Step active time	1
3:0021	T1__CASC.SPD_DMD2.A_NAME	Cascade speed demand	1
3:0022	T1__CASC.SPD_DMD.A_NAME	Cascade speed demand in %	100

3:0023	T1__CASC.B00_TM.A_NAME	CASC/ Step active time	1
3:0024	T1__CASC.B03_TM.A_NAME	CASC/ Step active time	1
3:0025	T1__DCPL.SETP_PERC.A_NAME	DCPL setpoint in %	100
3:0026	T1__DCPL.REM_SP_EU.A_NAME	Remote Decoupling EU	1
3:0027	T1__DCPL.SETPOINT.A_NAME	DCPL setpoint in EU	1
3:0028	T1__DCPL.REM_MAN_PR.A_NAME	Rem decoupl man Demand %	100
3:0029	T1__DCPL.DMD_PERC.A_NAME	Decoupling Demand %	1
3:0030	T1__DCPL.PV_PERC.A_NAME	Decoupling PV in %	100
3:0031	T1__DCPL.PV_UNIT.A_NAME	Decoupling PV in EU	1
3:0032	T1__DCPL.REM_SP_PER.A_NAME	DCPL/ Rem Decoupling %	1
3:0033	T1__EXTC.B03_TM.A_NAME	EXTC/ B03_/active time	1
3:0034	T1__EXTC.SETPOINT.A_NAME	EXTR setpoint in EU	USER DEFINED IN CCT
3:0035	T1__EXTC.SETP_PERC.A_NAME	EXTR setpoint in %	1
3:0036	T1__EXTC.Z00_TM.A_NAME	EXTC/ Z00_/active time	1
3:0037	T1__EXTC.Z01_TM.A_NAME	EXTC/ Z01_/active time	1
3:0038	T1__EXTC.REM_SP_EU.A_NAME	Remote Extraction EU	USER DEFINED IN CCT
3:0039	T1__EXTC.REM_MAN_PR.A_NAME	Remote manual Demand %	1
3:0040	T1__EXTC.P_LIMITED.A_NAME	P limited Demand %	100
3:0041	T1__EXTC.PV_PERC.A_NAME	EXTR PV in %	1
3:0042	T1__EXTC.PV_UNIT.A_NAME	EXTR PV in EU	USER DEFINED IN CCT
3:0043	T1__EXTC.B04_TM.A_NAME	EXTC/ B04_/active time	1
3:0044	T1__EXTC.B02_TM.A_NAME	EXTC/ B02_/active time	1

3:0045	T1__EXTC.A03_TM.A_NAME	EXTC/ A03_/active time	1
3:0046	T1__EXTC.REM_SP_PER.A_NAME	Remote Extraction %	1
3:0047	T1__EXTC.A04_TM.A_NAME	EXTC/ A04_/active time	1
3:0048	T1__EXTC.A00ETM.A_NAME	EXTC/ A00E/ active time	1
3:0049	T1__EXTC.A00_TM.A_NAME	EXTC/ A00_/active time	1
3:0050	T1__EXTC.A01_TM.A_NAME	EXTC/ A01_/Active time	1
3:0051	T1__EXTC.A02R_TM.A_NAME	EXTC/ A02R / active time	1
3:0052	T1__EXTC.A05_TM.A_NAME	EXTC/ A05_/active time	1
3:0053	T1__EXTC.A02_TM.A_NAME	EXTC/ A02_/active time	1
3:0054	T1__EXTC.A0A_TM.A_NAME	EXTC/ A0A_/active time	1
3:0055	T1__EXTC.B02R_TM.A_NAME	EXTC/ B02R/active time	1
3:0056	T1__EXTC.DMD_PERC.A_NAME	EXTR Demand %	1
3:0057	T1__FW__.FW_DMD.A_NAME	Feed forward demand	1
3:0058	T1__MAP_.SB_NORM.A_NAME	S Pt B normalized	100
3:0059	T1__MAP_.SC_NORM.A_NAME	S Pt c normalized	100
3:0060	T1__MAP_.HB_NORM.A_NAME	Flow Pt B normalized	100
3:0061	T1__MAP_.HC_NORM.A_NAME	Flow Pt C normalized	100
3:0062	T1__MAP_.LD0_NORM.A_NAME	Min load line at zero	100
3:0063	T1__MAP_.LD100_NORM.A_NAME	Min load at HP 100%	100
3:0064	T1__MAP_.SA_NORM.A_NAME	S Pt A normalized	100
3:0065	T1__MAP_.MNFL_NORM.A_NAME	Min EXT flow compensated	100
3:0066	T1__MAP_.HA_NORM.A_NAME	Flow Pt A normalized	100
3:0067	T1__SPDC.CONF_T2.A_NAME	Waiting time at H idle	10
3:0068	T1__SPDC.CONF_T1.A_NAME	Waiting time at low idle	10
3:0069	T1__SPDC.CONFRTE5.A_NAME	Loading rate	10

3:0070	T1__SPDC.CONFRTE4.A_NAME	Rate to min GOV	10
3:0071	T1__SPDC.CONF_T3.A_NAME	Waiting time at HH idle	10
3:0072	T1__SPDC.CONFRTE2.A_NAME	Rate to H idle	10
3:0073	T1__SPDC.SPDC_SP.A_NAME	Speed reference	1
3:0074	T1__SPDC.CONFRTE3.A_NAME	Rate to HH idle	10
3:0075	T1__SPDC.REMAIN_T.A_NAME	Actual Remaining time	10
3:0076	T1__SPDC.CONFRTE1.A_NAME	Rate to low idle	10
3:0077	T1__SPDC.SEQ2_MGS.A_NAME	Line 2 message for Speed	1
3:0078	T1__SPDC.A06_TM.A_NAME	SPDC / Step A06_ active T	1
3:0079	T1__SPDC.SPDC_SP2.A_NAME	Speed ref with bias	1
3:0080	T1__SPDC.SPDC_VP.A_NAME	Speed pid demand	100
3:0081	T1__SPDC.Z00_TM.A_NAME	SPDC / Step Z00_ active T	1
3:0082	T1__SPDC.Z01_TM.A_NAME	SPDC / Step Z01_ active T	1
3:0083	T1__SPDC.SEQ1_MSG.A_NAME	Line 1 message for Speed	1
3:0084	T1__SPDC.A04_RTMR.A_NAME	SPDC / Step A04_ remaining T	1
3:0085	T1__SPDC.A01_TM.A_NAME	SPDC / Step A01_ active T	1
3:0086	T1__SPDC.A00ATM.A_NAME	SPDC / Step A00A active T	1
3:0087	T1__SPDC.A00_TM.A_NAME	SPDC / Step A00_ active T	1
3:0088	T1__SPDC.A02ATM.A_NAME	SPDC / Step A02A active T	1
3:0089	T1__SPDC.A02_RTMR.A_NAME	SPDC / Step A02_ remain T(mn)	1
3:0090	T1__SPDC.A02_TM.A_NAME	SPDC / Step A02_ active T	1
3:0091	T1__SPDC.A08_TM.A_NAME	SPDC / Step A08_ active T	1

3:0092	T1__SPDC.A04_RTMM.A_NAME	SPDC / Step A04_ remain T(mn)	1
3:0093	T1__SPDC.ACTUAL_OF.A_NAME	actual schedule time	1
3:0094	T1__SPDC.A04_TM.A_NAME	SPDC / Step A04_ remaining T	1
3:0095	T1__SPDC.A05_TM.A_NAME	SPDC / Step A05_ active T	1
3:0096	T1__SPDC.A06_RTMM.A_NAME	SPDC / Step A06_ remain T(mn)	1
3:0097	T1__SPDC.A06_RTMR.A_NAME	SPDC / Step A06_ remaining T	1
3:0098	T1__SPDC.A07_TM.A_NAME	SPDC / Step A07_ active T	1
3:0099	T1__SPDC.A09_TM.A_NAME	SPDC / Step A09_ active T	1
3:0100	T1__SPDC.A10_TM.A_NAME	SPDC / Step A10_ active T	1
3:0101	T1__SPDC.A03_TM.A_NAME	SPDC / Step A03_ active T	1
3:0102	T1__SPDC.A02_RTMM.A_NAME	SPDC / Step A02_ remaining T	1
3:0103	T1__VLV_.LP_DEMAND.A_NAME	LP Valve demand (linear)	100
3:0104	T1__VLV_.LP_VLV2.A_NAME	LP Valve demand 2 (linear)	100
3:0105	T1__VLV_.LP_RAMP.A_NAME	LP RAMP Demand	100
3:0106	T1__VLV_.HP_RAMP.A_NAME	HP RAMP Demand	100
3:0107	T1__VLV_.HP_DEMAND.A_NAME	HP Demand Linear	100
3:0108	T1__VLV_.HP2_DEMAND.A_NAME	HP2 demand (linear)	100
3:0109	T2__AUX1.PROCESSVAL.A_NAME	AUX Process Value	1
3:0110	T2__CASC.EMGR_HOLD.A_NAME	Emergency cascade hold DLY	1
3:0111	T2__CASC.DROOP_ALON.A_NAME	Droop value alone	100
3:0112	T2__CASC.DROOP.A_NAME	Droop value	100
3:0113	T2__CASC.CAS_SLIDE.A_NAME	Sliding DB	1

3:0114	T2__CASC.BIAS.A_NAME	SP Bias demand on Cascade	1
3:0115	T2__CASC.LDSH_PV.A_NAME	load share parameter	1
3:0116	T2__CASC.EMRG_RTE.A_NAME	Emergency cascade Rate	10
3:0117	T2__CASC.INT.A_NAME	INT Gain	1
3:0118	T2__CASC.EMRG_GAIN.A_NAME	Emergency cascade gain	1
3:0119	T2__CASC.LD_GAIN.A_NAME	Load sharing Gain	1
3:0120	T2__CASC.LDSH_PV2.A_NAME	Load share parameter other Unit	1
3:0121	T2__CASC.WSPV2.A_NAME	WSPV other Unit	1
3:0122	T2__CASC.WSPV.A_NAME	WSPV	1
3:0123	T2__CASC.SDR.A_NAME	SDR Gain	1
3:0124	T2__CASC.REMOTE_SPD.A_NAME	Remote speed Setpoint	1
3:0125	T2__CASC.REMOTE_SP.A_NAME	Remote cascade Setpoint	1
3:0126	T2__CASC.PRP.A_NAME	Prop Gain	1
3:0127	T2__CASC.PROCESS_PV.A_NAME	Cascade PV	1
3:0128	T2__CASC.LSS_DMD.A_NAME	LSS demand on cascade	1
3:0129	T2__CASC.HSS_DMD.A_NAME	HSS demand on Cascade	1
3:0130	T2__DCPL.RMDCPL_PV.A_NAME	Remote Man DCPL PV	100
3:0131	T2__DCPL.SQ__DCPV.A_NAME	Decoupling process value	1
3:0132	T2__DCPL.PID_SDR.A_NAME	Signal Derivative Ratio	1
3:0133	T2__DCPL.PID_PRP.A_NAME	Proportional Gain	1
3:0134	T2__DCPL.PID_INT.A_NAME	Integral Gain	1
3:0135	T2__DCPL.SQ__RDCP.A_NAME	Remote Decoupling Setpoint	1
3:0136	T2__EXTC.PID_PRP.A_NAME	Proportional Gain	1
3:0137	T2__EXTC.RMEXTC_PV.A_NAME	Remote Man E/A PV	100
3:0138	T2__EXTC.PID_SDR.A_NAME	Signal Derivative Ratio	1
3:0139	T2__EXTC.PID_INT.A_NAME	Integral Gain	1
3:0140	T2__EXTC.CONFDOFS.A_NAME	Offset for decoupling	1
3:0141	T2__EXTC.CONFDRPC.A_NAME	Droop for Extraction	1

3:0142	T2__EXTC.CONFDRPD.A_NAME	Droop for decoupling	1
3:0143	T2__EXTC.CONFOFSET.A_NAME	Deadband for Extraction	1
3:0144	T2__EXTC.EXTR_PV.A_NAME	Extraction PV	1
3:0145	T2__EXTC.REM_PV.A_NAME	Remote ext setpoint	1
3:0146	T2__FW__.AI_FW.A_NAME	Process Value	1
3:0147	T2__SPDC.SPD_TARGET.A_NAME	Speed Target	1
3:0148	T2__SPDC.SRT_LEV.A_NAME	Step level for testing response	1
3:0149	T2__SPDC.SDR2.A_NAME	Derivative Ratio online	1
3:0150	T2__SPDC.SDR1.A_NAME	Derivative ratio offline	1
3:0151	T2__SPDC.RTIM_PV.A_NAME	Remote Timer PV	1
3:0152	T2__SPDC.PRP2.A_NAME	Proportional gain online	1
3:0153	T2__SPDC.PRP1.A_NAME	Proportional gain offline	1
3:0154	T2__SPDC.INT2.A_NAME	Integer gain online	1
3:0155	T2__SPDC.INT1.A_NAME	Integral gain offline	1
3:0156	T2__SPDC.SPEED.A_NAME	Actual Speed PV	1
3:0157	T2__VLV_.EXTERN_HPL.A_NAME	HP2 external limiter	1
3:0158	T2C_AUX1.PID_OFFSET.A_NAME	offset	1
3:0159	T2C_AUX1.PID_PRP.A_NAME	Proportional Gain	1
3:0160	T2C_AUX1.PID_SDR.A_NAME	Signal Derivative Ratio	1
3:0161	T2C_AUX1.PID_VPFR.A_NAME	Valve Pos. fast	1
3:0162	T2C_AUX1.SP_INI.A_NAME	Setpoint Initial Value	1
3:0163	T2C_AUX1.PID_INT.A_NAME	Integral Gain	1
3:0164	T2C_AUX1.PID_VPRT.A_NAME	Valve Pos. Rse/Lwr Rate (Man)	1
3:0165	T2C_AUX1.FST_MULT.A_NAME	Setpoint Rse/Lwr multiply factor	1
3:0166	T2C_AUX1.DLY_FST.A_NAME	delay to go fast	1
3:0167	T2C_AUX1.MAX_DEVAUT.A_NAME	max deviation authorized	100

3:0168	T2C_AUX1.MAX_PV.A_NAME	maximum process Value	1
3:0169	T2C_AUX1.MAX_SP.A_NAME	Setpoint Maximum limit	1
3:0170	T2C_AUX1.PID_DROOP.A_NAME	droop	1
3:0171	T2C_AUX1.SP_RATE.A_NAME	Setpoint Rse/Lwr Rate (Auto)	1
3:0172	T2C_AUX1.MIN_PV.A_NAME	min process value	1
3:0173	T2C_AUX1.MIN_SP.A_NAME	Setpoint Minimum limit	1
3:0174	T2C_CASC.RL_RTE.A_NAME	Normal R/L Sp Rate	1
3:0175	T2C_CASC.MAX_RTECAS.A_NAME	Max cascade speed rate	10
3:0176	T2C_CASC.MAX_SPD.A_NAME	Max casc& remote speed Demand	1
3:0177	T2C_CASC.MIN_CAS_SP.A_NAME	Min cascade SP	1
3:0178	T2C_CASC.MIN_LDSH.A_NAME	Minimum Load Sharing Setpoint	1
3:0179	T2C_CASC.MIN_PV.A_NAME	Minimum cascade PV	1
3:0180	T2C_CASC.NOR_MATCH.A_NAME	remote speed not match rate	10
3:0181	T2C_CASC.R_L_NONDLY.A_NAME	Delay before normal R/L rte	1
3:0182	T2C_CASC.MAX_RSPDRT.A_NAME	Max Remote speed rate	10
3:0183	T2C_CASC.MIN_SPD.A_NAME	Min casc& remote speed Demand	1
3:0184	T2C_CASC.MIN_PVRSPD.A_NAME	Minimum remote speed PV	1
3:0185	T2C_CASC.NOT_MATCHD.A_NAME	Remote speed Not match deviation	100
3:0186	T2C_CASC.MAX_RCASRT.A_NAME	remote Cascade max rate	1
3:0187	T2C_CASC.CASC_SPINI.A_NAME	Initial SP	1
3:0188	T2C_CASC.DIV_RTE.A_NAME	Divide factor of normal RL	1
3:0189	T2C_CASC.MAX_CAS_SP.A_NAME	Max cascade SP	1

3:0190	T2C_CASC.MAX_LDSH.A_NAME	Max load sharing Setpoint	1
3:0191	T2C_CASC.MAX_PV.A_NAME	Maximum cascade PV	1
3:0192	T2C_CASC.MAX_PVRSPD.A_NAME	Maximum Remote speed PV	1
3:0193	T2C_DCPL.PID_VPRT.A_NAME	Valve Pos. Rse/Lwr Rate (Man)	1
3:0194	T2C_DCPL.MN_DCPL_DM.A_NAME	Minimum DCPL demand	1
3:0195	T2C_DCPL.PID_SPRT.A_NAME	Decoupling SP Rse/Lwr Rate	1
3:0196	T2C_DCPL.PID_SPMX.A_NAME	Maximum Setpoint	1
3:0197	T2C_DCPL.PID_FSTD.A_NAME	Decoup SP Rse/Lwr fast delay	1
3:0198	T2C_DCPL.PID_ASR.A_NAME	Full-Auto Setpoint trck.Rate	1
3:0199	T2C_DCPL.MX_MREM_RT.A_NAME	Decoupling Rem MAN dmd max rate	1
3:0200	T2C_DCPL.PID_SP_I.A_NAME	Initial Setpoint	1
3:0201	T2C_DCPL.MIN_PV.A_NAME	Min decoupling Pv	1
3:0202	T2C_DCPL.MAX_PV.A_NAME	Max decoupling Pv	1
3:0203	T2C_DCPL.FAST_RLDM.A_NAME	Valve Rse/Lwr Rate Mult (Auto)	1
3:0204	T2C_DCPL.DLY_FST.A_NAME	Decoupling Demand Raise/Lower Fast Del	1
3:0205	T2C_DCPL.MULT_FST.A_NAME	Decoupling Sp Rse/Lwr Fast Mult	1
3:0206	T2C_DCPL.MX_DCPL_DM.A_NAME	Maximum DCPL demand	1
3:0207	T2C_DCPL.PID_SPMN.A_NAME	Minimum Setpoint	1
3:0208	T2C_EXTC.PID_FSTD.A_NAME	Extraction Setpoint R/L fast delay	1

3:0209	T2C_EXTC.PIDCSP_I.A_NAME	Extraction Setpoint Initial Value	1
3:0210	T2C_EXTC.PIDCSPRT.A_NAME	Setpoint Rse/Lwr Rate (Auto)	1
3:0211	T2C_EXTC.PIDCSPMX.A_NAME	Extraction Setpoint Maximum limit	1
3:0212	T2C_EXTC.PIDCSPMN.A_NAME	Extraction Setpoint Minimum limit	1
3:0213	T2C_EXTC.PIDCSPFR.A_NAME	Setpoint Fast Mult	1
3:0214	T2C_EXTC.MX_MREM_RT.A_NAME	Extraction Remote MAN demand max rate	1
3:0215	T2C_EXTC.MIN_PV.A_NAME	Min extraction PV	1
3:0216	T2C_EXTC.PIDCASR.A_NAME	Extraction Full-Auto Setpoint trck.Rat	1
3:0217	T2C_EXTC.MULT_DM.A_NAME	Extraction Demand Fast multiplier	1
3:0218	T2C_EXTC.PID_VPRT.A_NAME	P demand Rse/Lwr Rate (Man)	1
3:0219	T2C_EXTC.MAX_PV.A_NAME	Max extraction PV	1
3:0220	T2C_EXTC.DLY_FAST.A_NAME	Extraction Demand Fast Delay	1
3:0221	T2C_FW__.MAX_RATE_N.A_NAME	Max Rate	1
3:0222	T2C_FW__.DB_SPD.A_NAME	Deadband on speed	1
3:0223	T2C_FW__.LAG_EMER.A_NAME	Emergency Duration time	1
3:0224	T2C_FW__.MAX_RATE.A_NAME	Maximum Rate	1
3:0225	T2C_FW__.MIN_RATE.A_NAME	Min rate before acting	1
3:0226	T2C_FW__.MIN_RATE_N.A_NAME	Min Rate	1
3:0227	T2C_FW__.MN_SPD.A_NAME	Min Feedforward demand at min Rate	1
3:0228	T2C_FW__.MX_SPD_RTE.A_NAME	Maximum speed rate of change	10
3:0229	T2C_FW__.SPEED_ATMX.A_NAME	Speed deviation at maximum rate	1

3:0230	T2C_FW__.MX_SPD.A_NAME	MAX Feedforward demand at max rate	1
3:0231	T2C_FW__.LAG_NORMAL.A_NAME	Normal Duration time	1
3:0232	T2C_MAP_.MXEXT_CONF.A_NAME	Max LP flow (ext/adm only)	1
3:0233	T2C_MAP_.SC_CONF.A_NAME	Power pt C	1
3:0234	T2C_MAP_.SB_CONF.A_NAME	Power pt B	1
3:0235	T2C_MAP_.SA_CONF.A_NAME	Power pt A	1
3:0236	T2C_MAP_.MNHP_CONF.A_NAME	Min flow through HP when LP in ctlr	100
3:0237	T2C_MAP_.LD100_CONF.A_NAME	Min Flow Limit s-value if HP=100	1
3:0238	T2C_MAP_.LD0_CONF.A_NAME	Min Flow Limit S-value if HP=0	1
3:0239	T2C_MAP_.HC_CONF.A_NAME	Flow pt C	1
3:0240	T2C_MAP_.MXLP__CONF.A_NAME	LP maximum Lift	100
3:0241	T2C_MAP_.MXFL_CONF.A_NAME	Max HP flow for unit	1
3:0242	T2C_MAP_.HB_CONF.A_NAME	Flow pt B	1
3:0243	T2C_MAP_.HA_CONF.A_NAME	Flow pt A	1
3:0244	T2C_MAP_.MNLP_CONF.A_NAME	LP minimum lift	100
3:0245	T2C_MAP_.MXLD_CONF.A_NAME	Max power for unit	1
3:0246	T2C_SPDC.DL_IDLE1_7.A_NAME	Delay at Low idle rate 7	1
3:0247	T2C_SPDC.RAP_IDL3_1.A_NAME	Ramp to Idle 3 rate 1	10
3:0248	T2C_SPDC.RAP_IDL2_2.A_NAME	Ramp to Idle 2 rate 2	10
3:0249	T2C_SPDC.RAP_IDL2_3.A_NAME	Ramp to Idle 2 rate 3	10
3:0250	T2C_SPDC.RAP_IDL2_4.A_NAME	Ramp to Idle 2 rate 4	10
3:0251	T2C_SPDC.RAP_IDL2_5.A_NAME	Ramp to Idle 2 rate 5	10
3:0252	T2C_SPDC.RAP_IDL2_6.A_NAME	Ramp to Idle 2 rate 6	10
3:0253	T2C_SPDC.RAP_IDL2_7.A_NAME	Ramp to Idle 2 rate 7	10
3:0254	T2C_SPDC.RAP_IDL2_8.A_NAME	Ramp to Idle 2 rate 8	10
3:0255	T2C_SPDC.PV_F_CRV09.A_NAME	Level to select curve 10 to curve 9	1
3:0256	T2C_SPDC.RAP_IDL3_0.A_NAME	Ramp to Idle 3 rate 10	10
3:0257	T2C_SPDC.RAP_IDL1_9.A_NAME	Ramp to Low idle rate 9	10

3:0258	T2C_SPDC.RAP_IDL3_2.A_NAME	Ramp to Idle 3 rate 2	10
3:0259	T2C_SPDC.RAP_IDL3_3.A_NAME	Ramp to Idle 3 rate 3	10
3:0260	T2C_SPDC.RAP_IDL3_4.A_NAME	Ramp to Idle 3 rate 4	10
3:0261	T2C_SPDC.RAP_IDL3_5.A_NAME	Ramp to Idle 3 rate 5	10
3:0262	T2C_SPDC.RAP_IDL3_6.A_NAME	Ramp to Idle 3 rate 6	10
3:0263	T2C_SPDC.RAP_IDL3_7.A_NAME	Ramp to Idle 3 rate 7	10
3:0264	T2C_SPDC.RAP_IDL3_8.A_NAME	Ramp to Idle 3 rate 8	10
3:0265	T2C_SPDC.RAP_IDL3_9.A_NAME	Ramp to Idle 3 rate 9	10
3:0266	T2C_SPDC.RAP_IDL2_9.A_NAME	Ramp to Idle 2 rate 9	10
3:0267	T2C_SPDC.DL_IDLE1_5.A_NAME	Delay at Low idle rate 5	1
3:0268	T2C_SPDC.PV_O_CRV01.A_NAME	Level to select curve 2 to curve 1	1
3:0269	T2C_SPDC.PV_O_CRV02.A_NAME	Level to select curve 3 to curve 2	1
3:0270	T2C_SPDC.PV_O_CRV03.A_NAME	Level to select curve 4 to curve 3	1
3:0271	T2C_SPDC.PV_O_CRV04.A_NAME	Level to select curve 5 to curve 4	1
3:0272	T2C_SPDC.PV_O_CRV05.A_NAME	Level to select curve 6 to curve 5	1
3:0273	T2C_SPDC.PV_O_CRV06.A_NAME	Level to select curve 7 to curve 6	1
3:0274	T2C_SPDC.PV_O_CRV07.A_NAME	Level to select curve 8 to curve 7	1
3:0275	T2C_SPDC.PV_O_CRV08.A_NAME	Level to select curve 9 to curve 8	1
3:0276	T2C_SPDC.RAP_IDL2_1.A_NAME	Ramp to Idle 2 rate 1	10
3:0277	T2C_SPDC.RAP_IDL1_0.A_NAME	Ramp to Low idle rate 10	10
3:0278	T2C_SPDC.RAP_IDL2_0.A_NAME	Ramp to Idle 2 rate 10	10
3:0279	T2C_SPDC.RAP_IDL1_2.A_NAME	Ramp to Low idle rate 2	10
3:0280	T2C_SPDC.RAP_IDL1_3.A_NAME	Ramp to Low idle rate 3	10
3:0281	T2C_SPDC.RAP_IDL1_4.A_NAME	Ramp to Low idle rate 4	10
3:0282	T2C_SPDC.RAP_IDL1_5.A_NAME	Ramp to Low idle rate 5	10

3:0283	T2C_SPDC.RAP_IDL1_6.A_NAME	Ramp to Low idle rate 6	10
3:0284	T2C_SPDC.RAP_IDL1_7.A_NAME	Ramp to Low idle rate 7	10
3:0285	T2C_SPDC.RAP_IDL1_8.A_NAME	Ramp to Low idle rate 8	10
3:0286	T2C_SPDC.RAP_LOAD_2.A_NAME	Loading rate 2	10
3:0287	T2C_SPDC.CRIT3_RTE.A_NAME	Critical speed rate3	10
3:0288	T2C_SPDC.RT_LD_HOT.A_NAME	Load rate HOT	10
3:0289	T2C_SPDC.RAP_LOAD_0.A_NAME	Loading rate 10	10
3:0290	T2C_SPDC.RATED.A_NAME	Rated speed	1
3:0291	T2C_SPDC.RTIME_HOT.A_NAME	Remote timer PV value HOT	1
3:0292	T2C_SPDC.RT_L1_COLD.A_NAME	Start-up rate to level 1 COLD	10
3:0293	T2C_SPDC.RT_L1_HOT.A_NAME	Start-up rate to level 1 HOT	10
3:0294	T2C_SPDC.RT_L2_COLD.A_NAME	Start-up rate to level 2 COLD	10
3:0295	T2C_SPDC.RT_L2_HOT.A_NAME	Start-up rate to level 2 HOT	10
3:0296	T2C_SPDC.RT_L3_COLD.A_NAME	Start-up rate to level 3 COLD	10
3:0297	T2C_SPDC.RAP_RATED8.A_NAME	Ramp to Rated rate 8	10
3:0298	T2C_SPDC.RT_LD_COLD.A_NAME	Load rate COLD	10
3:0299	T2C_SPDC.RAP_RATED7.A_NAME	Ramp to Rated rate 7	10
3:0300	T2C_SPDC.RT_MN_COLD.A_NAME	Start-up rate to min.gov. COLD	10
3:0301	T2C_SPDC.RT_MN_HOT.A_NAME	Start-up rate to min. gov. HOT	10
3:0302	T2C_SPDC.R_L_SLOWDL.A_NAME	R/L command slow delay	1
3:0303	T2C_SPDC.STUCK_DLY.A_NAME	Delay before Alm/unload	1
3:0304	T2C_SPDC.RT_L3_HOT.A_NAME	Start-up rate to level 3 HOT	10
3:0305	T2C_SPDC.RAP_RATED2.A_NAME	Ramp to Rated rate 2	10
3:0306	T2C_SPDC.PV_O_CRV09.A_NAME	Level to select curve 9 to curve 10	1

3:0307	T2C_SPDC.RAP_LOAD_3.A_NAME	Loading rate 3	10
3:0308	T2C_SPDC.RAP_LOAD_4.A_NAME	Loading rate 4	10
3:0309	T2C_SPDC.RAP_LOAD_5.A_NAME	Loading rate 5	10
3:0310	T2C_SPDC.RAP_LOAD_6.A_NAME	Loading rate 6	10
3:0311	T2C_SPDC.RAP_LOAD_7.A_NAME	Loading rate 7	10
3:0312	T2C_SPDC.RAP_LOAD_8.A_NAME	Loading rate 8	10
3:0313	T2C_SPDC.RAP_LOAD_9.A_NAME	Loading rate 9	10
3:0314	T2C_SPDC.RAP_RATED9.A_NAME	Ramp to Rated rate 9	10
3:0315	T2C_SPDC.RAP_RATED1.A_NAME	Ramp to Rated rate 1	10
3:0316	T2C_SPDC.RAP_LOAD_1.A_NAME	Loading rate 1	10
3:0317	T2C_SPDC.TIME_LOOP.A_NAME	Time Loop Delay	1
3:0318	T2C_SPDC.UNDERSD_DL.A_NAME	Underspeed SD delay	1
3:0319	T2C_SPDC.UNDERSPD.A_NAME	Underspeed level(<99% of min gov)	1
3:0320	T2C_SPDC.UNDER_DLY.A_NAME	Underspeed alarm delay	1
3:0321	T2C_SPDC.RAP_RATED3.A_NAME	Ramp to Rated rate 3	10
3:0322	T2C_SPDC.RAP_RATED4.A_NAME	Ramp to Rated rate 4	10
3:0323	T2C_SPDC.RAP_RATED5.A_NAME	Ramp to Rated rate 5	10
3:0324	T2C_SPDC.RAP_RATED6.A_NAME	Ramp to Rated rate 6	10
3:0325	T2C_SPDC.RAP_RATED0.A_NAME	Ramp to Rated rate 10	10
3:0326	T2C_SPDC.PV_F_CRV08.A_NAME	Level to select curve 8 to curve 9	1
3:0327	T2C_SPDC.LEVEL0.A_NAME	Startup level 0-min speed	1
3:0328	T2C_SPDC.DL_IDLE3_3.A_NAME	Delay at Idle 3 rate 3	1
3:0329	T2C_SPDC.DL_IDLE3_4.A_NAME	Delay at Idle 3 rate 4	1
3:0330	T2C_SPDC.DL_IDLE3_5.A_NAME	Delay at Idle 3 rate 5	1
3:0331	T2C_SPDC.DL_IDLE3_6.A_NAME	Delay at Idle 3 rate 6	1
3:0332	T2C_SPDC.DL_IDLE3_7.A_NAME	Delay at Idle 3 rate 7	1
3:0333	T2C_SPDC.DL_IDLE3_8.A_NAME	Delay at Idle 3 rate 8	1

3:0334	T2C_SPDC.DL_IDLE3_9.A_NAME	Delay at Idle 3 rate 9	1
3:0335	T2C_SPDC.DL_IDLE3_1.A_NAME	Delay at Idle 3 rate 1	1
3:0336	T2C_SPDC.FREQUENCY.A_NAME	Max Frequency	1
3:0337	T2C_SPDC.DL_IDLE3_0.A_NAME	Delay at Idle 3 rate 10	1
3:0338	T2C_SPDC.HOT_RESET.A_NAME	Hot reset timer	1
3:0339	T2C_SPDC.HOT_TIME.A_NAME	HOT time	1
3:0340	T2C_SPDC.L1_COLD_DL.A_NAME	Warmup time level 1 COLD	10
3:0341	T2C_SPDC.L1_HOT_DL.A_NAME	Warmup time level 1 HOT	10
3:0342	T2C_SPDC.L2_COLD_DL.A_NAME	Warmup time level 2 COLD	10
3:0343	T2C_SPDC.L2_HOT_DL.A_NAME	Warmup time level 2 HOT	10
3:0344	T2C_SPDC.L3_COLD_DL.A_NAME	Warmup time level 3 COLD	10
3:0345	T2C_SPDC.L3_HOT_DL.A_NAME	Warmup time level 3 HOT	10
3:0346	T2C_SPDC.RAP_IDL1_1.A_NAME	Ramp to Low idle rate 1	10
3:0347	T2C_SPDC.DL_IDLE2_1.A_NAME	Delay at Idle 2 rate 1	1
3:0348	T2C_SPDC.DL_IDLE1_0.A_NAME	Delay at Low idle rate 10	1
3:0349	T2C_SPDC.DL_IDLE1_1.A_NAME	Delay at Low idle rate 1	1
3:0350	T2C_SPDC.DL_IDLE1_2.A_NAME	Delay at Low idle rate 2	1
3:0351	T2C_SPDC.DL_IDLE1_3.A_NAME	Delay at Low idle rate 3	1
3:0352	T2C_SPDC.DL_IDLE1_4.A_NAME	Delay at Low idle rate 4	1
3:0353	T2C_SPDC.DL_IDLE1_6.A_NAME	Delay at Low idle rate 6	1
3:0354	T2C_SPDC.DL_IDLE1_8.A_NAME	Delay at Low idle rate 8	1
3:0355	T2C_SPDC.DL_IDLE3_2.A_NAME	Delay at Idle 3 rate 2	1
3:0356	T2C_SPDC.DL_IDLE2_0.A_NAME	Delay at Idle 2 rate 10	1
3:0357	T2C_SPDC.GEAR.A_NAME	Gear Ratio	1
3:0358	T2C_SPDC.DL_IDLE2_2.A_NAME	Delay at Idle 2 rate 2	1
3:0359	T2C_SPDC.DL_IDLE2_3.A_NAME	Delay at Idle 2 rate 3	1
3:0360	T2C_SPDC.DL_IDLE2_4.A_NAME	Delay at Idle 2 rate 4	1
3:0361	T2C_SPDC.DL_IDLE2_5.A_NAME	Delay at Idle 2 rate 5	1
3:0362	T2C_SPDC.DL_IDLE2_6.A_NAME	Delay at Idle 2 rate 6	1
3:0363	T2C_SPDC.DL_IDLE2_7.A_NAME	Delay at Idle 2 rate 7	1

3:0364	T2C_SPDC.DL_IDLE2_8.A_NAME	Delay at Idle 2 rate 8	1
3:0365	T2C_SPDC.DL_IDLE2_9.A_NAME	Delay at Idle 2 rate 9	1
3:0366	T2C_SPDC.DL_IDLE1_9.A_NAME	Delay at Low idle rate 9	1
3:0367	T2C_SPDC.MULT_SLOW.A_NAME	Mult fact for loading gradient (Slow R)	1
3:0368	T2C_SPDC.MAX_REF.A_NAME	Maximum speed reference	1
3:0369	T2C_SPDC.PRED_SPDC.A_NAME	Predictive speed Level	1
3:0370	T2C_SPDC.PRED_ACC.A_NAME	Acceleration at Pred level	10
3:0371	T2C_SPDC.OVERR_TIME.A_NAME	Speed override max time	1
3:0372	T2C_SPDC.OSPD_RATE.A_NAME	Overspeed test rate	10
3:0373	T2C_SPDC.OSPD_H2.A_NAME	Overspeed level	1
3:0374	T2C_SPDC.LEVEL1.A_NAME	Startup level 1	1
3:0375	T2C_SPDC.PV_F_CRV02.A_NAME	Level to select curve 2 to curve 3	1
3:0376	T2C_SPDC.EMRG_RTE.A_NAME	Emergency min gov Rate	10
3:0377	T2C_SPDC.PV_F_CRV03.A_NAME	Level to select curve 3 to curve 4	1
3:0378	T2C_SPDC.MIN_RESET.A_NAME	Min speed to reset	1
3:0379	T2C_SPDC.MIN_PV_RHC.A_NAME	Minimum Remote hot/cold PV	1
3:0380	T2C_SPDC.MIN_GOV.A_NAME	Minimum governor speed	1
3:0381	T2C_SPDC.CRIT2_RTE.A_NAME	Critical speed rate2	10
3:0382	T2C_SPDC.CRIT3_H.A_NAME	Upper limit critical range 3	1
3:0383	T2C_SPDC.CRIT3_L.A_NAME	Lower limit critical range 3	1
3:0384	T2C_SPDC.LOSS_DLY.A_NAME	Loss of control delay before flt	1
3:0385	T2C_SPDC.MAX_GOV.A_NAME	rpm	1
3:0386	T2C_SPDC.MAX_PV_RHC.A_NAME	Minimum Remote hot/cold PV	1

3:0387	T2C_SPDC.OSPD_DELAY.A_NAME	Delay to quit if no R/L	1
3:0388	T2C_SPDC.CRIT1_H.A_NAME	Upper limit critical range 1	1
3:0389	T2C_SPDC.LEVEL2.A_NAME	Startup level 2	1
3:0390	T2C_SPDC.LEVEL3.A_NAME	Startup level 3	1
3:0391	T2C_SPDC.LOSS_DELTA.A_NAME	Max delta speed authorized	1
3:0392	T2C_SPDC.ACC_DELTA.A_NAME	Offline ACC delta speed Level	1
3:0393	T2C_SPDC.ACC_OFFACT.A_NAME	off line max acceleration	10
3:0394	T2C_SPDC.ACC_ON_RTE.A_NAME	ACC on line max accel	10
3:0395	T2C_SPDC.BST_DMD.A_NAME	Boost Valve position demand	100
3:0396	T2C_SPDC.PV_F_CRV01.A_NAME	Level to select curve 1 to curve 2	1
3:0397	T2C_SPDC.COLD_TIME.A_NAME	Cold timer	1
3:0398	T2C_SPDC.CRIT1_L.A_NAME	Lower limit critical range 1	1
3:0399	T2C_SPDC.CRIT1_RTE.A_NAME	Critical speed rate1	10
3:0400	T2C_SPDC.CRIT2_H.A_NAME	Upper limit critical range 2	1
3:0401	T2C_SPDC.CRIT2_L.A_NAME	Lower limit critical range 2	1
3:0402	T2C_SPDC.PV_F_CRV07.A_NAME	Level to select curve 7 to curve 8	1
3:0403	T2C_SPDC.PV_F_CRV06.A_NAME	Level to select curve 6 to curve 7	1
3:0404	T2C_SPDC.PV_F_CRV05.A_NAME	Level to select curve 5 to curve 6	1
3:0405	T2C_SPDC.PV_F_CRV04.A_NAME	Level to select curve 4 to curve 5	1
3:0406	T2C_SPDC.BST_LEV.A_NAME	Boost Trigger Level	1
3:0407	T2C_VLV_.LP_DLY_FST.A_NAME	Raise/Lower delay to fast	1
3:0408	T2C_VLV_.HP2_GAIN.A_NAME	HP2 gain	1
3:0409	T2C_VLV_.HPR_RTEFST.A_NAME	HP ramp rate at Restart or Manual	1

3:0410	T2C_VLV_.HPSPDDMDMN.A_NAME	Min speed => full HP2	1
3:0411	T2C_VLV_.HPSPDDMDMX.A_NAME	Max speed => full HP	1
3:0412	T2C_VLV_.HPVLVDMDMN.A_NAME	Min valve=> full HP2	1
3:0413	T2C_VLV_.HPVLVDMDMX.A_NAME	Max valve => full HP	1
3:0414	T2C_VLV_.HP_MX_RAMP.A_NAME	MAX HP ramp	100
3:0415	T2C_VLV_.LP_RL_RATE.A_NAME	Raise/Lower rate	1
3:0416	T2C_VLV_.HP_V1_INI.A_NAME	HP ramp max at start	100
3:0417	T2C_VLV_.XFER_TENBL.A_NAME	minimum transfer time	1
3:0418	T2C_VLV_.LPCONFINIR.A_NAME	Initial ramp rate	1
3:0419	T2C_VLV_.LPCONFOFST.A_NAME	LP fixed offset	1
3:0420	T2C_VLV_.LP_RL_FST.A_NAME	Raise/Lower rate fast MLT	1
3:0421	T2C_VLV_.MIN_LP_STR.A_NAME	LP min position at start	1
3:0422	T2C_VLV_.SPLIT_OFFS.A_NAME	Offset when split	1
3:0423	T2C_VLV_.XFER_TDIS.A_NAME	transfer time at disable	1
3:0424	T2C_VLV_.HP_RMP_RTE.A_NAME	HP ramp rate	1
3:0425	CNFG_AI01.AI01_VAL.A_NAME	Analog Input #1 current (mA)	100
3:0426	CNFG_AI01.AIN_SCLD.A_NAME	Analog Input #1 Scaled value	USER DEFINED IN CCT
3:0427	CNFG_AI02.AI02_VAL.A_NAME	Analog Input #2 current (mA)	100
3:0428	CNFG_AI02.AIN_SCLD.A_NAME	Analog Input #2 Scaled value	USER DEFINED IN CCT
3:0429	CNFG_AI03.AI03_VAL.A_NAME	Analog Input #3 current (mA)	100
3:0430	CNFG_AI03.AIN_SCLD.A_NAME	Analog Input #3 Scaled value	USER DEFINED IN CCT
3:0431	CNFG_AI04.AI04_VAL.A_NAME	Analog Input #4 current (mA)	100
3:0432	CNFG_AI04.AIN_SCLD.A_NAME	Analog Input #4 Scaled value	USER DEFINED IN CCT
3:0433	CNFG_AI05.AI05_VAL.A_NAME	Analog Input #5 current (mA)	100

3:0434	CNFG_AI05.AIN_SCLD.A_NAME	Analog Input #5 Scaled value	USER DEFINED IN CCT
3:0435	CNFG_AI06.AI06_VAL.A_NAME	Analog Input #6 current (mA)	100
3:0436	CNFG_AI06.AIN_SCLD.A_NAME	Analog Input #6 Scaled value	USER DEFINED IN CCT
3:0437	CNFG_AI07.AI07_VAL.A_NAME	Analog Input #7 current (mA)	100
3:0438	CNFG_AI07.AIN_SCLD.A_NAME	Analog Input #7 Scaled value	USER DEFINED IN CCT
3:0439	CNFG_AI08.AI08_VAL.A_NAME	Analog Input #8 current (mA)	100
3:0440	CNFG_AI08.AIN_SCLD.A_NAME	Analog Input #8 Scaled value	USER DEFINED IN CCT
3:0441	CNFG_AI09.AI09_VAL.A_NAME	Analog Input #9 current (mA)	100
3:0442	CNFG_AI09.AIN_SCLD.A_NAME	Analog Input #9 Scaled value	
3:0443	CNFG_AI10.AI10_VAL.A_NAME	Analog Input #10 current (mA)	100
3:0444	CNFG_AI10.AIN_SCLD.A_NAME	Analog Input #10 Scaled value	
3:0445	CNFG_AI11.AI11_VAL.A_NAME	Analog Input #11 current (mA)	100
3:0446	CNFG_AI11.AIN_SCLD.A_NAME	Analog Input #11 Scaled value	
3:0447	CNFG_AI12.AI12_VAL.A_NAME	Analog Input #12 current (mA)	100
3:0448	CNFG_AI12.AIN_SCLD.A_NAME	Analog Input #12 Scaled value	
3:0449	CNFG_AI13.AI13_VAL.A_NAME	Analog Input #13 current (mA)	100
3:0450	CNFG_AI13.AIN_SCLD.A_NAME	Analog Input #13 Scaled value	
3:0451	CNFG_AI14.AI14_VAL.A_NAME	Analog Input #14 current (mA)	100
3:0452	CNFG_AI14.AIN_SCLD.A_NAME	Analog Input #14 Scaled value	

3:0453	CNFG_AI15.AI15_VAL.A_NAME	Analog Input #15 current (mA)	100
3:0454	CNFG_AI15.AIN_SCLD.A_NAME	Analog Input #15 Scaled value	
3:0455	CNFG_AI16.AI16_VAL.A_NAME	Analog Input #16 current (mA)	100
3:0456	CNFG_AI16.AIN_SCLD.A_NAME	Analog Input #16 Scaled value	
3:0457	CNFG_AI17.AI17_VAL.A_NAME	Analog Input #17 current (mA)	100
3:0458	CNFG_AI17.AIN_SCLD.A_NAME	Analog Input #17 Scaled value	
3:0459	CNFG_AI18.AI18_VAL.A_NAME	Analog Input #18 current (mA)	100
3:0460	CNFG_AI18.AIN_SCLD.A_NAME	Analog Input #18 Scaled value	
3:0461	CNFG_AI19.AI19_VAL.A_NAME	Analog Input #19 current (mA)	100
3:0462	CNFG_AI19.AIN_SCLD.A_NAME	Analog Input #19 Scaled value	
3:0463	CNFG_AI20.AI20_VAL.A_NAME	Analog Input #20 current (mA)	100
3:0464	CNFG_AI20.AIN_SCLD.A_NAME	Analog Input #20 Scaled value	
3:0465	CNFG_AI21.AI21_VAL.A_NAME	Analog Input #21 current (mA)	100
3:0466	CNFG_AI21.AIN_SCLD.A_NAME	Analog Input #21 Scaled value	
3:0467	CNFG_AI22.AI22_VAL.A_NAME	Analog Input #22 current (mA)	100
3:0468	CNFG_AI22.AIN_SCLD.A_NAME	Analog Input #22 Scaled value	
3:0469	CNFG_AI23.AI23_VAL.A_NAME	Analog Input #23 current (mA)	100
3:0470	CNFG_AI23.AIN_SCLD.A_NAME	Analog Input #23 Scaled value	
3:0471	CNFG_AI24.AI24_VAL.A_NAME	Analog Input #24 current (mA)	100

3:0472	CNFG_AI24.AIN_SCLD.A_NAME	Analog Input #24 Scaled value	
3:0473	CNFG_AI25.AI25_VAL.A_NAME	Analog Input #25 current (mA)	100
3:0474	CNFG_AI25.AIN_SCLD.A_NAME	Analog Input #25 Scaled value	
3:0475	CNFG_AI26.AI26_VAL.A_NAME	Analog Input #26 current (mA)	100
3:0476	CNFG_AI26.AIN_SCLD.A_NAME	Analog Input #26 Scaled value	
3:0477	CNFG_AI27.AI27_VAL.A_NAME	Analog Input #27 current (mA)	100
3:0478	CNFG_AI27.AIN_SCLD.A_NAME	Analog Input #27 Scaled value	
3:0479	CNFG_AI28.AI28_VAL.A_NAME	Analog Input #28 current (mA)	100
3:0480	CNFG_AI28.AIN_SCLD.A_NAME	Analog Input #28 Scaled value	
3:0481	CNFG_AI29.AI29_VAL.A_NAME	Analog Input #29 current (mA)	100
3:0482	CNFG_AI29.AIN_SCLD.A_NAME	Analog Input #29 Scaled value	
3:0483	CNFG_AI30.AI30_VAL.A_NAME	Analog Input #30 current (mA)	100
3:0484	CNFG_AI30.AIN_SCLD.A_NAME	Analog Input #30 Scaled value	
3:0485	CNFG_AI31.AI31_VAL.A_NAME	Analog Input #31 current (mA)	100
3:0486	CNFG_AI31.AIN_SCLD.A_NAME	Analog Input #31 Scaled value	
3:0487	CNFG_AI32.AI32_VAL.A_NAME	Analog Input #32 current (mA)	100
3:0488	CNFG_AI32.AIN_SCLD.A_NAME	Analog Input #32 Scaled value	
3:0489	SPDSIG1.SPEED.A_NAME	Speed Signal #1	
3:0490	SPDSIG2.SPEED.A_NAME	Speed Signal #2	
3:0491	SPDSIG3.SPEED.A_NAME	Speed Signal #3	

3:0492	SPDSIG4.SPEED.A_NAME	Speed Signal #4	
3:0493	A_SPEED.ACTUAL_SPD.A_SW	Validated Turbine Speed Signal	
3:0494	T2__AUX1.RAUX1_PV.A_NAME	Remote AUX Setpoint (EU)	
3:0495	T2_GEN.LOAD2MOD.A_SW	Unit Percent Load	
3:0496	MODBUS.AI01_CF.OUT_1	Menu Configuration of AI 1	
3:0497	MODBUS.AI02_CF.OUT_1	Menu Configuration of AI 2	
3:0498	MODBUS.AI03_CF.OUT_1	Menu Configuration of AI 3	
3:0499	MODBUS.AI04_CF.OUT_1	Menu Configuration of AI 4	
3:0500	MODBUS.AI05_CF.OUT_1	Menu Configuration of AI 5	
3:0501	MODBUS.AI06_CF.OUT_1	Menu Configuration of AI 6	
3:0502	MODBUS.AI07_CF.OUT_1	Menu Configuration of AI 7	
3:0503	MODBUS.AI08_CF.OUT_1	Menu Configuration of AI 8	
3:0504	MODBUS.A5MOD_CH.OUT_1	Menu Configuration of AI 9	
3:0505	MODBUS.A5MOD_CH.OUT_2	Menu Configuration of AI 10	
3:0506	MODBUS.A5MOD_CH.OUT_3	Menu Configuration of AI 11	
3:0507	MODBUS.A5MOD_CH.OUT_4	Menu Configuration of AI 12	
3:0508	MODBUS.A5MOD_CH.OUT_5	Menu Configuration of AI 13	
3:0509	MODBUS.A5MOD_CH.OUT_6	Menu Configuration of AI 14	
3:0510	MODBUS.A5MOD_CH.OUT_7	Menu Configuration of AI 15	
3:0511	MODBUS.A5MOD_CH.OUT_8	Menu Configuration of AI 16	

3:0512	MODBUS.A5MOD_CH.OUT_9	Menu Configuration of AI 17	
3:0513	MODBUS.A5MOD_CH.OUT_10	Menu Configuration of AI 18	
3:0514	MODBUS.A5MOD_CH.OUT_11	Menu Configuration of AI 19	
3:0515	MODBUS.A5MOD_CH.OUT_12	Menu Configuration of AI 20	
3:0516	MODBUS.A5MOD_CH.OUT_13	Menu Configuration of AI 21	
3:0517	MODBUS.A5MOD_CH.OUT_14	Menu Configuration of AI 22	
3:0518	MODBUS.A5MOD_CH.OUT_15	Menu Configuration of AI 23	
3:0519	MODBUS.A5MOD_CH.OUT_16	Menu Configuration of AI 24	
3:0520	MODBUS.A5MOD_CH.OUT_17	Menu Configuration of AI 25	
3:0521	MODBUS.A5MOD_CH.OUT_18	Menu Configuration of AI 26	
3:0522	MODBUS.A5MOD_CH.OUT_19	Menu Configuration of AI 27	
3:0523	MODBUS.A5MOD_CH.OUT_20	Menu Configuration of AI 28	
3:0524	MODBUS.A5MOD_CH.OUT_21	Menu Configuration of AI 29	
3:0525	MODBUS.A5MOD_CH.OUT_22	Menu Configuration of AI 30	
3:0526	MODBUS.A5MOD_CH.OUT_23	Menu Configuration of AI 31	
3:0527	MODBUS.A5MOD_CH.OUT_24	Menu Configuration of AI 32	
3:0528	SIM_MBUS.BI_CNFGS.OUT_2	Menu Configuration of DI 2	
3:0529	SIM_MBUS.BI_CNFGS.OUT_3	Menu Configuration of DI 3	
3:0530	SIM_MBUS.BI_CNFGS.OUT_4	Menu Configuration of DI 4	

3:0531	SIM_MBUS.BI_CNFGS.OUT_5	Menu Configuration of DI 5	
3:0532	SIM_MBUS.BI_CNFGS.OUT_6	Menu Configuration of DI 6	
3:0533	SIM_MBUS.BI_CNFGS.OUT_7	Menu Configuration of DI 7	
3:0534	SIM_MBUS.BI_CNFGS.OUT_8	Menu Configuration of DI 8	
3:0535	SIM_MBUS.BI_CNFGS.OUT_9	Menu Configuration of DI 9	
3:0536	SIM_MBUS.BI_CNFGS.OUT_10	Menu Configuration of DI 10	
3:0537	SIM_MBUS.BI_CNFGS.OUT_11	Menu Configuration of DI 11	
3:0538	SIM_MBUS.BI_CNFGS.OUT_12	Menu Configuration of DI 12	
3:0539	SIM_MBUS.BI_CNFGS.OUT_13	Menu Configuration of DI 13	
3:0540	SIM_MBUS.BI_CNFGS.OUT_14	Menu Configuration of DI 14	
3:0541	SIM_MBUS.BI_CNFGS.OUT_15	Menu Configuration of DI 15	
3:0542	SIM_MBUS.BI_CNFGS.OUT_16	Menu Configuration of DI 16	
3:0543	SIM_MBUS.BI_CNFGS.OUT_17	Menu Configuration of DI 17	
3:0544	SIM_MBUS.BI_CNFGS.OUT_18	Menu Configuration of DI 18	
3:0545	SIM_MBUS.BI_CNFGS.OUT_19	Menu Configuration of DI 19	
3:0546	SIM_MBUS.BI_CNFGS.OUT_20	Menu Configuration of DI 20	
3:0547	SIM_MBUS.BI_CNFGS.OUT_21	Menu Configuration of DI 21	
3:0548	SIM_MBUS.BI_CNFGS.OUT_22	Menu Configuration of DI 22	
3:0549	SIM_MBUS.BI_CNFGS.OUT_23	Menu Configuration of DI 23	

3:0550	SIM_MBUS.BI_CNFGS.OUT_24	Menu Configuration of DI 24	
3:0551	SIM_MBUS.BO_CNFGS.OUT_2	Menu Configuration of Relay 2	
3:0552	SIM_MBUS.BO_CNFGS.OUT_3	Menu Configuration of Relay 3	
3:0553	SIM_MBUS.BO_CNFGS.OUT_4	Menu Configuration of Relay 4	
3:0554	SIM_MBUS.BO_CNFGS.OUT_5	Menu Configuration of Relay 5	
3:0555	SIM_MBUS.BO_CNFGS.OUT_6	Menu Configuration of Relay 6	
3:0556	SIM_MBUS.BO_CNFGS.OUT_7	Menu Configuration of Relay 7	
3:0557	SIM_MBUS.BO_CNFGS.OUT_8	Menu Configuration of Relay 8	
3:0558	SIM_MBUS.BO_CNFGS.OUT_9	Menu Configuration of Relay 9	
3:0559	SIM_MBUS.BO_CNFGS.OUT_10	Menu Configuration of Relay 10	
3:0560	SIM_MBUS.BO_CNFGS.OUT_11	Menu Configuration of Relay 11	
3:0561	SIM_MBUS.BO_CNFGS.OUT_12	Menu Configuration of Relay 12	
3:0562	SIM_MBUS.BO_CNFGS.OUT_13	Relay 2 Level Switch Value	
3:0563	SIM_MBUS.BO_CNFGS.OUT_14	Relay 3 Level Switch Value	
3:0564	SIM_MBUS.BO_CNFGS.OUT_15	Relay 4 Level Switch Value	
3:0565	SIM_MBUS.BO_CNFGS.OUT_16	Relay 5 Level Switch Value	
3:0566	SIM_MBUS.BO_CNFGS.OUT_17	Relay 6 Level Switch Value	
3:0567	SIM_MBUS.BO_CNFGS.OUT_18	Relay 7 Level Switch Value	
3:0568	SIM_MBUS.BO_CNFGS.OUT_19	Relay 8 Level Switch Value	

3:0569	SIM_MBUS.BO_CNFGS.OUT_20	Relay 9 Level Switch Value	
3:0570	SIM_MBUS.BO_CNFGS.OUT_21	Relay 10 Level Switch Value	
3:0571	SIM_MBUS.BO_CNFGS.OUT_22	Relay 11 Level Switch Value	
3:0572	SIM_MBUS.BO_CNFGS.OUT_23	Relay 12 Level Switch Value	
3:0573		Spare	
3:0574		Spare	
3:0575	CNFGIACT1.A6_ACT1.A_MUX_N_1	Demand Value to Integrating Act #1	
3:0576	CNFGIACT2.A6_ACT2.A_MUX_N_1	Demand Value to Integrating Act #2	
3:0577		Spare	
3:0578		Spare	
3:0579	CNFG_PACT1.ACT_FUNC.OUT_3	Function selected for Int Act 1	
3:0580	CNFG_PACT1.ACT_FUNC.OUT_4	Function selected for Int Act 2	
3:0581	CNFG_AO_01.SEL.A_MUX_N_1	Analog Output #1 Scaled Value	
3:0582	CNFG_AO_02.SEL.A_MUX_N_1	Analog Output #2 Scaled Value	
3:0583	CNFG_AO_03.SEL.A_MUX_N_1	Analog Output #3 Scaled Value	
3:0584	CNFG_AO_04.SEL.A_MUX_N_1	Analog Output #4 Scaled Value	
3:0585	CNFG_AO_05.SEL.A_MUX_N_1	Analog Output #5 Scaled Value	
3:0586	CNFG_AO_06.SEL.A_MUX_N_1	Analog Output #6 Scaled Value	
3:0587	CNFG_AO_07.SEL.A_MUX_N_1	Analog Output #7 Scaled Value	
3:0588	CNFG_AO_08.SEL.A_MUX_N_1	Analog Output #8 Scaled Value	
3:0589	CNFG_AO_09.SEL.A_MUX_N_1	Analog Output #9 Scaled Value	

3:0590	CNFG_AO_10.SEL.A_MUX_N_1	Analog Output #10 Scaled Value	
3:0591	CNFG_AO_11.SEL.A_MUX_N_1	Analog Output #11 Scaled Value	
3:0592	CNFG_AO_12.SEL.A_MUX_N_1	Analog Output #12 Scaled Value	
3:0593	MODBUS.AO_CNFGS.OUT_1	Function selected for AO 1	
3:0594	MODBUS.AO_CNFGS.OUT_2	Function selected for AO 2	
3:0595	MODBUS.AO_CNFGS.OUT_3	Function selected for AO 3	
3:0596	MODBUS.AO_CNFGS.OUT_4	Function selected for AO 4	
3:0597	MODBUS.AO_CNFGS.OUT_5	Function selected for AO 5	
3:0598	MODBUS.AO_CNFGS.OUT_6	Function selected for AO 6	
3:0599	MODBUS.AO_CNFGS.OUT_7	Function selected for AO 7	
3:0600	MODBUS.AO_CNFGS.OUT_8	Function selected for AO 8	
3:0601	MODBUS.AO_CNFGS.OUT_9	Function selected for AO 9	
3:0602	MODBUS.AO_CNFGS.OUT_10	Function selected for AO 10	
3:0603	MODBUS.AO_CNFGS.OUT_11	Function selected for AO 11	
3:0604	MODBUS.AO_CNFGS.OUT_12	Function selected for AO 12	
3:0605		Spare	100
3:0606		Spare	100
3:0607	*Spare*	*Spare*	*Spare*
3:0608	*Spare*	*Spare*	*Spare*
3:0609	IACT1_SEL.ACT1SEL.A_NAME	Integ Act 1 Position FDBK	10
3:0610	IACT1_SEL.ACT1AMA.A_NAME	Integ Act 1 A Torq Motor current	100
3:0611	IACT1_SEL.ACT1BMA.A_NAME	Integ Act 1 B Torq Motor current	100

3:0612	IACT1_SEL.ACT1MA.A_NAME	Integ Act 1 Total Torq Motor mA	100
3:0613	IACT2_SEL.ACT2SEL.A_NAME	Integ Act 2 Position FDBK	10
3:0614	IACT2_SEL.ACT2AMA.A_NAME	Integ Act 2 A Torq Motor current	100
3:0615	IACT2_SEL.ACT2BMA.A_NAME	Integ Act 2 B Torq Motor current	100
3:0616	IACT2_SEL.ACT2MA.A_NAME	Integ Act 2 Total Torq Motor mA	100
3:0617	TLKIT_OI.VLV1_MESSG.OUT_1	Control Status of V1 Valve	
3:0618	TLKIT_OI.VLV2_MESSG.OUT_1	Control Status of V2 Valve	
3:0619	MODBUS.TYPE.OUT_1	Turbine Type	
3:0620	MODBUS.HP_TYPE.OUT_1	HP Valve Type	
3:0621	MODBUS.LP_TYPE.OUT_1	LP Valve Type	
3:0622	MODBUS.DCPL_TYPE.OUT_1	Decoupling Type	
3:0623	T2C_EXTC.EXT_UNITS.OUT_1	Extraction Inputs Units	
3:0624	T2C_AUX1.AUX_UNITS.OUT_1	Auxiliary Inputs Units	
3:0625	T2C_CASC.CASC_UNITS.OUT_1	Cascade Inputs Units	
3:0626	T2C_EXTC.MOD_SCALE.A_MUX_N_1	Extraction PV/SP Multiplier	
3:0627	T2C_AUX1.MOD_SCALE.A_MUX_N_1	Auxiliary PV/SP Multiplier	
3:0628	T2C_CASC.MOD_SCALE.A_MUX_N_1	Cascade PV/SP Multiplier	
3:0629	PEAK_SPD.SPEED_HOLD.A_MAX	Peak Speed Reached	
3:0630	A1_A06_ACT.ACT_01.AVG_POS	Kern A IACT Chan 1 Fdbk Pos	10
3:0631	A1_A06_ACT.ACT_02.AVG_POS	Kern A IACT Chan 2 Fdbk Pos	10
3:0632	B1_A06_ACT.ACT_01.AVG_POS	Kern B IACT Chan 1 Fdbk Pos	10
3:0633	B1_A06_ACT.ACT_02.AVG_POS	Kern B IACT Chan 2 Fdbk Pos	10

3:0634	SEAL.GSEAL_DMD.A_NAME	Seal Gas Valve Demand	10
3:0635	SEAL.M4PID_SPN.A_NAME	Seal Gas Setpoint Value	10
3:0636	SEAL.M4PID_PV.A_NAME	Seal Gas Process Value	10
3:0637	SEAL.RMTSP_TEST.A_SW	Seal Gas Remote Setpoint Value	*Spare*
3:0638	A1_A06_ACT.AVGPOS_CH1.A_MAX	Avg FDBK Position IACT Chan 1	10
3:0639	A1_A06_ACT.AVGPOS_CH2.A_MAX	Avg FDBK Position IACT Chan 2	10
3:0640	T2_GEN.KW_SIG.A_NAME	Generator KW Load	0.01
3:0641	T2_GEN.REMSPDBIAS.A_SW	Sync/LS Speed Bias Value (rpm)	
3:0642	T2_GEN.KW_SETPT.ZMINUS1	Remote KW Setpoint	0.01
3:0643	MODBUS.TYPE.OUT_2	Start Mode Configuration	
3:0644	*Spare*	*Spare*	
3:0645	T2_GEN.MOD_SCALE.A_MUX_N_1	User cnfg scaler for KW	
3:0646	X1__SPDC.NORMSPEED.A_NAME	Normalized Speed (0-100%)	
3:0647	X1__SPDC.NORMSPD_SP.A_NAME	Normalized Speed Setpoint	
3:0648	X1__VLV_.S_TERM_IN.A_NAME	S Term into RatioLimiter	
3:0649	X1__VLV_.P_TERM_IN.A_NAME	P Term into RatioLimiter	
3:0650	EVENT_ALM.AL_FRSTOUT.A_NAME	Alarm First Out Event Message	
3:0651	EVENT_SD.SD_FRSTOUT.A_NAME	TRIP First Out Event Message	
3:0652 thru 3:0654	*Spare*	*Spare*	
3:0655	ANA_OUT1.AO_RM.RDBK_MA	Analog Output Chan 1 mA (x10)	
3:0656	ANA_OUT2.AO_RM.RDBK_MA	Analog Output Chan 2 mA (x10)	

3:0657	ANA_OUT3.AO_RM.RDBK_MA	Analog Output Chan 3 mA (x10)	
3:0658	ANA_OUT4.AO_RM.RDBK_MA	Analog Output Chan 4 mA (x10)	
3:0659	ANA_OUT5.AO_RM.RDBK_MA	Analog Output Chan 5 mA (x10)	
3:0660	ANA_OUT6.AO_RM.RDBK_MA	Analog Output Chan 6 mA (x10)	
3:0661	ANA_OUT7.AO_RM.RDBK_MA	Analog Output Chan 7 mA (x10)	
3:0662	ANA_OUT8.AO_RM.RDBK_MA	Analog Output Chan 8 mA (x10)	
3:0663	ANA_OUT9.AO_RM.RDBK_MA	Analog Output Chan 9 mA (x10)	
3:0664	ANA_OUT10.AO_RM.RDBK_MA	Analog Output Chan 10 mA (x10)	
3:0665	ANA_OUT11.AO_RM.RDBK_MA	Analog Output Chan 11 mA (x10)	
3:0666	ANA_OUT12.AO_RM.RDBK_MA	Analog Output Chan 12 mA (x10)	
3:0667	LOAD_CTRL.DIS_MWPID.A_SW	MW aux controller PID Demand	
3:0668	LOAD_CTRL.SETPOINT.RAMP	MW aux controler setpoint	
3:0669	MODBUS.TYPE_AUX.OUT_1	Type of auxiliary load ctrl	
3:0670	MODBUS.TYPE_AUX.OUT_2	Tpy of Aux load Sensor	
3:0671	T1__MAP_.SE_NORM.CALCULATE	S pt E of steam Map in %	
3:0672	T1__MAP_.HE_NORM.A_NAME	H pt E of steam Map in %	
3:0673	T1__MAP_.SF_NORM.A_NAME	S pt F of steam Map in %	
3:0674	T1__MAP_.HF_NORM.A_NAME	H pt F of steam Map in %	
3:0675	T1__MAP_.SD_NORM.A_NAME	S pt D of steam Map in %	

3:0676	T1__MAP_.HD_NORM.CALCULATE	H pt D of steam Map in %	
3:0677 thru 3:0680	*Spare*	*Spare*	
3:0681	CNFG_PACT1.HPDMD_CTL.A_SW	Prop Act HP Valve Demand Value	
3:0682	CNFG_PACT1.PACT1_MA.A_NAME	Prop Act HP Valve Current FDB	
3:0683	CNFG_PACT2.HPDMDSPLIT_CTL_SCALE.CURVES_2	Prop Act HP Split Valve Demand Value	
3:0684	CNFG_PACT2.PACT2_MA.A_NAME	Prop Act HP Split Valve Current FDB	
3:0685	CNFG_PACT3.LPDMD_CTL.A_SW	Prop Act LP Valve Demand Value	
3:0686	CNFG_PACT3.PACT3_MA.A_NAME	Prop Act LP Valve Current FDB	
3:0687	CNFG_PACT4.LPDMDSPLIT_CTL.A_SW	Prop Act LP Split Valve Demand Value	
3:0688	CNFG_PACT4.PACT3_MA.A_NAME	Prop Act LP Split Valve Current FDB	
3:0689 thru 3:0700	*Spare*	*Spare*	
3:0701	CNFG_AI33.AI33_VAL.A_NAME	Analog Input #33 current (mA)	100
3:0702	CNFG_AI33.AIN_SCLD.A_NAME	Analog Input #33 Scaled value	
3:0703	CNFG_AI34.AI34_VAL.A_NAME	Analog Input #34 current (mA)	100
3:0704	CNFG_AI34.AIN_SCLD.A_NAME	Analog Input #34 Scaled value	
3:0705	CNFG_AI35.AI35_VAL.A_NAME	Analog Input #35 current (mA)	100
3:0706	CNFG_AI35.AIN_SCLD.A_NAME	Analog Input #35 Scaled value	
3:0707	CNFG_AI36.AI36_VAL.A_NAME	Analog Input #35 current (mA)	100

3:0708	CNFG_AI36.AIN_SCLD.A_NAME	Analog Input #36 Scaled value	
3:0709	MODBUS.A5MOD_CH.OUT_21	Menu Configuration of AI 33	
3:0710	MODBUS.A5MOD_CH.OUT_22	Menu Configuration of AI 34	
3:0711	MODBUS.A5MOD_CH.OUT_23	Menu Configuration of AI 35	
3:0712	MODBUS.A5MOD_CH.OUT_24	Menu Configuration of AI 36	
3:0713 thru 3:0720	*Spare*	*Spare*	

Table 8-8. Analog Writes

Analog Writes (RPTaw)		
Addr	**Description**	**Multiplier**
4:0001	Speed Setpoint Target (Goto)	
4:0002	CASC Setpoint Target (Goto)	
4:0003	AUX Setpoint Target (Goto)	
4:0004	EXTR Setpoint Target (Goto)	
4:0005	EXTR Demand Target (Goto)	
4:0006	DCPL Setpoint Target (Goto)	
4:0007	DCPL Demand Target (Goto)	
4:0008	Force Value for Prop Act #1 (HP)	
4:0009	Force Value for Prop Act #2 (HP Split)	
4:0010	Force Value for Integrating Act #1	
4:0011	Force Value for Integrating Act #2	
4:0012	Force Value for AO #1	
4:0013	Force Value for AO #2	
4:0014	Force Value for AO #3	
4:0015	Force Value for AO #4	
4:0016	Force Value for AO #5	
4:0017	Force Value for AO #6	
4:0018	Force Value for AO #7	
4:0019	Force Value for AO #8	
4:0020	Force Value for AO #9	
4:0021	Force Value for AO #10	
4:0022	Force Value for AO #11	
4:0023	Force Value for AO #12	
4:0024	*Spare*	*Spare*
4:0025	KW Setpoint	
4:0026	Force Value for Prop Act #3 (LP)	
4:0027	Force Value for Prop Act #4 (LP Split)	
4:0028 thru 4:0050	*Spare*	*Spare*

Analog Input Configuration—The Analog Input Configuration (addresses 3:0496—0527) is an integer that represents the programmed function of each analog input and is defined as follows:

Table 8-9. Analog Input Menu List

NB	Description	NB	Description
1	NOT USED	14	Remote decoupling Setpt
2	Remote Speed Setpt	15	Monitor #1
3	Extraction/Admission #1	16	Monitor #2
4	Extraction/Admission #2	17	Monitor #3
5	Extraction/Admission #3	18	Monitor #4
6	Remote Extr/Adm Setpt	19	HP pilot fdbk1
7	Cascade Input #1	20	LP pilot fdbk2
8	Cascade Input #2	21	Feed-forward input
9	Cascade Input #3	22	Remote HOT/COLD input
10	Remote Cascade Setpt	23	Redundancy 1 IH-A Input
11	Decoupling Input #1	24	Redundancy 1 IH-B Input
12	Decoupling Input #2	25	Redundancy 2 IH-A Input
13	Decoupling Input #3	26	Redundancy 2 IH-A Input
		27	Seal GAS PID Process value Input

Analog Output Configuration—The Analog Output Configuration (addresses 3:0276—0279) is an integer that represents the programmed function of each analog output and is defined as follows:

Table 8-10. Analog Output Menu List

NB	Description	NB	Description
1	NOT USED	21	HP2 driver Demand
2	Actual Speed	22	LP1 driver Demand
3	Speed Setpoint	23	LP2 driver Demand
4	Remote Speed Setpt	24	Monitor Analog Input #1
5	Extr/Adm Input	25	Monitor Analog Input #2
6	Extr/Adm Setpoint	26	Monitor Analog Input #3
7	Rmt Extr/Adm Setpt	27	Monitor Analog Input #4
8	Cascade Input	28	IH-1A position feedback
9	Cascade Setpoint	29	IH-1B position feedback
10	Rmt Cascade Setpt	30	IH-2A position feedback
11	Decoupled Input	31	IH-2B position feedback
12	decoupled Setpoint	32	HP AVG LVDT position feedback
13	remote decoupled Setpt	33	LP AVG LVDT position feedback
14	Speed/Load Demand	34	Remote IO AO #1
15	Extr/Adm Demand	35	Remote IO AO #2
16	HP Valve Limiter Setpt	36	Remote IO AO #3
17	LP Valve Limiter Setpt	37	Remote IO AO #4
18	HP demand	38	Seal PID output
19	LP demand	39	Seal PID setpoint
20	HP1 driver Demand	40	Seal PID process value

Relay Configuration—The Relay Configuration is defined as follows:

Table 8-11. Relay Outputs Menu List

	Addr for Level Switch	S/W On/Off Value Level	Addr for State
Relay #2	3:0562	Set on CCT	3:0551
Relay #3	3:0563	Set on CCT	3:0552
Relay #4	3:0564	Set on CCT	3:0553
Relay #5	3:0565	Set on CCT	3:0554
Relay #6	3:0566	Set on CCT	3:0555
Relay #7	3:0567	Set on CCT	3:0556
Relay #8	3:0568	Set on CCT	3:0557
Relay #9	3:0569	Set on CCT	3:0558
Relay #10	3:0570	Set on CCT	3:0559
Relay #11	3:0571	Set on CCT	3:0560
Relay #12	3:0572	Set on CCT	3:0561

DESCRIPTION LEVEL

Table 8-12. Relay Level Switch Value Options List

NB	Description	NB	Description
1	NOT USED	**15**	LP Valve Limiter Setpt
2	Actual Speed	**16**	Actuator #1 Valve Demand Output
3	Speed Setpoint	**17**	Actuator #2 Valve Demand Output
4	GEN Load	**18**	lvl_sw_option18
5	Sync/Load Share Input	**19**	lvl_sw_option19
6	Extr/Adm Input	**20**	lvl_sw_option20
7	Extr/Adm Setpoint	**21**	lvl_sw_option21
8	Cascade Input	**22**	lvl_sw_option22
9	Cascade Setpoint	**23**	lvl_sw_option23
10	Auxiliary Input	**24**	lvl_sw_option24
11	Auxiliary Setpoint	**25**	lvl_sw_option25
12	Speed/Load Demand (S)	**26**	lvl_sw_option26
13	Extraction/Admiss Dmd P	**27**	lvl_sw_option27
14	HP Valve Limiter Setpt		

Table 8-13. Relay State Indications Menu List

DESCRIPTION STATE

NB	Description	NB	Description
1	<Not Used>	34	HP Valve Limiter in Control
2	Trip Relay	35	LP Valve Limiter in Control
3	Shutdown Indication	36	Extraction/Admission Priority Enabled
4	Alarm Indication	37	Extraction/Admission Priority Active
5	Major Alarm Indication	38	Extraction/Admission Input Failed
6	Overspeed Trip	39	Controlling on a Steam Map Limit
7	Overspeed Test Enabled	40	Command from Modbus BW addresses
8	Speed PID in Control	41	Remote Driver Reset
9	Remote Speed Setpoint Enabled	42	Horn Output
10	Remote Speed Setpoint Active	43	Speed Reference at Lower Limit
11	Underspeed Switch	44	Stage 1 Surge Detected
12	Auto Start Sequence in Progress	45	Stage 1 Surge Min Pos (SMP)
13	On-Line Speed PID Dynamics Mode	46	Stage 1 in Auto Mode
14	Local Interface Mode Selected	47	Stage 1 in Manual w/ Backup
15	Frequency Control Armed	48	Stage 1 in Full Manual
16	Frequency Control	49	Stage 2 Surge Detected
17	Sync Input Enabled	50	Stage 2 Surge Min Pos (SMP)
18	Sync / Loadshare Input Enabled	51	Stage 2 in Auto Mode
19	Loadshare Mode Active	52	Stage 2 in Manual w/ Backup
20	Extraction/Admission Control Enabled	53	spare54
21	Extraction/Admission Control Active	54	spare55
22	Extraction/Admission PID in Control	55	spare56
23	Remote Extract/Admiss Setpt Enabled	56	spare57
24	Remote Extract/Admiss Setpt Active	57	spare58
25	Cascade Control Enabled	58	spare59
26	Cascade Control Active	59	spare60
27	Remote Cascade Setpoint Enabled	60	spare61
28	Remote Cascade Setpoint Active	61	Zero Speed Detected
29	Auxiliary Control Enabled	62	spare63
30	Auxiliary Control Active	63	spare64
31	Auxiliary PID in Control	64	spare65
32	Remote Auxiliary Setpoint Enabled	65	spare66
33	Remote Auxiliary Setpoint Active	66	spare54

Contact Input Configuration—The Contact Input Configuration (addresses 3:0528—0550) is an integer that represents the programmed function of each contact input and is defined as follows:

Table 8-14. Discrete Input Menu List

NB	Description	NB	Description
1	NOT USED	51	External Trip #2
2	- Reserved -	52	External Trip #3
3	Event Reset Command (ALM & SD)	53	External Trip #4
4	Event Acknowledge Command (ALM & SD)	54	External Trip #5
5	Speed Reference Lower Setpoint Cmd	55	External Trip #6
6	Speed Reference Raise Setpoint Cmd	56	External Trip #7
7	GEN Breaker Aux (52) Closed (=Droop)	57	External Trip #8
8	Utility Tie Breaker	58	External Trip #9
9	Select Overspeed Test	59	External Trip #10
10	Start Command	60	External Alarm #1
11	Controlled Shutdown Command	61	External Alarm #2
12	HP Valve Limiter Raise	62	External Alarm #3
13	HP Valve Limiter Lower	63	External Alarm #4
14	Select Idle / Rated Speed Setpoints	64	External Alarm #5
15	Halt / Continue Auto Start Sequence	65	External Alarm #6
16	Override Speed Sensor Fault	66	External Alarm #7
17	Select On-Line Speed PID Dynamics	67	External Alarm #8
18	Select Local / Remote Interface Mode	68	External Alarm #9
19	Remote Speed Setpoint Enable	69	External Alarm #10
20	External Synchronizer Enabled	70	Enable Customer PID Analog Output
21	Enable MW Limiter/Controller	71	Enable Remote Customer PID Setpoint
22	Frequency Control Arm/Disarm	72	Enable Manual Customer PID Demand
23	Enable Cascade Control	73	Select Hot/Cold Startup Curves
24	Cascade Setpoint Raise Command	74	Enable Feed Forward Speed Dyn
25	Cascade Setpoint Lower Command	75	Redundant ESTOP (Use w/ DI01)
26	Remote Cascade Setpoint Enable	76	Emergency Go to Min Gov
27	Enable Auxiliary Control	77	spare77
28	Auxiliary Setpoint Raise Command	78	spare78
29	Auxiliary Setpoint Lower Command	79	spare79
30	LP Valve Limiter Raise	80	Stage 1 Online Auxiliary Input
31	LP Valve Limiter Lower	81	Stage 1 AS Valve Fault
32	Remote Auxiliary Setpoint Enable	82	Stage 1 Shutdown
33	Select Extraction/Admission Priority	83	Stage 2 Online Auxiliary Input
34	Extraction/Admission Control Enable	84	Stage 2 AS Valve Fault
35	Extraction/Admission Setpoint Raise	85	Stage 2 Shutdown
36	Extraction/Admission Setpoint Lower	86	Seal Gas Raise SP
37	Enable REM Extraction/Admission Setpt	87	Seal Gas Lower SP
38	Enable Manual Ext/Adm Demand	88	Seal Gas Raise Valve Dmd
39	Extraction/Admission Manual Dmd Raise	89	Seal Gas Lower Valve Dmd
40	Extraction/Admission Manual Dmd Lower	90	spare90
41	Enable Remote Manual Ext/Adm Demand	91	spare91
42	Enable Decoupling	92	spare92
43	Decoupling Setpoint Raise Command	93	spare93
44	Decoupling Setpoint Lower Command	94	spare94
45	Enable Remote Decoupling Setpoint	95	spare95
46	Enable Manual Decoupling	96	spare96
47	Enable Remote Manual Decoupling	97	spare97
48	DI Start Permissive #1	98	spare98
49	DI Start Permissive #2	99	spare99
50	DI Start Permissive #3		

Units Address: For monitoring purpose, the Units can be define for the following signal:

Table 8-15. Configured Units List

Signal	Addr
Extraction	3:0623
Auxiliary	3:0624
Cascade	3:0625

Units Configured—integers that represents the following:

Table 8-16. Units Legend List

NB	Unit	NB	Unit
1	None	**8**	atm
2	psi	**9**	T/h
3	psig	**10**	K#/hr
4	kPa	**11**	#/hr
5	barA	**12**	°C*
6	barG	**13**	°F*
7	kg/cm²	**14**	K*

(*)= Cascade, monitor, HP compensation, LP compensation, seal PID only

Turbine Type Configured—The turbine type (address 3:0619) is an integer that represents the following:
1. Single Valve
2. Extraction Only
3. Admission Only
4. Admission Direct Feed
5. Extraction/Admission
6. Extraction/Admission Split

HP Valve Type Configured—The HP Valve type (address 3:0620) is an integer that represents the following:
1. Single HP Valve
2. Two HP valves split range
3. Two HP with HP2 as Startup valve
4. Two HP valves with HP2 boost valve

LP Valve Type Configured—The LP Valve type (address 3:0621) is an integer that represents the following:
1. Single LP Valve
2. Two (Split) LP Valves

Decoupling Type Configured—The DCPL type (address 3:0622) is an integer that represents the following:
1. No Decoupling Used
2. Inlet & Speed Decoupling
3. Exhaust & Speed Decoupling
4. Total decoupling &No MAP

Start Mode Configured—The start mode configured (address 3:0643) is an integer that represents the following:
1. Automatic
2. Semiautomatic
3. Manual

Specific Address Information

Modbus Scale Factors

Modbus has two limitations:

- Only integers can be sent across.
- The value is limited between -32767 and 32767.

These limitations can be overcome by scaling the value before it is sent across the Modbus. The default scale factor for the analog values is automatically set by the control based on the scaling of the analog input. If the maximum value of the analog input (Value @ 20 mA) is less than 3200, the scale factor is automatically set to 10. If the maximum value of the analog input (Value @ 20 mA) is less than 320, the scale factor is automatically set to 100. If the maximum value of the analog input (Value @ 20 mA) is greater than 32000, the scale factor is automatically set to 0.1. The scale factor can be changed in the service mode between 0.1, 1.0, 10, and 100, if desired.

Some parameters have a configurable scalar value that is sent across the Modbus. These are listed in the Modbus list as "**USER DEFINED IN CCT"**, which means there is a user setting in the toolkit interface to define a 10x multiplier.

Values that require a decimal point must be multiplied by the scale factor (10, 100) prior to being sent across the Modbus. The value sent must then be divided by the scale factor in the Master. Values that are larger than the limitation of Modbus can be sent across by multiplying the value by a factor of 0.1, then dividing the value by the same scale factor in the Master.

The Scale Factor adjusts all associated analog reads and writes accordingly. For example, the Cascade Scale Factor adjusts the cascade input and setpoint analog read values as well as the Entered Setpt analog write value.

For example, if the Cascade setpoint of 60000 needs to be sent across the Modbus, the Cascade Scale Factor would automatically be set to 0.1, this will change the value so that it can be sent across the Modbus (60000 * 0.1 = 6000). After the value is sent across the Modbus, it must be rescaled in the Master to the original value (6000 / 0.1 = 60000).

Modbus Percentage

Some of the analog read addresses have percentages sent across. The formula used in the percentage calculation is ((max / actual) * 100). The percentage is multiplied by 100 before being sent across the Modbus.

Modbus Emergency Shutdown

Two different types of shutdown commands (emergency and controlled) can be issued through Modbus. The Emergency Shutdown command instantly takes the speed setpoint to zero and the HP & LP actuator currents to zero. Optionally the 5009FT Control System can be configured to ignore this Emergency Shutdown command if it is desired to not allow the unit to be tripped through Modbus.

To avoid an inadvertent trip, the emergency shutdown command from Modbus can be configured to require a two step process before a shutdown command is issued. When the shutdown is a two-step process, Boolean write address 0:0001 starts the shutdown process and an acknowledge on address 0:0002 has to be given within five seconds for the control to issue an emergency shutdown command.

For More Modbus Information

Detailed information on the Modbus protocol is presented in "Reference Guide PI-MBUS-300" published by AEC Corp./Modicon Inc., formerly Gould Inc. To implement your own source code, you must register with Modicon. Registration includes purchasing document PI-MBUS-303 and signing a non-disclosure agreement. You can register to use Modbus at your nearest Modicon field office. To find the office nearest you, contact Modicon Technical Support at 1-800-468-5342.

Appendix A. Passwords

IMPORTANT	**At initial release, these passwords are not changeable by the customer.**

Configure / Program Mode

Default Password : **1113**

If changed, write down the new password here and remove this page and store in a safe place.

____

NEW PASSWORD

Service Mode

Default Password : **1112**

If changed, write down the new password here and remove this page and store in a safe place.

____

NEW PASSWORD

Run Mode

Default Password : **1111**

If changed, write down the new password here and remove this page and store in a safe place.

____

NEW PASSWORD

IMPORTANT	**Remove this page to prevent unauthorized access to access to the Program, Service, and Run Modes.**

Appendix B. 5009FT Configuration Mode Worksheet

Governor Serial Number______________________________
Application Number________________________________

Date:__________________________

TURBINE OVERVIEW PAGE

Site Name____
Turbine Name______________________________________
ID Name____
Turbine Type
- Extraction Only___________________________________ y/n
- Admission Only___________________________________ y/n
- Admission Only with Direct Feed___________________ y/n
- Extraction & Admission____________________________ y/n
- Extraction & Admission with Split Valves___________ y/n

Decoupling Mode
- No Decoupling Used_______________________________ y/n
- Inlet & Speed Decoupling__________________________ y/n
- Exhaust & Speed Decoupling_______________________ y/n
- Total Decoupling & No Map________________________ y/n

Turbine Application
- Compressor / Mechanical Drive____________________ y/n
- Generator Drive__________________________________ y/n

Cascade Control?______________________________________ y/n
Auxiliary Controller?
- Auxiliary as Speed Ref Limiter___________________ y/n
- Auxiliary as Process Controller__________________ y/n

Remote Speed Setpoint?________________________________ y/n
Feed-forward Control?_________________________________ y/n
Use Module 5 Analog I/O?______________________________ y/n
Use Module 6 – Actuator Controller?___________________ y/n

START SETTINGS PAGE

Start Mode Selection
- Automatic Start___________________________________ y/n
- Semi-Automatic Start______________________________ y/n
- Manual Start______________________________________ y/n

Start Up Sequence Selection
- Idle Rated____ y/n
- Autostart Sequence________________________________ y/n
- No Idle____ y/n
- Multi Curves Start________________________________ y/n

Max Overspeed Test Limit______________________________ rpm
Overspeed Trip Setpoint_______________________________ rpm
Max Governor (Control) Speed Setpoint_________________ rpm
For GEN units, Min Governor is automatically calculated from Droop.
Min Governor (Control) Speed Setpoint_________________ rpm
Min Controlled Speed__________________________________ rpm

IDLE/RATED SETTINGS *(if configured)*

Idle Priority____ y/n
Rate to Low Idle______________________________________ rpm/s
Rate to Min Governor__________________________________ rpm/s
Loading Gradient Above Min Gov________________________ rpm/s
Idle Speed____ rpm
Rated Speed____ rpm

AUTO SEQUENCE SETTINGS *(if configured)*

Autostart Sequence at Shutdown
- Autostart ON at Shutdown__________________________ y/n
- Autostart Remains at Shutdown_____________________ y/n
- Autostart OFF at Shutdown_________________________ y/n

Hold at Idle Speed____________________________________ y/n
Low Idle Setpoint_____________________________________ rpm
Use Medium Idle Speed Setpoint________________________ y/n
Medium Idle Setpoint__________________________________ rpm
Use High Idle Speed Setpoint__________________________ y/n
High Idle Setpoint____________________________________ rpm
Rated Speed____ rpm
Curve Mode Selection
- Internal Curves Used______________________________ y/n
- Hot/Cold Binary Contact Used______________________ y/n
- Remote Hot/Cold Used______________________________ y/n

Internal Curves (if configured)
- Cold Start Time (< xx hrs)________________________ hrs
- Hot Start Time (> xx hrs)_________________________ hrs
- Min speed to Detect Warm Condition________________ rpm
- Time Switch to Fully Hot__________________________ mins

Remote Hot/Cold (if configured)
- Remote PV Value Cold______________________________ eu
- Remote PV Value Hot_______________________________ eu

Internal Curves, Hot/Cold Binary, & Remote Hot/Cold
Start-Up Curve Cold

Cold Rate to Low Idle_________________________________ rpm/s
Cold Hold Time at Low Idle____________________________ min

Cold Rate to Medium Idle______________________________ rpm/s
Cold Hold Time at Medium Idle_________________________ min

Cold Rate to High Idle________________________________ rpm/s
Cold Hold Time at High Idle___________________________ min

Cold Rate to Min Gov__________________________________ rpm/s
Cold Loading Gradient above Min Gov___________________ rpm/s

Start-Up Curve Hot

Hot Rate to Low Idle__________________________________ rpm/s
Hot Hold Time at Low Idle_____________________________ min

Hot Rate to Medium Idle_______________________________ rpm/s
Hot Hold Time at Medium Idle__________________________ min

Hot Rate to High Idle_________________________________ rpm/s
Hot Hold Time at High Idle____________________________ min

Hot Rate to Min Gov___________________________________ rpm/s
Hot Loading Gradient above Min Gov____________________ rpm/s

MULTI-CURVE PAGE SETTINGS *(if configured)*

When configured, sections will appear for # of curves selected

Start Curves 1-3 will be defined on the Start Settings page

Start Setting (Curve 1)
Ramp to Low Idle Rate 1____________________ rpm/s
Delay at Low Idle Rate 1____________________ min
Ramp to Medium Idle Rate 1____________________ rpm/s
Delay at Medium Idle Rate 1____________________ min
Ramp to High Idle Rate 1____________________ rpm/s
Delay at High Idle Rate 1____________________ min
Ramp to Min Gov Rate 1____________________ rpm/s
Loading Rate 1____________________ rpm/s

Start Setting (Curve 2)
Ramp to Low Idle Rate 2____________________ rpm/s
Delay at Low Idle Rate 2____________________ min
Ramp to Medium Idle Rate 2____________________ rpm/s
Delay at Medium Idle Rate 2____________________ min
Ramp to High Idle Rate 2____________________ rpm/s
Delay at High Idle Rate 2____________________ min
Ramp to Min Gov Rate 2____________________ rpm/s
Loading Rate 2____________________ rpm/s

Start Setting (Curve 3)
Ramp to Low Idle Rate 3____________________ rpm/s
Delay at Low Idle Rate 3____________________ min
Ramp to Medium Idle Rate 3____________________ rpm/s
Delay at Medium Idle Rate 3____________________ min
Ramp to High Idle Rate 3____________________ rpm/s
Delay at High Idle Rate 3____________________ min
Ramp to Min Gov Rate 3____________________ rpm/s
Loading Rate 3____________________ rpm/s

Start Setting (Curve 4)
Ramp to Low Idle Rate 4____________________ rpm/s
Delay at Low Idle Rate 4____________________ min
Ramp to Medium Idle Rate 4____________________ rpm/s
Delay at Medium Idle Rate 4____________________ min
Ramp to High Idle Rate 4____________________ rpm/s
Delay at High Idle Rate 4____________________ min
Ramp to Min Gov Rate 4____________________ rpm/s
Loading Rate 4____________________ rpm/s

Start Setting (Curve 5)
Ramp to Low Idle Rate 5____________________ rpm/s
Delay at Low Idle Rate 5____________________ min
Ramp to Medium Idle Rate 5____________________ rpm/s
Delay at Medium Idle Rate 5____________________ min
Ramp to High Idle Rate 5____________________ rpm/s
Delay at High Idle Rate 5____________________ min
Ramp to Min Gov Rate 5____________________ rpm/s
Loading Rate 5____________________ rpm/s

Start Setting (Curve 6)
Ramp to Low Idle Rate 6____________________ rpm/s
Delay at Low Idle Rate 6____________________ min
Ramp to Medium Idle Rate 6____________________ rpm/s
Delay at Medium Idle Rate 6____________________ min
Ramp to High Idle Rate 6____________________ rpm/s
Delay at High Idle Rate 6____________________ min
Ramp to Min Gov Rate 6____________________ rpm/s
Loading Rate 6____________________ rpm/s

Start Setting (Curve 7)
Ramp to Low Idle Rate 7____________________ rpm/s
Delay at Low Idle Rate 7____________________ min
Ramp to Medium Idle Rate 7____________________ rpm/s
Delay at Medium Idle Rate 7____________________ min
Ramp to High Idle Rate 7____________________ rpm/s
Delay at High Idle Rate 7____________________ min
Ramp to Min Gov Rate 7____________________ rpm/s
Loading Rate 7____________________ rpm/s

Start Setting (Curve 8)
Ramp to Low Idle Rate 8____________________ rpm/s
Delay at Low Idle Rate 8____________________ min
Ramp to Medium Idle Rate 8____________________ rpm/s
Delay at Medium Idle Rate 8____________________ min
Ramp to High Idle Rate 8____________________ rpm/s
Delay at High Idle Rate 8____________________ min
Ramp to Min Gov Rate 8____________________ rpm/s
Loading Rate 8____________________ rpm/s

Start Setting (Curve 9)
Ramp to Low Idle Rate 9____________________ rpm/s
Delay at Low Idle Rate 9____________________ min
Ramp to Medium Idle Rate 9____________________ rpm/s
Delay at Medium Idle Rate 9____________________ min
Ramp to High Idle Rate 9____________________ rpm/s
Delay at High Idle Rate 9____________________ min
Ramp to Min Gov Rate 9____________________ rpm/s
Loading Rate 9____________________ rpm/s

Start Setting (Curve 10)
Ramp to Low Idle Rate 10____________________ rpm/s
Delay at Low Idle Rate 10____________________ min
Ramp to Medium Idle Rate 10____________________ rpm/s
Delay at Medium Idle Rate 10____________________ min
Ramp to High Idle Rate 10____________________ rpm/s
Delay at High Idle Rate 10____________________ min
Ramp to Min Gov Rate 10____________________ rpm/s
Loading Rate 10____________________ rpm/s

SPEED CONTROL PAGE

Short Description________________________________

No SD when NSD Completed?________________________ y/n

Normal Shutdown (NSD) go to Low Idle Speed only?________ y/n

Use NSD Permissive < Min Governor?__________________ y/n

Critical Speeds *(if configured)*

General Critical Speed Settings

Enable Speed Lower in Critical Band?__________________ y/n

Min Speed is Highest Critical Speed?__________________ y/n

Force Speed Lower if stuck in Critical Band?______________ y/n

SD if stuck in Critical Band? (No = alarm)________________ y/n

Delay before Alarm/Unload/SD action___________________ y/n

Critical Speed Band 1 Settings

Critical Speed Band 1 Active?_______________________ y/n

Critical Speed 1 Rate Fixed?________________________ y/n

Critical Speed 1 Rate__________________________ rpm/s

Lower Limit Critical Speed 1_________________________ rpm

Upper Limit Critical Speed 1_________________________ rpm

Critical Speed Band 2 Settings

Critical Speed Band 2 Active?_______________________ y/n

Critical Speed 2 Rate Fixed?________________________ y/n

Critical Speed 2 Rate__________________________ rpm/s

Lower Limit Critical Speed 2_________________________ rpm

Upper Limit Critical Speed 2_________________________ rpm

Critical Speed Band 3 Settings

Critical Speed Band 3 Active?_______________________ y/n

Critical Speed 3 Rate Fixed?________________________ y/n

Critical Speed 3 Rate__________________________ rpm/s

Lower Limit Critical Speed 3_________________________ rpm

Upper Limit Critical Speed 3_________________________ rpm

Speed Setpoint R/L Command Rates

Setpoint Adjustment Normal Rate (Cold_________________ rpm/s

Setpoint Adjustment Normal Rate (Hot)_________________ rpm/s

Slow Rate in seconds before Normal rate________________ sec

Multiply factor Normal Rate for Slow Rate_______________ rpm/s

Initial Speed PID Settings

Off-Line Proportional Gain___________________________

Off-Line Integral Gain______________________________

Off-Line Derivative Ratio____________________________

External DI Select Online/Offline Dynamics_______________ y/n

On-Line Proportional Gain___________________________

On-Line Integral Gain______________________________

On-Line Derivative Ratio____________________________

If Remote Speed *(if configured)*

Min Remote Speed Value______________________________ rpm

Max Remote Speed Value______________________________ rpm

Min Remote Speed Range of Action_____________________ rpm

Max Remote Speed Range of Action_____________________ rpm

Max Remote Speed Rate_______________________________ rpm/s

Not Matched Deviation_______________________________ rpm

Not Matched Rate___________________________________ rpm/s

TURBINE PROTECTIONS PAGE

Max Speed Deviation (Spd vs. Ref)_____________________ rpm

Delay Before Alarm__________________________________ sec

Shutdown if Speed Control Lost?______________________ y/n

Trip Action Options

Trigger Trip at Power up______________________________ y/n

Check for Trip Relay Drives Actuators to Zero Current.

Un-Checked Drives to 0% Demand_____________________ y/n

Use Non-Latching Alarm Reset on GST CORE

Operational Events__________________________________ y/n

Underspeed Protection

Use Underspeed Protection____________________________ y/n

Underspeed Level (<99% of Min Gov)____________________ rpm

Alarm Delay____ sec

Use Underspeed trip?_________________________________ y/n

Underspeed SD Delay_________________________________ sec

Acceleration Protection

Use Acceleration Protection Offline_____________________ y/n

Min Deviation Before Acting___________________________ rpm

Offline Max Acceleration______________________________ rpm/s

Use Acceleration Protection Online_____________________ y/n

Max Acceleration Rate Online__________________________ rpm/s

Use Boost Protection_________________________________ y/n

Boost Speed Trigger Level_____________________________ rpm

Boost Valve Demand__________________________________ %

Emergency MIN Gov Rate (if used)

Emergency MIN Gov Rate______________________________ rpm/s

Speed Detection

Override Timer Not Used?_____________________________ y/n

Override Time_______________________________________ sec

Overspeed Test Settings

Delay to Quit if No Raise/Lower command is

issued____ sec

Predictive Overspeed

Use Predictive Overspeed Logic_________________________ y/n

Predictive Speed Level________________________________ rpm

Max Acceleration at Predictive Speed____________________ rpm/s

EXTRACTION / ADMISSION CONTROL PAGE *(if configured)*

Short Description________________________
Extr/Adm PV & SP Units____________________ eu
Invert Extr/Adm PID Action?________________ y/n
Manual Mode Only Available (Disable PID control)?________ y/n
PID Always in Control (No Manual)____________ y/n
Semi-Automatic First at Enable?______________ y/n
Semi-Automatic First from Decoupling?___________ y/n
Manual Enable Only________________________ y/n
Extraction Action Upon Fault
- Hold Position Got Manual______________ y/n
- Disable Extraction_________________ y/n
- Ramp LP to Max____________________ y/n
- Ramp LP to Min____________________ y/n
- Shutdown / Trip Unit________________ y/n
- Disable Extraction_________________ y/n

Sensor Range

Ext/Adm Min PV (value @ 4 mA)______________ eu
Ext/Adm Max PV (value @ 20 mA)______________ eu
Signal Difference ALM (multiple inputs)____________ eu

Manual Demand

Demand Normal R/L Rate (Manual)______________ eu/s
Extraction Demand Fast Delay_________________ sec
Fast Demand Multiplier______________________
Demand Entered Rate______________________ eu/s
Use Remote P Demand______________________ y/n

Remote Manual P Demand (if configured)

Remote Demand Max Deviation Level____________ eu
Max Remote P Demand Rate__________________ eu/s
Signal Difference ALM (multiple inputs)____________ eu

Use Speed Permissives

If not used Extraction is Inhibited below MinGov

Extraction Min Speed to Enable_______________ rpm

Extraction Setpoint

Minimum Ext/Adm Setpoint___________________ eu
Maximum Ext/Adm Setpoint___________________ eu
Setpoint Initial Value______________________ eu
Setpoint Entered Rate______________________ eu/s
Use Setpoint Tracking when Disabled?____________ y/n
Setpoint R/L Normal Rate____________________ eu/s
Delay for Fast Setpoint Rate_________________ sec
Fast Setpoint Multiplier_____________________
Use 4-20 mA Remote Extr/Adm Setpoint?__________ y/n

Remote Extraction Setpoint *(if configured)*

Maximum Remote SP Rate____________________ eu/s
Remote SP Max Deviation Level________________ eu
Signal Difference ALM (multiple inputs)____________ eu

Extraction/Admission (P) PID Control

Proportional Gain__________________________ %
Integral Gain______________________________ rps
Derivative Ratio___________________________ %
Droop (of Extraction/Admission)_______________ %
Sliding Deadband___________________________ rpm

STEAM MAP PAGE

Steam MAP Priorities – *If Checked then Speed has Priority*

Priority if LP at Max?_______________________ y/n
Priority if LP at Min?_______________________ y/n
Priority if S is at Max?______________________ y/n
Enable Min Flow Limiter?_____________________ y/n
Priority if Pressure at Min?___________________ y/n

EXTRACTION STEAM MAP

Min Flow Limit (S-value) at HP=0%______________ eu
Min Flow Limit (S-value) at HP=100%____________ eu

Maximum / Minimum Values

Maximum Power_____________________________ eu
Maximum HP Flow____________________________ eu
Min LP Valve Limiter_________________________ %
Max LP Valve Limiter_________________________ %

Point A Values

Max Power @ Min Extraction___________________ eu
Max HP Flow @ Min Extraction_________________ eu

Point B Values

Min Power @ Max Extraction___________________ eu
Min HP Flow @ Max Extraction_________________ eu

Point C Values

Min Power @ Min Extraction___________________ eu
Min HP Flow @ Min Extraction_________________ eu

ADMISSION STEAM MAP

Min Flow Limit (S-value) at HP=0%______________ eu
Min Flow Limit (S-value) at HP=100%____________ eu

Maximum / Minimum Values

Maximum Power_____________________________ eu
Maximum HP Flow____________________________ eu
Min HP Position_____________________________ %
Min LP Valve Limiter_________________________ %
Max LP Valve Limiter_________________________ %

Point A Values

Max Power @ Max Admission__________________ eu
Max HP Flow @ Max Admission________________ eu

ADMISSION STEAM MAP ***(cont.)***

Point B Values

Min Power @ Min Admission__________________________ eu
Min HP Flow @ Min Admission________________________ eu

Point C Values

Max Power @ Min Admission__________________________ eu
Max HP Flow @ Min Admission________________________ eu

EXTRACTION/ADMISSION STEAM MAP

Min Flow Limit (S-value) at HP=0%___________________ eu
Min Flow Limit (S-value) at HP=100%_________________ eu

Maximum / Minimum Values

Maximum Power__________________________________ eu
Maximum HP Flow________________________________ eu
Max Admission Flow_____________________________ eu
Min HP Position________________________________ %
Min LP Valve Limiter___________________________ %
Max LP Valve Limiter___________________________ %

Point A Values

Max Power @ Min Extr/Adm___________________________ eu
Max HP Flow @ Min Extr/Adm_________________________ eu

Point B Values

Min Power @ Max Extraction_________________________ eu
Min HP Flow @ Max Extraction_______________________ eu

Point C Values

Min Power @ Min Extr/Adm___________________________ eu
Min HP Flow @ Min Extr/Adm_________________________ eu

CASCADE CONTROL PAGE ***(if configured)***

Short Description______________________________
Invert Cascade PID Action?_______________________ y/n
Use Setpoint Tracking when Disabled?______________ y/n
Min Casc & Remote Speed Demand___________________ rpm
Max Casc & Remote Speed Demand___________________ rpm
Maximum Cascade Setpoint Rate____________________ eu/s
Cascade PV & SP Units___________________________ eu

Sensor

Extraction Action Upon Fault

- Use Cascade AI______________________________ y/n
- Use KW AI for Cascade________________________ y/n
- Use Exhaust AI for Cascade y/n
- Use Inlet AI for Cascade_______________________ y/n

Min Cascade PV (value @ 4ma)_____________________ eu
Max Cascade PV (value @ 20ma)____________________ eu
Signal Difference ALM (multiple inputs)_____________ eu

Speed Setpoint Values

Initial Cascade Setpoint Value______________________ eu
Min Cascade Setpoint Value_________________________ eu
Max Cascade Setpoint Value_________________________ eu
Rate for Go to Setpoint Entered_____________________ eu/s
Normal R/L Setpoint Rate___________________________ eu/s
Multiply Factor of Normal R/L Rate___________________
Delay Before Normal R/L Rate_______________________ s

Use 4-20 mA Remote Cascade Setpoint?______________ y/n

Remote Cascade Setpoint ***(if configured)***

Max Remote Cascade Setpoint_______________________ eu/s
Remote Setpoint Max Deviation Level_________________ eu
Signal Difference ALM (if multiple inputs used)_________ eu

Cascade PID Initial Settings

Proportional Gain_______________________________ %
Integral Gain___________________________________ rps
Derivative Ratio_________________________________ %
Sliding Deadband________________________________ %
Droop (in % of SP range)_________________________ %

Settings for GENERATOR applications

Disable Cascade if GEN Breaker Opens______________ y/n
Disable Cascade if UTIL Breaker Opens_____________ y/n

DECOUPLING CONTROL PAGE ***(if configured)***

General Settings

Reverse PID (compared to Type)____________________ y/n
Decoupling is Cascade?___________________________ y/n
Manual Mode Only Available_______________________ y/n
PID Always I Control (No Manual)___________________ y/n
PID Control First at Enable________________________ y/n

Demand Limits

Min Decoupling Demand___________________________ %
Max Decoupling Demand___________________________ %

Sensor Range (Set on AI)

Min Process value for 4 mA_________________________ eu
Max Process value for 20 mA________________________ eu

Manual Demand

Manual Demand Normal R/L Rate____________________ eu/s
Delay for Fast Demand R/L Rate_____________________ sec
Fast Multiply Factor of Normal R/L Rate_______________
Use 4-20 mA Remote Demand Setpoint?______________ y/n
Max Remote Demand Rate__________________________ eu/s
Remote Demand Max Deviation Level_________________ eu

Decoupling Setpoint
Decoupling Units________________ eu
Min Setpoint________________ eu
Max Setpoint________________ eu
Initial Setpoint at Bootup________________ eu
Setpoint Entered Rate________________ eu/s
Demand Entered Rate________________ eu/s

Setpoint Track When Disabled________________ y/n
SP Raise/Lower Rate________________ eu/s
Delay for Fast SP Rate________________ eu/s
Fast Setpoint Multiplier________________

Use Remote Decoupling Setpoint________________ y/n
Max remote SP Rate________________ eu/s
Remote SP Max Deviation________________ eu

Proportional Gain________________ %
Integral Gain________________ rps
Derivative Ratio________________ %
Droop________________ %
Sliding Deadband________________ %

FEED-FORWARD PAGE *(if configured)*
Use Direct Signal?________________ y/n
Inhibited if No Cascade?________________ y/n
Deadband on Speed________________ rpm

Min FFW Rate________________ %/s
Min FFW Demand at Min Rate________________ rpm
Max FFW Rate________________ %/s
Max FFW Demand at Max Rate________________ rpm
Normal Duration Time________________ sec

Use emergency FW?________________ y/n

Emergency Duration Time________________ s
Min Rate before Acting________________ %/s
Maximum Rate________________ rpm/s
Speed Deviation at Max Rate________________ rpm
Max Speed Rate of Change________________ rpm/S

AUXILIARY CONTROL PAGE *(if configured)*
Short Description________________ y/n
Reverse (Invert) Auxiliary PID Action?________________ y/n
Force Raise if Fault________________ y/n
Force Lower if Fault________________ y/n
Hold Speed at Start When Limiter________________ y/n
Disable Decoupling when limiter active________________ y/n
Alarm When Limiting________________ y/n

FEED-FORWARD PAGE *(if configured)*
Min Process Value (PV) at 4 mA________________ eu
Max Process Value (PV) at 20 mA________________ eu
Sig Difference ALM (multiple inputs)________________ eu

Setpoint Settings
Use Setpoint Tracking when Disabled?________________ y/n
Initial Aux Setpoint________________ eu
Min Aux Setpoint________________ eu
Max Aux Setpoint________________ eu
Setpoint Entered Rate________________ eu/s
Delay for Fast Setpoint Rate________________ eu/s
Setpoint Raise/Lower Rate________________ eu/s
Setpoint Fast Rate Multiply________________ s

Use 4-20 mA Remote Aux Setpoint?________________ y/n
Remote Auxiliary Setpoint
Remote Aux Max Rate________________ eu/s
Remote SP Max Deviation Level________________ eu
Signal Difference ALM (multiple inputs)________________ eu

Auxiliary PID Initial Settings
Proportional Gain________________ %
Integral Gain________________ rps
Droop (in % of SP range)________________ %
Sliding Deadband________________ %

Turbine Valve Settings Page
Enable Stuck Rotor Detection SD?________________ y/n
Use HP Initial Position at Start?________________ y/n
HP Ramp Max at Start________________ %/s
HP Valve Used Selection
One HP Valve________________ y/n
Two HP Split Range________________ y/n
Two HP, HP2 as Startup________________ y/n
Two HP, HP2 as Boost________________ y/n

If Two HP Valve w/ Split range
Offset When Split Valve________________ %

If Two HP with HP2 as Startup Valve
Transfer Time at Disable________________ sec
Min Transfer time________________ sec
Use Valve Demand for XFER________________ y/n
Min Speed => Full HP2________________ rpm
Max Speed => Full HP________________ rpm
HP2 Gain________________ %

If Two HP with HP2 as Boost Valve
HP2 Gain________________ %
Min Transfer time________________ sec
Transfer Time at Disable________________ sec

LP Settings ***(if configured)***
LP Valve Used
Single LP________________________________ y/n
Two LP Split______________________________ y/n

If Two Split LP
LP2 Fixed Offset__________________________ %

LP Ramp Options
LP2 Type at Start
LP Ramp at Max at Reset___________________ y/n
LP Ramp at Max at Start____________________ y/n

LP Valve Limiter Ramp Rates
Initial Ramp Rate__________________________ %/s
Normal Raise/Lower Rate____________________ %/s
Delay to Fast Rate_________________________ sec
Rate Fast Multiplier_______________________

Speed Signals Page
Device Tag Names
Speed Input #1_____________________________
Speed Input #2_____________________________
Speed Input #3_____________________________
Speed Input #4_____________________________

Speed Signal 1 Settings
Maximum Speed (Upper Range Limit)?_________ rpm
Speed Signal Gear Ratio____________________
Number of Gear Teeth_______________________
Speed Low Latch Setpoint___________________ rpm
Speed High Latch Setpoint__________________ rpm
Use MPU Override Time______________________ y/n
Max Override Time__________________________ sec

Check to use Speed Input #2________________ y/n
Check to make MPU #2 settings same as MPU #1_________ y/n

Check to use Speed Input #3________________ y/n
Check to make MPU #3 settings same as MPU #1_________ y/n

Speed Signal #4 Settings–
(Speed Signal #4 can only be used as a Prox Probe)
Maximum Speed (Upper Range Limit)?_________ rpm
Speed Signal Gear Ratio____________________
Number of Gear Teeth_______________________
Speed Low Latch Setpoint___________________ rpm
Speed High Latch Setpoint__________________ rpm
Slow Speed Signal filter___________________ sec
Null speed detected delay__________________ sec
Null speed OFF Level (hysteresis)__________ rpm

ANALOG INPUTS PAGE
Analog Input Channel #1
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #2
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #3
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #4
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #5
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #6
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #7
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #8
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #9
Function___________________________________
Value for 4 mA_____________________________
Value for 20 mA____________________________
Device Tag Name____________________________

Analog Input Channel #10
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #11
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #12
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #13
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #14
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #15
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #16
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #17
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #18
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #19
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #20
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #21
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #22
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #23
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #24
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #25
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #26
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #27
Function_______________________________________
Value for 4 mA_________________________________
Value for 20 mA________________________________
Device Tag Name________________________________

Analog Input Channel #28
Function______________________________
Value for 4 mA______________________________
Value for 20 mA______________________________
Device Tag Name______________________________

Analog Input Channel #29
Function______________________________
Value for 4 mA______________________________
Value for 20 mA______________________________
Device Tag Name______________________________

Analog Input Channel #30
Function______________________________
Value for 4 mA______________________________
Value for 20 mA______________________________
Device Tag Name______________________________

Analog Input Channel #31
Function______________________________
Value for 4 mA______________________________
Value for 20 mA______________________________
Device Tag Name______________________________

Analog Input Channel #32
Function______________________________
Value for 4 mA______________________________
Value for 20 mA______________________________
Device Tag Name______________________________

ANALOG READOUTS PAGE

Analog Output Channel #1
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #2
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #3
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #4
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #5
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #6
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #7
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #8
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #9
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #10
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #11
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

Analog Output Channel #12
Function______________________________
Value at 4 mA______________________________
Value at 20 mA______________________________
Device Tag Name______________________________

CONTACT INPUTS PAGE

Contact Input 1 Function FIXED = ESTOP
Device Tag Identifier______________________________

#2 Default = Event Reset
Contact Input 2 Function____________________________
Device Tag Identifier______________________________

#3 Default = Speed Reference Raise Setpoint
Contact Input 3 Function____________________________
Device Tag Identifier______________________________

#4 Default = Speed Reference Lower Setpoint
Contact Input 4 Function____________________________
Device Tag Identifier______________________________

#5 Default = Start Command
Contact Input 5 Function____________________________
Device Tag Identifier______________________________

#6 Default = Controlled Shutdown Command
Contact Input 6 Function____________________________
Device Tag Identifier______________________________

Contact Input 7 Function____________________________
Device Tag Identifier______________________________

Contact Input 8 Function____________________________
Device Tag Identifier______________________________

Contact Input 9 Function____________________________
Device Tag Identifier______________________________

Contact Input 10 Function___________________________
Device Tag Identifier______________________________

Contact Input 11 Function___________________________
Device Tag Identifier______________________________

Contact Input 12 Function___________________________
Device Tag Identifier______________________________

Contact Input 13 Function___________________________
Device Tag Identifier______________________________

Contact Input 14 Function___________________________
Device Tag Identifier______________________________

Contact Input 15 Function___________________________
Device Tag Identifier______________________________

Contact Input 16 Function___________________________
Device Tag Identifier______________________________

Contact Input 17 Function___________________________
Device Tag Identifier______________________________

Contact Input 18 Function___________________________
Device Tag Identifier______________________________

Contact Input 19 Function___________________________
Device Tag Identifier______________________________

Contact Input 20 Function___________________________
Device Tag Identifier______________________________

Contact Input 21 Function___________________________
Device Tag Identifier______________________________

Contact Input 22 Function___________________________
Device Tag Identifier______________________________

Contact Input 23 Function___________________________
Device Tag Identifier______________________________

Contact Input 24 Function___________________________
Device Tag Identifier______________________________

RELAY OUTPUTS PAGE

Relay 1 Function FIXED = Summary Alarm / Trip Relay
Check Reset Clears Trip Relay?____________________ y/n
External Trips Activate Trip Relay__________________ y/n
Trip Relay Drives Actuators to Zero Current___________ y/n
Invert Output State (Energize For Trip)______________ y/n
Configuration_____________________________________
Test Relay____
Device Tag Identifier______________________________

Relay 2
Use as a Level Switch_____________________________ y/n
Analog Signal_____________________________________
Switch On Level___________________________________
Switch Off Level__________________________________
Function____
Configuration_____________________________________
Test Relay____
Invert Output State for This Condition_______________ y/n
Device Tag Identifier______________________________

Relay 3
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 4
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 5
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 6
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 7
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 8
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 9
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 10
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 11
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

Relay 12
Use as a Level Switch_______________________________ y/n
Analog Signal_________________________________
Switch On Level_______________________________
Switch Off Level_______________________________
Function_____________________________________
Configuration__________________________________
Test Relay____________________________________
Invert Output State for This Condition___________________ y/n
Device Tag Identifier_____________________________

COMMUNICATIONS PAGE

Modbus Block 1

Modbus #1 Link #1 Settings

Select ModBus #1 Interface

- Modbus #1 Not Used_______________ y/n
- Modbus #1 View Only, No Writes_______________ y/n
- Modbus #1 Writes Always Enabled_______________ y/n
- Modbus #1 Writes When Selected_______________ y/n

Select Link #1 Interface

This will define Link 1 into CPU A and Link 2 into CPU B

- Ethernet UDP Port 5001_______________ y/n
- Ethernet TCP_______________ y/n
- Serial_______________ y/n

Set Slave Address_______________

Enable Write from Modbus #1 - Link #1_______________ y/n

Modbus #1 Link #2 Settings

Select ModBus #2 Interface

- Modbus #1 Link #2 Not Used_______________ y/n
- Modbus #1 Link #2 View Only, No Writes_______________ y/n
- Modbus #1 Link #2 Writes Always Enabled_______________ y/n
- Modbus #1 Link #2 Writes When Selected_______________ y/n
- Modbus #1 Link #2 Writes When Link #1 Failed_______________ y/n

Set Slave Address_______________

Enable Write from Modbus #1 - Link #1_______________ y/n

Link #2 is Not Redundant for HMI using Link #1_______________ y/n

Modbus #1 Link #3 Settings

Link #3 is view only with NO write enable option

Select ModBus #3 Interface y/n

- Modbus #1 Link #3 Not Used_______________ y/n
- Modbus #1 Link #3 View Only, No Writes_______________ y/n

Select ModBus #1 Interface

- Ethernet UDP Port 5003_______________ y/n
- Ethernet TCP_______________ y/n
- Serial_______________ y/n

Set Slave Address_______________

Modbus Block 2

Modbus #2 Link #1 Settings

Select ModBus #2 Interface

- Modbus #2 Not Used_______________ y/n
- Modbus #2 View Only, No Writes_______________ y/n
- Modbus #2 Writes Always Enabled_______________ y/n
- Modbus #2 Writes When Selected_______________ y/n

Select Link #1 Interface

This will define Link 1 into CPU A and Link 2 into CPU B

- Ethernet UDP Port 5001_______________ y/n
- Ethernet TCP_______________ y/n
- Serial_______________ y/n

Set Slave Address_______________

Enable Write from Modbus #2 - Link #1_______________ y/n

Modbus #2 Link #2 Settings

Select ModBus #2 Interface

- Modbus #2 Link #2 Not Used_______________ y/n
- Modbus #2 Link #2 View Only, No Writes_______________ y/n
- Modbus #2 Link #2 Writes Always Enabled_______________ y/n
- Modbus #2 Link #2 Writes When Selected_______________ y/n
- Modbus #2 Link #2 Writes When Link #1 Failed_______________ y/n

Set Slave Address_______________

Enable Write from Modbus #2 - Link #2_______________ y/n

Link #2 is Not Redundant for HMI using Link #1_______________ y/n

Serial Connections *(if configured)*

Modbus #1 Serial Settings

Protocol Link 1_______________ ASCII / RTU

Protocol Link 2_______________ ASCII / RTU

Protocol Link 3_______________ ASCII / RTU

Modbus #2 Serial Settings

Protocol Link 1_______________ ASCII / RTU

Protocol Link 2_______________ ASCII / RTU

Serial Port 1 CPU A Communication Settings

Driver Selection_______________ RS232 / RS422 / RS485

Baud Rate_______________ kbs

Parity_______________ Yes / No

Stop Bits_______________

Serial Port 1 CPU B Communication Settings

Driver Selection_______________ RS232 / RS422 / RS485

Baud Rate_______________ kbs

Parity_______________ Yes / No

Stop Bits_______________

Serial Port 1 CPU C Communication Settings

Driver Selection_______________ RS232 / RS422 / RS485

Baud Rate_______________ kbs

Parity_______________ Yes / No

Stop Bits_______________

ACTUATOR DRIVERS PAGE

Proportional Actuator Channel #1

ACT #1 Valve Demand Signal *(default=HP Demand)*

ACT #1 Tag Name__________________

ACT #1 Function

- Not Used Tunable 1__________________ y/n
- HP Demand__________________ y/n
- HP Demand Split Valve__________________ y/n
- LP Demand__________________ y/n
- LP VLV2 Demand__________________ y/n
- Anti-Surge Valve Stage 1__________________ y/n
- Anti-Surge Valve Stage 2__________________ y/n

Type of Coil

Output Current Range__________________0-20ma / 0-200ma

Actuator Coil Type

- Single Coil__________________ y/n
- Dual Coil__________________ y/n
- Redundant Actuators__________________ y/n

Invert Output__________________ y/n

Actuator Current Range

- Current @ 0 Demand (Min)__________________ ma
- Current @ 100 Demand (Max)__________________ ma
- Dither__________________ ma

Proportional Actuator Channel #2

ACT #2 Valve Demand Signal *(default=HP Demand)*

ACT #2 Tag Name__________________

ACT #2 Function

- Not Used Tunable 1__________________ y/n
- HP Demand__________________ y/n
- HP Demand Split Valve__________________ y/n
- LP Demand__________________ y/n
- LP VLV2 Demand__________________ y/n
- Anti-Surge Valve Stage 1__________________ y/n
- Anti-Surge Valve Stage 2__________________ y/n
- Readout Value__________________ y/n

Type of Coil

Output Current Range__________________0-20ma / 0-200ma

Actuator Coil Type

- Single Coil__________________ y/n
- Dual Coil__________________ y/n
- Redundant Actuators__________________ y/n

Invert Output__________________ y/n

Actuator Current Range

- Current @ 0 Demand (Min)__________________ ma
- Current @ 100 Demand (Max)__________________ ma
- Dither__________________ ma

If Actuator Controller module A6 is used then

Actuator Controller Channel #1

ACT #1 Demand Use

- Not Used Tunable 1__________________ y/n
- HP Demand__________________ y/n
- HP Demand Split Valve__________________ y/n
- LP Demand__________________ y/n
- LP VLV2 Demand__________________ y/n
- Anti-Surge Valve Stage 1__________________ y/n
- Anti-Surge Valve Stage 2__________________ y/n

ACT #1 Control type

- PROP - Proportional W/Command Trim__________________ y/n
- PI - proportional & Integral__________________ y/n
- P - Proportional Only__________________ y/n
- PI_LAG - PI W/Lag Filtered Demand__________________ y/n

Feedback type

- NONE - Act is P Only__________________ y/n
- A - Single Pair of Return Wires__________________ y/n
- A-B - Simple Difference Device__________________ y/n
- (A-B)/(A+B) - D/S or Constant Sum Device__________________ y/n

Action if Single Feedback Fails

- If Single FDBK Fails__________________Use High / Use Low

Set Feedback Excitation Voltage__________________ vrms

Check for Open Wire Detection__________________ y/n

Forward or Reverse Acting__________________Forward / Reverse

If Prop type is Configured

Current at 0 Demand__________________ ma

Current at 100 Demand__________________ ma

Set Dither Current Amplitude__________________ ma

Command Trim on FDBK__________________Enabled / Disabled

If Integrating type is Configured

Set NULL Current__________________ ma

Set Min Current__________________ ma

Set Max Current__________________ ma

Set Dither Amplitude__________________ ma

Act #1 Position Feedback Setup

Actuator Controller #1 Tag__________________

FDBK Position Tolerance__________________ %

FDBK Voltage Tolerance__________________ volts

Position Error Threshold__________________ %

Position Error Delay__________________ msec

Feedback Difference Tolerance__________________ %

Feedback Difference Delay__________________ sec

Act #1 Valve Response Dynamics

PROP (KP) gain__________________

Integral (KI) gain__________________

Actuator Controller Channel #2

ACT #2 Demand Use

Not Used Tunable 1______________________________ y/n
HP Demand_________________________________ y/n
HP Demand Split Valve_________________________ y/n
LP Demand_________________________________ y/n
LP VLV2 Demand____________________________ y/n
Anti-Surge Valve Stage 1________________________ y/n
Anti-Surge Valve Stage 2________________________ y/n

ACT #2 Control type

PROP - Proportional W/Command Trim______________ y/n
PI - proportional & Integral________________________ y/n
P - Proportional Only____________________________ y/n
PI_LAG - PI W/Lag Filtered Demand________________ y/n

Feedback type

NONE - Act is P Only____________________________ y/n
A - Single Pair of Return Wires____________________ y/n
A-B - Simple Difference Device____________________ y/n
(A-B)/(A+B) - D/S or Constant Sum Device____________ y/n

Action if Single Feedback Fails

If Single FDBK Fails_________________Use High / Use Low
Set Feedback Excitation Voltage____________________ vrms
Check for Open Wire Detection______________________ y/n
Forward or Reverse Acting_________________Forward / Reverse

If Prop type is Configured

Current at 0 Demand______________________________ ma
Current at 100 Demand____________________________ ma
Set Dither Current Amplitude_______________________ ma
Command Trim on FDBK_________________Enabled / Disabled

If Integrating type is Configured

Set NULL Current_________________________________ ma
Set Min Current__________________________________ ma
Set Max Current__________________________________ ma
Set Dither Amplitude_______________________________ ma

Act #2 Position Feedback Setup

Actuator Controller #1 Tag__________________________
FDBK Position Tolerance___________________________ %
FDBK Voltage Tolerance____________________________ volts
Position Error Threshold____________________________ %
Position Error Delay_______________________________ msec
Feedback Difference Tolerance______________________ %
Feedback Difference Delay__________________________ sec

Act #2 Valve Response Dynamics

PROP (KP) gain___________________________________
Integral (KI) gain__________________________________

Legend:
rpm = Revolutions Per Minute
rpm/s = RPM Per Second
rps = Repeats Per Second
eu = Engineering Units
msec=Milliseconds
min = Minutes
sec = Seconds
%/sec = Percent per Second
vrms = Volts RMS

Appendix C.
5009FT Service Mode Worksheet

GOVERNOR SERIAL NUMBER: ______________________________

DATE: ________________

APPLICATION: ____

APPLICATION FOLDER
Same as Configuration Mode

SPEED CONTROL PAGE
(additional parameters only)

Speed PID Settings
Off-Line Proportional Gain ________
Off-Line Integral Gain ________
Off-Line Derivative Ratio ________

On-Line Proportional Gain ________
On-Line Integral Gain ________
On-Line Derivative Ratio ________

Speed Setpoint R/L Command Rates
Delay for Slow R/L ________ s
Multiply Factor of Normal Rate for Slow ________

Loading Gradients
Hot Loading Gradient ________ rpm/s
Cold Loading Gradient ________ rpm/s

CASCADE TUNING PAGE
Cascade PID Settings
Normal R/L Setpoint Rate ________ eu/s
Multiply Factor of Normal R/L Rate ________
Delay before Normal R/L Rate ________ s

Go to Target
Target Cascade Setpoint ________
Rate to Target Setpoint ________

Cascade Controller PID Settings
Proportional Gain ________
Integral Gain ________
Derivative Ratio ________
Sliding Deadband ________
Droop ________ %

Scalar for Modbus CASC Parameters ________

Extraction/Admission Tuning

Extraction Controller PID Settings

Proportional Gain ____________________
Integral Gain ____________________
Derivative Ratio ____________________
Sliding Deadband ____________________

Setpoint Adjustments

Normal R/L Setpoint Rate ____________________ eu/s
Delay Before Fast R/L Rate ____________________ s
Multiply Factor of Normal for Fast R/L Rate ____________________

Scalar of Ext MODBUS Parameters ____________________

Setpoint

Initial Setpoint ____________________
Minimum Setpoint ____________________
Maximum Setpoint ____________________
Droop of Extraction ____________________

DECOUPLING TUNING PAGE

Decoupling Controller PID Settings

Proportional Gain ____________________
Integral Gain ____________________
Derivative Ratio ____________________
Droop ____________________ %
Sliding Deadband ____________________

Manual Decoupling Demand

Normal Demand R/L Setpoint Rate ____________________ eu/s
Delay for Fast Demand R/L Rate ____________________ s
Fast Demand Multiply Factor of Normal R/L Rate ____________________

AUXILIARY TUNING PAGE

Auxiliary Controller PID Settings

Proportional Gain ____________________
Integral Gain ____________________
Derivative Ratio ____________________
Droop ____________________ %
Sliding Deadband ____________________

Setpoint Settings

Delay for Fast R/L Rate ____________________ s
Normal R/L Setpoint Rate ____________________ eu/s
Fast Multiply Factor of Normal R/L Rate ____________________

Scalar of AUX MODBUS Parameters ____________________

Seal Gas PID FOLDER (if configured)

Activate Seal Gas Controller

Use / Enable Seal Gas Control ____________________
Automatic raise if sensor failed? ____________________ Y/N
Automatic lower if sensor failed? ____________________ Y/N

Seal Gas Setpoint Parameters

Setpoint track at initialization ____ Y/N
Setpoint Initial value ____
Min Seal setpoint ____
Max Seal setpoint ____
Setpoint R/L rate ____ eu/s
Setpoint fast rate multiplier ____
Fast R/L rate delay before mult ____ s
Remote Setpoint Rate Limiter ____

Valve Output Demand Adjustments

Valve Position Initial Demand ____ %
Min Valve Position Demand output ____ %
Max Valve Position Demand output ____ %
Manual Valve Demand R/L rate ____ %/s
Manual Valve Demand Fast rate multiplier ____
Fast rate demand delay ____ s

Seal Gas Controller Dynamic Adjustments

Proportional gain ____
Integer gain ____
Derivative ratio ____
Droop ____ %
Invert Seal gas input? ____ Y/N

GEN Load Control (if configured)

Min Load Setpoint ____
Rated KW Load of Generator ____
KW Limiter Options ____
Check to Use Modbus or Toolkit Setpoint ____

Use KW Droop (Uncheck to ALWAYS use Actuator Droop) ____
Droop Percent ____
Check to use fixed valve % to zero load ____
HP Valve % at Rated Speed/Zero Load ____
HP Valve % at Maximum Load ____
Check to use Actual Grid speed for Droop ____
Use Frequency control Arm/Disarm ____

KW Limiter PID Dynamic Adjustments

Proportional gain ____
Integer gain ____
Derivative ratio ____
PID Threshold Value ____

ANALOG INPUTS PAGE

Same as Configuration Mode

ANALOG OUTPUTS PAGE

Same as Configuration Mode

DISCRETE (Binary) INPUTS PAGE

Same as Configuration Mode

DISCRETE (Binary) RELAY OUTPUTS PAGE

Same as Configuration Mode

COMMUNICATIONS PAGE

Same as Configuration Mode

VALVE DRIVER PAGE

(Additional parameters only)

Single HP linearization curve

X1	%	Y1	%
X2	%	Y2	%
X3	%	Y3	%
X4	%	Y4	%
X5	%	Y5	%
X6	%	Y6	%
X7	%	Y7	%
X8	%	Y8	%
X9	%	Y9	%
X10	%	Y10	%
X11	%	Y11	%

Second Curve for Split HP linearization curve

X1	%	Y1	%
X2	%	Y2	%
X3	%	Y3	%
X4	%	Y4	%
X5	%	Y5	%
X6	%	Y6	%
X7	%	Y7	%
X8	%	Y8	%
X9	%	Y9	%
X10	%	Y10	%
X11	%	Y11	%

Single LP Valve Linearization curve

X1	%	Y1	%
X2	%	Y2	%
X3	%	Y3	%
X4	%	Y4	%
X5	%	Y5	%
X6	%	Y6	%
X7	%	Y7	%
X8	%	Y8	%
X9	%	Y9	%
X10	%	Y10	%
X11	%	Y11	%

Second Curve for Split LP Linearization curve

X1	%	Y1	%
X2	%	Y2	%
X3	%	Y3	%
X4	%	Y4	%
X5	%	Y5	%
X6	%	Y6	%
X7	%	Y7	%
X8	%	Y8	%
X9	%	Y9	%
X10	%	Y10	%
X11	%	Y11	%

Revision History

Changes in Revision G—
- Update Figure 2-1 and 2-4.
- Update how to open the Toolkit files.
- Update Requirements for PC
- Update Selection List for Analog Readout Outputs, Functional Selection List for 4-20 mA Analog Inputs, Table 3-1 and Table 3-3 to reflect updates in Toolkit menus.
- Update Trip Table, Alarm Events Table, Table 8-5, Table 8-6, Table 8-7 and Table 8-8 to reflect updates to Modbus lists.

Changes in Revision F—
- Update Figure 3-40.

Changes in Revision E—
- Update screen shots & miscellaneous changes as marked with change bars

Changes in Revision D—
- Miscellaneous updates as marked with change bars

Changes in Revision C—
- Updated Chapter 1 to include information on Volume 4, and CCT shipped with standard control cabinet

Changes in Revision B—
- New Figures 3-22 & 3-34
- Added line to end of Table 3-3
- Added entry to "Select Coil Type" (page 75)

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