

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



Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

General Precautions Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.



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Warnings and Notices

Important Definitions



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

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



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.



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	Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:
Electrostatic Precautions	 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 bandling, 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.



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.

Turbine configuration	
Туре	Extraction Only 😪
	No Extraction
	Extraction Only
	Admission Only
	Admssion only with Direct Feed
	Extraction&Admission
	Extraction & Admission split valves

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.

ITCC Analog IO Module

Actuator Controller Module

Use Module 6 - Actuators

Use Module 5 - Analog IO

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



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:

# 9928-1358RS_H.wtool - Woodward ToolKit		
File View Device Settings Tools Help		
📸 🔤 🎾 Connect 🛒 Disconnect 👷		
	5009FT Version	
Disconnected		

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.

D	Connect S	Disconnect			
raye -		, Disconnect E			
50	C Select a networ	k:			
00	Network				
Fault Tolerant S	Ste COM1				
	STCP/IP				
Turbi					
i ui bii	i e				
Turbine	9 S				
	Protocol:	Servlink			•
	Protocol:	Servlink			•
	Protocol: Check the devic	Servlink es to connect to: Host Name	Port		•
	Protocol: Check the devic Alias	Servlink ese to connect to: Host Name	Port		•
Control Information	Protocol: Check the devic Alias 712.16.100.	Servlink eses to connect to: Host Name 172.16.100.47 5 10.4.128.175	Port 666 666		•
Control Information	Protocol: Check the devic Alias 772.16.100. 10.4.128.17 10.4.428.17	Servlink es to connect to: Host Name 17216.100.47 5 10.4.128.175 1 0.4.128.172	Port 666 666 666		•
Control Information	Protocol: Check the devia Alias I 172.16.100. 10.4.128.17 10.4.128.17	Servlink ess to connect to: Host Name 47 172.16.100.47 5 10.4.128.175 2 10.4.128.172 0 10.4.128.170	Port 666 666 666 666		•
Control Information Control Identifier	Protocol: Check the devia ✓ 172.16.100. □ 104.128.17 □ 104.128.17 □ 104.128.17 □ 104.128.17	Servlink est to connect to: Host Name 47 172.16.100.47 5 10.4.128.175 2 10.4.128.172 3 10.4.128.173	Port 666 666 666 666 666		•
Control Information Control Identifier	Protocol: Check the devic 17216.100. 10.4.128.17 10.4.128.17 10.4.128.17 10.4.128.17	Servlink Host Name 47 17216.100.47 10.4.128.175 10.4.128.172 10.4.128.173 10.4.128.173 10.4.128.171	Port 666 666 666 666 666 666		•
Control Information Control Identifier Limited Configuration	Protocol: Check the devic Alias V172.16.100. 10.4.128.17 10.4.128.17 10.4.128.17 10.4.128.17 10.4.128.17 Host Name/Ad	Servlink Host Name 47 172.16.100.47 172.16.100.47 10.4.128.175 10.4.128.170 10.4.128.170 10.4.128.171 10.4.128.171 10.4.128.171 10.4.128.171	Port 666 666 666 666 666 666	Port	• •
Control Information Control Identifier Limited Configuration	Protocol: Check the devia Alias V 17216100. 104.128.17 104.128.17 104.128.17 104.128.17 104.128.17 Host Name/Ad	Servlink ets to connect to: Host Name 47 172.16.100.47 5 10.4.128.175 10.4.128.173 10.4.128.171 10.4.128.173 10.4.128.171 diress	Port 666 666 666 666 666 666	Port 666	, Add
Control Information Control Identifier Limited Configuration	Protocol: Check the devic Alias V 172.16.100. 10.4.128.17 10.4.128.17 10.4.128.17 10.4.128.17 Host Name/Ad	Servlink Host Name 47 172.16.100.47 5 10.4.128.175 2 10.4.128.175 3 10.4.128.173 1 10.4.128.171 dress areat to my last sele	Port 666 666 666 666 666	Port 666	, Add
Control Information Control Identifier Limited Configuration	Protocol: Check the devia Alias V172.15.100 10.4.128.17 10.4.128.17 10.4.128.17 10.4.128.17 10.4.128.17 Host Name/Ad	Servlink eses to connect to: Host Name 47 172.16.100.47 5 104.128.175 2 104.128.172 0 104.128.170 3 104.128.171 1 104.128.171 dress	Port 666 666 666 666 666 666	Port 666	Add

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.

Login		×
9	Device 5009FT Unit1 is a secure device. Please login.	
	Security Level: Operator	•
	Password:	
	<u> </u>]

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)

Manual 26518V3

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.

ile Men Device Setting	Tools Halo			
🗃 🕭 🛛 🖓 - 🔫 - 🗋 -	G General - Page 1 - Home Page	- 📃 : 🝠 Con	nnect 🚽 Disconnect	
		EO		
		500	JALI	WOODWAR
		Fault Tolerant Ste	eam Turbine Control	Contract of the second s
				CORE
Launch Exter	nal Programs			
Anoma	00007			ToolKit File P/N = 9928-1212RS Rev H
Appina	nager	Turbine	e Run	Build Number = 1
Control A	ssistant	Turking	Demise	
		Turbine a	Service	
On-So	reen			
Keyb	oard			
		Control Information	1641	
		Control Information Control Identifier 5009FT	Unit	
Operation Authorized	Service Authorized	Control Information Control Identifier 5009FT Limited Configuration	Unit Authorized Full Con	iguration 3 Not Authorized
Operation Authorized	Service Authorized	Control Information	Unit Authorized Full Con	iguration 3 Not Authorized
Operation Authorized Master File (Source & GGP P.M. Sct	Service Authorized	Control Information Control Identifier 5008FT Limited Configuration ball Steam Turbine (IST) CORE	Urel Full Con Coder	iguration 3 Not Authorized
Operation Authorized Master File (Source & GAP P.M 5411	Service Authorized Service Executable) Gis 96915 Rev NEW (Control Information Control Identifier 5005FT Limited Configuration Bul Seaan Turbine (051) CORE ALP PM 5418-0514 Rev NEW	Autorized Full Con Code coder 508	Iguration 3 Not Authorized
Operation Authorized Master Fae (Souce & L GAP P/N 541 Network Device	Service Authorized Decotable) Git 95515 Rev NEW (Tool Device	Control Information Control Identifier 5009FT Limited Configuration Boll Steam Turbine (DST) CORE AP P/N S418-6514 Rev NEW I	Unit Autholeed Full Con Coder coder 508 Application 14	Iguration 3 Not Authorized

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.

9028.12120E Gisteral - Wandward Tanikit		
Ele View Device Settings Tools Help		
🗅 🍅 🖬 🐌 🛐 👘 - 🐃 - 🔤 🧿 General - Page 1 - Home P	age 🔹 🚽 📝 Connect 🦼 Disconnect	
	5009FT	WOODWARD
	Fault Tolerant Steam Turbine Control	GST
Launch External Programs		
		ToolKit File P/N = 9928-1212CF Rev G
Appmanager		Build Number = 1
Control Assistant	Teching Configuration Limited Manual	
	Turbine Configuration Limited Menu	
On-Screen	EVIT	
Keyboard	Enter Full configuration Mode CALIBRATION	
		No Errors
		Coniguration Conect
,	Control Information	ESTOP
Operation Authorized Service	Adheritad United Conferences Antonioni	
	Constanting Constitution Admontee	Full Configuration Authonized
Master File (Source & Executable)	Global Steam Turbine (GST) CURL Coder	4
Saver Prive De 18/34 16 MeV J	General 2010-2007 mer *	NET DATE
Connected on TCP/IP U Details		
22		Lai,

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.

Turbine Configuration	n Limited Menu	
Enter Full configuration Mode	EXIT CALIBRATION Mode	0
CONFIGURATION	ERROR!	Con
Control Information		
Control Identifier 5009FT Unit	1	

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.

% 9928-1212CF_G.wtool - Woodward	ToolKit			- • •
Eile View Device Settings Ion	ols <u>H</u> elp			
i 🗅 🥔 🖌 🔌 📓 🖉 🗮 🛸	- 📄 🔇 🜍 Conf- Page 1 - General Overvi	ew 👻 🚽 📝 Connect 🦼 Disconnect 📗		
MAIN HOME	Start Settings Spe	ed Contr Turb. Protec. Extr. Contr. Steam Map	W.wo	DODWARD
	Valve Settings Sp	eed Sig Analog In. Readout Binary Input	Binary Out Communic. Drivers Conf	Save Value
ITCC Analog ID Module /	Actuator Controller Module	Config - Turbine General Overview	Configure CUSTOM ALARMS	
Use Module 5 - Analog ID	Use Module 6 - Actuator Controller	Config. Check		
Turbine configuration		LID VALVE		
Туре	Extraction Only	LP VALVE		
Decoupling mode	No Decoupling Used			
Turbine Application (GEN or COMP) -		THROTTLE		
Select MECH Drive or GENERATOR	Compressor / Mechanical Drive 💌	VALVE		
Process Controllers Ontions				
Cascade Control?	Cascade Not used -			
Auxiliary Controller?	Auxiliary Not used	щ ~ Ч		
Remote Speed Setpoint?	Remote speed Not used	EXTRACTION OR		
Feed-Forward Control?	Feed Forward Not used -	ADMISSION STEAM	EXHAUST STEAM	
Configuration Authorized				
Site Name:		Turbine Name:		
Site name		Turbine name		
		ID Name:		
		Tubine name		
Connected on TCP/IP 🛛 🔂 Details				

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.



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.

-
e Jators

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	~
No Extraction	
Extraction Only	
Admission Only	
Admssion only with Direct Feed	
Extraction&Admission	
Extraction & Admission split valves	

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).

Turbine Application (GEN or COMP)	
Select MECH Drive or GENERATOR	Compressor / Mechanical Drive 🛛 🗸
	Compressor / Mechanical Drive
Process Controllers Options	Generator Drive

This selection will affect many other options on other pages.

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

Auxiliary Not used	*
Auxiliary Not used	
Auxiliary as Speed Ref Limiter	
Auxiliary as Process controller	

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 ess Controller

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

Remote speed Not used	*
Remote speed Not used	
Remote Speed is Configured	

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.

6 9928-1212CF_G.wtool - Woodward ToolKit Eile Yiew Device Settings Iools Help □ 🗃 💭 🐌 🔛 📄 📅 - 📰 - 📄 🔇 €	Conf- Page 2 - Start Settings	• 📓 🖉 Connect 🦼 Disconnect
MAIN HOME GEN Control	span Speed Contr Valve Settings Speed Sig a Check Full Canfig Turb	Turb Protec Wood Analog In. Readout Binary Input Binary Out Communic. Drivers Cord
Configuration Start Mode Selection Start Up Sequence Selection Speed Configuration Status: Configuration C	Authorized Automatic Start Ide-Rated X	Speed Startup Curve
Normal Operation Levels (RPM) Max Overspeed Test Overspeed Trip SP Max Governor Speed Min Governor Speed Min Controlled Speed	4450 🗇 rpm 4400 🌍 rpm 3997 🗇 rpm 3400 💿 rpm 100 💿 rpm	Contract Bland F1 Contract Bland F2 Contract Bland F1 Contract Blan
Ide Rate Mode:	800 🔄 rpm 3600 🔶 rpm 100.0 🔶 rpmisec	
Rate to Min Governor Loading Gradient above Min Gov Overspeed Test Rate	100.0 🗢 rpm/sec 10.0 🗢 rpm/sec 10.0 🗢 rpm/sec	
anastad on TCD/ID		

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

Automatic Start

dflt = 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 Idle/Rated

dflt = 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 reselection 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. dflt = 2625 (10.0, 25000)

Min Governor Speed

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.

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Figure 3-6. Turbine Automatic Start Settings

Selection Autostart sequence at SD

Autostart ON at SD	*
Autostart ON at SD	
Autostart Remains at SD	
Autostart OFF 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? Low Idle Setpoint

dflt = Checked 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?

Medium Idle Setpoint (rpm)

dflt = Checked 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? Use High Idle Setpoint (rpm)

dflt = Checked 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)*

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Use High Idle Speed Setpoint?		Rated Speed	3600 🚖 rpm	
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Cold Rate to Medium Idle	100 \ominus 🗢 rpm/sec	Hot Rate to Medium Idle	100 \ominus 🖨 rpm/sec	
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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.

Curve Mode Select:	Internal Curves used calculation
	Internal Curves used calculation Hot/cold binary contact used Remote Hot/cold used

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)

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)

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

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):

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

COLD Delay Time at Medium Idle (min):

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):

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):

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

dflt = 4.0 (0.0, 500)

dflt = 20 (0.0, 500)

dflt = 4.0 (0.0, 500)

dflt = 100 (0, 1000)

dflt = 1.0 (0.0, 500)

dflt = 100 (0, 1000)

dflt = 100 (0, 1000)

stress.

COLD Loading Gradient above Min Gov(rpm/s):

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

Start-up Curve Hot –

HOT Rate to Low Idle (rpm/s):

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

HOT Delay Time at Low Idle (min): 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):

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):

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.

dflt = 10 (0.0, 1000)

dflt = 100(0, 1000)

dflt = 0.10 (0.0, 500)

dflt = 100 (0, 1000)

dflt = 100 (0, 1000)

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.

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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.

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.

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Ramp to Medium Level rate 4	50 🜩	Delay at Medium Level Rate 4	0.5 🜩	
Ramp to High Level Rate 4	50 🜲	Delay at High Level Rate 4	0 🖨	
Ramp to Min Gov Rate 4	12.5 🜩			
Loading Rate 4	125 🖨			
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Ramp to Medium Level Rate 5	50 🗢	Delay at Medium Level Rate 5	0.5 🚭	
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Figure 3-10. Multi-Curve Hot/Cold Settings (5 curve example)

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Conf – Page 4 – Turbine Speed Control

Figure 3-11. Turbine Speed Control

Normal SD Settings -No SD when NSD completed?

Check this to have the 5009FT NOT issue a Trip output when a normal shutdown sequence has been completed.

NSD to Low Level Only?

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?

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

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.

dflt = Unchecked

dflt = Unchecked

dflt = Unchecked

dflt = 10 (0.1, 10000.0)
Enable Speed Lower in Critical

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?

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?

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?

Check this box to use Critical Speed Band #1 Lower Limit Critical Range 1

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

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?

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

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?

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?

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

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?

Check this box to use Critical Speed Band #3

dflt = Unchecked

dflt = 100.0 (1.0, 2000)

dflt = Unchecked

dflt = 100.0 (1.0, 2000)

dflt = Unchecked

dflt = Unchecked

dflt = Unchecked

dflt = Unchecked

dflt = Checked

dflt = 2100 (1.0, 25000)

dflt = 2200 (1.0, 25000)

dflt = Unchecked

Lower Limit Critical Range 3

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

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?

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 dflt = 100.0 (1.0, 2000)

Critical Speed Rate 3

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.

Speed Setpoint R/L Command Rates	
Setpoint Adjustment Normal Rate (Cold)	10.0 🚔 🜩 rpm/sec
Setpoint Adjustment Normal Rate (Hot)	10.0 🔶 🔷 rpm/sec
Delay time for Rate change	3.0 🜩 sec
Multiply fact of Normal Rate	1.00 \ominus 🜩

Setpoint Adjustment Normal Rate (Cold) rpm/s

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

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

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

Initial PID Settings			
Off-Line Prop Gain	2 🜩	On-Line Prop Gain	2 🜲
Off-Line Integral Gain	1 🚔	On-Line Integral Gain	1 🖨
Off-Line Deriv Gain	100 🜩	On-Line Deriv Gain	100 🗢
✓ Use Online/Offline PID Switch ?			

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dflt = Unchecked

dflt = 2300 (1.0, 25000)

dflt = 2400 (1.0, 25000)

dflt = 10.0 (0.005, 100)

dflt = 20.0 (0.005, 100)

dflt = 3.0 (0.0, 60.0)

Off-Line Proportional Gain

dflt = 2.0 (0.005, 100)

dflt = 1.0 (.005, 50)

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

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)

Domoto Spood			
Min Remote Speed Value	0	Max Remote Speed Rate	100 🔶 🗮
Max Remote Speed Value	0	Not Matched Deviation	100 🔶 🜩
Min Cascade & Remote Speed Range of Action	3450 🗢	Not Matched Rate	100 🔶 🜩
Max Cascade & Remote Speed Range of Action	3800 🜲	Status: Error remote speed range	
		Signal Difference ALM (if multiple inputs)	10.0 🔶 🗬

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)

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)

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)

This value determines the rate the setpoint moves when remote is enabled and the remote input doesn't match the actual speed setpoint.

Conf – Page 5 – Turbine Protection

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.

% 9928-1212CF_G.wtool - Woodward Tool	lKit			
Elle Yiew Device Settings Tools	Help			
- D 🖻 🖌 🔊 🕅 🕛 - 🖉 - 🗍	Conf- P	age 5 - Turbine Protections	• S Connect Disconnect	
MAIN Turbine Over. S	tart Settings	Speed Contr	Turb. Protec. Extr. Contr. Steam Map	WOODWARD
HOME				Save Values
		laive Settings Speed Sig	Analog In. Readout Binary Input Binary O	ut Communic. Drivers Conf
		_		
	Config. Chec	Lim. Config Tu	bine Protection	
LOSS OF SPEED CONTROL PROTECTION			Break Away Protection Amount deducted to actual	5 🚭 %
Max Speed Deviation (Spd vs Ref)		400 - pr rpm	Protection? Trigger Level	100 🖨 rpm
Delay Before Alarm		10 🜩 sec	The Anton Online (Other Londin Balance) Conferences	
SD If Control Lost ?			Trisper Trisper Trisper Tours (Unter tours in Heisty #) Configuration)	
UNDERSPEED PROTECTION			If Charlest On a Trin Drive Artusteer To 0 Current (Uncharlest a 0)	7 Damand)
Use Underspeed Protection?			En checke, on a mp, one scaards to a caren (oncheckes - o	s Sherneray
		2000	ACCELERATION PROTECTION	
Underspeed Level (<33% of Min Gov)		2000 rpm	Use Acceleration Protection Offline ?	
Adarm Delay		iuu 👾 sec		
Use Underspeed SD?			Min Deviation Before Acting	50 🌧 romisec
Use Underspeed SD Delay ?		10.0	Offine Max Acceleration	100 mm/kec
				() () () () () () () () () () () () () (
EMERGENCY TO MIN GOVERNOR (if used)		100.0	The second second second second second	
Emergency Min Gov Hate		rou rpm/sec	Vise Acceleration Protection Unline /	
SPEED DETECTION	OverrideTime	60 🏝 sec		
Uverride Timer Not Used /			Max Acceleration Rate Online	200 😴 rpm/sec
OVERSPEED TEST SETTINGS		cn 🔺		
PREDICTOR CORRESPOND			V Use Boost Protection	
Use Predictive Overspeed Logic				
			Boost Speed Trigger level	3000 ⊕ rpm
Predictive Speed Level		20000 🜩 rpm	Boost Valve demand	0
Max Acceleration At Predictive Speed		1000 - rpm/sec		
Connected on TCP/IP Details				

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)

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?

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?

If checked, underspeed protection will be active.

dflt = 100 (0.1, 1000)

dflt = 100 (0.1, 500)

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dflt = Unchecked

dflt = 400 (0, 25000)

dflt = Unchecked

Underspeed Level (<99% of Min Gov)

Define the minimum acceptable speed setpoint (rpm).

Alarm Delay (sec)

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?

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)

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

runnina. 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?

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)

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

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.

dflt = 2000 (1, 10000)

dflt = 10 (0, 60)

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dflt = Unchecked If checked, a Trip will be initiated if the underspeed condition lasts more than the Underspeed SD Delay.

dflt = 100 (1, 100000)

dflt = 2000 (500, 20000)

dflt = Checked

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dflt = Unchecked

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

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

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)

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?

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.

dflt = Unchecked

dflt = Unchecked

dflt = Unchecked

dflt = Checked

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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

Hold Position Goto Manual	*
Hold Position Goto Manual	
Disable Extraction	
Ramp LP to Max	
Ramp LP to Min	
Shutdown/Trip Unit	

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 h	nere)
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

mar	Demand Normal R/L Rate (Manual) Rate in %/s that the manual Raise and Lower comm	dflt = 1.0 (0, 100) nands move the valve	
	Extraction Demand Fast Delay Time (sec) it will use normal rate before the rate will	dflt = 5.0 (0, 20) change to Fast rate	
	Fast Demand Multiplier Fast rate equals the normal rate times this number	dflt = 3.0 (1, 10)	
	Demand Entered Rate Rate in %/s that the GO TO commands move the va	dflt = 0.1 (0.001, 10) alve	
	Use Remote P Demand Check this box to use a remote P Demand signal	dflt = Unchecked	
	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	ant = 2000 (30, 20000)	

Extraction Setpoint

Minimum Setpoint

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

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

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

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 chan	ige 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 signa	I
Maximum Remote setpoint rate d	lflt = 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) df	flt = 10.0 (0, 10000)
Max allowable difference between inputs	

PID Settings

Proportional Gain

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)

dflt = 1.0 (0.0, 99.99)

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.

dflt = 1.0 (0.01, 10000)

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dflt = 1.0 (0.01, 1000)

dflt = Checked

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.

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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:

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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 Enter the Maximum Rated turbine Power.	dflt = 20000 (0.0, 100000)
Maximum HP Flow Enter the Maximum Rated HP Valve Flow.	dflt = 108000 (0.0, 999999)

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 whe	n HP=0%
Min Load limit at HP-100%	dflt = 0 (100000 100000)
	ant = 0 (-100000, 100000)

Point A Values

Maximum Power @ Minimum Extraction	dflt = 15062 (0.0, 999999)
Enter the maximum power attainable at zero extr	action 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	າ flow.
Minimum HP Flow @ Maximum Extraction	dflt = 86000 (-99999,	999999)
Enter the minimum HP Valve Flow at 100% o	r maximum extraction f	low.

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 e	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

Check this box to have the control switch to extraction/admission priority whenever the min load is reached, while extraction is in control.

dflt = Unchecked

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) \times K1'. •When the turbine control is 'Decoupled Exhaust&Speed mode', S_TERM will be not less than the value of '(P_TERM-K6) \times K4'.			

Woodward

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 backend 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

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Elle Yiew Device Settings Icols Help		
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MAIN Turbine Over. Start Settings Speed (ontr Turb. Protec. Extr. Contr. Steam Map	Woodward
Valve Settings Speed	iig Analog In. Readout Binary Input Binary Out Communic.	Drivers Conf
Config Check Full Config Tur	ine Steam Map	
Steam MAP Priorities - IF Checked Speed has Priority	MORE CONTROLLED PARAMETERS PRIORITY 1 = PRIORITY 0 =	
Priority if LP at Max ?	0 SPEED SPEED SPEED	
Priority If LP at Min ?	1 COUPLED SPEED EXTRACT SPEED EXTRACT	
Priority If S at Max True Means ?	2 DECOUPLED SPEED INLET SPEED INLET	
P Enable Min Flow Limiter ?	4 DECOUPLED	
Priority If Pressure at Min ?	125.000 Power C	
	÷ //	
Min Flow Limit S-value if HP=0 0	186,000	
Min Flow Limit S-value if HP=100		
Maximum / Minimum Values		
Max Power 100 🚭	75,000	-
Max HP Flow 100 🜩		
Min HP Position 0		
Min LP Valve Limiter 0		
Max LP Valve Limiter 100 🜩	2 A Nor 1	
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	Turbine Lood (Pover) au-Salation	
Admission	MAP Points	
Point A Values	N 100 01 11 1	
Max Power @ Max Admission 56.1	Max HP Flow @ Max Admission 15.6	
Point B Values	Min LD Elson @ Min Administra	
Point C Values Max Power @ Min Admission 6.1	May HP Flow @ Min Admission	
0.1	0.0	
	CONFIGURATION ERROR!	
Connected on TCP/IP 🔀 Details Min: 0, Max 1000000		La.

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 Enter the Maximum Rated Turbine Power.	dfit = 100 (0.0, 999999)
Maximum HP Flow	dflt = 100 (0.0, 999999)
Enter the Maximum Rated HP Valve Flow for the tur	bine.
Maximum Admission Flow	dfIt = 0.0 (0.0, 999999)
Enter the Maximum Rated Low Pressure Valve Flow	v (Admission) for the turbine.
Point A Values Maximum Power @ 0 E/A Enter the maximum power attainable at zero extr/ad Maximum HP Flow @ 0 E/A Enter the maximum HP Valve Flow attainable at zer	dfit = 77.7 (1.0, 999999) m flow. dfit = 28.6 (1.0, 999999) o extr/adm flow.

Minimum Power @ Maximum Extraction	dflt = 27.4 (-99999, 999999)
Enter the minimum power attainable at ma	aximum extraction flow.
Minimum HP Flow @ Maximum Extraction	dflt = 80.0 (-99999, 999999)
Enter the minimum HP Valve Flow at max	imum extraction flow.
Point C Values	
Minimum Power @ 0 E/A	dflt = 0.0 (-99999, 999999)
Enter the minimum power attainable at ze	ro 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

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)

dflt = 4000 (0.0, 25000)

dflt = Checked

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

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)

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:

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)
Max Cascade PV	(Value at 20 mA)

Signal Difference ALM (if multiple signals used) 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

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)

dflt = 0 (value set in Al) dflt = 100 (value set in Al)

dflt = 10.0 (0, 10000)

dflt = 0 (0, 1000)

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



dflt = 100 (0.01, 10000)

dflt = psi

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Normal Raise/Lower Setpoint Rate—(Slow)

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)

dflt = 1.0 (0.01, 10000)

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

Delay Before Fast Rate (sec)

dflt = 3(1.10)

dflt = Unchecked

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)

Remote Cascade Setpoint	
🔽 Use Remote Cascade Setpoint	
Max Remote Cascade Rate	
Remote Max Deviation Level	0.1 🔶 🗬
Signal Difference ALM (if multiple inputs)	10.0 🔶 🗬

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 Al) Max Remote Cascade Setpoint (Value at 20 mA) dflt=100 (value set in Al)

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

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

Signal Difference ALM (if multiple signals used)

Max allowable difference between inputs

Initial PID Settings

Proportional Gain

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

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)

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

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dflt = 0 (0.0, 100)

dflt = 0.1 (0.01, 1000)

dflt = 10.0 (0, 10000)

dflt = 1.0 (0.0, 99.99)

dflt = 100 (0.01, 99.99)

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

dflt = Checked

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

Disable Cascade if UTIL Breaker Opens

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.

6 9928-1212CF_G.wteel - Weedward TeelKit							
Elle View Device Settings Iools Help							
🗋 🗃 😽 🐌 📓 📑 🗮 👘 👘 😨 💿 Conf- Page 10 - Decou	pling	🕶 🔤 🔊 Connect 📝 Disconnect					
MAIN HOME Start Settings	Speed Contr	Turb. Protec. Extr. Contr. Steam Map	Caso	ade	₩ wo	ODWARD	Î
DCPL Valve Settings	Speed Sig	Analog In. Readout Binary Input	t Dinary	Out Communic.	Drivers Conf	Save Values	
Confis Check Full	Config Turbii	ne Decoupling					
Short Description Decoupling controller			ID Name	PIC-30000X			
Decoupling messages		Decoupling Setpoint					
Decoupling: Error Max PV <= Min PV		Decoupling PV&SP Unit		psi •			
General Setting		- Minimum Setpoint		0 🖨			
Reverse PID (Compared To Type)		Maximum Setpoint		100			
Decoupling is Cascade ?		Initial SP at Bootup		0			
Manual Mode Only Available		CD Entered Pate		01.			
PID Always in Control (No Manual)							
IO Control funct of function		Demand Entered Rate		0.1			
Description of the state of the state		Setpoint Track When Disabled					
Demand Limits		Setpoint Raise/Lower Normal Rate		1.			
Harlings Decoping Demand		Delay for Fast Sp Rate		2 🖨			
Maximum Decoupsing Demand	100	Fast Setpoint Multiplier		3 🗢			
Sensor Range		Use Remote Decoupling Setpoint					
Min Process Value	0						
Max Process Value	0						
Manual Demand							
Demand R/L Normal Rate	1 🖨						
Delay for Fast Demand Rate	3 💠	PID Inital Settings					
Fast Demand Mulitplier	3 🖨	Proportionnal Gain		1 🗢			
V Use Remote Demand		Integral Gain		1 🜩			
		Derivative Ratio		100 🜩			
Remote Demand Max Deviation Level	0.1	Droop		0.0			
May Remote Demand Pale		Stiding Deed Band		0 4			
THE CONTRACT STREET AT THESE		-					
Connected on TCP/IP Updails							

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.

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PID Always in Control (No Manual)

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

dflt = psi

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:



Minimum Setpoint

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

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

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

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

Demand Entered Rate

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

Setpoint Track when Disabled

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%.

dflt = 0.0 (0, 10000)

dflt = 0.0 (0.1000)

dflt = 0.0 (-10000, 10000)

dflt = 0.1 (0.01, 10000)

dflt = 0.1 (0.01, 10000)

dflt = Checked

Manual 26518V3

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.

AIN DME Turbine Over.	Start Settings	Speed Co	ntr Turb. Protec. Extr. C	iontr.	Steam Map Cascade		<u></u> woo	DWARD Save Values
GEN Load Control	Valve Setting	s Speed S	ig Analog In. Read	lout	Binary Input Binary Out	Commu	nic. Drivers Conf	
			Control Status	Messages -				
D SPEED SETPOI	NT — HP Valve Demand —		TRIP -	BOOT UP		Generato	Load	
0	-1 0.0	LP	0.0 -			Loed	0 KW	
ure / Service			Kell and controller PID Durami	- Settions			Branker Status	
	Grid Frequency is 50 Hz @ Ra	ted Speed 🔻	Sensor Selection	c seargs	Kiv/ sensor use for Aux Load Ctrl /	in v	Generator Breaker Closed	
d Speed	3600 rpm		Actual setpoint		1000		Utility Breaker Closed	
Frequency Offset	0 🜩 Hz		Current Load		0		-	
d Sliding Deadband	0 🖨 Hz		Actual PID Demand		0.2		Actual Status	
Load Setpoint	1000 🜩		Speed controller Bias when A	ux	10 📥 % of any 60		Enabled	
d Load of the Generator	10000 -		controller Active		100		Active	
Limiter/controller Options	Use KW as Controller		inisal sepont		100			
eck to Use Modbus or Toolkit (Cl	CT) Setpoint		Min Aux Load Ctrl Setpoint					
p Unit on GEN Breaker Opening			Max Aux Load Ctrl Setpoint		1000			
p Unit on UTIL Breaker Opening			SP normal rate of Change		1000 😜 KM/s			
itions to authorize Normal SD	Tie&Gen breaker Opened 💌		Delay before fast Rate		10 🜩 •			
itions to continue Normal SD	Tie&Gen breaker Opened		SP Fast rate of Change		1000		SP Tracked Not Selected	1
v hated			Proportional Gain		0.500 \ominus 🖨			
Pemote Load Setoo	int Signal Configured		Integral Gain		2.200 \ominus 🖨		Direct PID Action Selected	
o Remote Load Selpo	intorgnar conligued		Derivative Ratio		100.00 😓 🗢			1
					Genbrkr Open Aux Disable 💌			
					Tiebrkr Open Aux Disable 🔻			
s for Droop								
se Load Droop (Uncheck to ALWA	YS use Actuator Droop)							
p Percent		5.00 🔤 🜩	Select Breaker	Mahaal	Roost Europice Disabled	DISARM	Frequency Control	
heck to use Fixed valve % for zero	o load (Act Droop)		Bias Adjust (low amore action)	Tarre I	100 1 1:			
alve % at Rated Speed / Zero Loa	d	20.0 😂 🖨	bias Aujust (low Hindle action)		100 Y A	No Coo	od Cype Pipe or Load C	hara
/alve % at Maximum Load		100.0 😂 🗢	Island Boost Valve Protection			Signal (Configured	liare
heck to use Actual Grid speed (no	t Rated) for Droop Calculation		Esitmated Planf base	Island Valve I	Boost Function Disabled •			
se Frequency Control Arm/Disarm	Function		Load	50	₽ % 			
al Difference ALM (if multi inputs)		10.0 🕀 🜩	action)	100	• *			
n On ExtriAdm								
	No Action when Gen Brk Opened	•						
	No Action when Tie Brk Opened	•						

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

Load Limiter/controller Options	Disable KW Control Functions 🛛 🗸
Check to Use Modbus or Toolkit (CCT) Setpoint	Disable KW Control Functions Use KW as Limiter
Trip Unit on GEN Breaker Opening	Use KW as Controller Use AUX as limiter with LSS

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 Current Load Setpoint	Status LED VIEW ONLY
Target Load Setpoint User can enter a target value for the Load setpoint	dflt = 10000 (50, 100000)
Go to Target Rate (kw/sec) User can enter a rate at which to move to the targe	dflt = 100 (50, 10000) et setpoint.
Load limiter uses E/D buttons Use this to always enable the KW limiter – if progra	ammed.
Enable/Disable KW Limiter buttons Use these to enable or disable the KW limiter – if p	programmed.
Go to Load Target button If KW Limiter control is ON, the Go to Target button setpoint.	n will move the current KW setpoint to the target
Breaker Status LED's - indicate CLOSED condition	ons of the Generator and Utility Breakers
Use KW as Controller – if configured	
Auxiliary Load controller PID Dynamic Settings	;
Sensor Selectiondflt = KW senseSelect use KW AI or Aux AI for Aux Load Control /	sor use for Aux Load Ctrl/Lim Limit.
Actual setpoint	VIEW ONLY
Current Load	VIEW ONLY
Actual PID Demand	VIEW ONLY
Speed controller Bias when Aux controller Acti When KW Controller enabled, then Speed setpoint	ive dlft = 30.0 (1, 200) t 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

Enter the minimum Aux load setpoint that should be allowed for the system.

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

SP normal rate of Change

Rate in KW/s that Aux load setpoint moves.

Delay before fast Rate

Time (sec) it will use normal rate before the rate will change to Fast rate.

SP Fast rate of Change

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

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

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

Enter the PID derivative ratio. This value is used to set KW control response. This value can be changed while the turbine is operating.

MicroNet TMR 5009FT

dlft = 100.0 (0.0, 100.0)

dlft = 0.5 (0.001, 50.0)

dlft = 2.2 (0.0, 50.0)

62

dlft = 1000.0 (0.0, 10000000.0)

dlft = 1000.0 (0.0, 1000000.0)

dlft = 0.0 (-10000000.0, 10000000.0)

dlft = 10.0 (0.0, 30.0)

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.

9928-1212CF_G.wtool - Woodward ToolKit								
ile <u>V</u> iew <u>D</u> evice <u>Settings</u> <u>T</u> ools <u>H</u> elp								
0 0 Cor	nf- Page 11 - Feed-Forward	•	Connect 🗶 D	Disconnect				
MAIN Turbine Over. Start Settings HOME	Speed Contr	Turb. Protec.	Extr. Contr.	Steam Map	Cascade		₩.w	OODWARI
GEN Control	Valve Settings Speed Sig	Analog In.	Readout	Binary Input	Binary Out	Communic.	Drivers Conf	Save Values
Config. C	Theok Full Config Turk	bine Feed - Forwa	ard					
eed-forward Generic Settings								
Use Direct Signal ?								
Inhibited If No Cascade?								
Deadband On Speed	3 🜩							
Mini Rate	-10 🜩							
Min Food forward Domand at Min Rate	10 🜲							
Max Rate	10 🖨							
Max Feed-forward Demand at Max Rate	10 🖨							
Normal Duration Time	180 🜩							
mercency								
Vise Feed-forward Emergency?								
Emanancy East Any and Satisan								
Emergency Duration Time	10 🗢							
Min Rate Before Acting	3 🖨							
Max Rate	3 🖨							
Speed Deviation at Max Rate	150							
Max Sneed Bale Of Channe	200							
max opens man or crange.	300							
asserted on TCD/ID								

Figure 3-24. Feed-forward Performance Control

Feed-Forward Generic Settings

Used as direct speed bias only (rpm)

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

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

Deadband on Speed

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.

Woodward

dflt = 3 (0, 100)

dflt = Unchecked

dflt = Unchecked

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?

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

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)

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. dflt = *3 (0, 100)

Max FFW gradient (>0)

This setting is the max deviation/demand of the valve position minus lagged valve position.

Speed Deviation at Max Rate

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

This setting limits the rate of the speed bias when emergency loop is active.

dflt = *3(0, 100)

dflt = Unchecked

dflt = *10 (0, 100)

dflt = *150 (0, 300)

dflt = *300 (0, 1000)

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.

9928-1212CF_G.wtool - Woodward ToolKit					
Eile View Device Settings Iools Help					
🗋 🎯 🔲 🐌 🔛 📄 🗮 - 🔤 - 📄 🔇 🕥 Conf- Pa	ge 12 - Auxiliary		😸 🗦 Connect 🦼 Disconnect 📗		
MAIN HOME Start Settings	Speed C	ontr Turb. Protec.	Extr. Contr. Steam Map	Cascade Feed Forward	Woodware
GEN Control AuriEntry VI	has Sections Second	Sin Analog In	Readout Risson Inst	Piezzy Oct Communic	Memorizing
Gen Control Addamary	we seeings speed :	sig Analog in:	President Entrary input	Communic.	Universit Com
Conto	Come Full Con	fia Turbine Au	viliary		
Const	Check For Contra	ng. Tarente na	und y		
Short Description Auxiliary 1 controller				D Name LIC-X0000X	
Auxiliary Main settings					
Auxiliary Process Value & Setpoint Unit	psi 👻				
Reverse (Invert) Action Select ?		Speed SP =			
Forced Raise If Fault?					
Forced Lower If Fault?		Speed -			
V Hold Speed at Start When Limiter		Extracion SP			5
Disable Decoupling When Limiter Active?		Extraction PV			
Alarm When Limiting?		Audiary SP			
Auxiliary Sensor Settings		Audiary PV -			
Minimum PV	0.0		LSS		
Maximum PV	0.0				
Signal Difference ALM (if multiple inputs)	10.0 🕀 🌩	Initial PID Settings -			
Setroint Settings		Proportional Gain		0.55 \ominus 🖨	
Setpoint Track when Disable and controller		Integral Gain		0.75 😓 🖨	
Inital Setpoint- Step To on Power-up / Exit Configure	100 \ominus 🗢	Droop		0 \ominus 🗢	
Minimum Setpoint	0 😂 🗢	Sliding Dead Band		0 🔤 🗢	
Maximum Setpoint	100 🔤 🗢				
Setpoint Entered Rate	0.25 🜩	Configuration		Authorized	
Delay for Fast Setpoint	3.0 😓 🗢	Auxiliary Status:	Auxiliary not configured		
Setpoint Raise/Lower Rate	0.1 🕀 🗢				
Setpoint Fast Rate multiply	3 \ominus 🗢				
Use Remote Auxiliary Setpoint					
*					•
Connected on TCP/IP 🔐 Details Min: 0, Max: 50					

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.

9928-1212CF_G.wtool - Woodward ToolKit	00	
File View Device Settings Tools Help		
🗋 🎯 😡 🐌 📓 : 🗮 - 🔚 - 📓 : 🧿 🕥 Conf- Page 13 - Valves	• J S Connect Disconnect	
MAIN Turbine Over. Start Settings Speed Con HOME	nt Turb. Protec. Edit. Contr. Steam Map Cascade Feed Forward	10
GEN Control Auxiliary Valve Settings Speed Sig	g Analog In. Readout Binary Input Binary Out Communic. Drivers Conf	85
Config Claude Full Co	onfig Turbino Valvo	
HP RAMP Options	HP Valve Limiter Settings	
Enable Stuck Roader Detection SD ?	HP Valve Limiter Ramp Rate 2.00 🖝 %/sec	
Use HP Initial Position at Start?	HP Ramp Rate at Restart or Manual 5.0 🖝 %/sec	
	Max HP Valve Ramp Limit 100.0 🔿 %	
HP Ramp Max At Start 100 🜩		
HP Valve Used : One HP Valve •		
	MP Valve 1	
	HP Valve 2	
LP Settings		
LP Valve Used single LP 👻		
	LP Valve	
LP Ramp Options		U
LP Type at Start: LP Ramp at max at Reset 💌		
	7	
	LP Valve Status:	
R/L Delay to Fast 3	LP configuration OK	
R/L Rate 2 🗢		
R/L Rate Past ML 1 3	Memorize Settings	
Initial Hamp Hate 20 🜩		
<		•
Connected on TCP/IP 😼 Details		

Figure 3-26. Valve Settings

Use rotor stuck SD?

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

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)

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)

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.

dflt = Checked

dflt = 2.0 (0.0, 100)

dflt = 5.0 (0.0, 100)

dflt = 20% (0, 100)

Max HP Valve ramp Limit

dflt = 100 (0, 100)

dflt = One HP Valve

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

Manual 26518V3

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

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	Va	al	ve	Usec	
-					

Available types include -

One LP Valve Two LP Valves split range (most common) (% 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 chan	ge to Fast rate
Fast Demand Multiplier	dflt = 3.0 (1, 10)
Fast rate equals the normal rate times this number	

dflt = 0 (0, 100)

dflt = Single LP Valve

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.

V 0028-1212CE Guteel - Weedward TooWe						
File View Device Settings Tools Help						
	Conf- Page 14 - Speed Sign	uls •	Connect 🙀 Discon	nect		
MAIN Turking Over Divid Californ		Saved Cards Task Dates	Enter County Day		(Frankline)	W
HOME Start Setting	P	Ture: Protec.	Eld. Cord. Sils	an wap Cascade Pe	d Porward	WOODWARD
GEN Control	Value Collinse	Second Sin	Bendeut Bier	nolenat Binan Oct C	manair Driv	Save Values
den callou	Take Searga	Speed Sig	THEODOLE DELL	onay our co	unitaria.	is con
	Config. Check					
		AI/AO COMBO N	loquie			Reset
		Speed Signal In	outs			
Device Tag Names		Speed Signal Inputs 1-4		Speed Sensor Override		
Speed #01 Device Tag	SPX000K	Speed Signal Input #1	0	Use MPU Override Timer		
Speed #02 Device Tag	SPX000K	Speed Signal Input #2	0	Max Override Time	1.0 \ominus 🖨	
Speed #03 Device Tag	SPX0000	Speed Signal Input #3	0			
Speed #04 Device Tag	SPX000K	Speed Signal Input #4	0	 Speed Low Failed Sensor Limit = 2.5 	% of Max Speed	
				- Speed Sensor Difference Setting = 2	7% of Max Speed	
Speed Signal 1 Settings		Speed Signal 2 Settings				
Maximum Speed (Upper Range Limit)	4539	Check to Use Speed Signal Inpu	t#2	Check to Use Speed Signs	l Input #3	
Speed Signal Gear Ratio	1 🜩	Check to make MPU #2 Settings	same as MPU #1	Check to make MPU #3 Se	ttings same as MPU #	1
Number of Gear Teeth	49 🚭					
Speed Low Latch Setpoint	113	Speed Signal 2 Settings		Speed Signal 3 Settings		
Speed High Latch Setpoint	4450	Range Limit)	4000	Limit)	nge 4	.000
		Speed Signal Gear Ratio	1 🚭	Speed Signal Gear Ratio		1 🗢
Speed Signal 4 Settings		Number of Gear Teeth	60 🗢	Number of Gear Teeth		60 🗢
Signal #4 Proximity	Probe (Slow Speed)	Speed Low Latch Setpoint	113.475	Speed Low Latch Setpoint		113.475
Proximity Probe / Zero Speed Detect		Speed High Latch Setpoint	3950 🔶	Speed High Latch Setpoint	3	950 🚭
Maximum Speed (Upper Range Limit)	4000 🚭 rpm					
Speed Signal Gear Ratio	1 🚭					
Number of Gear Teeth	60 🚭					
Speed Low Latch Setpoint	10 🚭 rpm					
Speed High Latch Setpoint	3950 🔶 rpm					
Slow Speed Signal Filter	1.00 🕀 🚭 sec					
Null Speed Detected Delay	5.0 🕀 🌩 sec					
Null Speed OFF Level	10.0 🕀 🌒 rom					
Connected on TCP/IP 🙀 Details						

Figure 3-27. Speed Signal Settings

Maximum Speed (Upper Range Limit)

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

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

Enter the number of teeth on the gear that the speed probe is mounted on.

Speed Low Latch Setpoint

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

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—

Define if the speed probe #2 is used by the control.

dflt = 4450 (100, 25000)

dflt = 1.0 (0.1, 10)

dflt = 60 (1.0, 300)

(Calculated)

dflt = Checked

Woodward

Check to make Speed Input #2 setting same as #1 — Define if the speed probe #2 is used by the control. Check to use Speed Input #3— Define if the speed probe #3 is used by the control.

Check to make Speed Input #3 setting same as #1 — 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

Manual 26518V3

Select USED if null speed detection is desired, and null speed probe used.

Maximum Speed (Upper Range Limit)

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

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

Enter the number of teeth on the gear that the speed probe is mounted on.

Speed Low Latch Setpoint

Set this value as a fault detection on this input signal.

Speed High Latch Setpoint

Set this value as a fault detection on this input signal.

Slow Speed Signal Filter (seconds)

Enter the desired filter lag tau of the single pole filter used on this signal.

Null speed detected delay (seconds)

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)

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.

dflt = 10 (0.0, 200)

dflt = 4000 (100, 25000)

dflt= Unchecked

dflt = 2.0 (0.01, 20)

dflt = 4000 (100, 25000)

dflt = 10(0.1, 500)

dflt = 5.0 (0, 120)

dflt = Checked

dflt = Checked

dflt = Checked

MicroNet TMR 5009FT

dflt = 1.0 (0.1, 10)

dflt = 60 (1.0, 300)

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.

3 9928-1212CF_G.wtool - Woodwar	d ToolKit				- • •		
Eile View Device Settings I	ools <u>H</u> elp						
🗈 🗋 🖬 📚 📓 🖉 🗮 👘	🕞 🔤 😋 😋 Conf- Page 15 - Analog	Inputs •	📄 🗊 Connect 🦼 Disconnect 📗				
MAIN HOME Turbine Over.	Start Settings	Speed Contr Turb. Protec	Extr. Contr. Steam Map	Cascade Feed Forward	Woodward		
GEN Control	Valve Settings	Speed Sig Analog In.	Readout Binary Input	Binary Out Communic.	Save Values		
Corte Cludt AI/AO COMBO Module Reset							
		Analog Inputs 1 -8					
Configuration of Analog Input Chi	annels #1-8	Value at 4 mA	Value at 20 mA	Device Tag Names	·		
Select Function for AI #01	Customer Defined Monitor Input #1	 AI01 Low 	0 🗢 Al01 High	100 🜩 PD0000	Go to Al Chan #1 Details		
Select Function for AI #02	Extraction/Admission Input #1	 Al02 Low 	0 🗢 AJ02 High	100 🜩 PD0000	Go to Al Chan #2 Details		
Select Function for AI #03	Cascade Input #1	 AI03 Low 	0 🗢 AJ03 High	100 🜩 PDOOOX	Go to Al Chan #3 Details		
Select Function for AI #04	KW/Unit Load Input #1	 AI04 Low 	0 🗢 AJ04 High	100 🜩 PDOOOX	Go to Al Chan #4 Details		
Select Function for AI #05	Not Used	 AI05 Low 	0 🚭 Al05 High	100 🜩 PDOOOX	Go to Al Chan #5 Details		
Select Function for AI #06	Not Used	 Al06 Low 	0 🗢 AJ06 High	100 🜩 PDOOOX	Go to Al Chan #6 Details		
Select Function for AI #07	Not Used	 Al07 Low 	0 🗢 AJ07 High	100 🜩 PDOOOX	Go to Al Chan #7 Details		
Select Function for AI #08	Not Used	 AI08 Low 	0 🗢 AJOS High	100 🜩 PDOOOX	Go to Al Chan #8 Details		
Connected on TCP/IP 🞯 Details							

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 Al'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 VIv Fdbk A Signal
4-20 mA HP VIv Fdbk B Signal
Remote Manual Decoupling Demand #1
4-20 mA LP VIv Fdbk A Signal
4-20 mA LP VIv 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.

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Eile View Device	Settings Tools Help					
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Back to Al Config				🔥 woodwar	D	
		Analog Input Channel	#2 Details	Reset		
		Sensor Fac	ult	Modbus Multiplier		
		🤤 Analo	og Input #02 Signal Failed	Multiplier	x 1 👻	
	Settings of Analog Input Channel #2			Analog Input Channel #2 Signal Range	Configured Settings	
	Select Function for Analog Input #02	Extraction/Admission Input #1		Lower Range (4 mA =)	0	
	Validated AI #02 Signal Current		0.00	Upper Range (20 mA =)	100	
	Validated AI #02 Scaled Value		-25.00	Filter Constant (Lag Tau)	0	
к	Kernel A	Kernel B - åralog Ingel	ernel B	Kernel	C	
	Current Input	4.16 Current Input	4.16	Current Input	4.16	
	Channel 2 Fault	Channel 2 Fault		Channel 2 Fault		
	A03 Module Fault / Chan Disabled	A03 Module Fault	/ Chan Disabled	A03 Module Fault / Chan	Disabled	
	-	-		-		
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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.

iew Device Settings]	jools Help O O Conf- Page 16 - Rev	edOuts	- 📄 📝 Connect 🦼 Disconnect		
Turbine Over.	Start Settings	Speed Contr Turb	Protec. Estr. Contr. Steam M	lap Cascade Feed Forward	Woodwa
GEN Control	Valve Setting	s Speed Sig Ara	dog In. Readout Binary In	put Binary Out Communic.	Drivers Conf
	Config. Check		ABO Module		Reset
				Analog Outputs	
Configuration of Analog Output	Channels #1-4	Value at 4 mA	Value at 20mA	Device Tag Names	
Function for AD #01	Actual Shaft Speed	 AD01 Low 	0 🗢 AD01 High	100 🗢 PD000X	Go to AO Chan #1 Details
Function for AD #02	Speed Reference Setpoint	 AO02 Low 	0 🖨 AO02 High	100 🗢 P0000X	Go to AO Chan #2 Details
Function for AD #03	···· Not Used ····	- A003 Low	0 💠 AO03 High	100 💠 P0000X	Go to AO Chan #3 Details
Function for AD #04	Not Used	· AD04 Low	0 🗢 AD04 High	100 • PD000X	Go to AO Chan #4 Details

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

Manual 26518V3

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.

6 9928-1212CF_G.wtool - Woodward ToolKit			
<u>File View Device Settings Tools He</u>	lр		
🖸 🤐 🖌 🕼 👷 🖉 - 🖫 - 🔒 - 🛛	O Page 11 - AO Channel 1	• 🗾 🖉 Connect 🧝 Disconnect	
Back to AO Config		Reset	
	Analog Output Channe	el #01	
Calibration Mode	Configuration of Analog Outro & Channel	el #1	
CALMODE Permissive OK	Select Function for AO #01	Actual Shaft Speed -	
CALMODE Enabled	Manual Demand Output for AO 01	4.0 🚭	
AD #01 in CALMODE	Signal Demand Output Value	0.0	
	Califoratio AO Churrent # 1 Disabilited Hold at Min Current Hold at Max Current Current Output Demand (Total) Analog Output #01	Signal Pange / Current Settings Value at 4 mÅ 0.0 Value at 20 mÅ 100.0 Set Min Current Output 4.00 Set Max Current Output 20.00	
Kernel A	Kernel	IB Kernel C	
Kernel A - Analog Output #1 Status	Kernel B - Analog Output #1 Stat	atus Kernel C - Analog Output #1 Status	
Current Output	1.32 Current Output	1.32 Current Output 1.32	
ANADUT Chan 1 is Healthy	ANAOUT Chan 1 is Health	thy OANAOUT Chan 1 is Healthy	
ANADUT Chan 1 Failed	ANAOUT Chan 1 Failed	ANADUT Chan 1 Failed	
ANADUT Chan 1 is Shutdown	ANAOUT Chan 1 is Shutdo	down ANADUT Chan 1 is Shutdown	
Connected on TCP/IP 💱 Details			a.

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.

9928-1212CF_G.wtoo File View Device	ol - Woodward Too Settings Iools	IKit Help								
0 🗃 🖬 🛸 🔛		0 0 Ce	nf- Page 17 - Binary Inputs		- 🔄 🔊 Conn	ect 룾	Disconnect			
MAIN HOME	urbine Over. S	lart Settings	Speed Contr	Turb, Pi	rotec. Extr. C	iontr.	Steam Map Cascad	le Feed Forward	W wo	ODWARD
	EN Control		Mahan Datiman Record Dia	Anator			River Invest	Commit	Dataset Cont.	Save Values
	SEN CONDO		vaive Settings Speed Sig	Analog	g in. Neod	out	binary input	Communic.	Universi Com	
			Config. Check							Reset
Device Tag Na	ames		Device Tag Names			. 0	evice Tag Names			
ESTOP (Bin	#01) Device Tag	BDOOOK	Binary Input #09 Device Ta	9	BDOOOK		Binary Input #17 Device Tag	BDOOOK		
Binary Input	#02 Device Tag	BDOOOK	Binary Input #10 Device Ta	9	BDOOOK		Binary Input #18 Device Tag	BDOOOK		
Binary Input	#03 Device Tag	BDOOOK	Binary Input #11 Device Ta	9	BDOOOK		Binary Input #19 Device Tag	BDOOOK		
Binary Input	#04 Device Tag	BDOOOK	Binary Input #12 Device Ta	g .	BIDOOCK		Binary Input #20 Device Tag	BDOOOK		
Binary Input	#05 Device Tag	BDOOOK	Binary Input #13 Device Ta	9	BIDOOOK		Binary Input #21 Device Tag	BDOOOK		
Binary Input	#06 Device Tag	BDOOOK	Binary Input #14 Device Ta	9	BIDDOOK		Binary Input #22 Device Tag	BDOOOK		
Binary Input	#07 Device Tag	BDOOOK	Binary Input #15 Device Ta	g (BIDOOOK		Binary Input #23 Device Tag	BDOOOK		
Binary Input	#08 Device Tag	BDOOOK	Binary Input #16 Device Ta	9	BDOOOK		Binary Input #24 Device Tag	BDOOOK		
DI Status										
G Chan 1	ESTOP	ioTo		Di	screte Inpu	Its				
DI Status	Configuration of Dis	crete Input Ch	annels #2-12		. t) Status	Configuration of Discrete Input	Channels #13-24		
Q 2	Select Function D	#02	Event Reset Command (ALM & SD)	•	GoTo	9 13	Select Function DI #13	Not Used		GoTo
@ 3	Select Function D	#03	Speed Reference Raise Setpoint Cmd	•	GoTo	9 14	Select Function DI #14	··· Not Used ···		GoTo
4	Select Function D	#04	Speed Reference Lower Setpoint Cmd	•	GoTo	e 15	Select Function DI #15	··· Not Used ···	-	GoTo
9 5	Select Function D	#05	Start Command	٠	GoTo	e 16	Select Function DI #16	··· Not Used ···		GoTo
6	Select Function D	#06	Controlled Shutdown Command	٠	GoTo	@ 17	Select Function DI #17	··· Not Used ···	•	GoTo
97	Select Function D	#07	Enable MV/ Limiter/Controller	٠	GoTo	9 18	Select Function DI #18	Not Used		GoTo
9 8	Select Function D	#08	GEN Breaker Aux (52) Closed (=Droop)	•	GoTo	9 19	Select Function DI #19	Not Used	•	GoTo
9	Select Function D	#09	Not Used	•	GoTo	@ 20	Select Function DI #20	Not Used		GoTo
10	Select Function D	#10	Not Used	•	GoTo	@ 21	Select Function DI #21	Not Used		GoTo
• 11	Select Function D	#11	Not Used	•	GoTo	9 22	Select Function DI #22	Not Used		GoTo
12	Select Function D	#12	Not Used	•	GoTo	@ 23	Select Function DI #23	··· Not Used ···	-	GoTo
						@ 24	Select Function DI #24	··· Not Used ···	-	GoTo
Connected on TCP/IP	🗑 Details									

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
Pedundant External TPIP#2
Dedundant External TRIP#2
Reduitidant External TRIP#3
Redundant External I RIP#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
Sool Cap Daigo Valvo Dad
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.

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D 🧀 🖬 🔌 📓 🖉 😁	💡 📑 😯 10 Page 5- DI Channels 1-4	- 🚽 🍠 Connect	🛃 Disconnect 📄
Back To DI Gummary	Discrete Inpu	<u>it Signal Inputs</u>	WOODWARD Go To Next Channels 5-8
Discrete	e Input Channel #1	Discret	e Input Channel #3
		Discrete Input Channel 3 - Function	20
		Select Function	Speed Reference Raise Setpoint Cmd -
Discrete Input Channel 1 - ES	STOP Validated Signal Status		
Validated Signal of Disc	crete Input Channel 1 - ESTOP	Validated Signal Statu	s
Individual Kernel DI Status -	Individual Kernel DI Faulta	Indicated Neural Di Cirtae	Individual Knowl DI Facility
G Kernel A - DI Chan 1	Kernel A - DI Chan 1 Fault	Kernel A - Di Chan 3	Kernel A - Di Chan 3 Fault
C Kernel B - DI Chan 1	Kernel B - DI Chan 1 Fault	Kernel B - DI Chan 3	Kernel B - DI Chan 3 Fault
O Kernel C - DI Chan 1	Kernel C - DI Chan 1 Fault	Kernel C - DI Chan 3	Kernel C - DI Chan 3 Fault
Discrete	input Channel #2	Discre	te Input Channel #4
Calent Evention	Provide Comment (ALM & CD)	Discrete Input Channel 4 - Functio	n
Select Pariceon Ex	vent Heset Command (ALM & SU)	object Punction	speed Hererence Lower Serpoint Umd
Validated Signal Stat	ha	Validated Signal Statu	
Voted State of I	Discrete Input Channel 2	Voted State of Di	screte Input Channel 4
Individual Kernel DI Status -	Individual Kernel DI Faults	Individual Kernel DI Status	Individual Kernel DI Faults
Kernel A - DI Chan 2	Kernel A - DI Chan 2 Fault	Kernel A - DI Chan 4	Kernel A - DI Chan 4 Fault
Kernel B - DI Chan 2	Kernel B - DI Chan 2 Fault	Kernel B - DI Chan 4	Kernel B - DI Chan 4 Fault
Kernel C - DI Chan 2	Kernel C - DI Chan 2 Fault	Kernel C - DI Chan 4	Kernel C - DI Chan 4 Fault
TO B CON			
innected on TCP/IP By Details			

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.

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		Con	d - Page 18 - Rinary Outpu	uts	- Connect 🥥	Disconnect			
MAIN	urbine Over.	Start Settings	S	eed Contr Turb. F	Protec.	E.		NG W	VOODWARD
	_		Valve Settings S	ipeed Sig Anak	og In. Readout	Binary Input Bina	ry Out Communic.	Drivers Conf	Save Values
			Config. Check	Relay 0	Dutputs				Reset
									Data.
Status	Go to Channel 1	Relay 01 Trip R	lelay Status		State Indication	Function Selection		Go to Channel 7	Belay 07
e relay of		Uniter Resta	n/		Relay ≢7	Not Used			
Status		State Indication	Eurotico Selection		State Infication	Eurotion Selection		_	Status
Relay 02	Channel 2	Relay #2	Summary Alarm		Relay #3	Not Used		Go to Channel 8	Relay 08
-									
Status	Go to	State Indication	n Function Selection		State Indication	Function Selection		Gete	Status
Relay 03	Channel 3	Relay #3	Summary Shutdown		Relay #9	Not Used		Channel 9	Relay 09
Status	Go to	State indication	Function Selection		State Indication	n Function Selection		Go to	Status
Relay 04	Channel 4	Relay #4	Summery Shutdown (Ad	ditional Relay)	Relay #10	Not Used		Channel 10	Relay 10
Status	Go to	State Indication	Function Selection		State Indicatio	n Function Selection		Gete	Status
Relay 05	Channel 5	Relay #5	Not Used		Relay #11	Not Used		Channel 11	Relay 11
Status	Go to Channel 6	State Indicatio	n Function Selection		State Indicatio	n Function Selection		Go to	Status
Relay US	0.000	Relay #6	Not Used		Relay #12	Not Used		Channel 12	Relay 12
		Device Te	n Namer						
		Binary (Dutput #01 Device Tag	BOXOOX					
		Berry (Datest #02 Denice Tax	POWWW					
		omary v	Superior Device Tag	Down					
		Binary (Juput #03 Device Tag	80,0000					
		Binary (Dutput #04 Device Tag	BOX000X					
		Binary (Dutput #05 Device Tag	B03000X					
		Binary (Dutput #06 Device Tag	BOX000X					
Connected on TCP/IP	😿 Details								

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 pulldown 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.

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Eile Yiew Device Settings Iools Help	
🗋 🎯 🛃 🐌 🔛 📄 🗮 • 🚟 • 📑 • 📄 🛇 📀 10 Page 15- Relay O	iutput #1 - 📄 🛷 Connect 🦼 Disconnect
CONFIG Relay	Carlie Tables Balan Ostanta
	Coning - Turbine Relay Outputs
	Latency Test Frequency for all FT Relays
RELAY #1 OUTPUT COMMAND	Test Frequency III 🗛 Hrs
Palar 01 Trio Palar Config	Manual Latent Test Manual Latent Fault Test -
 Summary Shutdown / TRIP Relay Status 	Disabled Relay 01
Chack To Have Reset Class Trip Outruit Relay	Latent Fault Detection Feedback
The second secon	Fault Detected on FT Relay #1
Check To Have External Trips Activate Trip Relay	FT Relay #1 Health Status Customer Power Fault
Check To Have Trip Relay Drive Actuators To 0 Current	Fault Detected Fault Detected
Invert the Output State for this Condition (Energize for Trip)	Customer Power Fault Relay B2 or C1 Fault
Configuration N.O. Contact 24vdc Pwr 👻	A1 Readback Fault Relay C2 or A2 Fault
Test Relay Test When Open or Closed 💌	A2 Readback Fault
Econo Bolev ON	B1 Readback Fault A2 Relay Fault
TRIP RELAY Device Tao Name	B2 Readback Fault B1 Relay Fault
Relay #01 Device Tag B0X000X	C1 Readback Fault B2 Relay Fault
	C2 Readback Fault
	Relay A1 or B1 Fault
Individual Relay Commands - Individual Relay Commands -	
FT Relay 01 - A1 FT Relay 01 - A2	Chassis Kernel Status - DID Module Status
FT Relay 01 - B1 FT Relay 01 - B2	
FT Relay 01 - C1 FT Relay 01 - C2	Kernel B Fault DIO Module (A04) Kern B Failed
	Kernel C Fault DIO Module (A04) Kern C Failed
Connected on TCP/IP 😼 Details Min: 1, Max: 1000	

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)

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 cvcled, 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

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

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

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 deenergizing 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.

MicroNet TMR 5009FT

dflt = 48 (1, 1000)

dflt = Unchecked

dflt = Checked

dflt = Unchecked

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).

7 9928-1212CF_G.wtool - Woodward ToolKit			
Eile View Device Settings Tools Help	0		
🗋 ڬ 🖌 🐎 🔛 🖉 🚟 - 🚟 - 📗 🔇	10 Page 16- Relay Output #2	- 📄 🔊	Connect 🦼 Disconnect 📗
CONFIG Relay			WOODWAR
roctu	RELAY#2	OUTPUTCOMMAN	D
Must be in CALMODE			
CALMODE Enabled			
Default = Relay is State Indication		Manual Latent Test Disabled	Manual Latent Fault Test - Relay 02
Use Relay as Level Switch		Latest Exult Detection Earthsp	
Configuration N.O. C	iontact 24vdc Pwr 👻	Eault Detected on FT Rel	n. n: #7
Test Relay Test V	hen Open or Closed 🗢	ET Balau #2 Maalth Status	Customer Brune Fault
Invert the Output State for this	Condition	F I neley va nedrul Judius	Customer Power Paul
Force Rel	ay ON	Fault Detected	Fault Detected
Salart State Indication Eurotion for	ET Balay #2	Customer Power Fault	Relay B2 or C1 Fault
Menu Summary Alarm	•	A1 Readback Fault	Relay C2 or A2 Fault
		A2 Readback Fault	A1 Relay Fault
		B1 Readback Fault	A2 Relay Fault
		B2 Readback Fault	B1 Relay Fault
Device Tag Names		C1 Readback Fault	B2 Relay Fault
Relay #02 Device Tag	0	C2 Readback Fault	C1 Relay Fault
Present State		Relay A1 or B1 Fault	C2 Relay Fault
Output Command	De-energized	Chassis Kernel Status	DIO Modula Status
Individual Relay Commands-	Individual Relay Commands -	Kernel A Fault	DID Module (AD4) Kern A Failed
FT Relay 02 - A1	FT Relay 02 - A2	Kernel B Fault	DID Module (AD4) Kern B Failed
FT Relay 02 - B1	FT Relay 02 - B2	Channel C Face	
FT Relay 02 - C1	FT Relay 02 - C2	Remei C Fault	UIU Module (AD4) Kem C Failed
Connected on TCP/IP 🔐 Details Enter up	o to 39 characters.		

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 Control in Control
Cascade in Control
Zero Speed Detected
Warmun @ 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.

9928-1212CF_G.wtool - Woodward ToolKit				- • 🛋
<u>File View Device Settings Tools Help</u>				
	Conf- Page 19 - Communication	• S Connect	Z Disconnect	
MAIN HOME Start Se	tings Speed Contr	Turb. Protec. Extr. Contr.	Steam Map Cascade Feed Forward	Woodward
GEN Control	Valve Settings Speed Sig	Analog In. Readout	Binary Input Binary Out Communic.	Drivers Conf
	Lim Config Turbis	a Communication		
Cor	fig. Check			Reset
	I wo Modbus Blocks - Ea	ch with 2 Links are av	allable Re-Initialize	
	MODBUS	S BLOCK #1	Modbus Block 1	
MODBUS #1 Link #1 Interface Settings		MODBUS #1 Link #2 Settings -		
Select Modbus #1 Interface	Modbus1 Writes Always Enabled	Select Link #2 Interface	Modbus 1/Link2 Writes Always Enabled	
Select Connection Link 1 to Kernel A Link 2 to Kernel B	Ethernet TCP -	Set Slave Address Number	2 🚭	
Set Slave Address Number	1 🗢	Enable Writes from Modbus	#1 - Link #2	
Enable Writes from Modbus #1 - Lin	sk #1	Check if Link #2 is NOT a R	ledundant Link for Device (HMI) using Link #1	
ESTOP from HMI Modbus Block #1		MODBUS #1 Link #3 Settings - F	or NON-Critical VIEW ONLY	
Check to enable ESTOP from HMI		Select Link #3 Interface	MODBUS1/Link3 NOT USED -	
		Select Connection for Link 3	Ethernet UDP - Port 5003 -	
		Set Slave Address Number	3	
ESTOP from HMI Modbus Block #2			De latafar	
Check to enable ESTOP from HMI	MODBUS	S BLOCK #2	Modbus Block 2	
MODBUS #2 Link #1 Settings		MODBUS #2 Link #2 Settings -		
Select Modbus #2 Interface	MODBUS 2 NOT USED 🔹	Select Link #2 Interface	MODBUS2/Link2 NOT USED -	
Select Connection Link 1 to Kernel A Link 2 to Kernel B	Ethernet UDP - Port 5002 🔹	Set Slave Address Number	5 🗢	
Set Slave Address Number	4 🜩	Enable Writes from Modbus	#2 - Link #2	
Enable Writes from Modbus #2 - Lin	k #1	Check if Link #2 is NOT a F	ledundant Link for Device (HMI) using Link #1	
		MODBUS #2 Link #3 Settings - F	or NON-Critical VIEW ONLY - Connect to CPU C	-
		Select Link #3 Interface	MODBUS2/Link3 NOT USED -	
		Select Connection for Link 3	Ethernet UDP - Kern C Port 5003 -	
		Set Slave Address Number	6 🗢	
	No Serial (Connections		
		10		
Connected on TCP/IP 🔐 Details				

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

ASCII or RTU

dflt = 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.

6 9928-1212CF_G.wtool - Woodward	ToolKit						
Eile View Device Settings Too	ils <u>H</u> elp						
🗅 🥔 🖬 🔅 📓 🖉 😁	📳 🔇 🕤 Conf- Page 19	- Communication	•]] 5.	🛛 Connect 📝 Disconr	nect		
Serial Conn	ection Settings	Modbus Block 1 - Se Protocol Link 1 Protocol Link 2 Protocol Link 3	ASCII • ASCII • ASCII •	 Modbus Block 2 - Seri Protocol Link 1 Protocol Link 2 	ASCII ASCII	Reset Port after Changing Settings Reset Settings SIO Port CPUA Reset Settings	1
Serial Port 1 - CPU A -	Communication Settings	Serial Port 1 - CPU B - C	Communication Settings	Serial Port 1 - CPU C	- Communication Settings	SIO Port CPU B	
Driver Selection	R5232 -	Driver Selection	RS232 -	Driver Selection	RS232 -	Reset Settings	
Baud Rate	38400 💌	Baud Rate	38400 🔻	Baud Rate	38400 🔻	SIO Port CPU C	
Parity	None 💌	Parity	None 💌	Parity	None 💌		1
Stop Bits	1 Stop Bit 💌	Stop Bits	1 Stop Bit 🔹	Stop Bits	1 Stop Bit 💌		
•							
Connected on TCP/IP 📓 Details							

Driver Selection

Select the correct serial communication driver RS 232, RS-422, or RS-485. dflt = 38400

Baud Rate

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

dflt = RS232

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:

69928-1212CF_G.wtool - Woodward ToolKit							- • •
Eile View Device Settings Iools Help							
🗋 🕑 🖬 🐌 📓 📄 🗮 🖷 👘 🔂 😳 Conf- P	age 21 - Prop A	ct Chan 1	- 🖉 🖓 Connect	🖌 Disconnect 📗			
CONFIG Driver Menu							Woodward
P	roportio	onal Actuato	r Channel #1	I			Save Values
ACT #1 Valve Demand Signal			Device Tag Name				
Select ACT #1 Function	HP Demand		Proportional Act. #01	Tag PD0000			Reset
Type of Coil / Actuator			Current Output to Propo	rtiional Valve Actuato	ar #1		
Select Output Current Range	0-20 ma Ran	90 -	Act#1 Demand			0.0 %	
Select Coil Type	Single Coil		Total Current Output	to ACT 1		3.98 mA	
Invert Output (Reverse Acting Driver)			Number of Healthy O	utruts		3	
3 sec Delay on LP valve when SD							
SD if all kernel output failed			Proportional Act #1 Fau	lts	Proportional Act #	F1 Faults	
1			ALL ACT Chan 1 P	AILED ABC	Load Fault -	Coll 1 / Coll 2	
Current at 02: Demand (Min)		40 A mà	Load Fault - Single	e Coil	Load Fault -	Coil 3	
Content of the Dental D (Miny							
Corrent at 100°C Demand (Max)		2010 Q Q MA					
Actuator #1 Dither		0.00 😌 🗣 mA					
Kernel A		Kerne	el B		Kernel C		
Kernel A - Prop Act #1 Status		Kernel B - Prop Act #1 Status		Kernel C - Prop A	ct #1 Status		
ACT 1 Output 1.	33 mA	ACT 1 Output	1.33 mA	ACT 1 Output		1.32 mA	
Prop ACT 1 is Healthy		Prop ACT 1 is Healthy		Prop ACT 1	is Healthy		
Prop ACT 1 Failed		Prop ACT 1 Failed		Prop ACT 1	Failed		
Prop ACT 1 is Shutdown		Prop ACT 1 is Shutdown	n	Prop ACT 1	is Shutdown		
Disable this kernel output (Use w/ CAU	TION)	Disable this kernel outp	ut (Use w' CAUTION)	Disable this	kernel output (Us-	e w/ CAUTION)	
Calibrate Proportional	Actuator #1		Manually Stroke F	Proportional A	ctualor #1		
Use this to Set or Adjust Min/Max	Current Settings		Use this to Free	roportional /	22		
Enter PACT #1 CHANNEL CA	LIBRATION		Manual Stroking	case rare non e-re			
			Manual Demand Value		0 🗢 %		
Manual Valve Stroking Permitte	d		Manual Ramp Rate		10 🌩 %/sec		
Connected on TCP/IP 🔐 Details							

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 DemandLP2 DemandLP2 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

Actuator Type	Single coil 📃 💌
Dither	Single coil
Dittion	Dual coil
	Dual redundant

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.

dflt = 20 (12,24) or 160 (100, 196) Calibration Value at 100%

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

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

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.

Calibrate Proportional Actuator #1	Manually Stroke Proportional Actuator #1
Use this to Set or Adjust Min/Max Current Settings	Use this to Exercise Valve from 0-100%
Enter PACT #1 CHANNEL CALIBRATION	Manual Stroking
Manual Valve Stroking Permitted	Manual Ramp Rate 10 🔷 %/sec

Manual Demand Value Enter the desired manual valve position demand. Can tune or directly enter a value.

dflt = 0 (0, 100)

dflt = 0 (0, 100)

Manual Rate Enter the desired rate at which the valve should move to the entered manual valve position demand. Can tune or directly enter a value.

dflt = Unchecked

dflt = Unchecked

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%).

Calibrate Proportional Actuator #1	Engage HOLD at 0% (Min mA)	Adjust Min Current Setting	
Exit PACT #1 CHANNEL CALIBRATION	Engage HOLD at 100% (Max mA)	Adjust Max Current Setting	
		Calibration Mode Demand	
Manual Valve Stroking Permitted		Channel Calibration Demand	0.0 🚔 %

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

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.

dflt = 0.0 %

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.

¥ 9928-1212CF H.wto	ol - Woodward ToolKit								• • × •
File View Device	Settings Tools Help								
i 🗅 🧀 🖬 🔌 🔛	👷 🗮 - 🔚 🚽 😯 Conf- Pag	je 22 - Prop Act Cl	ian 2	•	🍠 Connect 📈 Di	sconnect			
	CONFIG Driver Menu							WOODWARD	^
		Propor	tional A	ctuator	Channel #	# 2		Save Values	
	ACT #2 (LP) Valve Demand Signal								
	Select ACT #2 Function	Not Used - Tuna	de #1 +		Device Tag Name				
					Proportional Act. #021	Tag PDOOOK		Reset	
	Type of Coil / Actuator				Current Output to Proport	tiional Valve Actuator #2 -			
1	Select Output Current Range	0-20 ma Range	•		Act #2 Demand		0.0 %		
	Select Coil Type	Single Coll	•		Total Current Output t	o ACT 2	0.02 mA		
	Invert Output (Reverse Acting Driv	er)			Number of Healthy Ou	tputs	1		_
	3 sec Delay on LP valve when SD				Proportional Actuator #2	Faults Proportion	al Actuator #2 Faults		
	SD if all kernel output failed				ALL ACT Chan 2 F	AILED ABC 🛛 🕚 Load	Fault - Coil 1 / Coil 2		_
	Actuator Type Range				Load Fault - Single	Coil 🕒 Load	Fault - Coil 3		_
	Current at 0% Demand (Min)	- 4	0 😂 🖨 mA		Option for dual Actuator	Redundancy			_
	Current at 100% Demand (Max)	20	0 😂 🖨 mA		Shutdown if 8	oth Prop Channels Failed	-		
	Actuator #2 Dither	0.0	0 🔶 🖨 mA		No ALM if Bot Alarm if Both	h Prop Channels Failed Prop Channels Failed			1
					Shutdown if B	oth Prop Channels Failed			_
	Kernel A			Kernel I	В	Ker	nel C		
	Kernel A - Prop Act #2 Status		Kernel B - Prop J	Act #2 Status -		Kernel C - Prop Act #2 S	latus		
	ACT 2 Output	0.00 mA	ACT 2 Output		0.01 mA	ACT 2 Output	0.01 mA		
	Prop ACT 2 is Healthy		Prop ACT 2	is Healthy		Prop ACT 2 is Heat	lthy:		_
	Prop ACT 2 Failed		Prop ACT 2	Failed		Prop ACT 2 Failed			_
	Prop ACT 2 is Shutdown		Prop ACT 2	is Shutdown		Prop ACT 2 is Shu	tdown		_
	Disable this kernel cutput (Use w/	CAUTION)	Disable this	s kernel output (l.	ise w/ CAUTION)	Disable this kernel	output (Use w/ CAUTION)		_
									_
	Calibrate Proportional /	ctuator #2		Manu	ally Stroke Prop	ortional Actuator	# <u>2</u>		
	Use this to Set or Adjust Min/Max	Surrent Settings			Use this to Exercise	Valve from 0-100%			
	Enter PACT #2 CHANNEL CAL	BRATION		Manual S Manual	Demand Value	0.0 %			
	Manual Valve Stroking Permitted			Manual	Ramp Rate	10 🖨 🐝	sec		
Connected on TCP/IP	Details								1

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**.

View Device Settings Tools	Kit Help					00
🗃 🖬 🕭 📓 📲 • 🖙 🚽	😋 🕤 Conf. Page 23	- Integ Act Chan 1	- 🚽 🍠 Con	nect 룾 Disconnect 📗		
CON	IFIG or Monu	Actuato	r Controller Cha	annel #1		Woodwar
	Follow Group He	ader Directions to	CHANGE THESE //	V CONFIGURE of	SERVICE Mode	Save Values
UST BE IN CONFIGURE MODE TO CHA	NGE THESE					
Select Demand Use for IAct #1	Not Used - Tunable	•	These can be c	nanged in Service	9 MODE	Pagat
Select Actuator Control Type	PI (Proportional & Integra	0 -	Actuator Controller #1 Devic	e Tag PD000X		rieser
Select Feedback Type	A - single pair of return w	ires 🝷	Faadback Position Tolerano	e (no delav)	50 4 4 1	
f Single FDBK Fails	Use HIGH FB on FDBK 0	Aff Alm 🔻	Feedback Voltage Televano	(an dalay)		
Set FDBK Excitation Voltage	7.07 🕀 🌩 volts		Peedback voltage rolerance	(no delay)	CO A A	
Check for Open Wire Detection on Fer	edback Signals		Position Error Threshold			
Forward or Reverse Acting	Forward Acting Output	•	Position Error Delay		1000 🗢 🗣 msec	
SD if all kernel signal failed			Feedback Difference Tolera	nce	10.0 😌 🗣 %	
Integrating ACT #1 Output Signal (SERVICE)		Feedback Difference Delay		1000 \ominus 🖨 msec	
Set NULL Current (IntegAct)	20.00	\ominus 🖨 mA				
Set Minimum Current	-200.0	\ominus 🖨 mA	ACT #1 Valve Response Dyna	mics		
Set Maximum Current	200.0	Am 🗢 🕀	Integ Act #1 Proportional Ga	in (RP)	1.000	
Set Dither Amplitude	0.00	\ominus 🖨 mA	Integ Act #1 Integral Gain (K	D	1.000 😌 🖶	
No Faults			No Faults	131115		
					Calibration NOT Available -	
xit Calibration fode	Redunda	nt Actuator C	Calibration Ste	<u>əps</u>	I/O Lock	
Calibration Procedure	e Steps for Integlict	Actuator Controller #1 Cha	an A (Kernel A)	Actuator Controller #1 Ch	an B (Kernel B)	
art Calibration	hanting to Basis	Position Demand	0.00 %	Position Demand	0.00 %	
(FIRM Valve at	loration to begin	Actuator Current	9.99 mA	Actuator Current	9.99 mA	
Min Position Channel A Strok	king to Minimum	Feedback 1 Position	0.00 %	Feedback 1 Position	0.00 %	
Continue Charnel A Conf	firmed at Min Position	FDBK Voltage 1A	0.00 v	FDBK Voltage 1A	0.00 v	
Channel A Strok	king to Maximum	FDBK Voltage 1B	0.00 v	FDBK Voltage 1B	0.00 v	
NFIRM Valve at Ochannel A Conf Max Position	firmed at Max Position	Actuator OHMS	0.0 ohm	Actuator OHMS	0.0 ohm	
Continue	al Stroke Test Enabled	CAL Status Not in	Calmode	CAL Status Not in	Calmode	
Calibration Chan A Complete	te / Switching to Chan B	Redundancy OK-	Sharing Operation	Redundancy OK	- Sharing Operation	
Channel B Strok	king to Minimum					
Calibrate B Ohannel B Conf	firmed at Min Position	FORCE A	CT #1 Output (when Module not	in Calibration Mode)		
NFIRM Valve at Ochannel B Strok	king to Maximum	ACT 1 F	orce Demand Stroke	I 🔶 %		
Min Position	firmed at Max Position	Force D	emand Ramp Rate	10 🜩 %	/sec	
Continue Calibration Chan B - Manus	al Stroke Test Enabled					
		Calibration Stroke GO	Stroke During Channel C	alibration Mode	1 August	
NFIRM Valve at Max Position		0.000	Enter namp nate		1 ¥ 4/800	
	Olevella and	Calibration Stroke HOLD	Enter Target Demand		0	
				100 H House		

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 DemandLP2 DemandLP2 Demand

Actuator Control Type Choices

dflt = PI	(Proportional	& Integral)
-----------	---------------	-------------

		_
Select Actuator Control Type	PI (Proportional & Integral)	*
Colori Frankrich Tran	PROP (Proportional w/ Command Trim)	
Select Feedback, Type	PI (Proportional & Integral)	
If Single EDBK Faile	P (Proportional Only)	
II Single FUBR Falls	PI_LAG (PI w/ Lag Filtered Demand)	- 1
Set EDBK Evolution Voltage	PI_LEADLAG (PI w/ LL Filtered Demand)	
Set FDBN Excitation Voltage	r.or 🗸 🔻	

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.



ΡΙ

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

Select Feedback Type	A - single pair of return wires 🛛 🗸 🗸
	NONE - Act used as P only
It Single FDBK Fails	A - single pair of return wires
	A-B - simple difference device
Set FDBK Excitation Voltage	(A-B)/(A+B) - D/S or constant sum dev

91

Α

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.

The type of LVDT used must be similar for each redundant channel.

If Single Feedback device fails

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

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

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)

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

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

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

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

Optional identifier that the user can use to relate this channel to the actual valve/actuator device.

Feedback Position Tolerance (no delay)

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)

Woodward

dflt = 20.00 mA

dflt = Forward Acting

dflt = -200.0 mA

dflt = 200.0 mA

dflt = 0.0 mA

dflt = 0.5 volts

MicroNet TMR 5009FT

dflt = Use HIGH FDBK

dflt = 7.07 volts

dflt = 5.0 %

XXXX

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

Position Error Threshold

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 Delav

Sets the delay before the position error alarm will go true when feedback exceeds demand +/- PE threshold.

Feedback Difference Tolerance

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 = 1.000Sets the proportional gain factor in the demand versus position control loop, controlled within the actuator module.

Integ Act #1 Integral Gain (KI)

WARNING

WARNING

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.

> 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.

> 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.



dflt = 1.000

dflt = 5.0 %

dflt = 1000 ms

dflt = 10.0 %

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-bystep 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.

% 9928-1212CF_G.wt	ool - Woodward ToolKit								ж
Eile View Device	Settings Tools Help								
🗅 🧀 🖬 🔌 📓	🖥 📄 🗮 • 🛗 • 📄 🔇 🜍 Conf. Page 23 -	Integ Act Chan 1		• 📄 🖉 Con	nect 🛒 Disconne	ct 🔡			
No Fas	lts .			No Faults					-
Exit Calibration Mode	Redundar	nt Actual	or Ca	libration Ste	eps		Calibration NOT Available -		
	Calibration Procedure Steps for IntegAct	Actuator Controlle	r #1 Chan A	(Kernel A)	Actuator Controller	#1 Chan	B (Kernel B)		
Start Calibration	Permissives Met to Enter Calib Mode	Position Demar	d	0.00 %	Position Demand		0.00 %		
	Press Start Calibration to Begin	Actuator Curren		-9.99 mA	Actuator Current		0.00 mA		
CONFIRM Valve at Min Position	Channel A Stroking to Minimum	Feedback 1 Po	-	0.00 %	Feedback 1 Posi	tion	0.00 %		
Continue	Channel A Confirmed at Min Position	EDBKUL		0.00	EDB////		0.00 %		
Calibration	Channel A Stroking to Maximum	FUER voltage	A	0.00 V	PUBK Voltage IA		0.00 V		
CONFIRM Valve at	Channel A Confirmed at Max Position	FDBK Voltage	в	0.00 v	FDBK Voltage 18	3	0.00 v		
Max Position	Chan A - Manual Stroke Test Enabled	Actuator OHMS		0.0 ohm	Actuator OHMS		0.0 ohm		
Continue		CAL Status	Manual (C	AL_IN) Mode	CAL Status	Not in Ca	almode		
Calibration	Chan A Complete / Switching to Chan B	Chan B Redundancy		OK - Solo Operation Redundancy Shutd			wħ		
Continue	Channel B Stroking to Minimum								
Calibrate B	Channel B Confirmed at Min Position	F	ORCE ACT #	1 Output (when Module not	in Calibration Mode)	_			
CONFIRM Valve at	Channel B Stroking to Maximum		ACT 1 Force	e Demand Stroke	0	7			
Min Position	Channel B Confirmed at Max Position		Force Dema	and Ramp Rate	10	\$ %/se	c		
Continue	Chan B - Manual Stroke Test Enabled								
Calibration	•	Calib	ration	Stroke During Channel C	alibration Mode				
CONFIRM Valve at May Desilion		- 500		Enter Hamp Hate			1 🔤 %/sec		
PAGET CONDUCT		Colt	ration	Enter Target Demand			0 🚔 %		
Continue Calibration	Stop/Abort Calibration	Stroko	HOLD	Calibration Stroke Der	nand (CALMODE)		0.0 %		
Finished	Reset to Reset to Channel A								
Calibration		_							
Connected on TCD (D)	C Date la								•
Connected on TCP/IP	ay beans								

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.

FORCE ACT #1 ACT 1 Manua	on Mode)	
	Calibration Procedure Steps for IntegAct — Permissives Met to Enter Calib Mode Press Start Calibration to Begin Channel A Stroking to Minimum Channel A Confirmed at Min Position Channel A Stroking to Maximum	

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**.

View Device Settings	<u>I</u> ools <u>H</u> elp						
🤐 🖬 🛸 🔝 🖉 🐔	🐩 - 📄 🔇 🕤 Conf. Page 24	Integ Act Chan 2	• 🔤 🔊	Connect 룾 Disconnect	6		
	CONFIG Driver Menu	Actuato	or Controller Cl	hannel #2			WOODWA
	Follow Group Head	ler Directions to	CHANGE THESE	IN CONFIGURE or	SERVICE Mode	•	Save Valu
ST BE IN CONFIGURE MODE	TO CHANGE THESE					·	
elect Demand Use for Act #2	Not Used - Tunable	•	These can l	be changed in Servic	e Mode		
elect Actuator Control Type	PI (Proportional & Integral)	•	Position Feedback setup -				Reset
elect Feedback Type	A - single pair of return wir	es 🔻	Actuator Controller #2 Ta	ng PD000K			
single FDBK Fails	Use HIGH FB on FDBK Di	f Alm 🔻	Feedback Position Toler	ance (no delay)	5.0 \ominus 🗢 %		
et FDBK Excitation Voltage	7.07 🕀 🔷 volts		Feedback Voltage Tolera	ince (no delay)	0.5 🕀 🌩 volts		
Check for Open Wire Detection	on on Feedback Signals		Position Error Threshold		5.0 😂 🗢 %		
orward or Reverse Acting	Forward Acting Output		Position Error Delay		1000 \ominus 🖨 msec		
SD if all kernel signal failed			Feedback Difference Tol	erance	10.0 🕀 🖨 🎋		
etup Integrating ACT #2 Output	Signal (SERVICE)		Feedback Difference Del	ay	1000 🔷 🖨 msec		
Set NULL Current (IntegAct)	20.00	😂 🜻 mA					
Set Minimum Current	-200.0	😂 🖨 mA	ACT #2 Valve Response D	ynamics			
Set Maximum Current	200.0	😂 🗢 mA	Integ Act #2 Proportional	Gain (KP)	1.000 😌 🚭		
Set Dither Amplitude	0.0	mA €	Integ Act #2 Integral Gain	n (KJ)	1.000 응 🗢		
Kernel A - Channel 2 F	ault Status		Kernel B - Channel	2 Fault Status			
No Faults			No Faults		Calibration N	OT Available -	
	Redunda	nt Actuato	r Calibration	Stens	O Loc	k	
Exit Calibration Node Calibration	Procedure Steps for IntegAct	Actuator Controller #2	Chan A (Kernel A)	Actuator Contro	oller #2 Chan B (Kernel B		
O Perm	ssives Met to Enter Calib Mode	Position Demand	0.00	Position Dem	and	0.00	
art Calibration 9 Press	Start Calibration to Begin	Actuator Current	9.99	Actuator Curr	rent	9.99	
NFIRM Valve at Chan	nel A Stroking to Minimum	Feedback 1 Position	n 0.00	Feedback 1 F	Position	0.00	
Chan	nel A Confirmed at Min Position	FDBK Voltage 1A	0.00	FDBK Voltage	e 1A	0.00	
Continue Calibration	nel A Stroking to Maximum	FDBK Voltage 1B	0.00	FDBK Voltage	e 1B	0.00	
NFIRM Valve at	nel A Confirmed at Max Position	Actuator OHMS	0.0	Actuator OHI	MS	0.0	
Max Position	A - Manual Stroke Test Enabled	CAL Status N	ot in Calmode	CAL Status	Not in Calmode		
Continue Calibration	A Complete / Switching to Chan B	Redundancy (OK - Sharing Operation	Redundancy	OK - Sharing Oper	ation	
Calibration Chan	nel B Stroking to Minimum						
Continue Gen	nel B Confirmed at Min Position	ACT 2	Force Demand Stroke	0 - %			
Calibrate B	nel R Stroking to Maximum	Force	Demand Ramn Rate	10 - %			
NFIRM Valve at Min Position	nel B Confirmed at Max Position						
Continue Char	B - Manual Stoke Test Enabled	Calibrati					
Calibration		Stroke C	Stroke During Calib	ration Mode	1	N/sec	
NFIRM Valve at		Calibrati	On Enter Target Dem	and	0	ē :	
max Position		Stroke HC	Calibration Strates	Demand	•	0.0 %	
Continue	Stop/Abort		Caleration broke				

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 multivalve 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.

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Eile View Device	Settings Iools	Help						
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BACK								Woodward
00550			10144-1					Save Value
0	SPEED SETPOINT	HP valve Demand	D LP valve t	0.0				
								Reset
			ше	Value Linear	instian C			
			defau	Ited to Prop A	ctuator C	han #1)		
		Single HP	Valve Cur		s	econd Curve for	SolitHPV	alve I Inite
	HP Demand Input V	alue	Valve Curve Ou	tout Value	HP2 Demand Inp	ut Value	Valve Curve Out	tput Value
	Present Value	0.00	Present Value	0.00	Present Value	0	Present Value	0
	HP Valve Curve - X	Values (curve input) -	HP Valve Curve	- Y Values (curve output)	HP2 Valve Curve - X Values (curve input) - HP2 Valve C			e - Y Values (curve output) -
	X_1	0.00 😂 🖨	Y_1	0.00 😂 🖨	X_1	0.00 😂 🖨	Y_1	0.00 😓 🗢
	X_2	10.00 🕀 🗢	Y_2	10.00 \ominus 🗢	X_2	10.00 \ominus 🗢	Y_2	10.00 \ominus 🗢
	X_3	20.00 🕀 🗘	Y_3	20.00 😓 🖨	X_3	20.00 \ominus 🌩	Y_3	20.00 😂 🗢
	X_4	30.00 \ominus 🌻	Y_4	30.00 😓 🌻	X_4	30.00 😓 🜩	Y_4	30.00 😓 🗢
	X_5	40.00 \ominus 🖨	Y_5	40.00 😂 🖨	X_5	40.00 \ominus 🜩	Y_5	40.00 😂 🗢
	X_6	50.00 🕀 🌩	Y_6	50.00 🕀 🜩	X_6	50.00 🕀 🜩	Y_6	50.00 😂 🗢
	X.7	60.00 😂 韋	Y_7	60.00 🕀 🌻	X_7	60.00 😂 🗢	Y_7	60.00 😂 🗢
	X_8	70.00 \ominus 🖨	Y_8	70.00 \ominus 🖨	X_8	70.00 \ominus 🖨	Y_8	70.00 😂 🖨
	X_9	80.00 \ominus 🗢	Y_9	80.00 \ominus 🕀	X_9	80.00 \ominus 🚭	Y_9	80.00 😓 🗢
	X_10	90.00 \ominus 🗢	Y_10	90.00 \ominus 🗢	X_10	90.00 🕀 🜩	Y_10	90.00 😓 🗢
	X_11	100.00 🕀 🌩	Y_11	100.00 😓 🌻	X_11	100.00 \ominus 🜩	Y_11	100.00 😓 🗢
Connected on TCP/IP	Details							

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.

9928-1212CF_S.wtool - Woodward ToolKit	- • 💌
File View Device Settings Iools Help	
🗋 🔯 🛃 🐌 📓 🔡 📲 🚆 - 📓 🛇 😮 Conf- Page 25 - Configuration Check 📓 🍠 Connect 🦼 Disconnect 🚽	
MAIN HOME Turbine Over. Start Settings Speed Contr. Turb. Protec: Extr. Contr. Steam Map Cascade Feed Forward W. M	NOODWARD
Valve Settings Speed Sig Analog In Readout Binary Input Binary Out Communic Drivers Conf	Save Values
Config. Check Full Config Turbine Configuration Check	Reset
Configuration Errors	
Connected on TCP/IP 😼 Details	

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.



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

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

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

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

Multiply Factor of Normal Rate for Slow

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.

MicroNet TMR 5009FT

dflt = 1.0 (.005, 50)

dflt = 1.0 (0.005, 100)

dflt = 100.0 (0.0, 100)

dflt = 3.0 (0.0, 25)dflt = 0.3 (0.01, 1)

Manual 26518V3

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.

Woodward

Multiply factor of Normal Raise/Lower Rate

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

Delay before Normal Rate

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.



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).

dflt = 3.0 (0.1, 25)

dflt = 0.3 (0.01, 1.0)

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.



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

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)

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

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

Initial Setpoint Value

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)

dflt = 0.0 (0.0, 10)

Enter the maximum extraction/admission setpoint that should be allowed for the system.

Droop of Extraction

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





dflt = 3.0 (0.1, 25)

dflt = 3.0 (0.01, 100)

dflt = 0.0 (-10000, 10000)

dflt = 1.0 (0.01, 500)

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.

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Setpoint R/L Rate 0.1	\$ \$	Go to Go to Target Setpoint	50 🜩	
Setpoint Fast Rate multiply 3.0	\$ \$	AUX Target Go to Target Rate	0.25	
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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.

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

IMPORTANT

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

If required, enter a droop percentage. If needed it is typically, set between 1-5% and not more than 10%.

Sliding Deadband

If required, enter the deadband percentage. Typically, set between 1-5% and not more than 10%.

Delay before Fast Rate (sec)

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

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

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

User can enter a target setpoint

Setpoint Entered Rate

Woodward

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

dflt = 0 (0.0, 100)

dflt = 0 (0.0, 100)

dflt = 3.0 (0.1, 25)

dflt = 0.1 (0.01, 500)

dflt = 3.0 (0.01, 100)

dflt = 50 (0, 100)

dflt = 0.25 (0.01, 100)

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.

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Seal Gas Al Signal Configured							
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Remote Setpoint Al Signal Configured			Seal Gas PID Output	0	-1E-05	1E-05	
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Remote Setpoint Rate Limiter	5.0 😂 🗢				Invert	Heverse the PID Action	-
Connected on TCP/IP Details							

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 Process Signal Max Value display only config in AI section 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 Automatically LOWER Demand if sensor failed

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
Remote	Setpoint	Signal	Min Value
Remote	Setpoint	Signal	Max Value

Seal Gas Setpoint Values

Setpoint Tracking Initialization

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

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)

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:

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)

Remote Setpoint Rate Limiter:

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 second second second for the Original DIR	

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.

110

dflt = 100.0 (-100000, 100000)

dflt = 1.0 (0.01, 10000)

dflt = Unchecked

dflt = Unchecked

display current value

dflt = Unchecked

display only config in AI section display only config in AI section

dflt =*3 (1,10)

Manual Valve Demand Fast Demand Rate

This multiplier factor will apply on the Demand R/L rate when the R/L delay is passed.

Fast Rate Delay

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 Enter the Seal PID proportional gain value. This value is used to set Seal PID control response. This

starting value is 1%.

dflt = 0.55 (0.0, 99.99)

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.

value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended

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)

dflt = Unchecked

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

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.

111

dflt = *5(1, 30)

dflt = *3(1, 10)

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)

dflt = 10000 (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

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.

Remote KW Setpoint	
Check to use Remote (AI) KW Setpoint	
Remote KW Setpoint Signal Healthy	
Ramp Rate for Remote Speed Setpoint	20.00 🔶 🜩

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

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 lsoch 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

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)

dflt = 0.5 (0.0, 99.99)

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.

dflt = 20.0 (0.0, 1000.0)

Manual 26518V3 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.

External Speed Bias (Sync/Load Share)	
🥚 Speed Bias/Load Share Signal Faulte	d
Load Share Speed Bias Active	
Sync Speed Bias Signal Active	
Ramp Rate for Sync/LS Bias	2.00 🗢 🜩

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.

6 9928-1212R5_G.wtool - Woodward ToolKit								
Elle View Device Settings Lools Help								
i 🗅 🎯 🖬 🔌 🔛 👷 🚟 - 📰 - 📓 🔇	😌 Run - P	age 10 - Analog Inputs	- 📄 🍠 🤇	ionnect 📝 Disconnect 📗				
BACK	A	I/AO COMBO Modul	e (A2)			₩.w	OODWARD	Î
	Speed Signal Inputs							
	Fault Statu	s — Speed Signals 1-4 —		Device Tao Names				
	Spee	d #1 Speed Signal Input #1	0	Speed #01 Device Tag	SPX000X			
	Spee	d #2 Speed Signal Input #2	0	Speed #02 Device Tag	SPIODOX			
	Spee	d #3 Speed Signal Input #3	0	Speed #03 Device Tag	SPX000X			
	Spee	d #4 Speed Signal Input #4	0	Speed #04 Device Tag	SPI000X			
Sensor Excit	Europian Ann	Analog Inputs	<u>1-8</u>	han and Value		Device Tax Names		×
Al #01 Eviled	AL-PD1	Customer Defined Manites Inter 51		Al #01 Scaled Value	40	Device Tag Names	Costs Al Chan R1 Dataile	
ALET? Exist	AL #02	Extraction/Admission Intel #1		ALBO2 Scaled Value	10	Proces	Go to Al Chan #2 Details	- 1
A POZ Falled	AL #02	Careeda lacet #1		Al #02 Scaled Value	69.7	BINOON	Co to Al Chen #1 Details	- 11
Al II A Failed	AL #04	Cascade input a 1		ALEM Scaled Value	0.0	PICCOC	Go to Al Chan #4 Details	- 1
A MAR Failed	AL #05	Remote Manual Decoupling Depoint #1		ALENE Coaled Value	40	BINON	Co to Al Chao #5 Details	- 11
A NOT Belef	AL #00	Exhaust Desce Descuse (1)		ALECT Coded Value	10	BIODOX	Co to Al Chan #C Dataile	- 1
Martin Faled	AL #07	Demote Mal Celeviat		AL #27 Cooled Value	1.7	00000	Co to Al Chan #7 Datale	- 1
ALKOT Falled	AL #07	Net land		AL #07 Scaled Value	60.7	Piccos		- 1
A NUC Pared	A1 #00	Not Used		Al NUL Scaled Value	0.0		Go to Al Chan #8 Unitalis	• 11
Connected on TCP/IP 🛞 Details								

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.

Were Review Settings Level Beig Were Review Settings Level Beig Were Review Settings Level Beig Contract Processor Contract Processor Contract Processor Settings of Analog Input Channel #1 Debails Settings of Analog Input Channel #1 Debails Settings of Analog Input Channel #1 Contract Part At 201 Signal Current Validated Al #01 Signal Current Current Input 454 Current Input Current Input 454 Current Input Current Input 454 Current Input Current Input	9928-1212R5_G.wtool - Woodward ToolKit			
Image:	<u>File View Device Settings Iools Help</u>			
Konsert Fixed Analog Input Channel #1 Details Settings of Analog Input Channel #1 Settings of Analog Input Channel #1 Settings of Analog Input Channel #1 Current Fixed Analog Input Channel #1 Current Fixed Settings of Analog Input #1 Status 4.64 Current Input 4.64 Current Input 4.64 Current Input 4.64 Current Input 6.40 Current Input 6.403 Module Fixed / Channel If Fixed 2.403 A03 Module Fixed / Channel Disabled 4.203	🗋 🎽 🖬 🐌 🔛 👷 🗮 - 🔚 😽 🚱 Ald	hannel 1	- 📄 🖉 Connect 🦼 Disconnect 📗	
Setting of Analog Input Channel #1 Debias Setting of Analog Input Channel #1 Unitset# A #01 Signal Current Analog Input #1 Current Input Current Input 454 Current Input Current Input Ad3 Module Fault (Chan Disabled	Back To Al Summary		Wood Wood	WARD
Sensor Fault Modus Multipler Analog Input Channel #1 Consernel Tault O Validated A# 011 Signal Current O O Validated A# 011 Signal Current O O Validated A# 011 Signal Current O O O O O O O O Validated A# 2013 Socied Valve 4.00 Filter Constart (Lag Teu) O O O Associe prop.4 #1 Statu Associe prop.4 #1 Statu Associe prop.4 #1 Statu		Analog Input Channel #1 De	Nails	eset
Analog leput 801 Signal Failed Multipler x1 Analog leput A01 Signal Failed Multipler x1 Analog leput A01 Signal Canner Bri Select Function for Analog leput 801 Signal Canner Defined Monitor leput 81 Lower Range (4 m A +) Upper Range (2 m A +) Upper Range (2 m A +) 100 Validated AI 801 Signal Current 4.00 Filter Constant (Lag Tau) 0 Kernel A Kernel B Kernel C Kernel C Analog leput 81 Status Analog leput 81 Status Current leput 4.64		Sensor Fault	Modbus Mu	Itiplier
Settings of Analog Irput Channel #1 Analog Irput Channel #1 Signal Range Configured Settings Setting function for Analog Irput #101 Cunsom Defined Monitor Irput #1 Lower Range (4 mÅ +) 0 Validated Al #01 Signal Current 4.64 Upper Range (20 mÅ +) 100 Validated Al #01 Signal Current 4.64 Upper Range (20 mÅ +) 100 Validated Al #01 Signal Current 4.00 Filter Constant (Lag Tau) 0 Validated Al #01 Sould Value 4.00 Filter Constant (Lag Tau) 0 Kernel A Analog Irput #1 Status Current Irput 4.64 Current Irput 4.64 Current Irput 4.54 Current Irput 4.64 Current Irput 4.54 Current Irput 4.64 Current Irput 4.64 Current Irput 4.64 Current Irput 4.64 Current Irput 4.64 Current Irput Current Irput A03 Module Fault / Chan Disabled A03 Module Fault / Chan Disabled A03 Module Fault / Chan Disabled		Analog Input I	101 Signal Failed Multiplier	×1 -
Stetet Function for Avelog lepul #01 Contorner Defined Monitor lepul #1 Lower Range (4 mA +) 0 Validates JI #01 Signal Current 4.64 Uspen Range (2 mA +) 100 Validated JI #01 Solid 4.00 Filter Constant (Lag Tau) 0 Kernel A Acatog lepul #1 Status 4.00 Filter Constant (Lag Tau) 0 Kernel A Acatog lepul #1 Status Kernel B Kernel C Kernel C Current lepul 4.54 Current lepul 4.54 Current lepul 4.54 Channel 1 Fault © Channel 1 Fault	Settings of Analog Input Channel #1		- Analog Input Channel #1 Signal Range Cor	nfigured Settings
Validated AI R01 Signal Current 4.64 Upper Range (20 mA +) 100 Validated AI R01 Seeled Value 4.00 Filter Constant (Lag Tau) 0 Kernel A - Analog Inpot #1 Status 6.64 Current Inpot 4.54 Current Inpot 4.54	Select Function for Analog Input #01 0	Customer Defined Monitor Input #1	Lower Range (4 mA =)	0
Velideed AI #01 Scaled Value 4.00 Filter Constant (Lag Tau) 0 Kernel A Kernel B Kernel B Kernel C Kernel A- Analog Input 81 Status 4.64 Kernel B - Analog Input 81 Status 4.64 Current Input 4.64 Current Input 4.64 Channel 1 Fault Channel 1 Fault Channel 1 Fault A03 Module Fault / Chan Disabled A03 Module Fault / Chan Disabled A03 Module Fault / Chan Disabled	Validated AI #01 Signal Current	4.64	Upper Range (20 mA =)	100
Kernel A Kernel B Kernel C Kernel A - Analog top £1 Status Analog top £1 Status Merrel B - Analog top £1 Status Merrel C - Analog top £1 Status Current Iput 4.64 Current Iput 4.64 Current Iput 6.64 Channel 1 Fault © Channel 1 Fault © Channel 1 Fault © Channel 1 Fault © Channel 1 Fault A203 Module Fault / Chan Disabled #A23 Module Fault / Chan Disabled #A23 Module Fault / Chan Disabled A23 Module Fault / Chan Disabled	Validated AI #01 Scaled Value	4.00	Filter Constant (Lag Tau)	0
Channel 1 Fault	Kernel A Kernel A - Analog Input #1 Status	Kernel Kernel B - Analog Input #1 Stat. 4.54 Current Input	B Kernel C - Analog Inp 4.64 Current Input	Cernel C put #1 Status 4.64
● A03 Module Fault / Chan Disabled ● A03 Module Fault / Chan Disabled ● A03 Module Fault / Chan Disabled	Channel 1 Fault	Channel 1 Fault	Channel 1 Faul	t
	A03 Module Fault / Chan Disables	d 🕘 A03 Module Fault / Chan I	Disabled 🕘 A03 Module Fa	ult / Chan Disabled

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.

	Jward Toolkit					- 8
[iew Device Settings	Icols Hel	þ				
) H 🕈 🖬 🕛 🖫	• 🔚 - 📗 🤇	Run - Page11A - Analog Outputs	• 📗 🖉 Connect 📈 Disconnect 📗			
VCK		AI/AO COMBO Module	(A2)		W woo	DDWARD
_			· -/			Reset
		Anal	og Outputs			
Sensor Fault	Function Ass	signments of Analog Output Channels #1-4	Current Demand Value of Analog Outp	ut Channels	Load Fault- Device Tag Names	
AO #01 Failed	AO #01	Actual Shaft Speed	AO #01 Output Value	4.0	PD000X	Go to AO Chan #1 Det
AD #02 Failed	AO #02	Speed Reference Setpoint	AO #02 Output Value	4.0	P0000X	Go to AO Chan #2 Det
AD #03 Failed	AQ #03	Not Used	AO #03 Output Value	4.0	P0000X	Go to AO Chan #3 Det
AD #04 Failed	AO #04	Not Used	AO #04 Output Value	4.0	PD000X	Go to AO Chan #4 Det

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.

#: 9928-1212R5_G.wtool - Woodward ToolKit File View Device Settings Tools H	elo				
□ → □ → □	A D Page 11, AD Changel 1		· Connect @	Disconnect	
Back To AO Summary			1	Reset	
	Analog Output Chann	el #01			
Calibration Mode	Function Assigned to Analog O	utput Chan #01			
CALMODE Permissive OK	Select Function for AO #01	Actual Shaft Spe	ed		
CALMODE Enabled	Signal Demand Output Value			0.0	
AD #01 in CALMODE	Secol Bar	one / Current Settinge			
	Value at	4 mA	0.0		
	Value at	20 mA	100.0		
	Set Min	Current Output	4.00		
	Set Max	Current Output	20.00		
	Current Output Demand (Total) - Analog Output #01	4.00			
Kernel A	Kerne	B	Ker	nel C	
Kernel A - Analog Output #1 Status -	Kernel B - Analog Output #1 S	katus	Kernel C - Analog Output	I'l Status	
Current Output	1.32 Current Output	1.32	Current Output	1.32	
ANAOUT Chan 1 is Healthy	ANADUT Chan 1 is Heat	ithy	ANAOUT Chan 1 is	Healthy	
ANADUT Chan 1 Failed	ANADUT Chan 1 Failed		ANADUT Chan 1 Fa	iled	
AN4DUT Chan 1 is Shutdown	AN4OUT Chan 1 is Shu	tdown	ANADUT Chan 1 is	Shutdown	
Connected on TCP/IP 😼 Details					

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.

¥ 9928-1212R5_G.wtool	- Woodward	ToolKit						- • •
Fue Tiem Device 3	ettings To	ois <u>H</u> eip						
	8 - 1 - 13	B Source Page 12 - Discrete Inputs		• 🗄 : 🖓 c	onnect 🔉	Disconnect		
BACK		WOODWA	RD					
			Discret	e Inputs				Reset
DI Status		Device Tag						
😑 Cha	n 1 = ESTOP	BIDDOOK		DI Status-	Function As	signments for Discrete Input Channels	Device Tags	
DI Status	Function Ass	ignments for Discrete Input Channels	- Device Tags	@ 13	DI #13	Not Used	BDOOOK	
Q 2	DI #02	Event Reset Command (ALM & SD)	BDODOX	9 14	DI #14	Not Used	BDOOOK	
• 3	DI #03	Speed Reference Raise Setpoint Cmd	BUODOX	9 15	DI #15	Not Used	BDOOOK	
• 4	DI #04	Speed Reference Lower Setpoint Cmd	BDOOOK	9 16	DI #16	Not Used	BDOOOK	
6 5	DI #05	Start Command	BDODOX	a 17	DI #17	Not Used	BDOOOC	
6	DI #06	Controlled Shutdown Command	BD000X	a 18	DI #18	···· Not Used ····	BDOOOK	
• 7	DI #07	GEN Breaker Aux (52) Closed (+Droop)	80000X	4 19	DI #19	···· Not Used ····	BDOOOK	
• 8	DI #08	Not Used	BDOOOK	@ 20	DI #20	Not Used	BDOOOK	
9 9	DI #09	Not Used	BDODOX	@ 21	DI #21	Not Used	BDOOOK	
• 10	DI #10	Not Used	80000X	@ 22	DI #22	Not Used	BDOOOC	
• 11	DI#11	Not Used	BD000X	@ 23	DI #23	Not Used	BDOOOK	
12	DI #12	Not Used	BDOOCK	@ 24	DI #24	Not Used	BDOOOK	
G G 1	To arnels	Go To Charnels 5-8		60 Ch 13	To annels 16	Go To Channels 1720		
Connected on TCP/IP	🖌 Details			**				• .d

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.

9928-1212RS_G.wteel - Weedward TeelKit					•
<u>Eile View Device Settings Iools Help</u>					
i 🗅 🤐 🖬 🐌 📓 🖉 · 🖫 🕛 🗿 🎯	Run - Page 13 - Relay Outputs	🔹 📄 💯 Connect 🖉 Discon	nect 10		
BACK				M woodward	
	Disc	rete/Relay Outputs			
	Relay #1 Trip Relay Config				
	Summary Shutdown / TRIP	Relay Status	De-energized	GoTo	eset
	•				
State Indication	on Function Selection	Present State			
Relay #2	Summary Alarm	Output Command	Energized	(3010	
State Indication	on Function Selection	Present State			
Relay #3	Frequency Control Armed	Output Command	De-energized	GoTo	
State Indicatio	n Function Selection	Present State		_	
Relay #4	Not Used	Output Command	De-energized	GoTo	
State Indicatio	n Function Selection	Present State		_	
Relay #5	Not Used	Output Command	De-energized	GoTo	
State Indicatio	on Function Selection	Present State		_	
Relay #6	Not Used	Output Command	De-energized	GoTo	
State Indication	n Function Selection	Present State		_	
Relay #7	Not Used	Output Command	De-energized	GoTo	
State Indicatio	n Function Selection	Present State		_	
Relay #3	Not Used	Output Command	De-energized	Golio	
State Indicatio	n Function Selection	Present State		_	
Relay #9	Not Used	Output Command	De-energized	GoTo	
State Indicatio	n Function Selection	Present State		_	
Relay #10	··· Not Used ···	Output Command	De-energized	GoTo	
State Indication	on Function Selection	Present State		_	
Relay #11	Not Used	Output Command	De-energized	GoTo	
State Indicati	on Function Selection	Present State		_	
Relay #12	Not Used	Output Command	De-energized	GoTo	
<		17			•
Connected on TCP/IP By Details					

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.

r -				
2 9928-1212R5_G.wtool - Woodward ToolKit				- • •
Eile View Device Settings Tools Help				
0 0 0 🖉 🚽 🖉 📲 📲 🖉 🖌	Page 17- Relay Output #3	• 📄 🖓 Connect	Z Disconnect	
Back To Relay Summary	RELAY#3 OI	UTPUT COMMAND	WOODWARD Reset	1
	Present State	State Indication Function Selection		
De-energized	Output Command	Relay #3 Frequency Control Arme	sd	
	Device Tag Names			
	Relay #03 Device Tag	8030000		
	Latent Fault Detection Feedba	sck		
	Fault Detected on FT Re	elay #3		
	FT Relay #3 Health Status	Normal		
	Fault Detected	Fault Detected		
	Customer Power Fault	Relay B2 or C1 Fault		
	A1 Readback Fault	Relay C2 or A2 Fault		
	A2 Readback Fault	A1 Relay Fault		
	B1 Readback Fault	A2 Relay Fault		
	B2 Readback Fault	B1 Relay Fault		
	C1 Readback Fault	B2 Relay Fault		
	C2 Readback Fault	C1 Relay Fault		
	Relay A1 or B1 Fault	C2 Relay Fault		
	Chassis Kernel Status -	DIO Module Status		
	Kernel A Fault	DIO Module (A04) Kern A Failed		
	Kernel B Fault	DIO Module (A04) Kern B Failed		
	Kernel C Fault	DIO Module (A04) Kern C Failed		
Connected on TCP/IP 😴 Details				

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.

9928-1212RS_G.wteel - Weedward TeelKit						- • •	
Eile View Device Settings Tools Help							
🗋 😂 🖬 📚 📓 🚽 🗮 - 🖫 - 📓 🗿 🛇 Run -	Page 11 - Actuator Outputs	- 📄 🍠 Connect 룾	Disconnect				
BACK AI/AO	COMBO Module (A2)				Woodward		
						Reset	
	Proportional	Actuator Outputs					
Device Tag Name Current Output to Propo	ortiional Valve Actuator #1	Current Output to P	roportiional Valve Act	uator #2	 Device Tag Name 	-	
PDOOX Act #1 Demand	0.0 %	Act #2 Demand		0.0 %	200000		
Total Current Output	to ACT 1 3.98 mA	Total Current Ou	Total Current Output to ACT 2 3.98				
Number of Healthy O	utputs 3	Number of Healt	Number of Healthy Outputs 3				
Device Tan Name				Device Tax Name			
Go to IntAct Chan #1 PD0000	Actuator Control	er Outputs (Integ	rating)	PDODOK	Go to IntAct Chan #2		
Actuator Controller #1 (Kernel A)	Actuator Controller #1 (Kernel B)	Actuators Controller #	2 (Kernel &)	Actuator Controller #2.0	Kernel F0		
Position 0.00	Position 0.00	Position	0	Position	0		
Current -9.99	Current 0.00	Current	9.99	Current	9.99		
Position 0.0 Feedback	Position 0.0 Feedback	Position Feedback	0.0	Position Feedback	0.0		
Connected on TCP/IP 😸 Details Enter up to 39 chara	cters.						

Figure 4-16. Service Actuator Outputs Summary

Using the navigation buttons the user can go to each individual integrating actuator channel if configured.

× 9928-1212RS_G.wteel - Weedward TeelKit								
Eile View Device Settings Tools Help								
🗈 😁 🖬 🐌 📓 📄 🗮 • 🐃 • 📄 🕴 😋 🕲 Run - Page 14 - Acto	uator Controller #1	• 📑 🍠 Connect 👷 Disconnect 📄						
BACK	BACK Actuator Controller Channel #1							
Monitor - Integrating Actuator Controller #1		Device Tag Name		Reset				
Selected Demand Use for IAct #1 Not	Used - Tunable	Integ Act. #1 Device Tag PD000X						
Actuator Controller #1 Chan A (Kernel A)		Actuator Controller #1 Chan B (Kernel B)						
Position Demand	0.00 %	Position Demand	0.00 %					
Actuator Current Output	9.99 ma	Actuator Current Output	9.99 ma					
Feedback 1 Position	0.0	Feedback 1 Position	0.0					
FDBK Voltage 1A	0.00	FDBK Voltage 1A	0.00					
FDBK Voltage 1B	0.00	FDBK Voltage 1B	0.00					
Actuator OHMS	0.0	Actuator OHMS	0.0					
CAL Alarm	False	CAL Alarm	False					
CAL Status Not in Calmode		CAL Status Not in Calmode						
REDUN Status OK - Sharing Ope	ration	REDUN Status OK - Sharing Operation						
IACT #1 A Driver Fault		IACT #1 B Driver Fault						
IACT #1 A Torque Motor Fault		IACT #1 B Torque Motor Fault						
IACT #1 A Feedback Fault		IACT #1 B Feedback Fault						
Fault Status No Faults		Fault Status No Faults						
<			_					
Connected on TCP/IP 📓 Details Enter up to 39 characters.								

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.

6 9928-121285_G.wtool -	Woodward ToolKit				
Eile View Device Set	ttings <u>I</u> ools <u>H</u> elp				
	2 • 🐘 - 📗 🔾 🔾 Run - Page 0		• 🔡 📝 Connect 💢 Disconnect		
MAIN	sed Control Ster	em Valves			🔥 woodward 👧
HOME	3937 rpm H	P 1.3 %		Generator Load	CORE
Setpoint	3937 rpm U	P 100.1 %		Load 0 KW	Deset
					Aarm Exist Reset
		Turbine	Operation		
Hardware Status	Turbine Control PIDs / Valve Demands	Turbine Startup Page	Extraction Control Page		
	DataLog (10 ms)	Cascade Control Page			
		Alarms Page	Shutdown page		
		Generator Load Control			
Turbine Speed / Inlet V	alve Position				
Turbine Speed	3937 rpm	Event Lat	lest Event Status Message		
HP Valve Demand	1.3 %	😑 ALARM 🛛 🖉	First Out Alarm FT Relay #1 Summary Fault		
Connected on TCP/IP	7 Details				

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.

-1212RS_G.wteel - Weedw	vard ToolKit							
ew Device Seconds	Toor Heb	Run - Page 16	- Hardware Summary Status	• Connect 🥩	Disconnect			
ME							🔥 woo	DWARD
51013	- AI/AU (JOMDO MOC	1016	Chassis	Cernel Module	<u>IS</u>		
Speed Signal Sta	al #1 Cailed	Speed Signal Value		Main Chassis Power	Kernel Power Supplies	CPU% S	Status	Deep
e apeer agn	al wir alley	UK I	0	Main Power A Status	CFU A Fower Sta	us or	FU A Status	Rese
Speed Sign	al #2 hailed	Ch. 2	0	Main Power B Status	CPU B Power Sta	tus 🙂 CP	PU B Status	
Speed Sign	al #3 Failed	Ch. 3	0		CPU C Power State	tus 😲 Ci	PU C Status	
Speed Sign	al #4 Failed	Ch. 4	0					
Al Fault Status	Value in mA -	Al Fault Status-V	alue in mA —		Slot 4 - DI/E	O Comb	oo Module	
Al #01	4.6	🕘 AI #05	4.6		DI Status	DI Status	DI Status	
Al #02	4.1	🕘 AI #06	4.1		O DI 1	DI 9	DI 17	
🕚 AI #03	14.7	🕘 Al #07	14.7		DI 2	DI 10	DI 18	
🕒 Al #04	4.0	🕘 AI #08	4.0		🕘 DI 3	🕘 DI 11	DI 19	
					🕘 DI 4	DI 12	DI 20	
Analog Output Deman	d (Total mA) -	AD	Status		🕘 DI S	👄 DI 13	DI 21	
Analog Output #01		4.00	AO #01 Failed		🕒 DI 6	🕒 DI 14	DI 22	
Analog Output #02		4.00	AO #02 Failed		DI 7	DI 15	DI 23	
Analog Output #03		4.00	AO #03 Failed		DIS	DI 16	DI 24	
Analog Output #04		4.00	AO #04 Failed		•	•	·	
ACT Status		ACT Status						
ACT Chan 1 FAILED	- ABC	ACT C	han 2 FAILED - ABC	Relay Con	mand Status - Relay	Command Statu	us - Relay Command Status -	
Actuator Channel 1 Values	s (%)	Actuator Ch	annel 2 Values (%)	Contraction (Contraction) Relation (Contra	y 01 🛛 🕌 F	telay 05	Relay 09	
A CPU	0.00	A CPU	100.00	Rela	y 02 🕚 F	lelay 06	Relay 10	
B CPU	0.15	B CPU	100.15	Rela	y 03 😐 P	telay 07	Relay 11	
C CPU	-0.15	C CPU	99.85	👄 Rela	y 04 🛛 🖷 P	telay 08	Relay 12	
					GREEN me	ans True/E	Energized	

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

9928-121285_G.wtool - Woodward ToolKit	
Elle Yiew Device Settings Tools Help	
🗋 🎯 😡 🐌 📓 🔤 📲 • 📑 • 📓 💿 Run - Page 1 - General Overview 🔹 👘 📝 Connect	Z Disconnect
HOME Speed Control Steam Valves Steam Valves SHUTDO	
Graph Sepaint -1 rpm LP 0.0 %	Load 0 Kh/ Alarm Exist Reset
Raiso Speed Lower Spaced Composition Spaced Composition Spaced Composition Spaced Composition Spaced Composition Spaced Composition Composition Spaced Composition	V1 - HP Vehre Demand HP Vehre Linter Road HP 00
EXTRACTION COL	
Enable Extraction Extr	Terrefor Target Extend Rate Reset LP Reset LP In mm E arget 50 UAP Limited Lmm E Mat 11 IP Mate Limite
Setpoint Actual Setpoint 0.00 psi	Go to Extraction Target Limber 40.1 %
CASCADE Cascade Control	
CONTROL Raise Status Cascade is Disabled	
Cascade Process 0.0	
Enable Cascade Setpoint 0.0	
Normal SD (bold for 2 sec) Shindown Res	Dverspeed Test - Max Governor
Peak Turbine Speed Captured	First Event Status Message
MAX (Peak) Speed Reached 0	rpm First Out Shutdown ESTOP - Emergency Stop #1 Alm/Msg
Max Acceleration 0	rpm/sec
Connected on TCP/IP 🛛 😴 Details	

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

9928-121285 Guttool - Woodward ToolKit	
Elle View Device Settings Tools Help	
🗋 📸 😹 🗮 📲 🐨 👘 🔕 🔾 Run - Page 1 - General Overview	🖉 Connect 🧝 Disconnect
Turbine speed Control Steam Valves	W WOODWARD
HOME Speed 0 rpm HP 0.0 %	NO OD WARD
Setpoint -1 rpm LP 100.1 %	Generator Load
Graph	4am Exist Reset
Cover Speed Seed Service Start Lower Speed 0 Seed Service Hait	V1 - HP Valve Demand 50 50 50 50 10 50 50 0 5 50 50 10 50 50 - 10 V1 - HP Valve Demand 10 50 50 50 10 50 50 - 10 V1 - HP Valve Demand V1 - HP Valve Demand 10 50 50 50 - 10 V1 - HP Valve Demand 10 50 50 50 - 10 V1 - HP Valve Demand 10 50 50 50 - 10 - 10 V1 - HP Valve Demand 10 50 50 50 - 10 - 1
EXTRAC	CTION CONTROL
Enable Secondary	
Raise Extraction Central - (P Centrellar)	Extraction Target Setpoint Rate Shawn Man Status Robort P
Detpoint Extraction Status EXTRADM Disabled	Target 50 😜 🔮 www- Unitsed
Lower Actual pressure 0.66 psi	Rate 1 Clave Limiter Lower LP
Setpoint Actual Setpoint 0.66 psi	Go to Extraction Target
Cascada Costeri	
CASCADE CONTROL Raise Status Cascade is Disabled	
Cascade Process ce o	
Enable Lower Carcele Setroint	
Cascade Velue Velue 69.0	
Normal SD (hold for 2 sec) Shutdown	For Overspeed Test - Max Governor - ESTOP
Peak Turbine Speed Captured	First Out Alarm Message
MAX (Peak) Speed Reached	0 rpm Alerm Status FT Relay #1 Summary Fault Alm/Msg
Max Acceleration	0 rpm/sec
Connected on TCP/IP 😴 Details	



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.

36 9928-1212R5_G.wtool - V	Voodward ToolKit									
Eile View Device Sett	ings Icols <u>H</u> elp									
i 🗅 🥶 🖬 🛸 🔛 🦷	2 • 🔚 - 📄 🔘 🛇 Run	- Page 1 - General O	verview	- 🖉 🖉 Conr	ect 🛒 Disconnect 📗					
Turbine spec	ed Control	Steam Valves -		_				W woon	WARD	^
HOME Speed	1201 rpm	HP	0.4 %						CORE	
Setpoint	1200 rpm	LP	100.1 %		6	lead	0.107			
Graph						000	U Pun	😑 Alarm Exist	Reset	
Raise Speed	Actual Speed	Speed Setpon 5000 5000 1000 40 500 100 500 100 100 100 100 100 100 100 100 100 1	t Holt 0000 Remaining in 0.0 mi	edule of scheduled to RACTION C	ne 05 mi	V1 - HP V0 20 10 10 10 10 10 10 10 10 10 1	alve Demand 50 60 70 90 90 100 2	HP Valve Limiter	Raise HP Limit Lower HP Lumit	
Enable	Decoupsing		EAT		ONTROL					
Extraction	Raise Extraction Co	ntrol (P Controller)			Extraction Target Setpoint	Rate Ste	am Map Status		Raise LP	
	Selpoint Extraction 5	Status EXTRIAD	M Disabled		Target	50 受	MAP Limited		Cana	
	Lower Actual pres	sure	0.67 p		Rate	10 UP	Valve Limiter		Lower LP	
	Setpoint Actual Setp	oint	0.67 pt	4	Go to Extraction	Taraet	imiter	100.1 %	Limit	
					Concentration	(a)get				
CASCADE	Cascade Contr	ol lo								
CONTROL	Setpoint Status	Cascade is Disabled								
	Cascade Pro Value	ocess	68.1							
Enable	Setpoint Cascade Set	tpoint	68.1							
Castado	Value					Max Gourson				
Normal SD (hold for 2 sec)	Quit Normal Shutdown				For Overspeed Test - Raise Speed Ref to Max	3937	rpm		ESTOP	
		Peak Turbine Spee	d Captured			First Out Alarm Me				
		MAX (Peak) Spe	ed Reached		1201 rpm	Alarm Status	FT Relay #1 Sur	nmary Fault	Alm/Msg	
		Max Acceleration	1		876 rpm/sec					
										- U
										-
Connected on TCP/IP 🛞	Details									

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

W 1000 (1000) Control - Mandarad Teally		
File View Device Settings Tools Help		
	Run - Rane 1 - General Quentieur	nonert 🤪 Disconnert
Turbine speed Control	Steam Valves	
HOME Speed 3600	rpm HP 12 %	WOODWARD A
Setsoint 3620	100 I P 100 I V	Generator Load
Graph		Loed 0 Kiv Ordern Exist Reset
Raise Speed	Speed Seport 500 500 800 874 3600 3600 3600 500 874 500 500 500 500 500 500 500 50	2022 ⊕ rom V1 - HP Valve Demand HP Valve Linker East 56 ⊕ rom/sec 12 HP Valve Linker Land
Decourties	EXTRACTION	CONTROL
Enable	EXTRACTION	
Raise	ion Control - (P Controller)	Extraction Target Setpoint Rate Steam May Status Rober LP
Settom Bay	action Status EXTRUADM Disabled	Target 50 - Wer Umited
Lower	val pressure 0.69 psi	Rate 1 C UP Valve Limiter Lower LP
Setpoint Actu	al Setpoint 0.69 psi	Go to Extraction Target
Carrado	te Control	
CASCADE CONTROL Raise Status	s Cascade is Disabled	
Casca	ade Process cs s	
Enable Lower Value	j Boos ade Satroint	
Cascade Value	63.4	
		Max Growney
Normal SD Quit Normal (hold for 2 sec) Shutdown		For Overspeed Test - Raise Speed Ref to Max 3997 rpm ESTOP
Control Status 1	Peak Turbine Speed Captured	First Out Alarm Message
Speed/Load Control	MAX (Peak) Speed Reached	3624 rpm Alarm Status FT Relay #1 Summary Fault Alm/MSg
Control Status 2	Max Acceleration	876 rpm/sec
LP Valve Limiter Ramp		
Connected on TCP/IP 😼 Details		•

Figure 5-7. Start/Run at Rated Speed (Extraction and Cascade configured)

Speed Target Buttons

Speed Target Setpoint/Ra	te						
Target Speed	3202 🚔 rpm						
Rate to Target	56 🜩 rpm/sec						
Go to Speed Target							

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.

3 9928-1212R5_G.wtool - Woodw	and ToolKit								-	,
Eile Yiew Device Settings	Iools Help									
🗈 🥶 🖬 🛸 🔛 🖉 -	🔚 - 📄 🔘 🕄 Run	- Page 1 - General O	Verview	•	🖉 Connect 🖌 Disconnei	ct				
Turbine speed Cont	trol	Steam Valves						W woody	VARD	*
HOME Speed	3937 rpm	HP	1.3 %			Convertex Lond			CORE	
Setpoint	3937 rpm	LP	100.1 %			Generator Load -	0.104			
Graph						Lond	U KAY	Alarm Exist	Reset	
Raise Speed	Actual Speed	Speed Setpo 2005 500 1500 35 1000 4 500 4		eed Target Setpoint Farget Speed Rate to Target Go to Sj	Rate 3202 💮 rpm 56 🔷 rpmise xeed Target	e V1-9	40 50 60 70 80 50 100	HP Valve Limiter	Raise HP Limit Lower HP Limit	
	0 R9M 3937	3937	<u> </u>			×	13	100.0		
Enable	Decoupling		EX	TRACTIC	ON CONTROL					
Extraction	Extraction Co	ntrol - (P Controllier)			Extraction Target	Setpoint/Rate	Gears Map Status		Raise I P	
Set	tpoint Extraction S	Ratus EXTRIAL	M Disabled		Tarpet	50 - 4	MAP Limited		Limit	1
			0.00	-	Pate		(Balance Linear			
LC Set	ower troint		0.00	per			Ramp	100.1 11	Lower LP Limit	
	Actual Setp	pint	0.69	pai	Go to Extr	action Target	Limiter			
	County Cout									
CASCADE	iso Status	on Cascade is Disabled								
Seg	point Cascada Pro									
Enable	wer Value		66.3							
Cascade	point Value	point	62.2							
Normal SD (hold for 2 sec)	Quit Normal Shutdown				EXTERNAL Overspeed Test	5009FT Overspeed Test			ESTOP	
Count Data of		Bask Turbina Sna	ed Cash and							
Consol Status 1		MAX (Peak) See	and Reached		2020 mm	First Out Alam	n message		Alm/Msg	
opeeu Load Control		in the second second			and a	Alarm Statue	F i Relay #15	ummary Pault		
Control Status 2		Max Acceleratio	'n		ave rpm/sec					
LP Valve Limiter Ramp										
Connected on TCP/IP 😴 Details	-									. li

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.

% 9928-12128	RS_G.wtool - Wood	ward ToolKit							
Eile View	Device Settings	Icols Help							
i 🗅 💣 😡	- 🛛 🔝 🖌 🕲	🔚 - 📄 🔘 🔘 Run - P	age 1b - Overspee	d	- 13	Connect 🛒 Disconnect			
	Turbine speed Cor	loth	Steam Valves -					W woodward	
HOME	Speed	3938 rpm	HP	1.3 %		0.00	units I and		CORE
	Setpoint	3939 rpm	LP	100.1 %		Le	ad 0 KN/		
								😑 Alarm Exist 🛛 🛛 🛛 Res	et
		Speed Reference		3939 rpm	Raise Speed	HP Valve Limiter			
		Speed PID Demand		4.6		30 50 60 70	NOTE: If no raise	or lower speed setpoint	
					Lower Speed	20 80	commands are rec	eived for the configured	
							delay interval, the o	control will exit the	
		TEST MODE - Ext	ernal Overs	peed Test			overspeed test mo	de.	
					0.07.0	100.0			
					Cault 1954	Raise Lower	Delay interval	60 Seconda	
		Overpseed Settings					-		
		Maximum Speed Reference	¢		4450 rpm				
		Internal 5005FT Overspee	d Trip Setting		4356				
		Bask Turbing Streed Cast of							
		MAX (Peak) Speed Reach	ed .		2030 rpm	Reset Peak Speed			
		Max Acceleration			\$76 mm/sec	Copture			
Connected on	TCP/IP Detai	H							

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.

36 9928-121285	G.wtool - Woodwi	ard ToolKit Tools Help						
	s ISI	C C Run -	ane 7 - Control	PIDe	• 🛛 🖓 Conn	ect 🤗 Disconnect		
	Turbine speed Contr	rol .	Steam Valver				23/	
HOME	Speed	3937 rpm	HP	1.3 %			Woodward Woodward	
_	Setpoint	3937 rpm	LP	100.1 %		Generator Load 0 Kin	/ Alem Erict Reset	
	Dava Carala	+ COURTED					-	
	K1	0.304	Controlle	r Demand Outputs				
		0.007	Speed	PID	4.60			
	M	0.648	Extrac	tion PID	0.00	HP Demand = K1*Sneed PID + K2	Extraction PID + K3	
	K3	0.000	STIM	150	4.60	The Demand - KT Speed FTD - R2	Extraction Pib + Ro	
	К4	1.476	0.000	100		Controller Demand Outputs		
	K5	-0.942	PLIM	TED	0.00	HP Demand	1.33	
	KS	24.273	Auxilia	ry Demand	0.00	HP Ramp Limiter	100.00	
	0	- DECOURTED	Feed F	orward Dmd	0.00			
	K1	0.304	Decou	ple Dmd	100.00			
	10	0.649	Renut	e Man Drind	0.00			
	Ne	0.040	Min los	ad line @ 0	0.00	LP Demand = K4*Speed PID + K5*	Extraction PID + K6	
	K3	0.000	Min los	sd at HP 100	1.00	Centralian Destand Output		
	K4	1.476				LP Demand	100.10	
	KS	-0.942				10 Perce Links	100.10	
	KS	24.273				Dr Hamp Limiter	100.10	
Control Status 1 Speed1	1					First Out Alarm Message Alarm Status — FT Rulay 21	Summary Fault Alm/Msg	
Control Status 2	2							
LP Valv	e Limiter Ramp							-
Connected on T	ICP/IP 🐨 Details.	-						

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.

9928-121285_G.wtool - Weedward ToolKit File - View Davide Settings Tools, Mela			
□ □	• 🔡 🖉 Con	nect 룾 Disconnect 📗	
HOME Speed Control Steam Valves - Speed 3600 rpm HP	1.2 %	Constant of	Woodward
Selpoint 3000 rpm LP	30.0 %	Load 0 Kiv/	Aarm Exist Reset
Descr Cascade controller		ID Name PIC-300000 Service	
Raise	PID Controller	-	
Enable	Setpoint 67.63	pai	
Cascade Lower Setpoint	Speed demand 3600	rpm	
Go To Cascode Target Go to Target Rate to Target Target Cascade Selpoint 00 文 ex	Cascade Sepuint with Droop	60.74	
Caseade Status Caseade is Disabled Control Status 1 ————————————————————————————————————	Speed Controller Normal operation	First Out Alarm Message Alarm Statue FT Roley #1 Sv	nnay Fault <u>Alm/Msg</u>
Connected on TCP/IP 😼 Details			



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.

View Device Settings Tools H	de .										19	001300
	O O Run - Pa	ete 4 - Austilian	×	.819	Connect	J Dec	onnect					
Turbine speed Control		Sleam Valves				-				W woo	WARD IN	
IOME Speed	3602 rpm	HP	12 %							AD WOOD	Sur Charles	
Setpoint	3600 rpm	1.P	100.1 %				Generator	Loof			I NUMB	
							List		0.64	Alarm Exist	Reset	
Autor Landard						Name	110,00000	Service				
Meter Automaty I controller		182.0				riane.		-	-			
	Onte	Automoty Lin	u and a second sec	1 999								
UX as Speed Ref	Setpoint			100.000								
imiter Always Enabled	Lower	runtary 5	1. July 1. Jul	100 000	- 20							
	Setpoint	Autilary D	mand	0.000	-							
		Limited P d	emand	0.000	-5							
		Status	motion is Disabled									
		1.000										
uliary EntiAdm Initiar												
versi Statua 1							First Out	Alarm Message			AND ADDRESS OF	
Speed Load Control							Alarm 1	Satur FT	Relay #1 Sum	mary Fault	Aim/Msg	
vend Status 2												
LP Valve Limiter Ramp												

Figure 5-14. RUN Auxiliary Limiter Control

If it is configured as a controller.

File ⊻iew	Device Settings To	cols Help								11. Carlo
다 🧀 🖬										
	ی - 🗂 📓 🗞	🗧 🖸 🕄 Run - I	Page 4 - Auxiliary		· • [] []	🖉 Connect 📈 Disc	connect			
HOME	Turbine speed Control Speed	0 rpm	Steam Valves	0.0 %			Generator	Load	Woodward	
	Setpoint	-1 rpm	LP	100.1 %			Load	0 KW	Alarm Exist Reset	
Descr	Auxiliary 1 controller					ID Name	LIC-X0000X	Service		
			Auxiliary Controller -					Go to Target Setpoint		
	Enable AUX	Raise	Auxiliary PV		3.999	psi	Go to	Go to Target Setpoint	50 🚭	
		Lough	Auxiliary SP		100.000	psi	Target	Go to Target Rate	0.25 🖨 rpm/sec	
		Setpoint	Auxilary Demand		0.000	_%				
			Limited P demand		0.000	_%				
			AUXILIARY Controller	Status						
			Status auxiliar	v is Disabled						
wellary Contro	aller - Only # ExclAdm									
Auxiliary Contro	niler - Only if Escilladm						First D. Alarm	a Alam Message Status FT Relay ≠1 Su	may Fadt Aim Msg	
Auxiliary Contro	oler - Only if Estilladm						First Oc Alarm	a Alam Message Status FT Relay #1 Su	may Fait	

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 timestamp 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).

≫ 9928-121285	S_G.wtool - Week	Iward ToolKit				
Eile View D	Device Settings	Icols Help				
i 🗅 🧀 😡 🗄	ə 🛐 📰	• 🔚 - 📗 : 🔿 🗢 Run - Page S - A	larms	- 📗 💹 Connect 👷 Disconn	ect	
	Turbine speed Co	ontrol Steam	Valves	D	10	
HOME	Speed	0 rpm HP	00 %			WOODWARD AND
					Generator L	.ost teo.
	Setpoint	-1 rpm LP	0.0 %		Load	0 KW
						Alarm Exist Reset
		A	Alarm Event Lis	t		Critical Alarm = Chassis, PS, CPU, Module Fault
	ID	Event	Time	Severty GAP source		MAJOR Alarm Condition Exists
	409	Reset command activated	2015-01-29 13:24:17:153	1 EVENT ALMALM LAT		
	335	Speed Signal Input Chan #1 Failed	2015-01-29 13:24:12.410	50 EVENT_ALM.ALM_LAT.SP	EL_335	
	335	Speed Signal Input Chan II2 Failed	2015-01-29 13:24:12:410	50 EVENT_ALM.ALM_LAT.SP	0.339	For Alarm/Shutdown History
	343	Speed Signal Input Chan #3 Failed	2015-01-29 13:24:12:410	50 EVENT_ALM.ALM_LAT.SP	EL_343	
	348	FT Relay #1 Summary Fault	2015-01-29 13:24:12:410	50 EVENT_ALM.ALM_LAT.SI	EL_348	
	349	FT Relay #2 Summary Fault	2015-01-29 13:24:13:226	50 EVENT_ALM.ALM_LAT.S	EL_349	Launch Control Assistant CONTROL
	9	Modbus1 Block Link 1 Error	2015-01-29 13:24:14.654	100 EVENT_ALM_ALM_LAT.SE	EL_9	& Go Io AF View
	10	Modbus1 Block Link 2 Error	2015-01-29 13:24:14.654	100 EVENT_ALM.ALM_LAT.SI	EL_10	ASSISTANT
	22	Modbus2 Block Link 1 Error	2015-01-29 13:24:14:654	100 EVENT_ALM ALM_LAT.S	EL_22	0.0
	23	Modbusz Block Link 2 Elfor	2010-01-20 13:24:14:604	100 EVENT_ALM.ALM_LAT.SI	1.23	OR
						Download SOS_AE_LOG.CSV file at C:\Woodward\Event_History
				[Export.	Jse EXPORT to save current Event List window to a file
		History of Last 5 'First Out' ALA	RMS (Top 1 is Most Recent)			
		Previous Alarm 1				Go To CUSTOM ALARMS Page
		Previous Alarm 2				
		Previous Alarm 3				SHUTDOWN Summary
		Previous Alarm 4				
		Previous Alarm 5				
					First Out	Alarm Message
					Alarm 5	Status FT Relay #1 Summary Fault
Connected on T		ile .				
configured on 1	and the second					

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.



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).

ALT						
Rank,	Timestanp	Source	Message	Category	Severty	
0	2005/12/17 14 31 50.090 (UTC)	5009FT Uwit	Alams & Everits reporting started	S05-Statuc Retech	Sector Contraction of	
29	2005/12/17 14 28 43 347 (UTC)	V50400009401	Alams & Events reporting started	S05:Status Reliesh	1	
28	2003/12/17 14 28 40 440 (UTC)	505 Alams & Events	Server Started	SDS Status Retreats	1	
27	2009/12/17 10:20:27 545 (UTC)	5009FT UWIT.EVENT_SD.TRIPSD_LAT	Reset command activated	SOS Reset Reheah	1	
26	2005/12/17 10:20:27:545 (UTC)	5009FT UWIT.EVENT_ALM.ALM_LAT	Reset command activated	SOS Reset Reheats	1	
25	2009/12/17 10.16:33 283 (UTC)	5009FT UWIT EVENT_ALM.ALM_LAT	All events cleared	SOS AlDeared Rehech	3	
24	2009/12/17 10 16 26 106 (UTC)	5009FT UWH DI_TIMES TS_DI_ON SEL_16	up_b(391)	S0S Refer	500	
23	2009/12/17 10 16:26 106 (UTC)	5009FT UWI1.EVENT_ALM.ALM_LAT.SEL_370	External Alarm #2	SDS:Refresh	50	
22	2029/12/17 10 13:34 876 (UTC)	5009FT UHI1.DL_TIMES.TS_DL_ON.SEL_17	4p_b(290)	SOS Rehesh	500	
21	2009/12/17 10 13:34 876 (L/TC)	5009FT UWRLEVENT_ALM ALM_LAT SEL_371	External Alam #3	SOS Rehesh	50	
20	2009/12/17 10:10:54.118 (UTC)	5009FT UW1 EVENT_ALM.ALM_LAT.SEL_369	External Aliam #1	SOS Refeats	50	
19	2009/12/17 10:10:54 118 (UTC)	5009FT UWIT.DI_TIMES.TS_DI_ON.SEL_15	up_5(390)	S05:Reliesh	500	
18	2009/12/17 09:37:29:419 (UTC)	5009FT UHRLEVENT_SD.TRIPSD_LAT	All events cleared	S0SAIDexetReleth	1	
17	2009/12/17 09:25:29:872 (UTC)	5009FT UW1.EVENT_SD.TRIPSD_LAT.SEL_419	External Trip #2	SDS Refeat	200	
15	2009/12/17 08:51:36:950 (UTC)	5009FT UWI1.EVENT_SD.TRIPSD_LAT.SEL_400	ESTOP - Emergency Stop #1	SOS Reheith	200	
15	2005/12/17 08:50:01 522 (UTC)	5009FT UWIT.DI_TIMES.TS_DI_ON.SEL_10	up_6(305)	SDS Reheith	500	
14	2009/12/17 08 47 07:329 (UTC)	5009FT Unit EVENT_SD.TRIPSD_LAT.SEL_420	External Trip #3	SDS:Reheub	200	
13	2009/12/17 07:34 07:146 (UTC)	5009FT UWIT.DL_TIMES.TS_DL_ON.SEL_13	40,26300	S05 Refeats	500	
12	2009/12/17 07:34 04:819 (UTC)	5009FT UWH DI_TIMES TS_DI_ON SEL_14	up_t(389)	505 Retents	500	
11	2009/12/17 07:31:35:321 (UTC)	5009FT UWI1 EVENT_ALM.ALM_LAT.SEL_320	Ptop Act Chan #1 Fail Kein A.	SOS Referit	50	
10	2009/12/17 07:31:34:521 (UTC)	5009FT UWITEVENT_ALM.ALM_LAT.SEL_190	AD 82 Chan Fail Kern A	SOS Retresh	50	
3	2009/12/17 07:31:34:521 (UTC)	5009FT UWITEVENT_ALM.ALM_LAT.SEL_105	AD #1 Chan Fail Kein A	SOS Reflecth	50	
8	2009/12/17 07:29:31 298 (UTC)	5009FT UW1 EVENT_SD.TRIPSD_LAT.SEL_418	Control in CALMODE	SOS Refeat	200	
1	1970/01/01 00:00 00 168 (UTC)	5009FT UWI EVENT_ALM ALM_LAT.SEL_381	Integrating ACT1 8 Failed	S05 Retreith	100	
¢ .	1970/01/01 00:00:00 160 (LTC)	5009FT UNIT EVENT_ALM ALM_LAT SEL_304	Integrating ACT2 8 Failed	SDS:Reheah	100	
5	1970/01/01 00:00:00 160 (UTC)	5009FT UWITEVENT_ALM.ALM_LAT.SEL_11	Kem A Module A03 Failed	505 Refeats	100	
4	1970/01/01 00:00:00 160 (UTC)	5009FT UWITEVENT_ALM.ALM_LAT.SEL_1	Kernel A CPU Faulted	SOS Relieth	100	
2	1970/01/01 00:00 00 160 (UTC)	5009FT UWIT EVENT_ALM.ALM_LAT SEL_14	Kern A Module ADS Failed	505 Retexh	100	
2	1970/01/01 00:00:00 160 (UTC)	5009FT UWIT EVENT, ALM ALM, LAT SEL, 300	Integrating ACT1 A Failed	SOS Rebeah	100	
	1970/01/01 00:00:00 160 JUTC)	5009FT UW1 EVENT ALM ALM LAT SEL 12	Kem & Module AD4 Failed	505 Rebeih	100	

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.

89928-121285_G.wtool - Weedward ToolKit				- • 💌
Elle View Device Settings Tools Help				
🗋 🎯 🛃 🐌 📓 🖉 📲 🐘 🔕 💿 DataLog Captures / Set RT Clock	- 🖉 🖉 Conne	ect 👮 Disconnect 🔤		
HOME Datalog C	aptures (10)	ms data)		
	Datal on Block Status			
Start DataLog	Collecting Data			
Otart DataLog	Time Span of Datalog	0		
	In Continuous Media		-	
Stop DataLog Auto Print	S Distance file to March Distance	Start		
File to CP	Phinting File to Hard Drive	Print		
	Error in Configurable File	Stop		
	Configuration File Revision	Print		
NOTE: Whenever the M Re-Started to use the ne	ode, Time Span or Configu www.setting.	ration File is changed the Datalog must b	he Stopped and	
File Capture Mode		Turbine Counters/Ho	ours Data	
		Non-Volatile Memory Info		
This is the default mode that should be active at all times. The when the turbing starts and constantly store data (for the data)	control will start a buffer	Number of Start Attempts	21	
automatically stop logging and create a Datalog file on the CPL	hard drive 20 seconds	Number of Shutdowns	21	
It will store a maximum of 3 of these files on the CPU before it b	egins over-writing them.	Turbine Operation Hours	1.2	
Set F	<u>Real Time Cl</u>	<u>ock</u>		
System Date: 1 /	29 / 2015 System Time (2	4W): 13 : 25		
Time and Date Settings		OF ALL DALK		
Set Month (1 - 12)	6 🚓 🖨 Set Time Com	mand Click to Set Time		
Set Day of Month (1 - 31)	1 🗇 🗢			
Set Year (0 - 99)	10 \ominus 🖨 To set the ti	me, adjust ALL fields correctly, then select the "S	let	
Set Hour (24hr format)	Time Comm	and button.		
Set Minute (0 - 59)	0 0 0			
Connected on TCP/IP 😼 Details				a la

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.

₩ 9928-121285_G.w	rtool - Woodward ToolKit				
Eile View Device	e Settings Icols Help				
i 🗅 💣 🖬 📓	🛛 🗮 • 🚟 - 📄 🔇 🛇 General	Page1 - Home Page •	😴 Connect 👷 Disconnect 📗		
		50	09FT	WOODWARD	
		Fault Tolerant S	team Turbine Control		
Launch	h External Programs				
	Appmanager	Turbin	le Run	ToolKit File P/N = 9928-1212RS Rev G Build Number = 1	
c	Control Assistant	Turbine	Service		
	On-Screen Keyboard				
Core P/N					
5050072 Gap		Control Information			
Coder Used		Control Identifier			
Operation	Service	Limited Configuration	Full Configuration	t Authorized	
Network Device		Tool Devices	Application M	Status	
5009FT Unit1-10.4.1	128.128	Devicel	 \$418-3416_J 2015-01-08 11.24.18 	Reconnecting	
					,
		🔀 Disconnect	🐠 Log In 🔰 Log Out 🔰 Save Values		
Reconnecting on TCI	P/IP 😴 Details				

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.

😝 АррМа	inager -	Woodw	ard Con	trol /	Application Manage	r				
<u>A</u> dminister	Control	Datalog	Options	Help)					
Control Na	ame	IP Addr	ess	^	Application Name	Size		Date	Status	\$
+5009FT L	Jnit1				5418-3416_a.out	13287286	2009/12/22	10:15:18	Inactive	
-VXM000	109966	10.14.1	42.241		5418-3416_new.out	12369345	2009/09/27	09:23:16	Stopped	Ø+
-VXM000	J10096	10.14.1	42.242							đ +
-VXM000	J10097	10.14.1	42.243							-
ATLAS2_	_SVU1	10.14.1	40.205							1
ATLAS2_	_SVU2	10.14.1	40.206							-
ATLAS2_	_SVU3	10.14.1	40.207							
ATLAS2_	_SVU4	10.14.1	40.208							Č (
ATLAS2_	_SVU5	10.14.1	40.209							_
DIO_CPL	ΥĽ	10.14.1	41.148							
DIO_CPL	J_R	10.14.1	41.149							
DLB_SIM	11	10.14.1	40.38							-
DPETER	26	10.14.1	40.26							• <u>•</u> }
DUG+WI	м	10.14.1	40.30							
+DugsTMF	3				1					8
- DPETER	327	10.14.1	40.27							
DPETER	328	10.14.1	40.28		Error in ReadValidateEE	FileHeading (In	valid Applicatio	nName or C	oderDate ㅅ	
+EMC_SE	TUP				Initializing EE: Creating	new save-file: 5	418-3416_A.ee	- 2009/12/	22 10:11	
-VXM_EN	MC_R	10.14.1	40.219		Initializing Chassis 1 Mo	dules • 2009/*	12/22 10:17:15	5	_	
FFT_TMF	3_A	10.14.1	41.153		Application is running - 2	2009/12/22 10	:17:23			
FFT_TMF	3_В	10.14.1	41.154		Application 5418-3416_	a.out is set to A	utoStart.		=	
FFT_TMF	R_DAUX	10.14.1	41.144		System Message - TMR	KernelABC faile	ed (ALL), ID=60	/5 - 2009/12	2/22 10:!	
GERIG_1	1	10.14.1	42.11						×	
GERIG_2	2	10.14.1	42.12	~	<				>	
Connected	to "VXMO	0009966"			Datalog file retrieval tas	sk inactive		COM St	atus 🔍 🔍	

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.

<mark>₩ 9928-1212_500</mark> 9F	6 9928-1212_5009FT.wtool - Woodward ToolKit									
File View Device	Setting	s Tools Help								
i 🗅 📄 📙 🗞 📓	D N	New from SID Specification Defaults								
	终 s	ave from Device to File								
	📝 E	dit Settings File								
	۵ 🍣	pad Settings File to Device								
	🚱 Р	ssociate Settings File with Application								
	s 🔊	ompare Settings File Differences								
Launch E	R R	Replace the Settings in an Application File								
	1	C:\Documents and Settings\User\Desktop\5009FT_100.wset								

Figure 6-3. Save Settings to File

The following dialog box should appear:

Save Settings from Device to File	
Settings File Selection	
Select or create the settings file to save the settings to.	
Click 'Browse' to select or create the file	
	Browse
Set selected directory as default directory	
	<u>C</u> ancel <u>N</u> ext >

Figure 6-4. Save Settings Folder

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".

Save As							? 🗙
Savejn:	🗀 ToolKit		~	0	ø	• 🖭 👏	
My Recent Documents Desktop My Documents	1-G-0-CHL 1-G-0-CHL-GSE/ 1-G-C-CHL 1-G-C-CHL 1-G-R-CHL 1-G-R-CHL 1-M-0-CHL 1-M-C-CHL 2-G-0-CHL 2-G-0-CHL 2-G-ACTRL-CHL 2-G-C-CHL 2-G-C-CHL 2-G-C-CHL 2-G-C-CHL 2-G-C-CHL 2-G-C-CHL 2-G-C-CHL 2-G-C-CHL 2-M-0-CHL 2-M-0-CHL 2-M-0-CHL 2-M-0-CHL	2-M-ALIM-CHL 2-M-C-CHL 2-M-R-CHL current_1-15-10					
	File <u>n</u> ame:	mysettings				*	<u>S</u> ave
My Network	Save as <u>t</u> ype:	Device Settings (*.wset)				*	Cancel

Figure 6-5. Settings File Name

Manual 26518V3

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.

Save Settings from Device to File	
Settings File Selection	
Select or create the settings file to save the settings to.	
Click 'Browse' to select or create the file.	
C:\Woodward\5009FT_Project\ToolKit\mysettings.wset	Browse
✓ Set selected directory as default directory	

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.

Save Settings from Device to File					
Select Device					
Select the device to work with and press Next.					
	Device	Status			
	5009FT Unit1-192.168.128.22	Connected			
					_
				Cancel <u>N</u> ext>	
					i

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

Save Settings from Device to File			
Settings File Notes Enter optional notes for this settings file and press Next.			
Settings file notes:			
Settings file save on 1/15/10.			
	Cancel Next >		

Figure 6-9. Notes for settings file







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.



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:

Load Settings File to Device	
Settings File Selection	
Select the settings file to load.	
Click 'Browse' to select the file.	
	Browse
Set selected directory as default directory	
	<u>C</u> ancel <u>N</u> ext≻



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.

Load Settings File to Device	
Settings File Selection	
Click 'Browse' to select the file.	
C:\Woodward\5009FT_Project\ToolKit\mysettings.wset	Browse
Set selected directory as default directory	
	<u>C</u> ancel <u>N</u> ext >

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.

Load Settings File to Device					
Se	Select Device				
Select the device to work with and press Next.					
	Device	Status			
	5009FT Unit1-192.168.128.22	Connected			

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.





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.

Load Settings File to Device	
Loading Settings	
Please wait	
Settings File: C/W/oddward/5009ET_Project/ToolK/i/\musettings.uset	
Loading Settings]
Processing 3044 of 6070 settings.	
	<u>C</u> ancel <u>N</u> ext≻

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.

Load Settings File to Device	
Finished	
Device settings loaded successfully.	
	<u>Close</u>

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.

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

Table 7-1. Trips (10	ms Scan Time)
----------------------	---------------

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
EV/ENT078	
LVENIO/O	AI #11 Chan Diff between Kernels

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

	AL #00 lane at Circular Englisher
EVENT124	
EVENT125	AI #21 Chan Fall Kern A Mod A05
EVENT126	AI #21 Chan Fail Kern B Mod A05
EVENT127	Al #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	Al #27 Input Signal Failure
EVENT160	Al #28 Chan Fail Kern A Mod A05
EVENT161	Al #28 Chan Fail Kern B Mod A05
EVENT162	Al #28 Chan Fail Kern C Mod A05
EVENT163	Al #28 Chan Diff between Kernels
EVENT164	Al #28 Input Signal Failure
EVENT165	Al #29 Chan Fail Kern A Mod A05
EVENT166	Al #29 Chan Fail Kern B Mod A05
EVENT167	Al #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
EVEN1288	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
	DI #18 Chan Fail Kern A
	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

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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—Anlq 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

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).

Woodward

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.

	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.

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)

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	. ASUII V	/S. KIU	INIOUDUS

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

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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

CODE	DEFINITION	REFERENCE ADDRESS
01	Read Digital Outputs	0XXXX
	(Raise/Lower and Enable/Disable Commands)	
02	Read Digital Inputs	1XXXX
	(Status Indications / Alarms and Trips)	
03	Read Analog Outputs	4XXXX
04	Read Analog Inputs	3XXXX
	(Speed, Setpt, etc.)	
5	Write Single Discrete Output	0XXXX
	(Raise/Lower and Enable/Disable Commands)	
6	Write Single Register	4XXXX
	(Enter Setpt Directly)	
8	Loopback Diagnostic Test	N/A
	(supports subfunction 0 only)	
5	Write Digital Outputs	0XXXX
16	Write Analog Outputs	4XXXX

Table 8-2	2. Modbus	Function	Codes
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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).

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.

Table 8-3. Modbus Slave Error Codes

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.

В	oolean Writes (RPTbw)]
Addr	Description	1
0.0001	Modbus Shutdowns	0.012
0.0001	Modbus Shutdowns	0.012
0:0002	acknowledge	0:012
0:0003	Normal SD	0:012
0:0004	Quit normal SD	0:012
0:0005	Start permissive	0:012
0:0006	RESET	0:012
0:0007	START	0:012
0:0008	HP ramp limiter UP	0:012
0:0009	HP ramp limiter down	0:012
0:0010	Lower speed	0:013
0:0011	Raise speed	0:013
0:0012	Halt sequence	0:013
0:0013	Continue autostart	0:013
0:0014	Remote speed enable	0:013
0:0015	Remote speed disable	0:013
0:0016	reset max speed	0:013
0:0017	External overspeed test	0:013
0:0018	Internal Overspeed request	0:013

Table 8-5. Boolean Writes

0:0121	Raise D1
0:0122	Lower DB
0:0123	Raise DB
0:0124	Lower Droop
0:0125	Raise Droop
0:0126	Fast action for PID adjust
0:0127	Extraction SP track
0:0128	Extraction SP no track
0:0129	Update EEPROM
0:0130	Request calibration
0:0131	Quit calibration
0:0132	Start calibration procedure
0:0133	Valve At min
0:0134	Valve at max
0:0135	Stroke completed
0:0136	Raise manual actuator stroke
0:0137	Lower manual actuator stroke
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		
0.002+		
0.0025	Cascade disable	
0.0026	Cascade lower SP	
0.0020		
0.0027	Enable remote cascade	
0.0020	Disable remote cascade	
0.0029		
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	
0:00 <u>5</u> 1	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)		
0.0	Frequency control Disarm		
0.0145	(Dicabla)		
0.0146	(Disable)		
0.0140	Spare		
0:0147			
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		
0:0157	Temporary activate relay#10		
0.0156			
0:0159	Temporary activate relay#12		
	Binary signal Xfer through		
0:0160	Modbus		
	Binary signal Xfer through		
0:0161	Modbus		
	Binary signal Xfer through		
0:0162	Modbus		
	Binary signal Xfer through		
0:0163	Modbus		
0.0.00	Binary signal Xfer through		
0.0164	Modbus		
0.0104	Binary signal Xfer through		
0.0165	Modbus		
0.0105	Binary signal Xfer through		
0.0166	Modbuo		
0.0100	Nioubus		
0.0407	Binary signal Xter through		
0:0167	Modbus		
	Binary signal Xfer through		
0:0168	Modbus		
	Binary signal Xfer through		
0:0169	Modbus		
	Binary signal Xfer through		
0:0170	Modbus		
	Binary signal Xfer through		
0:0171	Modbus		
0.0.1.1	Binary signal Xfer through		
0.0172	Modbus		
0.0172	Pipery signal Vfor through		
0.0170			
0:0173			
0.04-1	Binary signal Xter through		
0:0174	Modbus		
	Binary signal Xfer through		
0:0175	Modbus		
	Binary signal Xfer through		
0:0176	Modbus		
	Binary signal Xfer through		
0:0177	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
0.0000	Lower Extraction Demand (vlv
0.0060	out)
0.0000	Baise Extraction Demand (v/v
0:0070	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
0.0000	Lower deriv Gain off-line
0.0001	Raise deriv Gain off-line
0.0002	Lower deriv Gain on-line
0.0000	Raise deriv Gain on-line
0.0004	Lower Deadband online
0.0000	Reice Deadband online
0.0000	fact action for DID adjust
0.0007	
0.0000	
0:0089	
0:0090	
0:0091	
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

	Binary signal Xfer through
0:0178	Modbus
	Binary signal Xfer through
0:0179	Modbus
	Binary signal Xfer through
0:0180	Modbus
	Binary signal Xfer through
0:0181	Modbus
	Binary signal Xfer through
0:0182	Modbus
	Binary signal Xfer through
0:0183	Modbus
	Binary signal Xfer through
0:0184	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 VIv Dmd
0:0207	Disable Manual VIv 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	T1AUX1.A02_ST.B_NAME	AUX in Manual	
1:0005	T1AUX1.A01_ST.B_NAME	AUX Control Limiting	
1:0006	T1CASC.CASC_RSPAC.B_NAME	Remote Cascade SP enabled	
1:0007	T1CASC.Z02_ST.B_NAME	Remote Speed / CASC Enabled	
1:0008	T1CASC.CAS_ENBLD.B_NAME	Cascade is Enabled	
1:0009	T1CASC.Z00_ST.B_NAME	Cascade is Disabled	
1:0010	T1CASC.RSPD_ENBLD.B_NAME	Remote Speed Enabled	
1:0011	T1CASC.RSPD_ACTV.B_NAME	Remote Speed Active	
1:0012	T1CASC.LDSH_ENBLD.B_NAME	load sharing enabled	
1:0013	T1AUX1.AUX_ENA.NOT	AUX is Enabled	
1:0014	T1CASC.CASC_OVLSS.B_NAME	LSS Cascade Override active	
1:0015	T1CASC.CASC_OVHSS.B_NAME	HSS Cascade Override active	
1:0016	T1CASC.CASC_EMER.B_NAME	Emergency activated	
1:0017	T1CASC.CASC_ACTV.B_NAME	Cascade In-Control Active	
1:0018	T1CASC.B03_ST.B_NAME	CASC/ Load Sharing	
1:0019	T1CASC.B02_ST.B_NAME	Swing mode selected	
1:0020	T1CASC.B01_ST.B_NAME	Droop mode selected	
1:0021	T1CASC.B00_ST.B_NAME	Remote speed active	
1:0022	T1CASC.EMRG_CTRL.B_NAME	Emergency in control	
1:0023	T1CEALM09.B_NAME	Aux in control/ No speed Raise	
1:0024	T1CEALM01.B_NAME	Underspeed alarm	
1:0025	T1CEALM03.B_NAME	Stuck in critical Band	
1:0026	T1CETRIP09.B_NAME	SD for rotor stuck	
1:0027	T1CEALM05.B_NAME	Configuration Error while running	
1:0028	T1CEALM06.B_NAME	Cascade Override Activated	
1:0029	T1CETRIP02.B_NAME	Overspeed	
1:0030	T1CETRIP10.B_NAME	Speed lost or fail to start	
1:0031	T1CETRIP11.B_NAME	Boot up	
1:0032	T1CETRIP12.B_NAME	Configuration Error&starting	
1:0033	T1CETRIP13.B_NAME	Spare	
1:0034	T1CETRIP14.B_NAME	Spare	
1:0035	T1CETRIP15.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	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	T1CEALM16.B_NAME	Spare
1:0049	T1CEALM15.B_NAME	Spare
1:0050	T1CEALM14.B_NAME	Spare
1:0051	T1CEALM13.B_NAME	Spare
1:0052	T1CEALM12.B_NAME	Spare
1:0053	T1CEALM11.B_NAME	Spare
1:0054	T1CEALM10.B_NAME	Spare
1:0055	T1CEALM02.B_NAME	Speed control lost
1:0056	T1CETRIP04.B_NAME	Predictive Overspeed SD
1:0057	T1CEALM04.B_NAME	Rotor stuck
1:0058	T1DCPL.TRACK_ST.B_NAME	DCPL/ Setpoint tracking
1:0059	T1EXTC.EXTC_NOCON.B_NAME	Extraction NOT Configured
1:0060	T1EXTC.A00_ST.B_NAME	Extraction Control is Disabled
1:0061	Spare	Spare
1:0062	T1EXTC.Z01_ST.B_NAME	EXT Control Ramp LP
1:0063	11_EXIC.TRACK_ST.B_NAME	EXT Control Setpoint is tracking
1:0064		Extraction Control Enabled
1:0065	11_EXIC.EXIC_ACTIV.B_NAME	Extraction Control Active
1:0066	T1EXTC.B04_ST.B_NAME	EXT/RemSP Decoupling
1:0067	T1_EXTC.AU2_ST.B_NAME	Extraction in Manual
1:0060	T1_EXTC.D02_ST.D_NAME	EXT Decoupling in Manual
1.0009	T1_EXTC.00A_ST_B_NAME	Extraction Auto enabling
1.0070	T1_EXTCA01_STB_NAME	Extraction Manual Enabling
1.0071	T1_EXTCA05_ST_B_NAME	Extraction is Disabling
1:0072	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 A028 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_FWFW_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	T1MAPHPMIN_LMT.B_NAME	HP Min Limited
1:0083	T1MAPLPMAX_LMT.B_NAME	LP Max Limited
1:0084	T1MAPLPMIN_LMT.B_NAME	LP MIN Limited
1:0085	T1MAPMAP_LIMITD.B_NAME	STEAMMAP LIMIT ACTIVE
1:0086	T1MAPDECOUP_ACT.B_NAME	DECOUPLING ACTIVE
1:0087	T1MAPMAX_S_LMT.B_NAME	Max S Limited
1:0088	T1MAPMIN_P_LMT.B_NAME	MinP limited
1:0089	T1MAPK_ILLEGAL.B_NAME	Error K-VALUES
1:0090	T1MAPMN_FLW_LMT.B_NAME	MIn Flow Limited
1:0091	T1MAPRECOUP_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
1.0007	T1 SPDC OVERRIDE B NAME	Override speed fault
1.0000	T1 SPDC SRT ENBL B NAME	Speed Response Test enabled
1.0000	T1 SPDC NOT COMPLET B NAME	Startup not completed
1.0100	T1 SPDC 700 ST B NAME	Shutdown Step
1.0102	T1 SPDC A10 ST B NAME	Abort overspeed Step
1.0102	T1 SPDC A07 ST B NAME	Startup to Rated Step
1.0103	T1 SPDC A09 ST B NAME	Test oversneed Step
1.0105	T1 SPDC AUTO SEL B NAME	Automatic start selected
1.0105	T1 SPDC NSDCPLTE B NAME	Normal SD completed
1.0107		Engine started (running)
1.0107	T1_SPDC.WARN SCHED B NAME	Warning/of schedule
1.0100	T1_SPDC.701_ST_B_NAME	Normal SD Step
1.0109	T1_SPDC.201_ST.B_NAME	At auto lovel 2
1.0110	T1_SPDC.A05_ST_B_NAME	Startup to auto level 3 Step
1.0111		
1.0112	T1_SPDC.A02_ST_B_NAME	Startup to auto lovel 2 Stop
1.0113	T1 SPDC Δ02 ST R NAME	At idle 1 Sten
1.0114	T1_SPDC_A02AST_B_NAME	Manual Sten
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 Sten
1.0119	T1 SPDC A08 ST B NAME	Startup completed
1.0120	T1 SPDC START ACT B NAME	Turbine Started
1.0120	T1 VIV HPSTRTVIENB NAME	Startup valve enabled
1:0122	T1 VIV 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	T2AUX1.LOWER_DMD.B_NAME	Lower Demand
1:0127	T2AUX1.SENSOR_FLT.B_NAME	fault detected
1:0128	T2AUX1.QUIT_AUX1.B_NAME	Quit AUX1 request
1:0129	T2AUX1.RAISE_SP.B_NAME	Raise SP
1:0130	T2AUX1.RQ_AUTO.B_NAME	AUX1 auto request
1:0131	T2AUX1.RQ_MAN.B_NAME	AUX1 manual request
1:0132	T2AUX1.LOWER_SP.B_NAME	Lower SP
1:0133	T2CASC.LDSH_DIS.B_NAME	LD share disable
1:0134	T2CASC.CASC_DIS.B_NAME	Cascade mode is disabled
1:0135	T2CASC.CASC_IH.B_NAME	Cascade Inhibited
1:0136	T2CASC.GOTO_CAS.B_NAME	Enable cascade
1:0137	T2CASC.GOTO_LDSH.B_NAME	Go to load share command/remote
1:0138	T2CASC.GOTO_REM.B_NAME	Go to remote speed
1:0139	T2CASC.GOT_DCAS.B_NAME	Disable cascade
1:0140	T2CASC.DIS_RCAS.B_NAME	Remote Cascade disable
1:0141	12_CASC.LOWER_SP.B_NAME	Lower SP
1:0142	12_CASC.OTHER_SD.B_NAME	Other Unit SD
1:0143	12_CASC.UTHER_SW.B_NAME	Other Unit swing or LDSH
1:0144	12_UASU.PROUESS_FL.B_NAME	
1:0145		Quit Remote cascade
1:0146		Quit remote speed
1:0147		Raise SP Demote encod dischie
1.0148		Remote Cascado Enchia
1.0149		

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 CE ERR B NAME	External Configuration Error
1:0154	T2		Go to commands inhibited
1:0155	T2	CE RESET ALMB 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		Shutdown command
1:0159	T2	CE .CONFIG SELB NAME	In configure mode
1:0160	T2		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.SQDCRS.B_NAME	Raise DCPL SP
1:0167	T2_	_DCPL.SQDCLS.B_NAME	Lower DCPL SP
1:0168	T2_	_DCPL.SQADCL.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
1:01/8	12_	_EXIC.RQ_REM.B_NAME	Remote extraction request
1:01/9	12_		Extraction disable
1:0180	12_		Extraction auto disable BUS
1:0181	12_ T2		Disable Remote E/A Manual demand
1.0102	12_ T2	EXTOREM DIS.D NAME	Extraction requested
1.0184	T2_	EXTC RO RMAN B NAME	EXtraction requested
1.0185	T2	EXTCLOWER DMD B NAME	Lower extraction demand (valve output)
1:0186	T2	EXTCLOWER SP B NAME	Lower extraction setpoint
1:0187	T2	EXTC.QUIT REM.B NAME	Extraction guit 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_		Extraction/Admission SEMI-AUTO
1:0191	T2_	_EXTC.EXTR_FLT.B_NAME	Extraction fault
1:0192	T2_	_FWFWQUIT.B_NAME	Quit FW
1:0193	T2_	_FWAI_FLT.B_NAME	Disable Bus from HWR
1:0194	T2_	_FWFWCMD.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	12_	_SPDC.QUII_NSD.B_NAME	Quit NSD request command
1:0204	12_	_SPDC.SPD_GOTO.B_NAME	Go To speed Target
1:0205	12_		Permissive for NSD < min gov
1:0206	12	SPUC.SKI STAKI.B NAME	START SKI IESI

1:0207	T2 SPDC.HOT SELTED.B NAME	HOT curve selection command
1.0208	T2SPDC HALT B_NAME	Halt sequence command
1.0209	T2SPDC_FRC_LOWER_B_NAME	Lower speed forced
1.0210	T2SPDC_ENBL_OSPD_B_NAME	Overspeed test request command
1.0211	T2 SPDC ENBL NSD B NAME	Normal SD request command
1.0212	T2SPDC_EMER_MNGOV_B_NAME	Emergency min gov Request
1:0213	T2SPDC CONTINUE BNAME	Continue sequence command
1.0214	T2COLD_SELTD_B_NAME	COLD curve selection command
1:0215	T2 SPDC.OVER BLB 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_CENON_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	12C_DCPL.USE_RDCP.B_NAME	Use Remote Decoupling
1:0246		SP Track
1:0247	12C_EXTC.CONFSMPR.B_NAME	Semiautomatic/Remote Only
1:0248		Semiautomatic First from Decoupling
1:0249		Reverse Action select
1:0250		Use Remote Extraction
1:0251		Semiautomatic First at Enable
1:0252		Extraction SP Track when Disabled
1:0253		Use Remote man Extraction
1.0254		Extraction Drocours Control Duraceed
1.0200		
1.0200		
1.0207		Inhibited if no cascado?
1.0200		
1.0259	T2C MAP P MX PRIOB NAME	SPEED
1.0260	T2C MAP S MX PRIOB 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

		Priority If HP at MAX. TRUE MEANS
1:0262	T2C_MAPHP_MX_PRIO.B_NAME	SPEE
		Priority If LP at MAX. TRUE MEANS
1:0263	T2C_MAPLP_MX_PRIO.B_NAME	SPEE
1:0264	T2C_MAPENB_MINFLW.B_NAME	ENABLE MIN FLOW LIMITER
		Priority If HP at MIN. TRUE MEANS
1:0265	T2C_MAPHP_MN_PRIO.B_NAME	SPEE
		Priority If LP at MIN. TRUE MEANS
1:0266	T2C_MAPLP_MN_PRIO.B_NAME	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?
1:02/3	12C_SPDC.LOSS_SD.B_NAME	SD if control lost?
1:0274	12C_SPDC.SD_STUCK.B_NAME	SD if stuck?
1:0275	12C_SPDC.NSD_PERM.B_NAME	Use NSD permissive< min gov
1:0276	12C_SPDC.NSD_NO_SD.B_NAME	No SD at the end
1:0277	12C_SPDC.NSD_IDLE.B_NAME	NSD to low idle only?
1:0278	12C_SPDC.LOWER_CR_E.B_NAME	Enable speed lower in critical?
1:0279	12C_SPDC.UNDER_ENBL.B_NAME	Use underspeed?
1:0280		Startup level 2 active
1:0281	12C_SPDC.CR_IS_MIN.B_NAME	Min speed is High critical?
1:0282		Use Online/Offline PID Switch
1:0283	12C_SPDC.FRC_UNLD.B_NAME	Force Unioad If stuck?
1:0284		
1:0285	T2C_SPDC.IDLE_PRIOR.B_NAME	Spare
1:0286		Curve selected via analog value
1.0207	T2C_SPDC.LEVELSE.D_INAME	Startup level 3 active
1.0200	T2C_SPDC.DT_FASS_OV.B_NAME	Critical range 1 active
1.0209	T2C_SPDC.CRITIE.B_NAME	Critical speed 1 rate fixed?
1.0290	T2C_SPDC.CRIT2E B_NAME	Critical range 2 active
1.0231	T2C_SPDC_CRIT3E_B_NAME	Critical range 3 active
1.0202	T2C SPDC IDLE HOLD B NAME	Hold speed at idle
1.0200	T2C_VIV_HP_STR_VIV_B_NAME	Lise valve demand for yfer
1.0204		Use V1 INI?
1:0296	T2C_VLV_SD_IESTLICK B_NAME	SD if stuck
1:0297	T2 SPDC ON INFDYN 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	CNEG DI14 DI14 VAL B NAME	DI 14 Status

1:0315	CNEG DI15.DI15 VAL.B NAME	DI 15 Status
1:0316	CNFG DI16.DI16 VAL.B NAME	DI 16 Status
1:0317	CNEG DI17 DI17 VAL B NAME	DI 17 Status
1:0318	CNEG 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	CNEC DO 11 USE AS LS D NAME	Relay #10 Used as Level Switch
1.0340	CNEG BO 12USE AS LS B NAME	Relay #17 Used as Level Switch
1.0347	CHASS CNEG USE MODOS B NAME	True – Module A5 Included
1.0340	CHASS_CNEG LISE_MOD06.B_NAME	True - Module A6 Included
1:0350		True = Calibration Mode Permitted
1:0351		True = Unit in Calibration Mode
1:0352	CALMODE.ENA MODERC.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 VIv 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	T2EXTC.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 Falled
1:0419	ALM_MASTR.EVENT019.B_ALARM	Kern C Module A03 Failed
1:0420	ALM MASTR EVENTO20.D_ALARM	Kern C Module A04 Failed
1.0421	ALM MASTR EVENTO22 B ALARM	Medbue2 Block Link 1 Error
1.0422	ALM MASTR EVENTO22.B ALARM	Modbus2 Block Link 1 Ellol
1.0423	ALM MASTR EVENTO23.B_ALARM	Redundant DLESTOR Alarm
1.0424	ALM_MASTR EVENT024.B_ALARM	Al #01 Chan Fail Kern A Mod A03
1.0425		AI #01 Chan Fail Kern B Mod A03
1.0420	ALM MASTR EVENTO20.B_ALARM	Al #01 Chan Fail Kern C Mod A03
1.0428	ALM MASTR EVENT028 B ALARM	Al #01 Chan Diff between Kernels
1.0429	ALM MASTR EVENT029 B ALARM	Al #01 Input Signal Failure
1:0430	ALM_MASTR.EVENT030 B_ALARM	Al #02 Chan Fail Kern A Mod A03
1:0431	ALM MASTR EVENT031 B ALARM	Al #02 Chan Fail Kern B Mod A03
1:0432	ALM MASTR EVENT032 B ALARM	Al #02 Chan Fail Kern C Mod A03
1:0433	ALM_MASTR EVENT033 B_ALARM	Al #02 Chan Diff between Kernels
1:0434	ALM_MASTR EVENT034 B_ALARM	Al #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.EVEN1067.B_ALARM	Al #09 Chan Fail Kern C Mod A03
1:0468	ALM_MASTR.EVENT068.B_ALARM	Al #09 Chan Diff between Kernels
1:0469	ALM_MASTR.EVEN1069.B_ALARM	Al #09 Input Signal Failure
1:0470	ALM_MASTR.EVENT070.B_ALARM	AI #10 Chan Fail Kern A Mod A03
1:04/1	ALM_MASTR.EVENT071.B_ALARM	AI #10 Chan Fail Kern B Mod A03
1:0472	ALM_MASTR.EVENT072.B_ALARM	Al #10 Chan Fall Kern C Mod A03
1:0473	ALM_MASTREVENTU73.B_ALARM	Al #10 Chan Dill between Kernels
1.0474		Al #10 Input Signal Failure
1:0475		AL#11 Chan Fall Kern R Mod A03
1.0470		Al #11 Chan Fail Kern C Mod A03
1.0477		Al #11 Chan Diff between Kernels
1.0470	ALM_MASTREVENTO70.B_ALARM	Al #11 Input Signal Failure
1.0473	ALM_MASTREVENTORS B ALARM	Al #12 Chan Fail Kern A Mod A03
1.0400	ALM_MASTR EVENTO81 B_ALARM	AI #12 Chan Fail Kern B Mod A03
1.0482	ALM MASTR EVENT082 B ALARM	Al #12 Chan Fail Kern C Mod A03
1:0483	ALM MASTR EVENT083 B ALARM	Al #12 Chan Diff between Kernels
1:0484	ALM MASTR.EVENT084.B ALARM	Al #12 Input Signal Failure
1:0485	ALM MASTR.EVENT085.B ALARM	Al #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	Al #20 Input Signal Failure
1:0525	ALM_MASTR.EVENT125.B_ALARM	Al #21 Chan Fail Kern A Mod A05
1:0526	ALM_MASTR.EVENT126.B_ALARM	Al #21 Chan Fail Kern B Mod A05
1:0527	ALM_MASTR.EVENT127.B_ALARM	Al #21 Chan Fail Kern C Mod A05
1:0528	ALM_MASTR.EVENT128.B_ALARM	Al #21 Chan Diff between Kernels
1:0529	ALM_MASTR.EVENT129.B_ALARM	Al #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 Fall Kern B Mod A05
1.0532		AI #22 Chan Fall Kelli C Mou A05
1.0533	ALM MASTREVENTISS.D_ALARM	AI #22 Chan Dill between Kennels
1.0534	ALM_MASTREVENTISER ALARM	AI #22 Input Signal Failure
1:0536	ALM_MASTREVENTISS.D_ALARM	AI #23 Chan Fail Kern B Mod A05
1:0537	ALM_MASTREVENTI37.B ALARM	Al #23 Chan Fail Kern C Mod A05
1:0538	ALM_MASTREVENTI38.B ALARM	Al #23 Chan Diff between Kernels
1:0539	ALM_MASTR EVENT139 B ALARM	Al #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	Al #24 Chan Fail Kern B Mod A05
1:0542	ALM MASTR.EVENT142.B ALARM	Al #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
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1:0560		AI #28 Chan Fail Kern A Mod A05
1:0561		Al #28 Chan Fail Kern B Mod A05
1.0501		AI #28 Chan Fail Kern C Mod A05
1.0502		Al #20 Chan Pitt between Kernele
1:0563		Al #28 Chan Diff between Kernels
1:0564	ALM_MASTR.EVENT164.B_ALARM	AI #28 Input Signal Failure
1:0565	ALM_MASTR.EVEN1165.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	Al #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	Al #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		AO #7 Viol and Detected
1.0010		AO #7 Chan Fail All Kornola
1.0019		AO #7 Chan Fail Korn A
1.0020		AO #0 Chan Fail Kern R
1.0021		AO #0 Chan Fail Kern C
1.0022		AO #0 Chail Fall Kell C
1:0624		AO #8 Chan Eail All Karnala
1:0625		AO #0 Chan Fail Air Kern A
1.0020		AO #9 Chan Fail Kern R
1.0020		AO #9 Chan Fail Kern C
1:0628	ALM_MASTR EVENT228 B ALARM	
1:0620	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	AQ #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.EVEN1253.B_ALARM	DI #3 Chan Fail Kern C
1:0654	ALM_MASTR.EVEN1254.B_ALARM	DI #4 Chan Fail Kern A
1:0655	ALM_MASTR.EVEN1255.B_ALARM	DI #4 Chan Fail Kern B
1:0656	ALM_MASTR.EVENT256.B_ALARM	DI #4 Chan Fail Kern C
1:0657		DI #5 Chan Fall Kern A
1.0050		DI #5 Chan Fail Kern C
1.0650		DI #3 Uldii Fall Kelli U DI #6 Chan Fail Korn A
1.0000		DI #0 Olidii Fall Kelli A DI #6 Chan Fail Korn P
1.0001		DI #6 Chan Fail Kern C
1.0002	ALM MASTR EVENT262 R ALARM	DI #7 Chan Fail Kern Δ
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		DI #11 Chan Fail Kern A
1.0075		DI #11 Chan Fail Kern R
1.0070		
1:0677		DI #11 Chan Fall Kern C
1:0678	ALM_MASTR.EVEN1278.B_ALARM	DI #12 Chan Fail Kern A
1:0679	ALM_MASTR.EVEN1279.B_ALARM	DI #12 Chan Fail Kern B
1:0680	ALM_MASTR.EVEN1280.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 EVENTS17 B ALARM	Speed Signal #1 Difference ALM
1:0718		Speed Signal #2 Difference ALM
1.0710	ALM MASTR EVENTS10.B ALARM	Speed Signal #2 Difference ALM
1.0719	ALM MASTR EVENTSON & ALADM	Share
1.0720	ALM MASTR EVENTS20.0_ALANM	Spare
1.0721		Share
1.0722		Spare
1.0723		Spare
1.0724		Spare
1.0726		Spara
1.0727		Spare
1.0720		Spare
1.0720		Spare
1.0729	ALIVI IVIASTK.EVENTJ29.8 ALAKIVI	Spare

1.0730	ALM MASTR EVENT330 B ALARM	Spare	
1.0731	ALM MASTR EVENT331 B ALARM	Spare	
1.0732		Speed Chan #1 Eail Kern A	
1.0732	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.EVEN1370.B_ALARM	External Alarm #2	
1:0/71	ALM_MASTR.EVEN13/1.B_ALARM	External Alarm #3	
1:0772		External Alarm #4	
1:0773		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	
1.0770		External Alarm #10	
1.0770		External Additi #10 Kernel Fault/CPU Veting Error	
1.07790		Integrating ACT1 A Eailed	
1.0700		Integrating ACT1 R Failed	
1.0701			
1.0702	ALM_MASTR EVENTSO2.D_ALARM	Integrating ACT2 A Failed	
1.0784	ALM MASTR EVENT384 B ALARM	Integrating ACT2 R Failed	
1.0785	ALM MASTR EVENT385 B ALARM	Overspeed Alarm Level	
1:0786	ALM_MASTR.EVENT386.B_ALARM	Spare CORE AI M11	

	ALM MASTR EVENT387 B ALARM	Spare CORE ALM12	
1.0788		Spare CORE ALM12	
1.0780		Spare CORE ALM13	
1.0709		Spare CORE ALM15	
1.0790		Spare CORE ALMIS	
1.0791		Overepand Test Made Active	
1.0792			
1.0793			
1.0794			
1.0795			
1.0790			
1.0797			
1.0790			
1.0799		ESTOD Emorgonov Stop #1	
1.0000		ESTOP - Emergency Stop #1	
1.0001		Max Overspeed Trip SD	
1.0002		Dradiative Overspeed Reactied	
1:0803		Predictive Overspeed SD	
1:0804		Normal SD Completed	
1:0805		Chaerspeed Shutdown	
1.0000		Speed Control Lost	
1.0007		Stuck in Childal Speed Band	
1.0000		Rolor Sluck SD Speed Sig Lest / Fail to Start	
1.0009		Configuration Error (COPE)	
1.0010		Extraction Sonsor Fault	
1.0011		Spare CORE SD14	
1.0012	ALM MASTR EVENT413 B ALARM	Spare CORE SD14	
1.0013	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	
1.0021		External Trip #4	
1:0822	ALM_MASTR.EVENT422.B_ALARM	External Trip #4 External Trip #5	
1:0822	ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM	External Trip #4 External Trip #5 External Trip #6	
1:0822 1:0823 1:0824	ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7	
1:0822 1:0823 1:0824 1:0825	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8	
1:0822 1:0823 1:0824 1:0825 1:0826	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9	
1:0822 1:0822 1:0823 1:0824 1:0825 1:0826 1:0827	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT427.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10	
1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT427.B_ALARM ALM_MASTR.EVENT428.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare	
1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT427.B_ALARM ALM_MASTR.EVENT428.B_ALARM ALM_MASTR.EVENT429.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare Spare	
1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829 1:0830	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT427.B_ALARM ALM_MASTR.EVENT428.B_ALARM ALM_MASTR.EVENT429.B_ALARM ALM_MASTR.EVENT430.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare Spare Integrating ACT1 A&B Failed	
1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829 1:0830 1:0831	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT427.B_ALARM ALM_MASTR.EVENT429.B_ALARM ALM_MASTR.EVENT430.B_ALARM ALM_MASTR.EVENT431.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare Spare Integrating ACT1 A&B Failed Integrating ACT2 A&B Failed	
1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829 1:0830 1:0831 1:0832	ALM_MASTR.EVENT421.B_ALARMALM_MASTR.EVENT422.B_ALARMALM_MASTR.EVENT423.B_ALARMALM_MASTR.EVENT424.B_ALARMALM_MASTR.EVENT425.B_ALARMALM_MASTR.EVENT426.B_ALARMALM_MASTR.EVENT426.B_ALARMALM_MASTR.EVENT427.B_ALARMALM_MASTR.EVENT428.B_ALARMALM_MASTR.EVENT429.B_ALARMALM_MASTR.EVENT429.B_ALARMALM_MASTR.EVENT430.B_ALARMALM_MASTR.EVENT431.B_ALARMALM_MASTR.EVENT432.B_ALARMALM_MASTR.EVENT432.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare Spare Integrating ACT1 A&B Failed Integrating ACT2 A&B Failed Input/Output Configuration Error	
1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829 1:0830 1:0831 1:0832 1:0833	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT427.B_ALARM ALM_MASTR.EVENT429.B_ALARM ALM_MASTR.EVENT430.B_ALARM ALM_MASTR.EVENT431.B_ALARM ALM_MASTR.EVENT432.B_ALARM ALM_MASTR.EVENT433.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare Spare Integrating ACT1 A&B Failed Integrating ACT2 A&B Failed Input/Output Configuration Error Breaker Opened Trip	
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1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829 1:0830 1:0831 1:0833 1:0833 1:0834 1:0835	ALM_MASTR.EVENT421.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT428.B_ALARM ALM_MASTR.EVENT429.B_ALARM ALM_MASTR.EVENT430.B_ALARM ALM_MASTR.EVENT431.B_ALARM ALM_MASTR.EVENT432.B_ALARM ALM_MASTR.EVENT433.B_ALARM ALM_MASTR.EVENT434.B_ALARM ALM_MASTR.EVENT435.B_ALARM ALM_MASTR.EVENT435.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare Spare Integrating ACT1 A&B Failed Integrating ACT2 A&B Failed Input/Output Configuration Error Breaker Opened Trip Spare Spare Spare	
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1:0822 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829 1:0830 1:0831 1:0833 1:0833 1:0834 1:0835 1:0836 1:0837 1:0838 1:0839 1:0840 1:0841	ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT422.B_ALARM ALM_MASTR.EVENT423.B_ALARM ALM_MASTR.EVENT424.B_ALARM ALM_MASTR.EVENT425.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT426.B_ALARM ALM_MASTR.EVENT428.B_ALARM ALM_MASTR.EVENT429.B_ALARM ALM_MASTR.EVENT430.B_ALARM ALM_MASTR.EVENT431.B_ALARM ALM_MASTR.EVENT432.B_ALARM ALM_MASTR.EVENT433.B_ALARM ALM_MASTR.EVENT435.B_ALARM ALM_MASTR.EVENT435.B_ALARM ALM_MASTR.EVENT436.B_ALARM ALM_MASTR.EVENT436.B_ALARM ALM_MASTR.EVENT436.B_ALARM ALM_MASTR.EVENT437.B_ALARM ALM_MASTR.EVENT438.B_ALARM ALM_MASTR.EVENT439.B_ALARM ALM_MASTR.EVENT439.B_ALARM ALM_MASTR.EVENT439.B_ALARM ALM_MASTR.EVENT440.B_ALARM ALM_MASTR.EVENT440.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #7 External Trip #9 External Trip #10 Spare Spare Integrating ACT1 A&B Failed Integrating ACT2 A&B Failed Input/Output Configuration Error Breaker Opened Trip Spare Spare Spare Spare Spare Spare Spare ALL REM Speed Setpoints Failed REM Speed Setpoint Sig Diff	
1:0822 1:0823 1:0823 1:0824 1:0825 1:0826 1:0827 1:0828 1:0829 1:0830 1:0831 1:0832 1:0833 1:0834 1:0835 1:0837 1:0838 1:0837 1:0838 1:0839 1:0840 1:0841 1:0842	ALM_MASTR.EVENT421.B_ALARMALM_MASTR.EVENT422.B_ALARMALM_MASTR.EVENT423.B_ALARMALM_MASTR.EVENT424.B_ALARMALM_MASTR.EVENT425.B_ALARMALM_MASTR.EVENT426.B_ALARMALM_MASTR.EVENT426.B_ALARMALM_MASTR.EVENT427.B_ALARMALM_MASTR.EVENT429.B_ALARMALM_MASTR.EVENT429.B_ALARMALM_MASTR.EVENT430.B_ALARMALM_MASTR.EVENT430.B_ALARMALM_MASTR.EVENT431.B_ALARMALM_MASTR.EVENT433.B_ALARMALM_MASTR.EVENT433.B_ALARMALM_MASTR.EVENT435.B_ALARMALM_MASTR.EVENT436.B_ALARMALM_MASTR.EVENT436.B_ALARMALM_MASTR.EVENT436.B_ALARMALM_MASTR.EVENT436.B_ALARMALM_MASTR.EVENT436.B_ALARMALM_MASTR.EVENT436.B_ALARMALM_MASTR.EVENT436.B_ALARMALM_MASTR.EVENT437.B_ALARMALM_MASTR.EVENT438.B_ALARMALM_MASTR.EVENT438.B_ALARMALM_MASTR.EVENT439.B_ALARMALM_MASTR.EVENT440.B_ALARMALM_MASTR.EVENT440.B_ALARMALM_MASTR.EVENT440.B_ALARMALM_MASTR.EVENT441.B_ALARMALM_MASTR.EVENT442.B_ALARM	External Trip #4 External Trip #5 External Trip #6 External Trip #7 External Trip #8 External Trip #9 External Trip #10 Spare Spare Integrating ACT1 A&B Failed Integrating ACT2 A&B Failed Integrating ACT2 A&B Failed Input/Output Configuration Error Breaker Opened Trip Spare Spare Spare Spare Spare ALL REM Speed Setpoints Failed REM Speed Setpoint Sig Diff ALL Cascade Inputs Failed	

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	
		ALL Manual Remote Decoupling Sigs	
1:0864	ALM_MASTR.EVENT464.B_ALARM	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.EVEN1467.B_ALARM	Feed Forward Signals Diff	
1:0868	ALM_MASTR.EVEN1468.B_ALARM	All Sync/Speed Bias Signals Failed	
1:0869	ALM_MASTR.EVEN1469.B_ALARM	Sync/Speed Bias Signal Difference	
1:08/0	ALM_MASTR.EVEN1470.B_ALARM	ALL Load Signals Failed	
1:0871	ALM_MASTR.EVEN1471.B_ALARM	Load Signal Difference	
1:0872	ALM_MASTR.EVENT472.B_ALARM	ALL Comp Flow 1 Signals Failed	
1:0873		Comp Flow 1 Signal Dillerence	
1.0074		ALL Suction Pressure Signal Difference	
1.0075		ALL Discharge Pressure Failed	
1.0070	ALM_MASTREVENT470.B_ALARM	Nischarge Press Signal Diff	
1.0077	ALM_MASTREVENT478.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 CTRLAUX 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	Al #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.EVEN1518.B_ALARM	Al #36 Chan Fail Kern C Mod A05	
1:0940	ALM_MASTR.EVEN1519.B_ALARM	AI #36 Chan Diff between Kernels	
1:0941	ALM_MASTR.EVEN1520.B_ALARM	Al #36 Input Signal Failure	
1:0942			
thru		Onesse	
1:0950		AQ #1 No Lood Detected trip	
1:0951		AO #1 NO LOAD DETECTED TIP	
1:0952		AO #1 Unan Fall All Kernels trip	
1.0953		AO #2 NO LOAD Detected (fip	
1.0904		AO #2 Under Fall All Aernels (IIP	
1.0905		AO #3 NO LOAU Delected tip	
1.0900		AO #3 Ghan Fall All Aernels lip	
1.0907		AO #4 NO LOAU DELECIEU IIIP	
1.0900			

Table 8-7. Analog Reads

	Analog Reads (RPTar		
۸ddr	CAP Block Name	Decorintion	Mult
Addr	GAP DIOCK Name		wun
3.0001		AUX 1/Step	1
3.0001			
3.0002	Τ1 ΔΗΧ1 ΔΟ2 ΤΜ Δ ΝΑΜΕ	active time	1
3.0002		ALIX1 dmd in	
		RPM (on	
3:0003	T1 AUX1.DMD EU.A NAME	spd REF)	1
		AUX1	
3:0004	T1AUX1.DMD_PERC.A_NAME	demand in %	100
		AUX1	
		Process	
3:0005	T1AUX1.PV_PERC.A_NAME	Value in %	1
		AUX1	
		Process	
3:0006	T1AUX1.PV_UNIT.A_NAME	Value in EU	
		AUX1	
0 0007		setpoint in	USER DEFINED IN
3:0007	AUX1.SETPOINT.A_NAME	EU	CCI
0.0000		AUX1	100
3:0008	TIAUXT.SETP_PERC.A_NAME	Setpoint in %	100
2.0000		AUX1/ Step	1
3.0009			
3.0010		active time	1
3.0010		Cascade PV	
3.0011	T1 CASC CASC PV A NAME	in %	100
0.0011		CASC/ Step	
3:0012	T1 CASC.B02 TM.A NAME	active time	1
		CASC/ Step	
3:0013	T1CASC.B01_TM.A_NAME	active time	1
		Cascade PV	USER DEFINED IN
3:0014	T1CASC.CASC_PV2.A_NAME	in EU	CCT
		Cascade	
3:0015	T1CASC.CASC_SP.A_NAME	setpoint in %	100
		Cascade	
		setpoint in	USER DEFINED IN
3:0016	T1CASC.CASC_SP2.A_NAME	EU	CCT
		Casc	
2.0017	T1 CASC CASC SD2 A NAME	droop in EU	
3.0017	11_0A30.0A30_3F3.A_NAME		
3.0018	T1 CASC 702 TM A NAME	active time	1
3.0010		CASC/ Sten	
3:0019	T1 CASC.Z01 TM.A NAME	active time	1
2.0010		CASC/ Step	
3:0020	T1 CASC.Z00 TM.A NAME	active time	1
		Cascade	
		speed	
3:0021	T1CASC.SPD_DMD2.A_NAME	demand	1
		Cascade	
		speed	
3:0022	T1 CASC.SPD DMD.A NAME	demand in %	100

		1	1
2.0000		CASC/ Step	
3:0023	TT_CASC.BUU_TM.A_NAME	active time	1
2.0004		CASC/ Step	1
3:0024	T1CASC.B03_TM.A_NAME		1
2.0005		DUPL	100
3:0025		Bemete	100
		Decoupling	
3.0026	T1 DCPLREM SP ELLA NAME	FII	1
0.0020			
		setpoint in	
3:0027	T1 DCPL.SETPOINT.A NAME	EU	1
		Rem decoupl	
		man Demand	
3:0028	T1DCPL.REM_MAN_PR.A_NAME	%	100
		Decoupling	
3:0029	T1DCPL.DMD_PERC.A_NAME	Demand %	1
		Decoupling	
3:0030	T1DCPL.PV_PERC.A_NAME	PV in %	100
		Decoupling	
3:0031	T1DCPL.PV_UNIT.A_NAME	PV in EU	1
		DCPL/ Rem	
		Decoupling	
3:0032	I1DCPL.REM_SP_PER.A_NAME	%	1
		EXIC/	
2.0022		BU3_/active	1
3.0033			
		setpoint in	
3.0034	T1 EXTC SETPOINT A NAME	FU	CCT
3:0034	T1EXTC.SETPOINT.A_NAME	EU EXTR	CCT
3:0034 3:0035	T1EXTC.SETPOINT.A_NAME T1 EXTC.SETP PERC.A NAME	EU EXTR setpoint in %	CCT
3:0034 3:0035	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME	EU EXTR setpoint in % EXTC/	CCT
3:0034 3:0035	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active	CCT 1
3:0034 3:0035 3:0036	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time	CCT 1
3:0034 3:0035 3:0036	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/	1 1
3:0034 3:0035 3:0036	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active	1
3:0034 3:0035 3:0036 3:0037	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time	1 1 1
3:0034 3:0035 3:0036 3:0037	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote	1 1 1
3:0034 3:0035 3:0036 3:0037	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction	1 1 USER DEFINED IN
3:0034 3:0035 3:0036 3:0037 3:0038	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Bomote	1 1 USER DEFINED IN CCT
3:0034 3:0035 3:0036 3:0037 3:0038	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual	1 1 USER DEFINED IN CCT
3:0034 3:0035 3:0036 3:0037 3:0038	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR_A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand %	1 1 USER DEFINED IN CCT
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited	1 1 USER DEFINED IN CCT
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1_EXTC.P_LIMITED.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand %	1 1 USER DEFINED IN CCT 1 100
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in	1 1 USER DEFINED IN CCT 1 100
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in %	1 1 USER DEFINED IN CCT 1 100 1
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in %	1 1 USER DEFINED IN CCT 1 100 1 USER DEFINED IN
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041 3:0042	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME T1EXTC.PV_UNIT.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in % EXTR PV in EU	1 USER DEFINED IN CCT 1 USER DEFINED IN CCT 1 USER DEFINED IN CCT
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041 3:0042	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME T1EXTC.PV_UNIT.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in % EXTR PV in EU EXTC/	1 1 USER DEFINED IN CCT 1 100 1 USER DEFINED IN CCT
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041 3:0042	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME T1EXTC.PV_UNIT.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in % EXTR PV in EU EXTC/ B04_/active	1 1 USER DEFINED IN CCT 1 100 1 USER DEFINED IN CCT
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041 3:0042 3:0043	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME T1EXTC.PV_UNIT.A_NAME T1EXTC.B04_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in % EXTR PV in EU EXTC/ B04_/active time	1 1 USER DEFINED IN CCT 1 100 1 USER DEFINED IN CCT 1
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041 3:0042 3:0043	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME T1EXTC.PV_UNIT.A_NAME T1EXTC.B04_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in % EXTR PV in EU EXTC/ B04_/active time	1 1 USER DEFINED IN CCT 1 100 1 USER DEFINED IN CCT 1
3:0034 3:0035 3:0036 3:0037 3:0038 3:0039 3:0040 3:0041 3:0042 3:0043	T1EXTC.SETPOINT.A_NAME T1EXTC.SETP_PERC.A_NAME T1EXTC.Z00_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.Z01_TM.A_NAME T1EXTC.REM_SP_EU.A_NAME T1EXTC.REM_MAN_PR.A_NAME T1EXTC.P_LIMITED.A_NAME T1EXTC.PV_PERC.A_NAME T1EXTC.PV_UNIT.A_NAME T1EXTC.B04_TM.A_NAME	EU EXTR setpoint in % EXTC/ Z00_/active time EXTC/ Z01_/active time Remote Extraction EU Remote manual Demand % P limited Demand % EXTR PV in % EXTR PV in EU EXTC/ B04_/active time EXTC/ B04_/active	1 1 USER DEFINED IN CCT 1 100 1 USER DEFINED IN CCT 1

		EXTC/	
		A03_/active	
3:0045	T1EXTC.A03_TM.A_NAME	time	1
		Remote	
3:0046	T1EXTC.REM_SP_PER.A_NAME	Extraction %	1
		EXTC/	
		A04 /active	
3:0047	T1 EXTC.A04 TM.A NAME	time	1
		EXTC/ A00E/	
3:0048	T1 EXTC.A00ETM.A NAME	active time	1
		EXTC/	
		A00 /active	
3:0049	T1 EXTC.A00 TM.A NAME	time	1
		FXTC/	-
		A01 /Active	
3.0020	T1 FXTC A01 TM A NAME	time	1
0.0000		EXTC/ A02R	
3.0051	T1 EXTC A02R TM A NAME	/ active time	1
0.0001		FXTC/	•
		A05 /active	
3.0022	Τ1 ΕΧΤΟ ΔΟ5 ΤΜ Δ ΝΔΜΕ	time	1
3.0032			1
		$\Delta 02$ /active	
3.0053		time	1
3.0033			
		ANA /active	
2:0054		time	1
3.0054			
		EAIC/ BOOD/active	
2.0055		buzk/active	1
3.0055			
2:0050		EAIR Domond %	4
3.0050		Demand %	
0.0057		Feed forward	
3:0057			1
0.0050		S Pt B	100
3:0058	11MAPSB_NORM.A_NAME	normalized	100
0.0050		SPtC	100
3:0059	11MAPSC_NORM.A_NAME	normalized	100
		Flow Pt B	
3:0060	I1MAPHB_NORM.A_NAME	normalized	100
		Flow Pt C	100
3:0061	I1MAPHC_NORM.A_NAME	normalized	100
		Min load line	
3:0062	T1MAPLD0_NORM.A_NAME	at zero	100
		Min load at	
3:0063	T1MAPLD100_NORM.A_NAME	HP 100%	100
		S Pt A	
3:0064	T1MAPSA_NORM.A_NAME	normalized	100
		Min EXT flow	
3:0065	T1MAPMNFL_NORM.A_NAME	compensated	100
		Flow Pt A	
3:0066	T1MAPHA_NORM.A_NAME	normalized	100
		Waiting time	
3:0067	T1SPDC.CONF_T2.A_NAME	at H idle	10
		Waiting time	
3:0068	T1SPDC.CONF_T1.A_NAME	at low idle	10
3:0069	T1 SPDC.CONFRTE5.A NAME	Loading rate	10

		Rate to min	
3:0070	T1SPDC.CONFRTE4.A_NAME	GOV	10
		Waiting time	
3:0071	T1SPDC.CONF_T3.A_NAME	at HH idle	10
0.0070		Rate to H	10
3:0072	T1SPDC.CONFRTEZ.A_NAME	Idle	10
3.0073	T1 SPDC SPDC SP & NAME	speed	1
5.0075		Rate to HH	
3.0074	T1 SPDC CONFRTE3 A NAME	idle	10
0.007 1		Actual	
		Remaining	
3:0075	T1SPDC.REMAIN_T.A_NAME	time	10
		Rate to low	
3:0076	T1SPDC.CONFRTE1.A_NAME	idle	10
		Line 2	
		message for	
3:0077	T1SPDC.SEQ2_MGS.A_NAME	Speed	1
		SPDC / Step	
0.0070		A06_ active	
3:0078	11SPDC.A06_TM.A_NAME		1
2.0070		Speed ref	1
3.0079	TI_SPDC.SPDC_SP2.A_NAME	Speed pid	
3.0080		demand	100
3.0000		SPDC / Sten	100
		Z00 active	
3:0081	T1 SPDC.Z00 TM.A NAME	T	1
		SPDC / Step	
		Z01_ active	
3:0082	T1SPDC.Z01_TM.A_NAME	Т	1
		Line 1	
		message for	
3:0083	T1SPDC.SEQ1_MSG.A_NAME	Speed	1
		SPDC / Step	
2.0094	T1 SPDC 404 PTMP A NAME	AU4_	4
3.0064			
		A01 active	
3.0082	T1 SPDC A01 TM A NAME	T	1
0.0000		SPDC / Step	•
		A00A active	
3:0086	T1SPDC.A00ATM.A_NAME	Т	1
		SPDC / Step	
		A00_ active	
3:0087	T1SPDC.A00_TM.A_NAME	Т	1
		SPDC / Step	
0.0000		A02A active	
3:0088	I1_SPDC.A02ATM.A_NAME		1
		SPDC / Step	
3.0060		T(mp)	1
3.0009		SPDC / Stop	
		A02 active	
3:0090	T1 SPDC.A02 TM.A NAME	T	1
2.0000		SPDC / Step	
		A08_active	
0 0004	T1 SPDC A08 TM A NAME	т	1

		SPDC / Step	
		A04_ remain	
3:0092	T1SPDC.A04_RTMM.A_NAME	T(mn)	1
		actual	
0.0000		schedule	
3:0093	TISPDC.ACTUAL_OF.A_NAME		1
		SPDC / Step	
3.0004		A04_ remaining T	1
3.0094		SPDC / Sten	1
		A05 active	
3:0095	T1 SPDC.A05 TM.A NAME	T	1
		SPDC / Step	
		A06_ remain	
3:0096	T1SPDC.A06_RTMM.A_NAME	T(mn)	1
		SPDC / Step	
		A06_	
3:0097	T1SPDC.A06_RTMR.A_NAME	remaining T	1
		SPDC / Step	
		A07_ active	
3:0098	T1SPDC.A07_TM.A_NAME	T	1
		SPDC / Step	
0.0000		A09_active	
3:0099	TTSPDC.A09_TM.A_NAME		1
		A10 active	
3.0100			1
3.0100		SPDC / Sten	1
		A03 active	
3:0101	T1 SPDC.A03 TM.A NAME	T	1
		SPDC / Step	
		A02_	
3:0102	T1SPDC.A02_RTMM.A_NAME	remaining T	1
		LP Valve	
		demand	
3:0103	T1VLVLP_DEMAND.A_NAME	(linear)	100
		LP Valve	
0.0404		demand 2	100
3:0104	11VLVLP_VLV2.A_NAME	(linear)	100
2.04.05			100
3:0105			100
3.0106	Τ1	Demand	100
3.0100		HP Demand	100
3:0107	T1 VLV HP DEMAND A NAME	Linear	100
0.0101		HP2 demand	
3:0108	T1 VLV .HP2 DEMAND.A NAME	(linear)	100
		AUX Process	-
3:0109	T2AUX1.PROCESSVAL.A_NAME	Value	1
		Emergency	
		cascade hold	
3:0110	T2CASC.EMGR_HOLD.A_NAME	DLY	1
		Droop value	
3:0111	T2CASC.DROOP_ALON.A_NAME	alone	100
3:0112	T2CASC.DROOP.A_NAME	Droop value	100
3:0113	T2 CASC.CAS SLIDE.A NAME	I Slidina DB	1

		SP Bias	
		demand on	
3:0114	T2CASC.BIAS.A_NAME	Cascade	1
0.0445		load share	
3:0115	12CASC.LDSH_PV.A_NAME	parameter	1
		Emergency	
3.0116	T2 CASC EMPG RTE A NAME	Rate	10
3.0110			1
3.0117		Emergency	1
3.0118	T2 CASC EMRG GAIN A NAME	cascade dain	1
0.0110		Load sharing	
3:0119	T2 CASC.LD GAIN.A NAME	Gain	1
		Load share	
		parameter	
3:0120	T2CASC.LDSH_PV2.A_NAME	other Unit	1
		WSPV other	
3:0121	T2CASC.WSPV2.A_NAME	Unit	1
3:0122	T2CASC.WSPV.A_NAME	WSPV	1
3:0123	T2CASC.SDR.A_NAME	SDR Gain	1
		Remote	
		speed	
3:0124	T2CASC.REMOTE_SPD.A_NAME	Setpoint	1
		Remote	
		cascade	
3:0125	12CASC.REMOTE_SP.A_NAME	Setpoint	1
3:0126	12_CASC.PRP.A_NAME	Prop Gain	1
3:0127	12CASC.PROCESS_PV.A_NAME	Cascade PV	1
0.0400		LSS demand	
3:0128	TZCASC.LSS_DMD.A_NAME	On cascade	1
2.0120		HSS demand	1
5.0129		Permote Man	
3.0130	T2 DCPL RMDCPL PV A NAME		100
0.0100		Decoupling	100
		process	
3:0131	T2 DCPL.SQ DCPV.A NAME	value	1
		Signal	
		Derivative	
3:0132	T2DCPL.PID_SDR.A_NAME	Ratio	1
		Proportional	
3:0133	T2DCPL.PID_PRP.A_NAME	Gain	1
3:0134	T2DCPL.PID_INT.A_NAME	Integral Gain	1
		Remote	
0.0405		Decoupling	
3:0135	IZ_DUPL.SQ_KDUP.A_NAME	Setpoint	1
2,0126		Proportional	1
3:0136		Gain Demote Mon	
2.0127			100
5.0137		Signal	100
		Derivative	
3:0138	T2 EXTC.PID SDR.A NAME	Ratio	1
3:0139	T2 EXTC.PID INT.A NAME	Integral Gain	1
2.0.00		Offset for	
3:0140	T2 EXTC.CONFDOFS.A NAME	decouplina	1
		Droop for	
3:0141	T2EXTC.CONFDRPC.A_NAME	Extraction	1

		Droop for	
3:0142	T2EXTC.CONFDRPD.A_NAME	decoupling	1
		Deadband	
3:0143	12EXIC.CONFOFSEI.A_NAME	for Extraction	1
0.0111		Extraction	
3:0144	IZEXIC.EXIR_PV.A_NAME	PV Demote evit	1
2.0145		Remote ext	1
3.0145		Process	1
3.0146	T2 FW ALFWA NAME	Value	1
0.0140		Speed	
3:0147	T2 SPDC.SPD TARGET.A NAME	Target	1
		Step level for	
		testing	
3:0148	T2SPDC.SRT_LEV.A_NAME	response	1
		Derivative	
3:0149	T2SPDC.SDR2.A_NAME	Ratio online	1
		Derivative	
3:0150	T2SPDC.SDR1.A_NAME	ratio offline	1
		Remote	
3:0151	T2SPDC.RTIM_PV.A_NAME	Timer PV	1
		Proportional	
3:0152	12SPDC.PRP2.A_NAME	gain online	1
0.0450		Proportional	
3:0153	12SPDC.PRPT.A_NAME	gain online	
2.0154		integer gain	1
3.0154	TZSFDC.INTZ.A_NAME		
3.0155	T2 SPDC INT1 A NAME	offline	1
0.0100		Actual Speed	•
3:0156	T2 SPDC.SPEED.A NAME	PV	1
		HP2 external	
3:0157	T2VLVEXTERN_HPL.A_NAME	limiter	1
3:0158	T2C_AUX1.PID_OFFSET.A_NAME	offset	1
		Proportional	
3:0159	T2C_AUX1.PID_PRP.A_NAME	Gain	1
		Signal	
		Derivative	
3:0160	T2C_AUX1.PID_SDR.A_NAME	Ratio	1
0.04.04		Valve Pos.	
3:0161		Tast	1
2.0162		Setpoint Initial Value	1
3:0163		Integral Cain	1
3.0103		Valve Pos	1
		Rse/Lwr	
3.0164	T2C AUX1 PID VPRT A NAME	Rate (Man)	1
0.0101		Setpoint	-
		Rse/Lwr	
		multiply	
3:0165	T2C_AUX1.FST_MULT.A_NAME	factor	1
		delay to go	
3:0166	T2C_AUX1.DLY_FST.A_NAME	fast	1
		max	
		deviation	
3:0167	T2C_AUX1.MAX_DEVAUT.A_NAME	authorized	100

		maximum	
		process	
3:0168	T2C_AUX1.MAX_PV.A_NAME	Value	1
		Setpoint	
		Maximum	
3:0169	T2C_AUX1.MAX_SP.A_NAME	limit	1
3:0170	T2C_AUX1.PID_DROOP.A_NAME	droop	1
		Setpoint	
		Rse/Lwr	
3:0171	T2C_AUX1.SP_RATE.A_NAME	Rate (Auto)	1
0.0470		min process	
3:0172	12C_AUX1.MIN_PV.A_NAME	Value	1
		Setpoint	
2.0172		limit	1
3.0173		Normal P/I	
3.0174	T2C CASC BL RTE A NAME	So Rate	1
3.0174		Max cascade	1
3.0175	T2C CASC MAX RTECAS A NAME	speed rate	10
0.0170		Max case&	10
		remote	
		speed	
3:0176	T2C CASC.MAX SPD.A NAME	Demand	1
0.0110		Min cascade	
3:0177	T2C CASC.MIN CAS SP.A NAME	SP	1
		Minimum	
		Load Sharing	
3:0178	T2C_CASC.MIN_LDSH.A_NAME	Setpoint	1
		Minimum	
3:0179	T2C_CASC.MIN_PV.A_NAME	cascade PV	1
		remote	
		speed not	
3:0180	T2C_CASC.NOR_MATCH.A_NAME	match rate	10
		Delay before	
		normal R/L	
3:0181	T2C_CASC.R_L_NONDLY.A_NAME	rte	1
		Max Remote	
3:0182	T2C_CASC.MAX_RSPDRT.A_NAME	speed rate	10
		Min casc&	
		remote	
2.0102		Speed	1
3.0163	12C_CASC.WIIN_SPD.A_NAME	Minimum	1
		romoto	
3.0184	T2C CASC MIN DVRSPD A NAME	speed PV	1
3.0104		Remote	1
		speed Not	
		match	
3:0185	T2C CASC.NOT MATCHD.A NAME	deviation	100
		remote	-
		Cascade	
3:0186	T2C_CASC.MAX_RCASRT.A_NAME	max rate	1
3:0187	T2C_CASC.CASC_SPINI.A_NAME	Initial SP	1
		Divide factor	
3:0188	T2C_CASC.DIV_RTE.A_NAME	of normal RL	1
		Max cascade	
3:0189	T2C_CASC.MAX_CAS_SP.A_NAME	SP	1

_			-
		Max load	
		sharing	
3:0190	T2C_CASC.MAX_LDSH.A_NAME	Setpoint	1
		Maximum	
3:0191	T2C_CASC.MAX_PV.A_NAME	cascade PV	1
		Maximum	
		Remote	
3:0192	T2C_CASC.MAX_PVRSPD.A_NAME	speed PV	1
		Valve Pos.	
		Rse/Lwr	
3:0193	T2C_DCPL.PID_VPRT.A_NAME	Rate (Man)	1
		Minimum	
		DCPL	
3:0194	T2C_DCPL.MN_DCPL_DM.A_NAME	demand	1
		Decoupling	
		SP Rse/Lwr	
3:0195	T2C_DCPL.PID_SPRT.A_NAME	Rate	1
		Maximum	
3:0196	T2C_DCPL.PID_SPMX.A_NAME	Setpoint	1
		Decoup SP	
		Rse/Lwr fast	
3:0197	T2C_DCPL.PID_FSTD.A_NAME	delay	1
		Full-Auto	
		Setpoint	
3:0198	T2C_DCPL.PID_ASR.A_NAME	trck.Rate	1
		Decoupling	
		Rem MAN	
		dmd max	
3:0199	T2C_DCPL.MX_MREM_RT.A_NAME	rate	1
		Initial	
3:0200	T2C_DCPL.PID_SP_I.A_NAME	Setpoint	1
		Min	
		decoupling	
3:0201	T2C_DCPL.MIN_PV.A_NAME	Pv	1
		Max	
		decoupling	
3:0202	T2C_DCPL.MAX_PV.A_NAME	Pv	1
		Valve	
		Rse/Lwr	
		Rate Mult	
3:0203	T2C_DCPL.FAST_RLDM.A_NAME	(Auto)	1
		Decoupling	
		Demand	
		Raise/Lower	
3:0204	T2C_DCPL.DLY_FST.A_NAME	Fast Del	1
		Decoupling	
		Sp Rse/Lwr	
3:0205	T2C_DCPL.MULT_FST.A_NAME	Fast Mult	1
		Maximum	
		DCPL	
3:0206	T2C_DCPL.MX_DCPL_DM.A_NAME	demand	1
		Minimum	
3:0207	T2C_DCPL.PID_SPMN.A_NAME	Setpoint	1
		Extraction	
		Setpoint R/L	
3:0208	T2C EXTC.PID FSTD.A NAME	fast delay	1

		Extraction	
		Setpoint	
3:0209	T2C_EXTC.PIDCSP_I.A_NAME	Initial Value	1
		Setpoint	
		Rse/Lwr	
3:0210	T2C_EXTC.PIDCSPRT.A_NAME	Rate (Auto)	1
		Extraction	
		Setpoint	
		Maximum	
3:0211	T2C_EXTC.PIDCSPMX.A_NAME	limit	1
		Extraction	
		Setpoint	
0.0040		Minimum	
3:0212	12C_EXTC.PIDCSPMN.A_NAME		1
0.0040		Setpoint Fast	
3:0213	12C_EXTC.PIDCSPFR.A_NAME		1
		Extraction	
		Remote MAN	
0.0044	TOO EVTO MY MOEM DT A NAME	demand max	
3:0214		rate	1
0.0045	TOO EVTO MINE DV A NAME	IVIIN	
3:0215	12C_EXTC.MIN_PV.A_NAME	extraction PV	1
		Extraction	
		Full-Auto	
0.0040		Setpoint	
3:0216	TZC_EXTC.PIDCASR.A_NAME	trck.Rat	1
		Extraction	
0.0047		Demand Fast	
3:0217		multiplier	1
		P demand	
0.0040		Rse/Lwr	
3:0218		Rate (Man)	1
2.0240	TOO EVTO MAY DV A NAME	Max	4
3:0219		Extraction PV	1
		Extraction	
2.0220		Demand Fast	4
3.0220		Delay Max Data	1
3.0221		Nax Rate	1
2.0000		Deadband	4
3:0222	TZC_FWDB_SPD.A_NAME	On speed	1
2.0222		Emergency	4
3.0223		Duration time	
2.0224		Rete	1
3.0224		Min roto	1
2.0225		hoforo opting	1
3.0225		Min Boto	1
3.0220		Min Kale	1
		IVIIII Foodforword	
		demand at	
2.0227		min Poto	1
3.0227		Maximum	1
		ivia XIII UIII	
3.0000		change	10
3.0220		Speed	
		deviation of	
3.0220		rate	1
0.0220			

		MAX	
		Feedforward	
		demand at	
3:0230	12C_FWMX_SPD.A_NAME	max rate	1
2.0221		Normal Duration time	1
3.0231		Max I P flow	1
		(ext/adm	
3:0232	T2C MAP .MXEXT CONF.A NAME	only)	1
3:0233	T2C MAP .SC CONF.A NAME	Power pt C	1
3:0234	T2C_MAPSB_CONF.A_NAME	Power pt B	1
3:0235	T2C_MAPSA_CONF.A_NAME	Power pt A	1
		Min flow	
		through HP	
0.0000		when LP in	400
3:0236	12C_MAPMNHP_CONF.A_NAME	Ctir Min Flow	100
		lviin Flow	
3.0237	T2C MAP I D100 CONF A NAME	if HP=100	1
5.0257		Min Flow	1
		Limit S-value	
3:0238	T2C_MAPLD0_CONF.A_NAME	if HP=0	1
3:0239	T2C_MAPHC_CONF.A_NAME	Flow pt C	1
		LP maximum	
3:0240	T2C_MAPMXLPCONF.A_NAME	Lift	100
		Max HP flow	
3:0241	T2C_MAPMXFL_CONF.A_NAME	for unit	1
3:0242	T2C_MAPHB_CONF.A_NAME	Flow pt B	1
3:0243	12C_MAPHA_CONF.A_NAME	Flow pt A	1
2.0244			100
3.0244	TZC_MAFMINEF_CONF.A_NAME	Max power	100
3.0245	T2C MAP MXLD CONF A NAME	for unit	1
0.0210		Delay at Low	•
3:0246	T2C_SPDC.DL_IDLE1_7.A_NAME	idle rate 7	1
		Ramp to Idle	
3:0247	T2C_SPDC.RAP_IDL3_1.A_NAME	3 rate 1	10
		Ramp to Idle	
3:0248	T2C_SPDC.RAP_IDL2_2.A_NAME	2 rate 2	10
0.0040		Ramp to Idle	10
3:0249	12C_SPDC.RAP_IDL2_3.A_NAME	2 rate 3	10
3.0250		2 rate 4	10
3.0230		Ramp to Idle	10
3:0251	T2C SPDC.RAP IDL2 5.A NAME	2 rate 5	10
0.0201		Ramp to Idle	
3:0252	T2C_SPDC.RAP_IDL2_6.A_NAME	2 rate 6	10
		Ramp to Idle	
3:0253	T2C_SPDC.RAP_IDL2_7.A_NAME	2 rate 7	10
		Ramp to Idle	
3:0254	T2C_SPDC.RAP_IDL2_8.A_NAME	2 rate 8	10
		Level to	
3.0255		10 to ourve	1
3.0200		Ramp to Idlo	1
3.0256	T2C SPDC RAP IDL3 0 A NAME	3 rate 10	10
0.0200		Ramp to Low	
3:0257	T2C_SPDC.RAP_IDL1_9.A_NAME	idle rate 9	10

		Ramp to Idle	
3:0258	T2C_SPDC.RAP_IDL3_2.A_NAME	3 rate 2	10
0.0050		Ramp to Idle	40
3:0259	120_SPDU.RAP_IDL3_3.A_NAME	3 rate 3	10
3.0260		3 rate /	10
3.0200		Ramp to Idle	10
3:0261	T2C SPDC.RAP IDL3 5.A NAME	3 rate 5	10
0.0201		Ramp to Idle	
3:0262	T2C SPDC.RAP IDL3 6.A NAME	3 rate 6	10
		Ramp to Idle	
3:0263	T2C_SPDC.RAP_IDL3_7.A_NAME	3 rate 7	10
		Ramp to Idle	
3:0264	T2C_SPDC.RAP_IDL3_8.A_NAME	3 rate 8	10
0.0005		Ramp to Idle	10
3:0265	12C_SPDC.RAP_IDL3_9.A_NAME	3 rate 9	10
2.0266		Ramp to Idle	10
3.0200	12C_SPDC.RAP_IDL2_9.A_NAME	Z Tale 9	10
3.0267	T2C SPDC DL IDLE1 5 A NAME	idle rate 5	1
0.0201		Level to	
		select curve	
3:0268	T2C SPDC.PV O CRV01.A NAME	2 to curve 1	1
		Level to	
		select curve	
3:0269	T2C_SPDC.PV_O_CRV02.A_NAME	3 to curve 2	1
		Level to	
		select curve	
3:0270	12C_SPDC.PV_O_CRV03.A_NAME	4 to curve 3	1
		Level to	
2.0271		5 to curve	1
3.0271			1
		select curve	
3:0272	T2C SPDC.PV O CRV05.A NAME	6 to curve 5	1
		Level to	
		select curve	
3:0273	T2C_SPDC.PV_O_CRV06.A_NAME	7 to curve 6	1
		Level to	
		select curve	
3:0274	T2C_SPDC.PV_O_CRV07.A_NAME	8 to curve 7	1
		Level to	
3.0275			1
3.0275		Ramp to Idle	I
3.0276	T2C SPDC RAP IDL2 1 A NAME	2 rate 1	10
0.0210		Ramp to Low	10
3:0277	T2C SPDC.RAP IDL1 0.A NAME	idle rate 10	10
		Ramp to Idle	
3:0278	T2C_SPDC.RAP_IDL2_0.A_NAME	2 rate 10	10
		Ramp to Low	
3:0279	T2C_SPDC.RAP_IDL1_2.A_NAME	idle rate 2	10
		Ramp to Low	
3:0280	I2C_SPDC.RAP_IDL1_3.A_NAME	Idle rate 3	10
0.0004		Ramp to Low	10
3:0281	IZU_SPUU.KAP_IUL1_4.A_NAME	Idle rate 4	10
2.0000		Ramp to LOW	10
3.0202		iule late 5	

		Ramp to Low	
3:0283	T2C_SPDC.RAP_IDL1_6.A_NAME	idle rate 6	10
2.0204		Ramp to Low	10
3.0264		Pamp to Low	10
3.0285	T2C SPDC RAP IDI 1 8 A NAME	idle rate 8	10
3.0203		Loading rate	10
3:0286	T2C SPDC.RAP LOAD 2.A NAME	2	10
		Critical	-
3:0287	T2C_SPDC.CRIT3_RTE.A_NAME	speed rate3	10
		Load rate	
3:0288	T2C_SPDC.RT_LD_HOT.A_NAME	НОТ	10
		Loading rate	
3:0289		10	10
3:0290	12C_SPDC.RATED.A_NAME	Rated speed	1
		Remote timer	
3.0201	T2C SPDC RTIME HOT & NAME		1
5.0291		Start-up rate	1
		to level 1	
3:0292	T2C SPDC.RT L1 COLD.A NAME	COLD	10
		Start-up rate	
		to level 1	
3:0293	T2C_SPDC.RT_L1_HOT.A_NAME	HOT	10
		Start-up rate	
		to level 2	
3:0294	T2C_SPDC.RT_L2_COLD.A_NAME	COLD	10
		Start-up rate	
2.0205			10
3.0295		Start up rate	10
		to level 3	
3.0296	T2C SPDC RT 13 COLD A NAME		10
0.0200		Ramp to	10
3:0297	T2C SPDC.RAP RATED8.A NAME	Rated rate 8	10
		Load rate	
3:0298	T2C_SPDC.RT_LD_COLD.A_NAME	COLD	10
		Ramp to	
3:0299	T2C_SPDC.RAP_RATED7.A_NAME	Rated rate 7	10
		Start-up rate	
		to min.gov.	
3:0300	T2C_SPDC.RT_MN_COLD.A_NAME	COLD	10
		Start-up rate	
3.0301	T2C SODC OT MN HOTA NAME		10
3.0301		R/I	10
		command	
3:0302	T2C SPDC.R L SLOWDL.A NAME	slow delay	1
		Delay before	
3:0303	T2C_SPDC.STUCK_DLY.A_NAME	Alm/unload	1
		Start-up rate	
		to level 3	
3:0304	T2C_SPDC.RT_L3_HOT.A_NAME	НОТ	10
		Ramp to	
3:0305	I2C_SPDC.RAP_RATED2.A_NAME	Rated rate 2	10
		Level to	
2.0200		Select Curve	1
3.0300			I

3.0307	T2C SPDC RAP LOAD 3 A NAME	Loading rate	10
0.0001		Loading rate	
3:0308	T2C_SPDC.RAP_LOAD_4.A_NAME	4	10
3.0300		Loading rate	10
5.0503		Loading rate	10
3:0310	T2C_SPDC.RAP_LOAD_6.A_NAME	6	10
		Loading rate	
3:0311	12C_SPDC.RAP_LOAD_7.A_NAME	/	10
3:0312	T2C SPDC.RAP LOAD 8.4 NAME	8	10
0.0012		Loading rate	
3:0313	T2C_SPDC.RAP_LOAD_9.A_NAME	9	10
2.0214	TOC ODC DAD DATEDO A NAME	Ramp to	10
3:0314		Rated rate 9	10
3:0315	T2C SPDC.RAP RATED1.A NAME	Rated rate 1	10
		Loading rate	
3:0316	T2C_SPDC.RAP_LOAD_1.A_NAME	1	10
0.0047		Time Loop	
3:0317	12C_SPDC.TIME_LOOP.A_NAME	Delay	1
3.0318	T2C SPDC UNDERSD DLA NAME	SD delay	1
0.0010		Underspeed	1
		level(<99%	
3:0319	T2C_SPDC.UNDERSPD.A_NAME	of min gov)	1
		Underspeed	
3:0320	12C_SPDC.UNDER_DLY.A_NAME	alarm delay	1
3.0321	T2C SPDC RAP RATED3 & NAME	Ramp to Rated rate 3	10
0.0021		Ramp to	
3:0322	T2C_SPDC.RAP_RATED4.A_NAME	Rated rate 4	10
		Ramp to	
3:0323	T2C_SPDC.RAP_RATED5.A_NAME	Rated rate 5	10
3.03.24		Ramp to	10
3.0324		Ramp to	10
		Rated rate	
3:0325	T2C_SPDC.RAP_RATED0.A_NAME	10	10
		Level to	
2,0226		select curve	1
3.0320		Startup level	
3:0327	T2C SPDC.LEVEL0.A NAME	0-min speed	1
		Delay at Idle	
3:0328	T2C_SPDC.DL_IDLE3_3.A_NAME	3 rate 3	1
2.0200		Delay at Idle	4
3:0329		3 rate 4	
3:0330	T2C SPDC.DL IDLE3 5.A NAME	3 rate 5	1
2.0000		Delay at Idle	
3:0331	T2C_SPDC.DL_IDLE3_6.A_NAME	3 rate 6	1
2,0200		Delay at Idle	4
3:0332		3 rate /	
3:0333	T2C_SPDC.DL_IDLE3_8.A_NAME	3 rate 8	1

		Delay at Idle	
3:0334	T2C_SPDC.DL_IDLE3_9.A_NAME	3 rate 9	1
0 0005		Delay at Idle	
3:0335	12C_SPDC.DL_IDLE3_1.A_NAME	3 rate 1	1
2.0226		Fraguanay	1
3.0330		Prequency Dolay at Idlo	
3.0337		3 rate 10	1
0.0007		Hot reset	1
3:0338	T2C SPDC.HOT RESET.A NAME	timer	1
3:0339	T2C SPDC.HOT TIME.A NAME	HOT time	1
		Warmup time	
3:0340	T2C_SPDC.L1_COLD_DL.A_NAME	level 1 COLD	10
		Warmup time	
3:0341	T2C_SPDC.L1_HOT_DL.A_NAME	level 1 HOT	10
		Warmup time	
3:0342	T2C_SPDC.L2_COLD_DL.A_NAME	level 2 COLD	10
		Warmup time	
3:0343	T2C_SPDC.L2_HOT_DL.A_NAME	level 2 HOT	10
0.0044		Warmup time	40
3:0344	12C_SPDC.L3_COLD_DL.A_NAME	level 3 COLD	10
2.0245	T2C SPRC12 HOT DLA NAME		10
3:0345		Domp to Low	10
2.0246		idlo rato 1	10
3.0340		Delay at Idle	10
3.0347	T2C SPDC DL IDLE2 1 A NAME	2 rate 1	1
0.0047		Delay at Low	1
3:0348	T2C SPDC.DL IDLE1 0.A NAME	idle rate 10	1
		Delay at Low	
3:0349	T2C SPDC.DL IDLE1 1.A NAME	idle rate 1	1
		Delay at Low	
3:0350	T2C_SPDC.DL_IDLE1_2.A_NAME	idle rate 2	1
		Delay at Low	
3:0351	T2C_SPDC.DL_IDLE1_3.A_NAME	idle rate 3	1
		Delay at Low	
3:0352	T2C_SPDC.DL_IDLE1_4.A_NAME	idle rate 4	1
0.0050		Delay at Low	
3:0353		Delay at Law	
3.0354		idle rate 8	1
3.0334		Delay at Idle	1
3.0355	T2C SPDC DL IDLE3 2 A NAME	3 rate 2	1
0.0000		Delay at Idle	
3:0356	T2C SPDC.DL IDLE2 0.A NAME	2 rate 10	1
3:0357	T2C_SPDC.GEAR.A_NAME	Gear Ratio	1
		Delay at Idle	
3:0358	T2C_SPDC.DL_IDLE2_2.A_NAME	2 rate 2	1
		Delay at Idle	
3:0359	T2C_SPDC.DL_IDLE2_3.A_NAME	2 rate 3	1
0.0000		Delay at Idle	
3:0360	TZC_SPDC.DL_IDLE2_4.A_NAME	2 rate 4	1
2,0204		Delay at Idle	4
3.0301			1
3.0360		2 rate 6	1
J.030Z		Delay at Idla	1
3.0363	T2C SPDC DL IDLE2 7 A NAME	2 rate 7	1
0.0000		- 10.0 /	•

3.0364		Delay at Idle	1
3.0304		Z Tale 0	1
2.0265		2 roto 0	1
3.0305		Z rate 9	
		Delay at Low	
3:0366	12C_SPDC.DL_IDLE1_9.A_NAME	Idle rate 9	1
		Mult fact for	
		loading	
		gradient	
3:0367	T2C_SPDC.MULT_SLOW.A_NAME	(Slow R)	1
		Maximum	
		speed	
3:0368	T2C_SPDC.MAX_REF.A_NAME	reference	1
		Predictive	
3:0369	T2C SPDC.PRED SPDC.A NAME	speed Level	1
		Acceleration	
3.0370	T2C SPDC PRED ACC A NAME	at Pred level	10
0.0070		Speed	
		override max	
2.0271		time	1
3.0371		Unite	
0.0070		Overspeed	10
3:0372	IZC_SPDC.OSPD_RATE.A_NAME	test rate	10
		Overspeed	
3:0373	T2C_SPDC.OSPD_H2.A_NAME	level	1
		Startup level	
3:0374	T2C_SPDC.LEVEL1.A_NAME	1	1
		Level to	
		select curve	
3:0375	T2C_SPDC.PV_F_CRV02.A_NAME	2 to curve 3	1
		Emergency	
3:0376	T2C_SPDC.EMRG_RTE.A_NAME	min gov Rate	10
		Level to	
		select curve	
3:0377	T2C_SPDC.PV_F_CRV03.A_NAME	3 to curve 4	1
		Min speed to	
3:0378	T2C SPDC.MIN RESET.A NAME	reset	1
		Minimum	
		Remote	
3.0379	T2C SPDC MIN PV RHC A NAME	hot/cold PV	1
0.0070		Minimum	•
		dovernor	
3.0380	T2C SPDC MIN GOV & NAME	speed	1
0.0000		Critical	
2.0291		spood rate?	10
3.0301		Linnor limit	
2.0202			4
3:0382		3	1
		Lower limit	
		critical range	
3:0383	12C_SPDC.CRIT3_L.A_NAME	3	1
		Loss of	
		control delay	
3:0384	T2C_SPDC.LOSS_DLY.A_NAME	before flt	1
3:0385	T2C_SPDC.MAX_GOV.A_NAME	rpm	1
		Minimum	
		Remote	
3:0386	T2C SPDC.MAX PV RHC.A NAME	hot/cold PV	1

3.0387	T2C SPDC OSPD DELAY A NAME	Delay to quit	1
0.0007		Upper limit	1
		critical range	
3:0388	T2C_SPDC.CRIT1_H.A_NAME	1	1
		Startup level	
3:0389	T2C_SPDC.LEVEL2.A_NAME	2	1
		Startup level	
3:0390	T2C_SPDC.LEVEL3.A_NAME	3	1
		Max delta	
2.0201		speed	1
3.0391			
		delta speed	
3:0392	T2C SPDC.ACC DELTA.A NAME	Level	1
0.0002		off line max	
3:0393	T2C_SPDC.ACC_OFFACT.A_NAME	acceleration	10
		ACC on line	
3:0394	T2C_SPDC.ACC_ON_RTE.A_NAME	max accel	10
		Boost Valve	
		position	
3:0395	T2C_SPDC.BST_DMD.A_NAME	demand	100
		Level to	
0.0000		select curve	
3:0396		1 to curve 2	1
3.0397			
		critical range	
3.0398	T2C_SPDC_CRIT1_L_A_NAME	1	1
0.0000		Critical	
3:0399	T2C_SPDC.CRIT1_RTE.A_NAME	speed rate1	10
		Upper limit	
		critical range	
3:0400	T2C_SPDC.CRIT2_H.A_NAME	2	1
		Lower limit	
0.0404		critical range	
3:0401			1
		Level to	
3.0402	T2C SPDC PV E CRV07 A NAME	7 to curve 8	1
0.0402		Level to	
		select curve	
3:0403	T2C_SPDC.PV_F_CRV06.A_NAME	6 to curve 7	1
		Level to	
		select curve	
3:0404	T2C_SPDC.PV_F_CRV05.A_NAME	5 to curve 6	1
		Level to	
2.0405		select curve	4
3:0405		4 to curve 5	1
3.0406	T2C SPDC BST LEV & NAME		1
0.0400		Raise/Lower	1
3:0407	T2C VLV .LP DLY FST.A NAME	delay to fast	1
3:0408	T2C VLV .HP2 GAIN.A NAME	HP2 gain	1
• • •		HP ramp rate	
		at Restart or	
3:0409	T2C_VLVHPR_RTEFST.A_NAME	Manual	1

0.0440		Min speed	
3:0410	12C_VLVHPSPDDMDMN.A_NAME	=> full HP2	1
0.0444		Max speed	
3:0411	12C_VLVHPSPDDMDMX.A_NAME	=> full HP	1
0.0440		Min valve=>	
3:0412	12C_VLVHPVLVDMDMN.A_NAME	full HP2	1
0.0440		Max valve =>	
3:0413			1
0.0444		MAX HP	100
3:0414	I2C_VLVHP_MX_RAMP.A_NAME	ramp	100
0.0445		Raise/Lower	
3:0415	IZC_VLVLP_RL_RATE.A_NAME	rate	1
2.0446		HP ramp	100
3.0410			100
2.0447		minimum transfor time	1
3.0417			
0.0440			4
3:0418		rate	
2.0440		LP fixed	1
3.0419			
2.0420		Raise/Lower	4
3.0420			
		LP min	
2.0421		position at	1
3.0421		Offect when	
2.0422		Oliset when	1
3.0422		spiit transfor time	
2.0422			1
3.0423			1
5.0424			
		#1 current	
3.0425		(mA)	100
5.0425			100
		#1 Scaled	
3.0426	CNEG AI01 AIN SCLDA NAME	value	CCT
0.0420		Analog Input	001
		#2 current	
3.0427	CNEG AI02 AI02 VALA NAME	(mA)	100
0.0121		Analog Input	100
		#2 Scaled	USER DEFINED IN
3:0428	CNEG AI02.AIN SCLD.A NAME	value	CCT
		Analog Input	
		#3 current	
3:0429	CNFG_AI03.AI03_VAL.A_NAME	(mA)	100
		Analog Input	
		#3 Scaled	USER DEFINED IN
3:0430	CNFG_AI03.AIN_SCLD.A_NAME	value	ССТ
		Analog Input	
		#4 current	
3:0431	CNFG_AI04.AI04_VAL.A_NAME	(mA)	100
		Analog Input	
		#4 Scaled	USER DEFINED IN
3:0432	CNFG_AI04.AIN_SCLD.A_NAME	value	CCT
		Analog Input	
		#5 current	
3:0433	CNFG_AI05.AI05_VAL.A_NAME	(mA)	100

3:0434	CNFG AI05.AIN SCLD.A NAME	Analog Input #5 Scaled value	USER DEFINED IN
		Analog Input	
		#6 current	
3:0435	CNFG_AI06.AI06_VAL.A_NAME	(mA)	100
		#6 Scaled	
3.0436	CNEG AI06 AIN SCLD A NAME	value	CCT
0.0.00		Analog Input	
		#7 current	
3:0437	CNFG_AI07.AI07_VAL.A_NAME	(mA)	100
		Analog Input	
3.0438	CNEG AIOZAINI SCI DA NAME	#7 Scaled	
3.0430		Analog Input	
		#8 current	
3:0439	CNFG_AI08.AI08_VAL.A_NAME	(mA)	100
		Analog Input	
0.0440		#8 Scaled	USER DEFINED IN
3:0440		Value Appleg Ipput	
		#9 current	
3:0441	CNFG AI09.AI09 VAL.A NAME	(mA)	100
		Analog Input	
		#9 Scaled	
3:0442	CNFG_AI09.AIN_SCLD.A_NAME	value	
		Analog Input	
3.0443	CNEG ALLO ALLO VAL A NAME	(mA)	100
0.0440		Analog Input	100
		#10 Scaled	
3:0444	CNFG_AI10.AIN_SCLD.A_NAME	value	
		Analog Input	
2.0445		#11 current	100
3.0445		Analog Input	100
		#11 Scaled	
3:0446	CNFG_AI11.AIN_SCLD.A_NAME	value	
		Analog Input	
0.0447		#12 current	100
3:0447	CNFG_AI12.AI12_VAL.A_NAME	(MA)	100
		#12 Scaled	
3:0448	CNFG AI12.AIN SCLD.A NAME	value	
		Analog Input	
		#13 current	
3:0449	CNFG_AI13.AI13_VAL.A_NAME	(mA)	100
		Analog Input	
3.0450	CNEG ALL3 AIN SCLDA NAME	value	
0.0100		Analog Input	
		#14 current	
3:0451	CNFG_AI14.AI14_VAL.A_NAME	(mA)	100
		Analog Input	
3.0452	CNEG ALLA AIN SCL DA NAME	#14 Scaled	
0.0402		value	1

		Analog Input	
		#15 current	
3:0453	CNFG_AI15.AI15_VAL.A_NAME	(mA)	100
		Analog Input	
		#15 Scaled	
3:0454	CNFG_AI15.AIN_SCLD.A_NAME	value	
		Analog Input	
		#16 current	
3:0455	CNFG_AI16.AI16_VAL.A_NAME	(mA)	100
		Analog Input	
0.0450		#16 Scaled	
3:0456	CNFG_AI16.AIN_SCLD.A_NAME		
2:0457		#17 current (mA)	100
3.0457		(IIIA)	100
		#17 Scaled	
2.0459			
3.0450	CNFG_AITT.AIN_SOLD.A_NAME		
		#18 current	
3.0459	CNEG ALLA ALLA NAME	$(m\Delta)$	100
0.0400		Analog Input	100
		#18 Scaled	
3:0460	CNEG AI18 AIN SCLD A NAME	value	
0.0.00		Analog Input	
		#19 current	
3:0461	CNFG AI19.AI19 VAL.A NAME	(mA)	100
		Analog Input	
		#19 Scaled	
3:0462	CNFG_AI19.AIN_SCLD.A_NAME	value	
		Analog Input	
		#20 current	
3:0463	CNFG_AI20.AI20_VAL.A_NAME	(mA)	100
		Analog Input	
		#20 Scaled	
3:0464	CNFG_AI20.AIN_SCLD.A_NAME	value	
		Analog Input	
		#21 current	
3:0465	CNFG_AI21.AI21_VAL.A_NAME	(mA)	100
		Analog Input	
0.0400		#21 Scaled	
3:0466	CNFG_AI21.AIN_SCLD.A_NAME	value	
		Analog Input	
2.0407		#22 current	100
3:0467		(MA)	100
		Analog Input	
2.0469			
3.0400			
		#23 current	
3.0469	CNEG A123 A123 VALA NAME	(mA)	100
0.0400		Analog Input	
		#23 Scaled	
3:0470	CNFG AI23.AIN SCLD.A NAME	value	
0.0110		Analog Input	
		#24 current	
3:0471	CNFG_AI24.AI24_VAL.A_NAME	(mA)	100

		Analog Input	
3.0472	CNEG A124 AIN SCI D A NAME	#24 Scaled	
3.0472		Analog Input	
		#25 current	
3:0473	CNFG_AI25.AI25_VAL.A_NAME	(mA)	100
		Analog Input	
0.0474		#25 Scaled	
3:0474	UNFG_AIZ5.AIN_SOLD.A_NAME	Analog Input	
		#26 current	
3:0475	CNFG_AI26.AI26_VAL.A_NAME	(mA)	100
		Analog Input	
		#26 Scaled	
3:0476	CNFG_AI26.AIN_SCLD.A_NAME	Value	
		#27 current	
3:0477	CNFG AI27.AI27 VAL.A NAME	(mA)	100
0.0 11 1		Analog Input	
		#27 Scaled	
3:0478	CNFG_AI27.AIN_SCLD.A_NAME	value	
		Analog Input	
3.0479	CNEG AI28 AI28 VALA NAME	#26 current (mA)	100
0.0110		Analog Input	
		#28 Scaled	
3:0480	CNFG_AI28.AIN_SCLD.A_NAME	value	
		Analog Input	
3.0481		#29 current	100
3.0401		Analog Input	100
		#29 Scaled	
3:0482	CNFG_AI29.AIN_SCLD.A_NAME	value	
		Analog Input	
2.0402		#30 current	100
3:0483		(IIIA) Analog Input	100
		#30 Scaled	
3:0484	CNFG_AI30.AIN_SCLD.A_NAME	value	
		Analog Input	
0.0405		#31 current	100
3:0485	UNFG_AI31.AI31_VAL.A_NAME	(MA)	100
		#31 Scaled	
3:0486	CNFG AI31.AIN SCLD.A NAME	value	
		Analog Input	
		#32 current	
3:0487	CNFG_AI32.AI32_VAL.A_NAME	(mA)	100
		Analog Input	
3:0488	CNFG AI32.AIN SCLD.A NAME	value	
0.0100		Speed Signal	
3:0489	SPDSIG1.SPEED.A_NAME	#1	
		Speed Signal	
3:0490	SPDSIG2.SPEED.A_NAME	#2	
3.0491	SPDSIG3 SPEED A NAME	speed Signal #3	
0.0 10 1			

3:0492	SPDSIG4.SPEED.A NAME	Speed Signal #4	
		Validated	
		Turbine	
3:0493	A_SPEED.ACTUAL_SPD.A_SW	Speed Signal	
		Remote AUX	
3:0494	T2AUX1.RAUX1_PV.A_NAME	Setpoint (EU)	
		Unit Percent	
3:0495	T2_GEN.LOAD2MOD.A_SW	Load	
		Menu	
2.0406		Conliguration	
3.0490		Monu	
		Configuration	
3.0497	MODBUS AI02 CE OUT 1	of AI 2	
0.0101		Menu	
		Configuration	
3:0498	MODBUS.AI03_CF.OUT_1	of AI 3	
		Menu	
		Configuration	
3:0499	MODBUS.AI04_CF.OUT_1	of AI 4	
		Menu	
		Configuration	
3:0500	MODBUS.AI05_CF.OUT_1	of AI 5	
		Menu	
0.0504		Configuration	
3:0501		OF AL 6	
		Nenu	
3.0502		of ALZ	
3.0302		Menu	
		Configuration	
3.0503	MODBUS AI08 CE OUT 1	of AL8	
0.0000		Menu	
		Configuration	
3:0504	MODBUS.A5MOD_CH.OUT_1	of AI 9	
		Menu	
		Configuration	
3:0505	MODBUS.A5MOD_CH.OUT_2	of AI 10	
		Menu	
		Configuration	
3:0506	MODBUS.A5MOD_CH.OUT_3	of AI 11	
		Menu	
2.0507			
3.0007			
		Configuration	
3:0508	MODBUS.A5MOD CH.OUT 5	of AI 13	
0.0000		Menu	
		Configuration	
3:0509	MODBUS.A5MOD_CH.OUT_6	of AI 14	
		Menu	
		Configuration	
3:0510	MODBUS.A5MOD_CH.OUT_7	of AI 15	
		Menu	
		Configuration	
3:0511	MODBUS.A5MOD_CH.OUT_8	of AI 16	

		Menu	
3:0512	MODBUS.A5MOD_CH.OUT_9	of AI 17	
		Menu	
2.0512	MODBUS ASMOD CHIOLIT 10	Configuration	
3.0513		Menu	
		Configuration	
3:0514	MODBUS.A5MOD_CH.OUT_11	of AI 19	
		Menu	
3.0515		of AL 20	
0.0010		Menu	
		Configuration	
3:0516	MODBUS.A5MOD_CH.OUT_13	of AI 21	
		Menu	
3.0517		of AL 22	
5.0517		Menu	
		Configuration	
3:0518	MODBUS.A5MOD_CH.OUT_15	of AI 23	
		Menu	
3.0510		of AL 24	
5.0513		Menu	
		Configuration	
3:0520	MODBUS.A5MOD_CH.OUT_17	of AI 25	
		Menu	
3.0521		of AL 26	
3.0321		Menu	
		Configuration	
3:0522	MODBUS.A5MOD_CH.OUT_19	of AI 27	
		Menu	
3.0523		of AL 28	
5.0525		Menu	
		Configuration	
3:0524	MODBUS.A5MOD_CH.OUT_21	of AI 29	
		Menu	
3.0525	MODBUS A5MOD CHOUT 22	of AL 30	
0.0020		Menu	
		Configuration	
3:0526	MODBUS.A5MOD_CH.OUT_23	of AI 31	
		Menu	
3.0527	MODBUS A5MOD CHOUT 24	of AL32	
0.0021		Menu	
		Configuration	
3:0528	SIM_MBUS.BI_CNFGS.OUT_2	of DI 2	
		Menu	
3:0529	SIM MBUS.BI CNEGS.OUT 3	of DI 3	
0.0020		Menu	
		Configuration	
3:0530	SIM_MBUS.BI_CNFGS.OUT_4	of DI 4	

		Menu	
3:0531	SIM_MBUS.BI_CNFGS.OUT_5	of DI 5	
		Menu	
2.0522		Configuration	
3.0032		Menu	
		Configuration	
3:0533	SIM_MBUS.BI_CNFGS.OUT_7	of DI 7	
		Menu	
3.0534		of DI 8	
0.0004		Menu	
		Configuration	
3:0535	SIM_MBUS.BI_CNFGS.OUT_9	of DI 9	
		Menu	
3.0536	SIM MBUS BLONEGS OUT 10	of DI 10	
3.0330		Menu	
		Configuration	
3:0537	SIM_MBUS.BI_CNFGS.OUT_11	of DI 11	
		Menu	
3.0538	SIM MBUS BLONEGS OUT 12	of DI 12	
5.0550		Menu	
		Configuration	
3:0539	SIM_MBUS.BI_CNFGS.OUT_13	of DI 13	
		Menu	
3.0540	SIM MBUS BLONEGS OUT 14	of DI 14	
3.0340		Menu	
		Configuration	
3:0541	SIM_MBUS.BI_CNFGS.OUT_15	of DI 15	
		Menu	
3.0542	SIM MBUS BLONEGS OUT 16	of DI 16	
5.0042		Menu	
		Configuration	
3:0543	SIM_MBUS.BI_CNFGS.OUT_17	of DI 17	
		Menu	
3.0544	SIM MBUS BLONEGS OUT 18	of DI 18	
0.0044		Menu	
		Configuration	
3:0545	SIM_MBUS.BI_CNFGS.OUT_19	of DI 19	
		Menu	
3.0546	SIM MBUS BLONEGS OUT 20	of DI 20	
0.0040		Menu	
		Configuration	
3:0547	SIM_MBUS.BI_CNFGS.OUT_21	of DI 21	
		Menu	
3:0548	SIM MBUS.BI CNEGS.OUT 22	of DI 22	
0.0010		Menu	
		Configuration	
3:0549	SIM_MBUS.BI_CNFGS.OUT_23	of DI 23	

		Menu	
3:0550	SIM MBUS.BL CNEGS.OUT 24	of DI 24	
0.0000		Menu	
		Configuration	
3:0551	SIM_MBUS.BO_CNFGS.OU1_2	of Relay 2	
		Configuration	
3:0552	SIM_MBUS.BO_CNFGS.OUT_3	of Relay 3	
		Menu	
0.0550		Configuration	
3:0553	SIM_MBUS.BO_CNFGS.OUT_4	of Relay 4	
		Configuration	
3:0554	SIM_MBUS.BO_CNFGS.OUT_5	of Relay 5	
		Menu	
0 0555		Configuration	
3:0555	SIM_MBUS.BO_CNFGS.OU1_6	of Relay 6	
		Configuration	
3:0556	SIM_MBUS.BO_CNFGS.OUT_7	of Relay 7	
		Menu	
0 0557		Configuration	
3:0557	SIM_MBUS.BO_CNFGS.OU1_8	of Relay 8	
		Configuration	
3:0558	SIM_MBUS.BO_CNFGS.OUT_9	of Relay 9	
		Menu	
		Configuration	
3:0559	SIM_MBUS.BO_CNFGS.OUT_10	of Relay 10	
		Configuration	
3:0560	SIM_MBUS.BO_CNFGS.OUT_11	of Relay 11	
		Menu	
		Configuration	
3:0561	SIM_MBUS.BO_CNFGS.OUT_12	of Relay 12	
		Level Switch	
3:0562	SIM_MBUS.BO_CNFGS.OUT_13	Value	
		Relay 3	
0.0500		Level Switch	
3:0563	SIM_MBUS.BO_CNFGS.OUT_14	Value Rolov 4	
		Level Switch	
3:0564	SIM_MBUS.BO_CNFGS.OUT_15	Value	
		Relay 5	
0.0505		Level Switch	
3:0565	SIIVI_IVIBUS.BU_CINEGS.UU1_16	value Relay 6	
		Level Switch	
3:0566	SIM_MBUS.BO_CNFGS.OUT_17	Value	
		Relay 7	
0.0507		Level Switch	
3:0567		Value Rolay ^e	
		Level Switch	
3:0568	SIM_MBUS.BO_CNFGS.OUT_19	Value	

		Relay 9
		Level Switch
3:0569	SIM_MBUS.BO_CNFGS.OUT_20	Value
		Relay 10
		Level Switch
3:0570	SIM_MBUS.BO_CNFGS.OUT_21	Value
		Relay 11
		Level Switch
3:0571	SIM_MBUS.BO_CNFGS.OUT_22	Value
		Relay 12
0 0570		Level Switch
3:0572	SIM_MBUS.BO_CNFGS.OU1_23	
3:0573		Spare
3:0574		Spare
		Demand
2.0575		Act #1
3.0375		Demand
		Value to
		Integrating
3.0576	CNEGIACT2 A6 ACT2 A MUX N 1	Act #2
3.0577		Spare
3.0578		Spare
0.0070		Function
		selected for
3:0579	CNFG PACT1.ACT FUNC.OUT 3	Int Act 1
		Function
		selected for
3:0580	CNFG PACT1.ACT FUNC.OUT 4	Int Act 2
		Analog
		Output #1
3:0581	CNFG_AO_01.SEL.A_MUX_N_1	Scaled Value
		Analog
		Output #2
3:0582	CNFG_AO_02.SEL.A_MUX_N_1	Scaled Value
		Analog
		Output #3
3:0583	CNFG_AO_03.SEL.A_MUX_N_1	Scaled Value
		Analog
0.0504		Output #4
3:0584	CNFG_AO_04.SEL.A_MUX_N_1	
		Analog Output #F
3.0585		Scaled Value
3.0305		
		Output #6
3.0586	CNEG AO 06 SEL A MUX N 1	Scaled Value
0.0000		Analog
		Output #7
3:0587	CNFG AO 07.SEL.A MUX N 1	Scaled Value
		Analog
		Output #8
3:0588	CNFG_AO_08.SEL.A_MUX_N_1	Scaled Value
		Analog
		Output #9
3:0589	CNFG_AO_09.SEL.A_MUX_N_1	Scaled Value

			1
		Analog	
		Output #10	
3:0590	CNFG_AO_10.SEL.A_MUX_N_1	Scaled Value	
		Analog	
		Output #11	
3.0501	CNEG AO 11 SEL A MUX N 1		
5.0531			
		Analog	
		Output #12	
3:0592	CNFG_AO_12.SEL.A_MUX_N_1	Scaled Value	
		Function	
		selected for	
3:0593	MODBUS.AO CNEGS.OUT 1	AO 1	
		Function	
		colocted for	
2:0504			
3.0594		AU Z	
		Function	
		selected for	
3:0595	MODBUS.AO_CNFGS.OUT_3	AO 3	
		Function	
		selected for	
3.0596	MODBUS AO CNEGS OUT 4		
0.0000		Function	
		selected for	
3:0597	MODBUS.AO_CNFGS.OUT_5	AO 5	
		Function	
		selected for	
3:0598	MODBUS.AO CNFGS.OUT 6	AO 6	
		Function	
		selected for	
2.0500			
3.0399		AU 7	
		Function	
		selected for	
3:0600	MODBUS.AO_CNFGS.OUT_8	AO 8	
		Function	
		selected for	
3:0601	MODBUS.AO CNFGS.OUT 9	AO 9	
		Function	
		selected for	
2,0602			
3.0602			
		Function	
		selected for	
3:0603	MODBUS.AO_CNFGS.OUT_11	AO 11	
		Function	
		selected for	
3:0604	MODBUS,AO CNFGS,OUT 12	AO 12	
3.0605		Spare	100
3:0606		Spare	100
3.0000	Spore	Spare	Spara
3:0607	Spare	Spare	Spare
3:0608	Spare	Spare	Spare
		Integ Act 1	
		Position	
3:0609	IACT1_SEL.ACT1SEL.A_NAME	FDBK	10
	_	Integ Act 1 A	
		Torg Motor	
3.0610	IACTI SELACTIAMA A NAME	current	100
3.0010			100
		i ord iviotor	
3:0611	IACI1_SEL.ACI1BMA.A_NAME	current	100

		Integ Act 1	
		Total Torq	
3:0612	IACT1_SEL.ACT1MA.A_NAME	Motor mA	100
		Integ Act 2	
		Position	
3:0613	IACT2_SEL.ACT2SEL.A_NAME	FDBK	10
		Integ Act 2 A	
		Torq Motor	
3:0614	IACT2_SEL.ACT2AMA.A_NAME	current	100
		Integ Act 2 B	
		Torq Motor	
3:0615	IACT2_SEL.ACT2BMA.A_NAME	current	100
		Integ Act 2	
		Total Torq	
3:0616	IACT2_SEL.ACT2MA.A_NAME	Motor mA	100
		Control	
		Status of V1	
3:0617	TLKIT_OI.VLV1_MESSG.OUT_1	Valve	
		Control	
		Status of V2	
3:0618	TLKIT_OI.VLV2_MESSG.OUT_1	Valve	
3:0619	MODBUS.TYPE.OUT_1	Turbine Type	
		HP Valve	
3:0620	MODBUS.HP_TYPE.OUT_1	Туре	
		LP Valve	
3:0621	MODBUS.LP_TYPE.OUT_1	Туре	
		Decoupling	
3:0622	MODBUS.DCPL_TYPE.OUT_1	Туре	
		Extraction	
3:0623	T2C_EXTC.EXT_UNITS.OUT_1	Inputs Units	
		Auxiliary	
3:0624	T2C_AUX1.AUX_UNITS.OUT_1	Inputs Units	
		Cascade	
3:0625	T2C_CASC.CASC_UNITS.OUT_1	Inputs Units	
		Extraction	
		PV/SP	
3:0626	T2C_EXTC.MOD_SCALE.A_MUX_N_1	Multiplier	
		Auxiliary	
		PV/SP	
3:0627	T2C_AUX1.MOD_SCALE.A_MUX_N_1	Multiplier	
		Cascade	
		PV/SP	
3:0628	T2C_CASC.MOD_SCALE.A_MUX_N_1	Multiplier	
		Peak Speed	
3:0629	PEAK_SPD.SPEED_HOLD.A_MAX	Reached	
		Kern A IACT	
		Chan 1 Fdbk	
3:0630	A1_A06_ACT.ACT_01.AVG_POS	Pos	10
		Kern A IACT	
		Chan 2 Fdbk	
3:0631	A1_A06_ACT.ACT_02.AVG_POS	Pos	10
		Kern B IACT	
		Chan 1 Fdbk	
3:0632	B1_A06_ACT.ACT_01.AVG_POS	Pos	10
		Kern B IACT	
		Chan 2 Fdbk	
3:0633	B1 A06 ACT.ACT 02.AVG POS	Pos	10

		i	i i i i i i i i i i i i i i i i i i i
		Seal Gas	
		Valve	
3:0634	SEAL.GSEAL DMD.A NAME	Demand	10
		Seal Gas	
		Setpoint	
3.0635	SEAL MARID SPN A NAME	Value	10
5.0055			10
		Seal Gas	
0.0000		Process	10
3:0636	SEAL.M4PID_PV.A_NAME	value	10
		Seal Gas	
		Remote	
		Setpoint	
3:0637	SEAL.RMTSP_TEST.A_SW	Value	Spare
		Avg FDBK	
		Position	
3:0638	A1 A06 ACT.AVGPOS CH1.A MAX	IACT Chan 1	10
0.0000		Avg FDBK	
		Position	
2.0620		IACT Chap 2	10
3.0039		Conorator	10
0.0040		Generator	0.04
3:0640	12_GEN.KW_SIG.A_NAME	KW Load	0.01
		Sync/LS	
		Speed Bias	
3:0641	T2_GEN.REMSPDBIAS.A_SW	Value (rpm)	
		Remote KW	
3:0642	T2 GEN.KW SETPT.ZMINUS1	Setpoint	0.01
		Start Mode	
3.0643	MODBUS TYPE OUT 2	Configuration	
0.0010		Configuration	
3.0611	Snaro	Snara	
3:0644	Spare	Spare	
3:0644		Spare User cnfg	
3:0644 3:0645	Spare T2_GEN.MOD_SCALE.A_MUX_N_1	Spare User cnfg scaler for KW	
3:0644 3:0645	Spare T2_GEN.MOD_SCALE.A_MUX_N_1	Spare User cnfg scaler for KW Normalized	
3:0644 3:0645	Spare T2_GEN.MOD_SCALE.A_MUX_N_1	Spare User cnfg scaler for KW Normalized Speed (0-	
3:0644 3:0645 3:0646	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%)	
3:0644 3:0645 3:0646	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized	
3:0644 3:0645 3:0646	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed	
3:0644 3:0645 3:0646 3:0647	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint	
3:0644 3:0645 3:0646 3:0647	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into	
3:0644 3:0645 3:0646 3:0647 3:0648	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1_VLVS_TERM_IN.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter	
3:0644 3:0645 3:0646 3:0647 3:0648	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLV_S_TERM_IN.A_NAME X1_VLV_P_TERM_IN.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into Ratiol imiter	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651 3:0652	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651 3:0652 thru	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message Spare	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651 3:0652 thru 3:0654	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message Spare	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651 3:0652 thru 3:0654	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message Spare Analog	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651 3:0652 thru 3:0654	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare ANA_OUT1.AO_RM.RDBK_MA	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message Spare Analog Output Chan	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651 3:0652 thru 3:0654 3:0655	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare ANA_OUT1.AO_RM.RDBK_MA	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message Spare Analog Output Chan 1 mA (x10)	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0651 3:0652 thru 3:0654 3:0655	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare ANA_OUT1.AO_RM.RDBK_MA	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message Spare Analog Output Chan 1 mA (x10) Analog	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0650 3:0651 3:0652 thru 3:0654 3:0655	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare ANA_OUT1.AO_RM.RDBK_MA	SpareUser cnfgscaler for KWNormalizedSpeed (0-100%)NormalizedSpeedSetpointS Term intoRatioLimiterP Term intoRatioLimiterAlarm FirstOut EventMessageTRIP FirstOut EventMessageSpareAnalogOutput Chan1 mA (x10)AnalogOutput Chan1 mA (x10)	
3:0644 3:0645 3:0646 3:0647 3:0648 3:0649 3:0650 3:0650 3:0651 3:0652 thru 3:0654 3:0655	Spare T2_GEN.MOD_SCALE.A_MUX_N_1 X1SPDC.NORMSPEED.A_NAME X1SPDC.NORMSPD_SP.A_NAME X1VLVS_TERM_IN.A_NAME X1VLVP_TERM_IN.A_NAME EVENT_ALM.AL_FRSTOUT.A_NAME EVENT_SD.SD_FRSTOUT.A_NAME Spare ANA_OUT1.AO_RM.RDBK_MA ANA_OUT2.AO_RM.RDBK_MA	Spare User cnfg scaler for KW Normalized Speed (0- 100%) Normalized Speed Setpoint S Term into RatioLimiter P Term into RatioLimiter P Term into RatioLimiter Alarm First Out Event Message TRIP First Out Event Message Spare Analog Output Chan 1 mA (x10) Analog Output Chan	
		Analog Output Chan	
--------	--------------------------	-----------------------	
3.0657		3 mA (x10)	
0.0007			
	ANA OUT4.AO RM.RDBK MA	Output Chan	
3:0658		4 mA (x10)	
0.0000		Analog	
	ANA OUTS AO RM RDBK MA	Output Chan	
3.0659		5 mA(x10)	
		Analog	
	ANA OUT6.AO RM.RDBK MA	Output Chan	
3:0660		6 mA (x10)	
		Analog	
	ANA OUT7.AO RM.RDBK MA	Output Chan	
3:0661		7 mA (x10)	
		Analog	
	ANA OUT8.AO RM.RDBK MA	Output Chan	
3:0662		8 mA (x10)	
		Analog	
	ANA OUT9.AO RM.RDBK MA	Output Chan	
3:0663		9 mA (x10)	
		Analog	
	ANA OUT10.AO RM.RDBK MA	Output Chan	
3:0664		10 mA (x10)	
		Analog	
	ANA OUT11.AO RM.RDBK MA	Output Chan	
3:0665		11 mA (x10)	
		Analog	
	ANA OUT12.AO RM.RDBK MA	Output Chan	
3:0666		12 mA (x10)	
		MW aux	
		controller	
3:0667	LOAD CTRL.DIS MWPID.A SW	PID Demand	
		MW aux	
		controler	
3:0668	LOAD_CTRL.SETPOINT.RAMP	setpoint	
		Type of	
	MODBUS.TYPE_AUX.OUT_1	auxiliary load	
3:0669		ctrl	
		Tpy of Aux	
3:0670		load Sensor	
		S pt E of	
		steam Map in	
3:0671	T1MAPSE_NORM.CALCULATE	%	
		H pt E of	
	T1MAPHE_NORM.A_NAME	steam Map in	
3:0672		%	
		S pt F of	
	T1MAPSF_NORM.A_NAME	steam Map in	
3:0673		%	
		H pt F of	
	T1MAPHF_NORM.A_NAME	steam Map in	
3:0674		%	
		S pt D of	
	T1MAPSD_NORM.A_NAME	steam Map in	
3:0675		%	

		H pt D of steam Map in	
3:0676	T1MAPHD_NORM.CALCULATE	%	
3:0677 thru	Spare	Spare	
3:0680		opulo	
0.0000		Prop Act HP	
		Valve	
	CNFG_PACT1.HPDMD_CTL.A_SW	Demand	
2.0691		Voluo	
3.0001			
		Prop Act HP	
	CNFG_PACI1.PACI1_MA.A_NAME	Valve	
3:0682		Current FDB	
		Prop Act HP	
		Split Valve	
		Demand	
3:0683	CNFG PACT2.HPDMDSPLIT_CTL_SCALE.CURVES_2	Value	
0.0000		Prop Act HP	
	CNEG ΡΔCT2 ΡΔCT2 ΜΔ Δ ΝΔΜΕ	Split Valve	
2.0694			
3.0004			
		Prop Act LP	
	CNEG PACT3 I PDMD CTL A SW	Valve	
		Demand	
3:0685		Value	
		Prop Act LP	
	CNFG PACT3.PACT3 MA.A NAME	Valve	
3:0686		Current FDB	
		Prop Act I P	
		Solit Valve	
		Domond	
0.0007		Demano	
3.0007	CNFG_PAC14.LPDIVIDSPLI1_CTL.A_SW		
		Prop Act LP	
		Split Valve	
3:0688	CNFG_PAC14.PAC13_MA.A_NAME	Current FDB	
3:0689			
thru	Spare	Spare	
3:0700			
		Analog Input	
	CNFG AI33.AI33 VAL.A NAME	#33 current	
3:0701		(mA)	100
		Analog Input	
	CNEG A133 AIN SCLDA NAME	#33 Scaled	
3.0202			
3.07.02		Analog Innut	
0.0700	CNFG_AI34.AI34_VAL.A_NAME	#34 current	100
3:0703		(mA)	100
		Analog Input	
	CNFG_AI34.AIN_SCLD.A_NAME	#34 Scaled	
3:0704		value	
		Analog Input	
	CNFG_AI35.AI35_VAL.A_NAME	#35 current	
3:0705		(mA)	100
		Analog Input	
	CNEG AI35.AIN SCIDA NAME	#35 Scaled	
3.0206		value	
0.0700			
		#25 ourreast	
2.0707			100
3:0707		(IIIA)	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	Spare	Spare		
4:0050				

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:

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

Table 8-9. Analog Input Menu List

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:

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

Table 8-10. Analog Output Menu List

Relay Configuration—The Relay Configuration is defined as follows:

	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

Table 8-11.	Relav	Outputs	Menu	List
	rtoituy	Outputs	monu	LIOU

DESCRIPTION LEVEL

Table 8-12. F	Relav 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		

DESCRIPTION STATE

NB	Description	NB	Description
1	<not used=""></not>	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:

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 &	54	
	SD)		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	//	spare//
28	Auxiliary Setpoint Raise Command	78	spare/8
29	Auxiliary Setpoint Lower Command	79	spare/9
30	LP Valve Limiter Raise	80	Stage 1 Online Auxiliary Input
31	LP Valve Limiter Lower	01	Stage 1 AS Valve Fault
32 22	Select Extraction/Admission Dright	02	Stage 2 Opling Auxiliant Input
24	Select Extraction/Admission Control Enable	03	Stage 2 AS Valve Fault
34	Extraction/Admission Setpoint Paise	04 85	Stage 2 Shutdown
36	Extraction/Admission Setpoint Lower	86	Seal Gas Raise SP
37	Enable REM Extraction/Admission Setot	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	ſ	

Table 8-14. Discrete Input Menu List

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

Table 8-16. Units Legend List

Units Configured—integers that represents the following:

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/cm ²	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 3200, the scale factor is automatically set to 100. 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



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



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	
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

Date:

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	mm/s
Cold Hold Time at Low Idle	min
Cold Rate to Medium Idle	mm/s
Cold Hold Time at Medium Idle	min
Cold Rate to High Idle	mm/s
Cold Hold Time at High Idle	min
Cold Rate to Min Gov	rom/s
Cold Loading Gradient above Min Gov	mm/s
Start-Up Curve Hot	
Hot Rate to Low Idle	mm/s
Hot Hold Time at Low Idle	min
Hot Rate to Medium Idle	mm/s
Hot Hold Time at Medium Idle	min
Hot Rate to High Idle	mm/s
Hot Hold Time at High Idle	
Hot Rate to Min Gov	mm/s
	a second second second

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

01-+ 0-# (0 8)	
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	
Delay at High Idle Rate 9	min
Ramp to Min Gov Rate 9	rpm/s
Loading Rate 9	
-	
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 rpm/s Delay at High Idle Rate 10______min 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

y/n
y/n
rpm/s
rpm
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)

Vin Remote Speed Value	rpm
Max Remote Speed Value	rpm
Vin 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	

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	v/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	i
issued		

.

Predictive Overspeed	
Use Predictive Overspeed Logic	y/n
Predictive Speed Level	rpm
Max Acceleration at Predictive Speed	rpm/s

sec

EXTRACTION / ADMISSION CONTROL PAGE (if configured) Extraction/Admission (P) PID Control

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 Inhibite	d 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

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

Foline & 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____ Max HP Flow @ Max Admission

eu

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 Al	y/n
Use KW AI for Cascade	vin
Use Exhaust Al for Cascade	wn
Use Inlet AI for Cascade	wn
Min Cascade PV (value @ 4ma)	eu
Max Cascade PV (value @ 20ma)	eu
Signal Difference ALM (multiple inputs)	eu
· · · · · · · · · · · · · · · · · · ·	

Parad Patraint Values	
Speed Setpoint Values	
Min Cascade Setpoint Value	eu
Max Cascade Setpoint Value	eu
Rate for Go to Setpoint Entered	eu
Namal P/L Sciencist Pate	eurs
Normal R/L Selpoint Rate	eu/s
Delay Befere Normal P/L Pate	
	*
Use 4-20 mA Remote Cascade Setpoint?	v/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)	CU
orginal billerende view (il manple inputs used)	
Cascade PID Initial Settings	
Proportional Gain	%
Integral Gain	
Derivative Ratio	%
Sliding Deadband	%
Droop (in % of SP range)	~ %
Settings for GENERATOR applications	
Disable Cascade if GEN Breaker Opens	v/n
Disable Cascade if UTIL Breaker Opens	y/n
DECOUPLING CONTROL PAGE (if configured)	
General Settings	
Reverse PID (compared to Type)	v/n
Decoupling is Cascade?	y/n
Manual Mode Only Available	 v/n
PID Always I Control (No Manual)	y/n
PID Control First at Enable	v/n
Demand Limits	
Min Decoupling Demand	%
Max Decoupling Demand	%
Sensor Range (Set on Al)	
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	5
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	5
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	
Sneed Signals Page	
Device Tag Names	
Speed Input #1	
Speed Input #2	
Speed Input #3	
Speed Input #4	
opeed input ini	
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	v/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)?	трт
Speed Signal Gear Ratio	
Number of Gear Teeth	
Speed Low Latch Setpoint	
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

Analog Input Channel #8

Function	
Value for 4 mA	
Value for 20 mA	
Device Tag Name	

Analog Input Channel #9

_

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	
/alue for 4 mA	-
/alue for 20 mA	
Device Tag Name	

Analog Input Channel #16

Function	F
Value for 4 mA	V
Value for 20 mA	V
Device Tag Name	D

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

unction	
/alue for 4 mA	
/alue 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

unction	
/alue for 4 mA	
/alue 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

unction	
alue for 4 mA	
alue for 20 mA	
evice 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	
unction	
/alue at 4 mA	
/alue 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	Contact Input 17 Function	
Device Tag Identifier	e Tag Identifier Device Tag Identifier	
#2 Default = Event Reset	Contact Input 18 Function	
Contact Input 2 Function	Device Tag Identifier	
Device Tag Identifier		
	Contact Input 19 Function	
#3 Default = Speed Reference Raise Setpoint	Device Tag Identifier	
Contact Input 3 Function		
Device Tag Identifier	Contact Input 20 Function	
	Device Tag Identifier	
#4 Default = Speed Reference Lower Setpoint		
Contact Input 4 Function	Contact Input 21 Function	
Device Tag Identifier	Device Tag Identifier	
#5 Default = Start Command	Contact Input 22 Function	
Contact Input 5 Function	Device Tag Identifier	
Device Tag Identifier		
	Contact Input 23 Function	
#6 Default = Controlled Shutdown Command	Device Tag Identifier	
Contact Input 6 Function		
Device Tag Identifier	Contact Input 24 Function	
	Device Tag Identifier	
Contact Input 7 Function		
Device Tag Identifier		
Contact Input 8 Function		
Device Tag Identifier	RELAY OUTPUTS PAGE	
Contact Input 9 Function	Relay 1 Function FIXED = Summary Alarm / Trip Relay	
Device Tag Identifier	Check Reset Clears Trip Relay?	_y/n
	External Trips Activate Trip Relay	_y/n
Contact Input 10 Function	Trip Relay Drives Actuators to Zero Current	_y/n
Device Tag Identifier	Invert Output State (Energize For Trip)	_ y/n
	Configuration	_
Contact Input 11 Function	lest Relay	-
Device Tag Identifier	Device Tag Identifier	_
Contact Input 12 Eurotion	Palay 2	
Device Tag Identifier	Reidy z Uso as a Loval Switch	ude.
	Appleg Signal	_ y/11
Contact Input 13 Eurotion	Switch On Level	_
Device Tag Identifier	Switch Off Level	
Device rag identifier	Switch Oil Level	
Contact Input 14 Eurotion	Configuration	_
Device Tan Identifier	Tost Rolav	-
Denice ray identifier	Invert Output State for This Condition	
Contact Input 15 Function	Device Tao Identifier	_ yn1
Device Tag Identifier	eserve rag menuner	-
o since registeriumer		
Contact Input 16 Function		
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

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 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	v/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	 wn
Modbus #1 Writes Always Enabled	ýn
Modbus #1 Writes When Selected	 wn
Select Link #1 Interface	
This will define Link 1 into CPU A and Link 2 into CPU B	
Ethernet UDP Port 5001	ν'n
Ethemet TCP	
Serial	
Set Slave Address	
Enable Write from Modbus #1 - Link #1	 w/n
Modbus #1 Link #2 Sottings	
Select ModBus #2 Interface	
Modbus #1 Link #2 Not Lload	win
Modbus #1 Link #2 View Only No Writes	
Modbus #1 Link #2 Writes Always Enabled	
Modbus #1 Link #2 Writes Always Enabled	
Modbus #1 Link #2 Writes When Selected	
Modbus #1 Link #2 writes when Link #1 Failed	yn
Set Slave Address	
Enable Write from Modbus #1 - Link #1	yn
LINK #2 IS NOT Redundant for HMI using LINK #1	yn
Madhua #11 iab #2 Cattiana	
Modbus #1 Link #3 Settings	
Link #3 is view only with NO write enable option	
Select ModBus #3 Interface	yn.
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 Wri	tesy/n
Modbus #2 Link #2 Writes Always Ena	abledy/n
Modbus #2 Link #2 Writes When Sele	ctedy/n
Modbus #2 Link #2 Writes When Link	#1 Failedy/n
Set Slave Address	
Enable Write from Modbus #2 - Link #2	y/n
Link #2 is Not Redundant for HMI using Lin	1k #1y/n
Parial Compations (Secondary	
Senai Connections (Il conligured) Modhus #1 Social Sottings	
Restand Link 4	ACCIL/DT
Protocol Link 1	
Protocol Link 2	
	A3017 KT
Modbus #2 Serial Settings	
Protocol Link 1	ASCII / RT
Protocol Link 2	ASCII / RT
Serial Port 1 CPU A Communication Settin	gs
Driver Selection	RS232 / RS422 / RS485
Baud Rate	kbs
Parity	Yes / No
Stop Bits	
Serial Port 1 CPU B Communication Settin	gs
Driver Selection	RS232 / RS422 / RS485
Baud Rate	kbs
Parity	Yes / No
Stop Bits	
Serial Port 1 CPU C Communication Settin	gs
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 y/n HP Demand HP Demand Split Valve_____ y/n LP Demand______ y/n y/n _y/n Anti-Surge Valve Stage 1 _ y/n Anti-Surge Valve Stage 2____ 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 _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 y/n Redundant Actuators Invert Output _y/n Actuator Current Range Current @ 0 Demand (Min) ma Current @ 100 Demand (Max) ma Dither

If Actuator Controller module A6 is used then	
Actuator Controller Channel #1	
ACT #1 Demand Use	
Not Used Tunable 1y/r	n
HP Demandy/r	n
HP Demand Split Valvey/r	n
LP Demand y/r	n
LP VLV2 Demandy/r	n
Anti-Surge Valve Stage 1y/r	n
Anti-Surge Valve Stage 2y/r	n
ACT #1 Control type	
PROP - Proportional W/Command Trimy/r	n
PI - proportional & Integraly/r	n
P - Proportional Onlyy/r	n
PI_LAG - PI W/Lag Filtered Demandy/r	л
Feedback type	
NONE - Act is P Onlyy/r	n
A - Single Pair of Return Wires y/r	n
A-B - Simple Difference Devicey/r	n
(A-B)/(A+B) - D/S or Constant Sum Devicey/r	л
Action if Single Feedback Fails	
If Single FDBK Fails Use High / Use Low	N
Set Feedback Excitation Voltagevr	ms
Check for Open Wire Detectiony/r	n
Forward or Reverse ActingForward / Reverse	æ
If Prop type is Configured	
Current at 0 Demand ma	а
Current at 100 Demand ma	а
Set Dither Current Amplitude ma	а
Command Trim on FDBKEnabled / Disabled	1
If Integrating type is Configured	
Set NULL Currentm	а
Set Min Currentm	a
Set Max Currentm	a
Set Dither Amplitudem	а
Act #1 Position Feedback Setup	
Actuator Controller #1 Tag	
FDBK Position Tolerance%	,
FDBK Voltage Tolerancevo	olts
Position Error Threshold%	
Position Error Delaym	sec
Feedback Difference Tolerance%	
Feedback Difference Delayse	2C
Act #1 Valve Response Dynamics	

PROP (KP) gain Integral (KI) gain____

ma

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)

Sneed PID Settings

Speed FID 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

Mariual 2031883	
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	<u> </u>
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

<u>X1</u>	<u>% Y1</u>	%
X2	% Y2	%
X3	% Y3	%
X4	<u>%</u> Y4	%
X5	<u>% Y5</u>	%
X6	<u>% Y6</u>	%
X7	<u>%</u> Y7	%
X8	<u>% Y8</u>	%
<u>X9</u>	<u>%</u> Y9	%
X10	<u>%</u> Y10	%
<u>X11</u>	<u>% Y11</u>	%

Second Curve for Split HP linearization curve

X1	% Y1	%
X2	% Y2	%
X3	% Y3	%
X4	% Y4	%
X5	% Y5	%
X6	% <u>Y6</u>	%
<u>X7</u>	<u>% Y7</u>	%
X8	% <u>Y8</u>	%
X9	% <u>Y9</u>	%
<u>X10</u>	<u>% Y10</u>	%
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	<u>% Y10</u>	%
X11	% Y11	%

Second Curve for Split LP Linearization curve

X1	<u>% Y1</u>	%
X2	% Y2	%
X3	% Y3	%
X4	% Y4	%
X5	<u>% Y5</u>	%
X6	<u>% Y6</u>	%
X7	% Y7	%
X8	<u>% Y8</u>	%
<u>X9</u>	<u>% Y9</u>	%
X10	<u>% Y10</u>	%
<u>X11</u>	<u>% Y11</u>	%

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)

We appreciate your comments about the content of our publications.

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