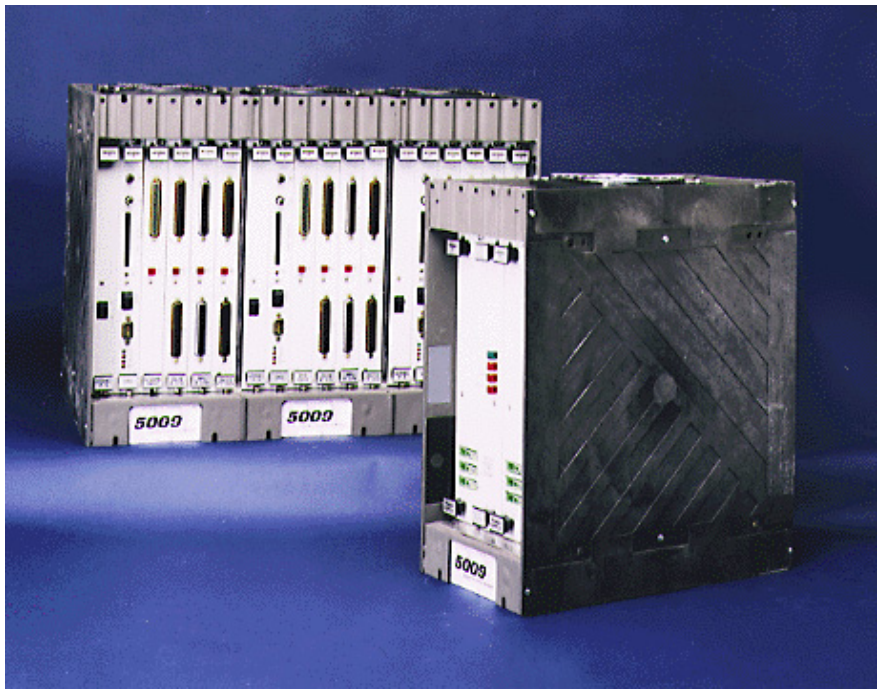
WOODWARD

Manual 85580V3
(Revision F)
Original Instructions



MicroNet TMR® 5009 Digital Control System

Volume 3, PCI Software Manual

Manual 85580 consists of 4 volumes (85580V1, 85580V2, 85580V3, 85580V4).

Installation and Operation Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

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

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

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Important Definitions

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

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

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

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

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

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

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

Chapter 1.
General Information

Introduction

The technical documentation for the 5009 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 5009 control's personal computer based interface software program (PCI), information on all PCI features and modes (Program, 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 OpView™ operator control station, if provided with your system.

Active 5009 part numbers covered in this manual are: 9907-794, 9907-795, 9907-796, 9907-797, 9907-846, 9907-847, 9907-848, 9907-849, 9907-850, 9907-886, 9907-887, 9907-889, 9907-890, 9907-991, 9907-1000, 9907-1001, 9907-1002, 9907-1003, 9907-1004, 9907-1005, 9907-1006, 9907-1007, 9907-1011, 9907-1012.

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

PCI Software Package

The 5009 control is a field configurable steam turbine control. A software package is included as an installation kit with every 5009 control to allow users to program, service, and operate (Run) their 5009 control. The provided software package must be installed on a capable computer which is connected to the 5009 control to allow users to interact with the 5009 control. The different modes of the PCI program 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 PCI installation kit includes the following programs:

- PCI—operator interface program
- Watch Window—debug program
- Servlink—DDE communications program
- Print Program—configuration & wiring list print program

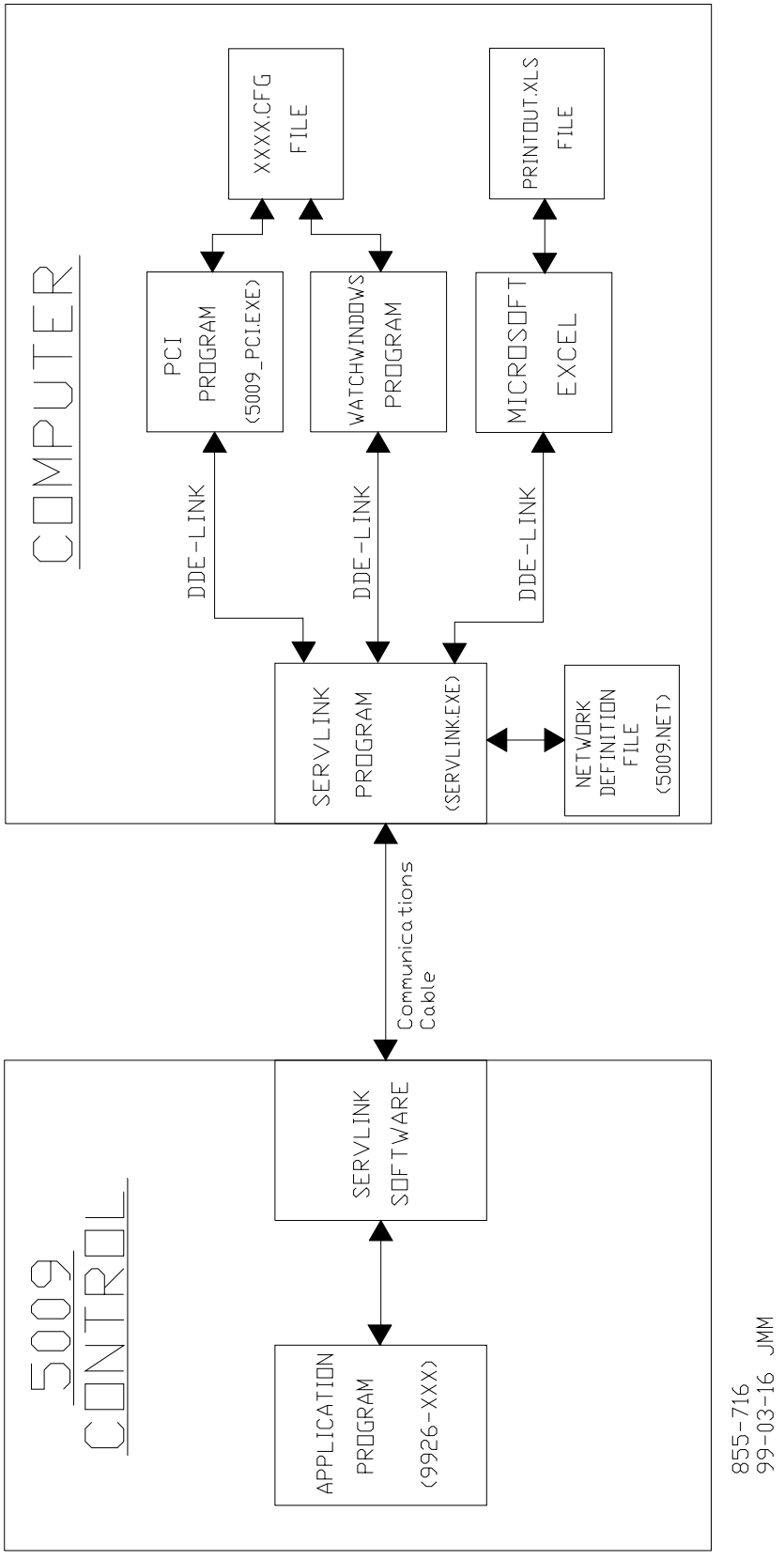


Figure 1-1. 5009 Software Program Relationships

PCI Program

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

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

- Configure the control to an application
- Change control input/output voting logic
- Load a control's configuration from a computer file

Service 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
- Change Voting logic
- Test Voting Logic
- Test control and system protection logic

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

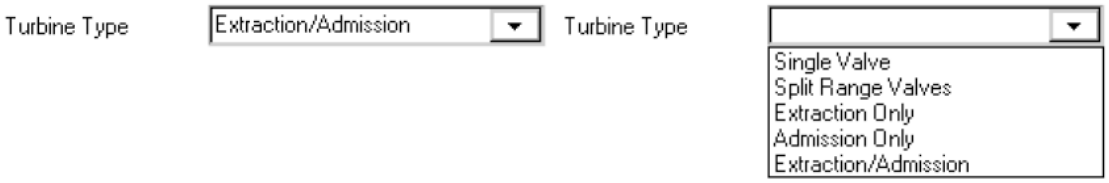
- Start and Stop the turbine
- Enable and Disable all system control modes (Aux, Cascade, Ext/Adm, Sync, etc.)
- Monitor control and application alarms
- Monitor control and application trips

This volume applies to all 5009 control systems but may not include information that is unique to your system. It also does not apply to any custom MicroNet TMR® applications. This volume and the PCI software described covers only the 5009 application program as generated by Woodward.

5009 PCI Program

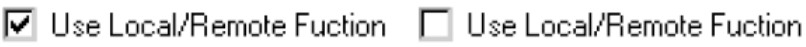
As with any Windows based program, the folders and options inside the folders change radically depending on the input from the user. If certain options of the PCI program are not used, entire folders will disappear and not be shown. For the purpose of this manual, all options and all folders have been displayed in the figures that follow. The folders and screens that you as the user will see on your own PC 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. i.e. Extraction, Admission, and Extraction/Admission folders cannot all appear at the same time on the PC.

The primary way to select options in the 5009 control is the pull-down menu. 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 arrow in the box with the mouse (placing the mouse cursor over it and clicking the left mouse button), all available options will appear below the pull-down menu. 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 5009 control. At that time additional options may appear or disappear depending on whether they are valid.



Extraction/Admission Option Selected Select Option

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



Option Selected Option Not Selected

As options are selected (check mark appears) other options or input values appear in the folder and allow the user to further define the 5009 control. If Use Remote Speed Setpoint is “checked”, the necessary input values corresponding to a 4 mA speed setpoint and a 20 mA speed Setpoint need to be entered into the edit boxes that appear only when the option is selected. 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.

Watch Window Program

The Watch Window program is a trouble shooting and debugging tool that provides a window into the control system. This program is provided with all Woodward Servlink (DDE) based controls to allow internal program calculation and logic monitoring by Woodward technicians and engineers. It is anticipated that a typical 5009 control user will never use this program.

Watch Window 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.

Servlink Program

The PCI software program runs in parallel with a communications program called Servlink. Servlink is an interface program which directs and manages the transfer of data between the PCI program and the 5009 control. Refer to Figure 1-1.

The setup program that installs the PCI and Watch Windows programs on your computer will also install the Servlink program. All PCI-to-5009 control communications are performed through the Servlink program (designated computer port, baud rate, etc.).

This program can also be used to link Microsoft based programs (Excel, Access, Word) to the control for monitoring or report purposes. This link is performed through DDE communications, thus the program linked-to must be compatible with DDE (Dynamic Data Exchange) servers (communications). Refer to Figure 1-1.

To link a Microsoft based program, close the PCI program and open both the Servlink program and the Microsoft based program at the same time. From the 5009 Servlink program, open the ".net" file then step to the output signal desired by double clicking on the desired program folder to, open it to the next level (category, block output), then select the output desired. Reference this Volume's Modbus list for a list of available application program output signals. At this point perform a Copy command from the Servlink program's Edit menu, open the Microsoft program, and perform a paste special function (selecting the paste link option). After the path has been copied once, any further connections can be made by simply typing in the path name; including the desired output signal name.

Network Definition File

The Servlink program uses a network definition file to communicate with the 5009 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.

This file must be created before the PCI program can communicate with the 5009 control. Once created this file will not have to be recreated unless it is accidentally deleted, the computer port being used is changed, or the 5009 control's application program changes (via an application upgrade). A new network definition file can be created at any time with no affect on the 5009 control's operation.

Printing

Printing control information and configurations can be performed through one of two methods. One method of printing system related information is to issue a "Print Current Page" command from the Tool Bar's File menu. A second method of printing system related information is to use the provided Microsoft Excel based file (PrntoutX.xls) to print the control's Program mode configuration, Service mode configuration, and wiring list.

Print Current Page

The visible folder of the PCI program can be sent to a printer by using the Print Current Page option of the "File" pull-down menu as shown below. The printed pages can be used to record the control's configuration and RUN mode information in a paper format. As an example, most of the figures in this manual resemble the printed output of a folder.

Print Program, Service, & Wiring Lists

The Microsoft Excel based file (PrntoutX.xls) provided with control's PCI software kit allows the control's Program mode configuration, Service mode configuration, and I/O wiring list to be printed out. A Microsoft Excel based file is used for this purpose because of its public acceptance, and DDE interface capabilities. This file allows users to record, save, and printout the control's configuration in a readable format. A set of wiring printout sheets is also created for each of the control's field termination modules, which can be customized with site-specific information before printing.

The PrntoutX.xls print-file can be accessed from Windows Task bar's Start—Programs—Woodward 5009 PCI Group menu. This file can be opened at any time to allow system printing. Once opened this file momentarily establishes a DDE link to the control, reads the control's configuration, then breaks the DDE link. The read configuration data can then be stored, and or printed out. If the control's configuration is changed the print-file's data must be updated again to reflect the control's latest configuration.

If while the print-file is opened a change is made to the control's configuration, the print-file data can also be updated by clicking on the "Read Control Configuration" button located on the Update_Data page.

Once the print-file has completed reading the control's configuration, the user can customize the printout sheets to meet their needs. Site specific information can be added to any and all sheets (i.e. turbine ID numbers, cable numbers, junction box labels, device names, etc.).

Printing Procedure

1. Verify that the Microsoft Excel program is resident on the computer being utilized.

2. If the 5009_PCI program is running, and communicating with the control (using a network definition file named 5009.net) skip to step #5.

3. Verify that the Network Definition file used is named 5009.net. If it is not, temporarily rename the file "5009.net".

4. Verify that Servlink is open and communicating with the control using the 5009.net network definition file. The Servlink program is located in the Woodward 5009 PCI Tools Group. Optionally the 5009_PCI.exe program can be started to accomplish this task.

5. From the Windows Task bar's Start—Programs—Woodward 5009 PCI Tools Group menu select the "Print Program" file.

6. When prompted to Re-establish links, select "YES". At this point the print- file reads the control's configuration by updating each linked data point. Depending on computer loading, this step may take up to 5 minutes.

7. When prompted that the print-file's update routine is complete, select the desired sheet or sheets by clicking on its TAB, perform any additions or modifications to the sheet(s), and issue an Excel based print command. This will result in the selected sheet/folder being printed to the computer's defaulted printer.

8. At this point the updated print-file can also be saved to a computer directory and or diskette.

9. If at any point the control's configuration changes, the print-file's data can be updated by clicking on the "Read Control Configuration" button.

GOVERNOR SERIAL NUMBER: _____
DATE: _____

APPLICATION FOLDER

Site:		
Turbine:		
ID Tag:		
Turbine Type:	Single Valve	
Application:	Generator Drive	

START SETTINGS FOLDER

Start Routine:	Automatic	
Idle to Rated Routine:	Automatic Start Sequence	
Speed Setpoint Rate to Min Speed:	100.00	rpm/sec
HP Valve Limiter Rate:	2.50	%/sec
Use Critical Speed Avoidance?	Yes	
Critical Rate:	150.00	rpm/sec
Critical Speed Band 1 Minimum:	1100.00	rpm
Critical Speed Band 1 Maximum:	1500.00	rpm
Use Critical Speed Avoidance Band 2?	Yes	
Critical Speed Band 2 Minimum:	2100.00	rpm
Critical Speed Band 2 Maximum:	2500.00	rpm
AUTO SEQUENCE SETTINGS		
Cold Star (> xx hrs):	10.00	hrs
Hot Start (< xx hrs):	1.00	hrs
Low Idle Setpoint:	500.00	rpm
Low Idle Delay (Cold):	0.50	min
Low Idle Delay (Hot):	0.00	min
Low Idle to High Idle Rate (Cold):	75.00	rpm/sec
Low Idle to High Idle Rate (Hot):	100.00	rpm/sec
High Idle Setpoint:	2000.00	rpm
High Idle Delay Time (Cold):	0.50	min
High Idle Delay Time (Hot):	0.00	min
High Idle to Rated Rate (Cold):	75.00	rpm/sec
High Idle to Rated Rate (Hot):	100.00	rpm/sec
Rated Setpoint:	3600.00	rpm

SPEED CONTROL FOLDER

Overspeed Test Limit:	4000.00	rpm
Overspeed Trip Level:	3780.00	rpm
Max Control Setpoint:	3780.00	rpm
Min Control Setpoint:	3420.00	rpm
Setpoint Slow Rate:	6.05	rpm/sec
Use 4-20mA Remote Speed Setpoint?	Yes	
Remote Setpt Max Rate:	49.50	rpm/sec
Off-Line Proportional Gain:	3.53	%
Off-Line Integral Gain:	1.28	rps
Off-Line Derivative Ratio:	5.00	%
On-Line Proportional Gain:	5.86	%
On-Line Integral Gain:	1.60	rps
On-Line Derivative Ratio:	5.00	%

Figure 1-2. Example Program Printout Sheet

ATM-1	TB	CONFIGURED FOR	WIRED TO
Speed Input #1			
A & B Kernel Input (+)	1	MPU #!	
A & B Kernel Input (-)	27	MPU #!	
C Kernel Input (+)	2	Jumper to TB1	
C Kernel Input (+)	28	Jumper to TB27	
Shield	3	Shield	
Speed Input #2			
A & B Kernel Input (+)	31	MPU #2	
A & B Kernel Input (-)	6	MPU #2	
C Kernel Input (+)	32	Jumper to TB31	
C Kernel Input (+)	7	Jumper to TB6	
Shield	33	Shield	
Analog Output #1			
Output (+)	36	Speed Meter (+)	
Output (-)	11	Speed Meter (-)	
Shield	10	Shield	
Actuator Driver #1			
A & B Output (+)	39	Actuator #1 (+)	
A & B Output (-)	14	Actuator #1 (-)	
C Output (+)	40	Jumper to TB39	
C Output (+)	15	Jumper to TB14	
Shield	13	Shield	
Analog In #1 (Loop Pwrd)			
+24Vdc Power	16	Remote Speed Setpoint Input (+)	
Input (+)	18	Remote Speed Setpoint Input (-)	
Shield	17	Shield	
Input (-)	43	Jumper to TB42	
Common	42	Jumper to TB43	
Chassis Ground	52	Earth Ground	

Figure 1-3. Example Wiring List Printout Sheet

Regulatory Compliance

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

Wiring must be in accordance with the authority having jurisdiction.

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

⚠AVERTISSEMENT **RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.**

Chapter 2.
PCI Installation

Introduction

The 5009 control's PCI software installation kit is included with the control on either 3.5" floppy computer diskettes or on a CD-ROM. The diskettes or CD-ROM must be inserted into and used to install the PCI software kit on a computer that meets the below listed requirements. Once installed the PCI program and associated computer function together as an engineering workstation and operator control panel.

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

Requirements

The PCI software package is installed and runs on any compatible PC hardware platform with the following minimum restrictions:

As a Configuration Only Tool	**As an On-line Operator Interface**
486 50 MHz	Pentium 200 MHz
24 Meg RAM	48 Meg RAM
10 Meg Disk Drive Space	10 Meg Disk Drive Space
Windows 95, Windows NT, or Windows 2000	Windows NT, Windows 2000
3.5" floppy or CD-ROM drive	3.5" floppy or CD-ROM drive

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

The connection between the PC and the 5009 control consists of a standard Null-modem computer cable with a standard 9 Pin-Sub-D, female connector used to interface with the 5009 control. The control-to-PCI-computer cable provided with the control system, is a 3.05 meter (10') serial cable with 9 Pin-Sub-D, female connectors. If a custom cable is necessary, reference the RS-232 pinout diagram in Figure 2-1. The 5009 control must be connected to the designated computer before the PCI program can be successfully started.

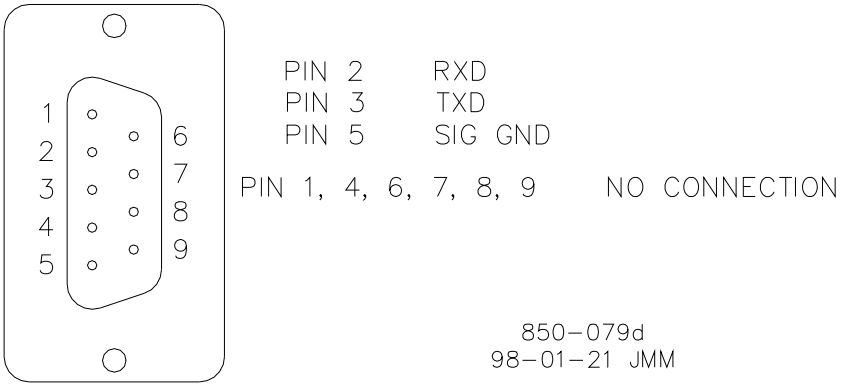
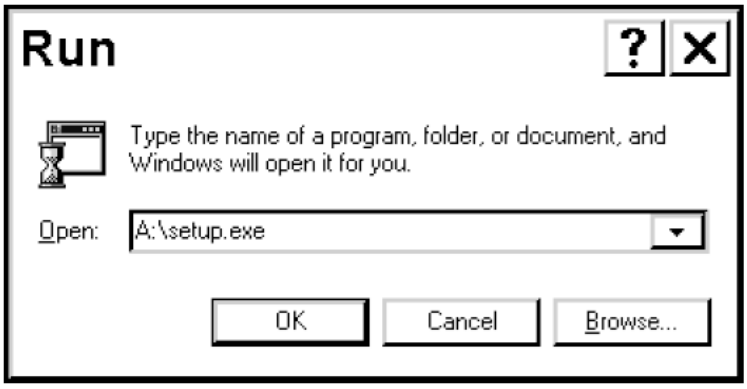


Figure 2-1. CPU RS-232 Pinouts

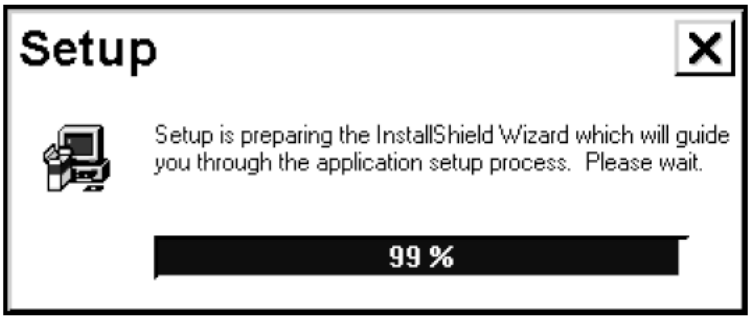
This manual is not intended to teach the user the basics of how to operate a Windows based program. The user should be familiar with how to open and close folders and how to execute pull-down menu options. The PCI program and the Servlink program are both 32 bit operating system programs. This means that Windows 3.1 will NOT work for this application. Windows 95 or Windows NT are the only two operating systems that these programs have been tested with. A Windows compatible 32 bit operating system should work with these programs, but only the Windows 95 and Windows NT have been verified.

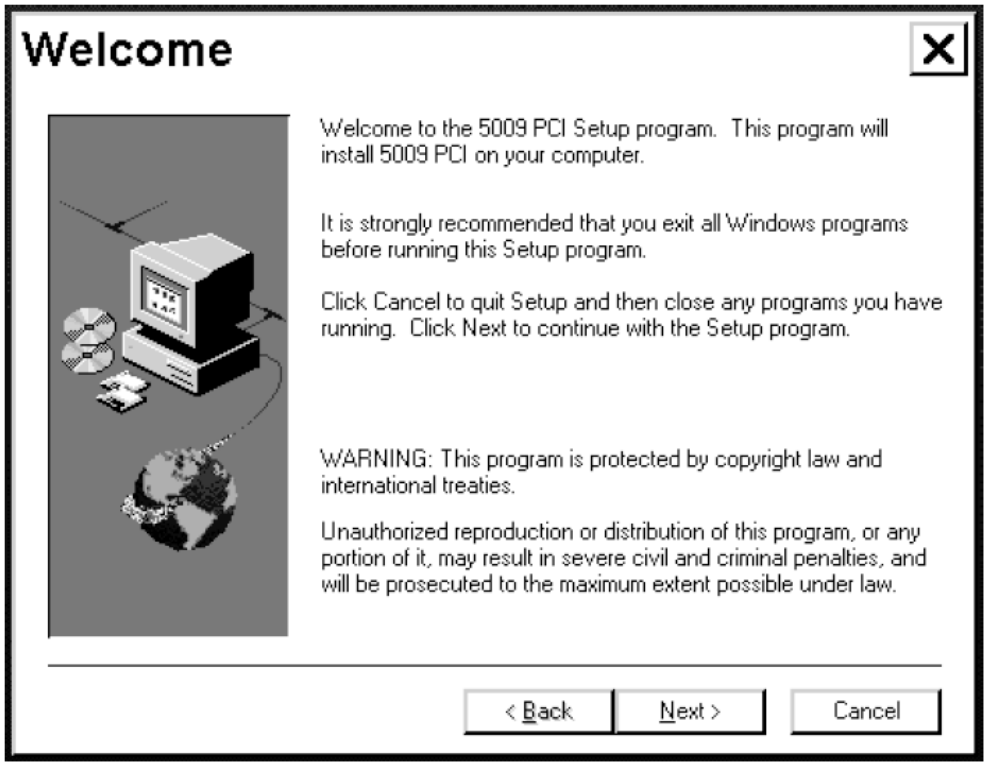
PCI Installation Procedure

STEP 1: Insert Diskette 1 of the installation disks or the CD-ROM provided with the 5009 control into the appropriate drive of your PC. Open the Run folder under Windows 95, Windows NT, or Windows 2000 as shown below.

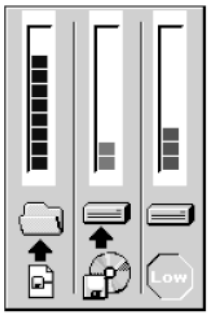


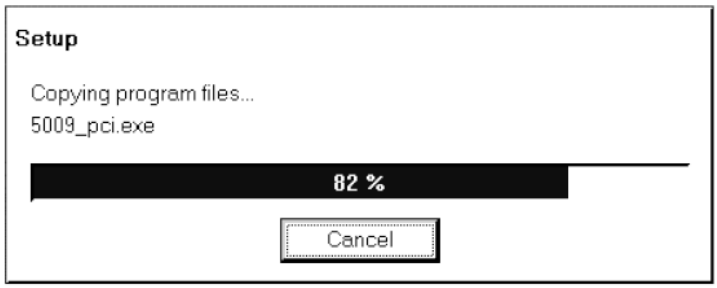
You can use the Browse feature of this folder to find the **Setup.exe** file on the disk or enter it directly on the Open line as **drive letter:\ setup.exe**. In the above figure the drive letter is A. Upon pressing a <CR> or clicking on the “OK” button the setup program will proceed to install the PCI and Servlink programs.



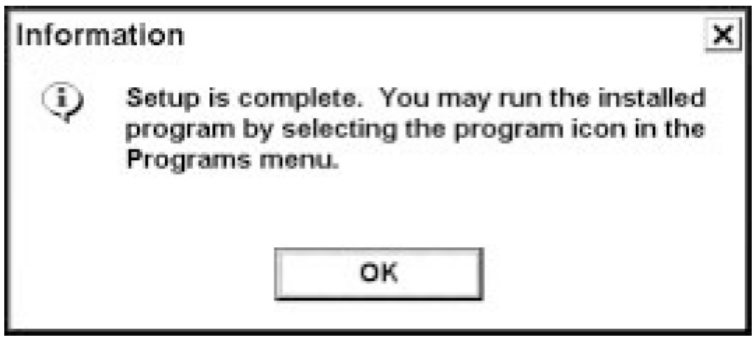


Once the setup program Welcomes you, click on “Next” button to copy all necessary files from the installation disks to your PC. When prompted insert Diskette 2.



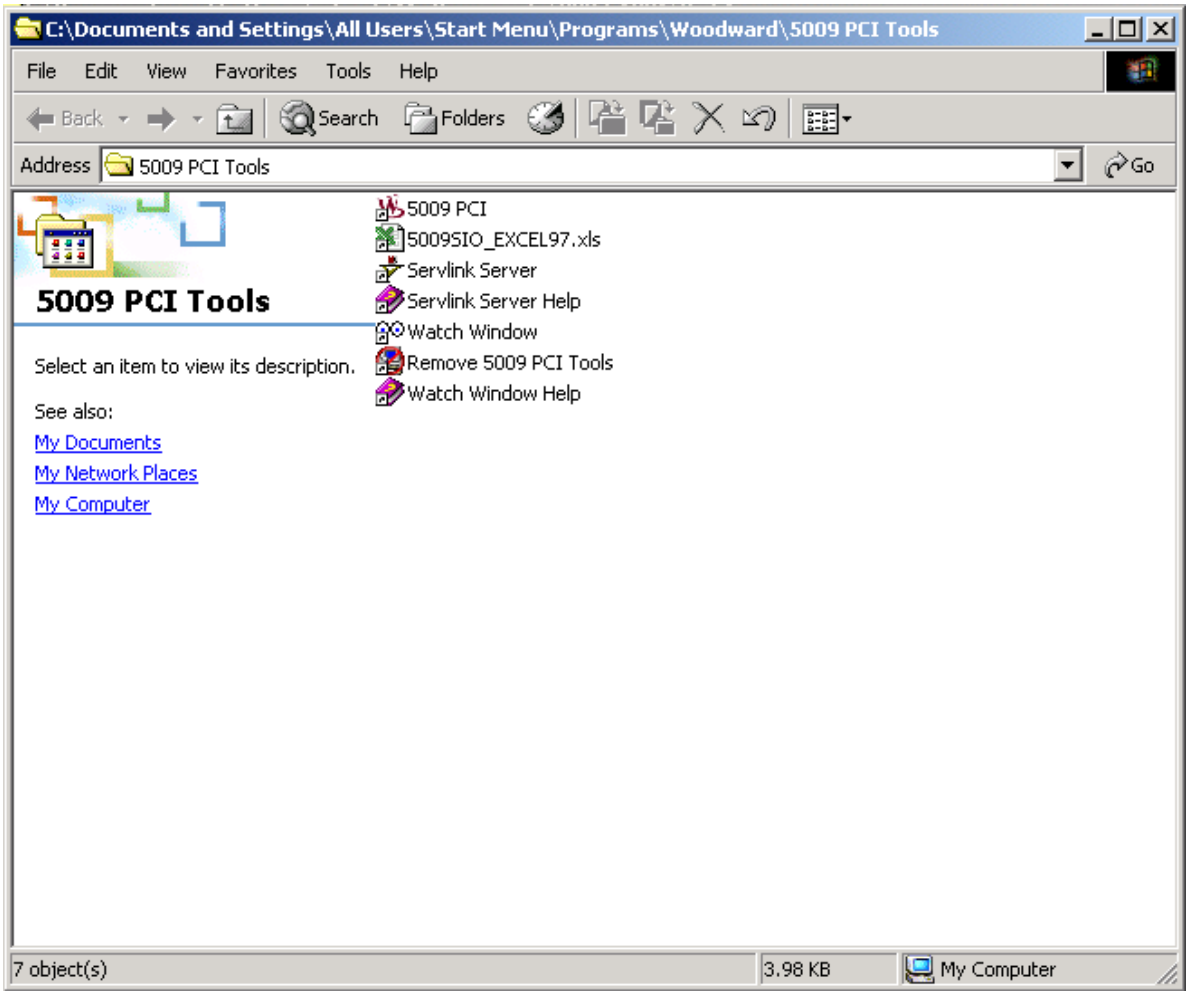


When the setup program has completed the installation, click OK on the screen below.



The setup program will install a Woodward 5009 PCI Tools menu into the Windows Start—Program menu tree. Within this menu the 5000_PCI, Print, Servlink, and Watch Window programs can be accessed. These programs can be initiated run by double-clicking on the icons associated with each program.

The setup program will automatically place all the necessary files for the PCI and Servlink programs in the **C:\Program Files \Woodward** directory. Once the installation is complete, you can verify that the files listed below have been installed on your PC. The size and dates of the files may not be the same as the ones at the time of this publication, and additional files may have been added for future features and upgrades.



STEP 2: Verify that the 5009 control has been properly installed with power applied and that all CPU's are correctly reset (reference Volume 1, CONTROL SYSTEM INSTALLATION PROCEDURE).

STEP 3: Connect the provided RS-232 serial cable (W20) between the 5009 control's CPU-C port and the desired computer port.

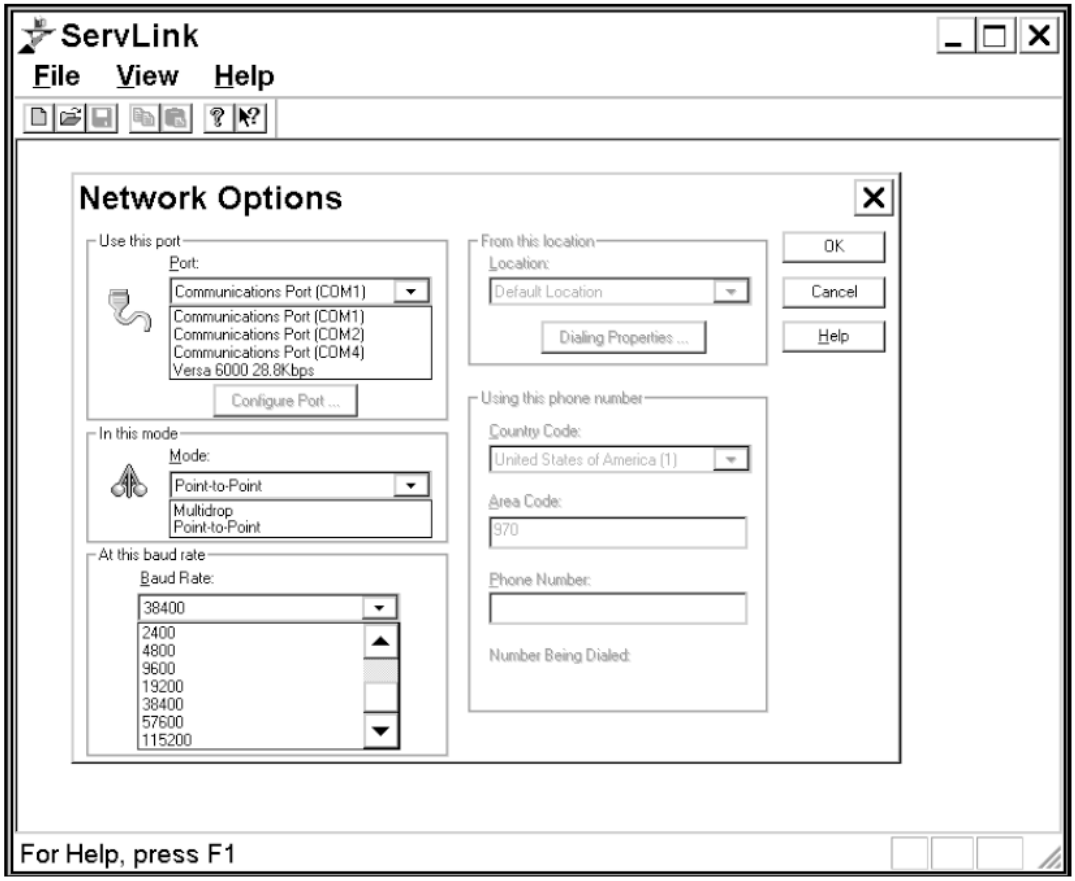
STEP 4: Open the Servlink program by selecting the Servlink Server option from the Windows Task bar's Start—Programs—Woodward 5009 PCI Tools menu or by Windows Explorer with the **C:\Program Files\Woodward\Servlink Server** directory open.

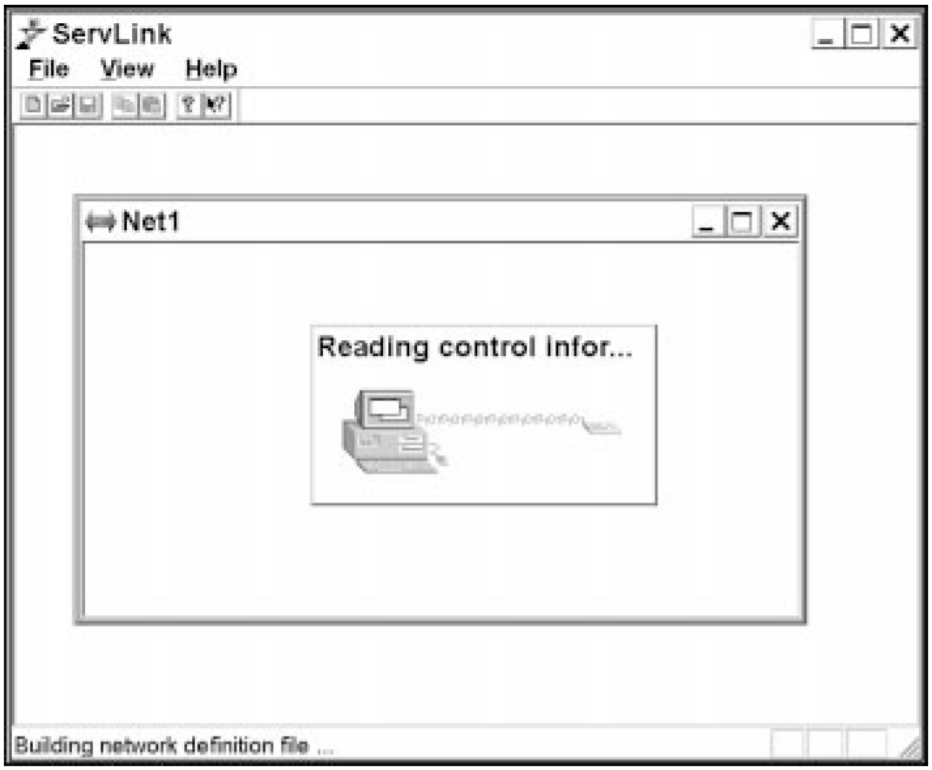
IMPORTANT

If when opening this program a TAPI error is received, install or reinstall the computer's modem drivers. The Servlink program uses one of the computer's modem ".dll" library files which is loaded with the computer's modem drivers.

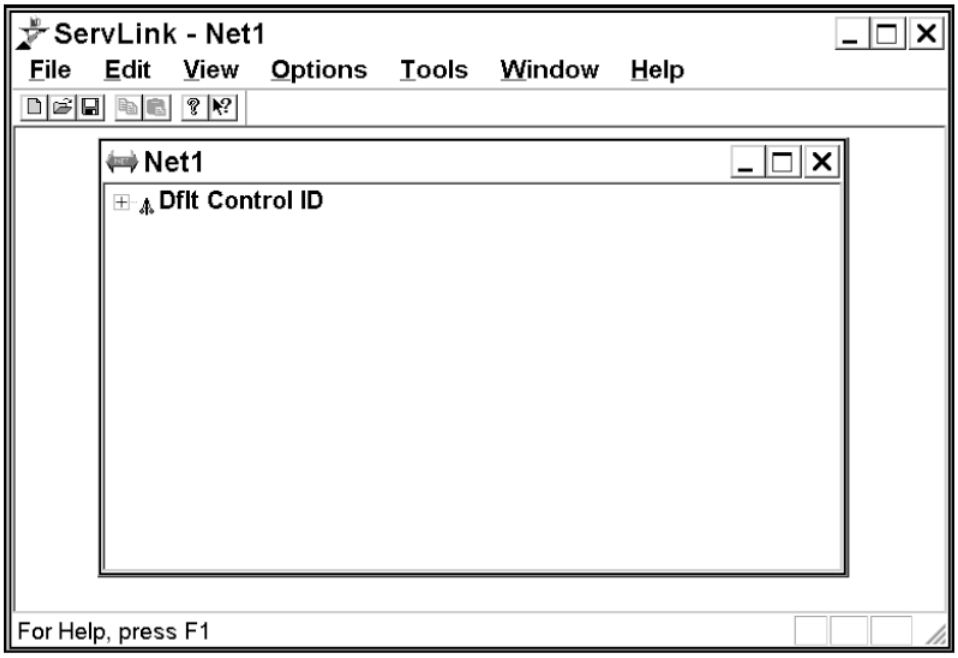
STEP 5: Within the Servlink program click on the New Page icon in the tool bar or select "NEW" under the "File" pull down menu. At this point a menu will appear to set up communications with the control. Select the communication port that the 5009 control is connected to, then click on the "OK" button. Unless otherwise directed by a Woodward representative, do not change any of the other default settings. The Default settings are: Communications Port—COM1, Mode—Point-to-Point, Baud Rate—38400.

Once the "OK" button has been selected, Servlink will access the control and build the network configuration file. The building of the network definition file may take 5 to 10 minutes. The "Reading Control information" folder will remain active until the Servlink program has finished building the configuration file. In the event that communications between the PC and the control are not working, a message will appear to that effect. Check your cable connections and verify your option selections in the above folder until the "Reading Control information" folder appears.


ServLink
File View Help
Network Options
Use this port
Port:
Communications Port (COM1)
Communications Port (COM1)
Communications Port (COM2)
Communications Port (COM4)
Versa 6000 28.8Kbps
Configure Port ...
In this mode
Mode:
Point-to-Point
Multidrop
Point-to-Point
At this baud rate
Baud Rate:
38400
2400
4800
9600
19200
38400
57600
115200
From this location
Location:
Default Location
Dialing Properties ...
Using this phone number
Country Code:
United States of America (1)
Area Code:
970
Phone Number:
Number Being Dialed:
OK
Cancel
Help
For Help, press F1


ServLink
File View Help
Net1
Reading control infor...
Building network definition file ...

STEP 6: Once the program has finished building the file, the new network definition file must be saved. Use the Save As option in the File pull-down menu of the Servlink toolbar to save the new file under the "**C:\Program Files\Woodward\Servlink Server**" directory. The Servlink—Net1 folder shows the new Dflt_Control_ID.NET file that has been created. Because the PCI program is defaulted to look for network definition file "5009.net" it is recommended that the new file be named "5009.net". In cases where multiple controls are being interfaced to with one computer it is recommended that each network definition file be given a unique name.



STEP 7: Close the Servlink Program. At this point the PCI and Servlink programs are fully installed and are ready for communication with the 5009 control. When the PCI program is opened and a network configuration file is requested, select the new file (typically 5009.net). This should guarantee compatibility between the control and the PCI program.

Starting the PCI

The PCI program is the only program that needs to be started to initiate communications with the 5009 control. The Servlink program will be automatically started by the PCI program as soon as a mode of operation is selected. The 5009 control must be connected to the designated computer before the PCI program can be started.

1. Verify that the PCI program has been installed on the designated computer (reference Volume 3, chapter 2, PCI INSTALATION PROCEDURE).

2. Verify that the 5009 control has been properly installed with power applied and that all CPU's are correctly reset (reference Volume 1, CONTROL SYSTEM INSTALLATION PROCEDURE).

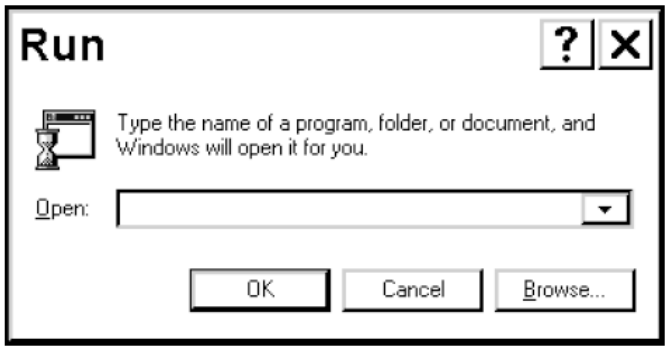
3. Connect the provided RS-232 serial cable between the control's CPU-C serial port and the designated RS-232 port on the computer.

The connection between the PC and the 5009 control consists of an EMI filter pin connector and a standard Null-modem computer cable with a standard 9 Pin-Sub-D, female connector used to interface with the 5009 control. The control-to- PCI-computer cable provided with the control system, is a 3.05 meter (10') serial cable with 9 Pin-Sub-D, female connectors. If a custom cable is necessary, reference the RS-232 Pinout diagram in Figure 2-1. The 5009 control must be connected to the designated computer before the PCI program can be successfully started.

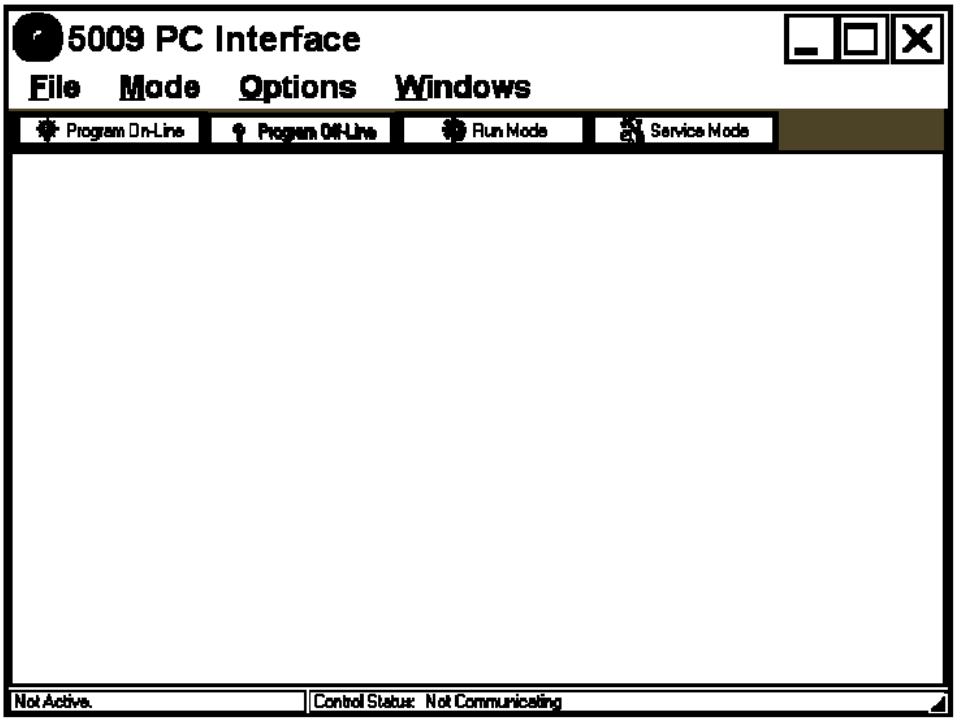
4. Open the 5009_PCI program from the Windows Task bar's Start—Programs—Woodward 5009 PCI Tools menu or by Windows Explorer with the **C:\Program Files\Woodward\5009 PCI** directory open.

5. Select the Program, Run, or Service mode as desired.

6. When prompted select the Network definition file (5009.net) then select the "Open" button or press enter.



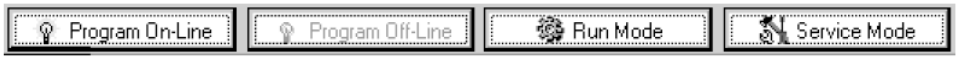
The following screen will appear if the PCI program is started correctly.



As shown below the control's CPU C's communication port is used to connect to the PCI program. Optionally the control can be configured to switch PCI communications from CPU C's port to CPU B's port if CPU C fails. Refer to Volume 2 of this manual for all possible PCI port options.

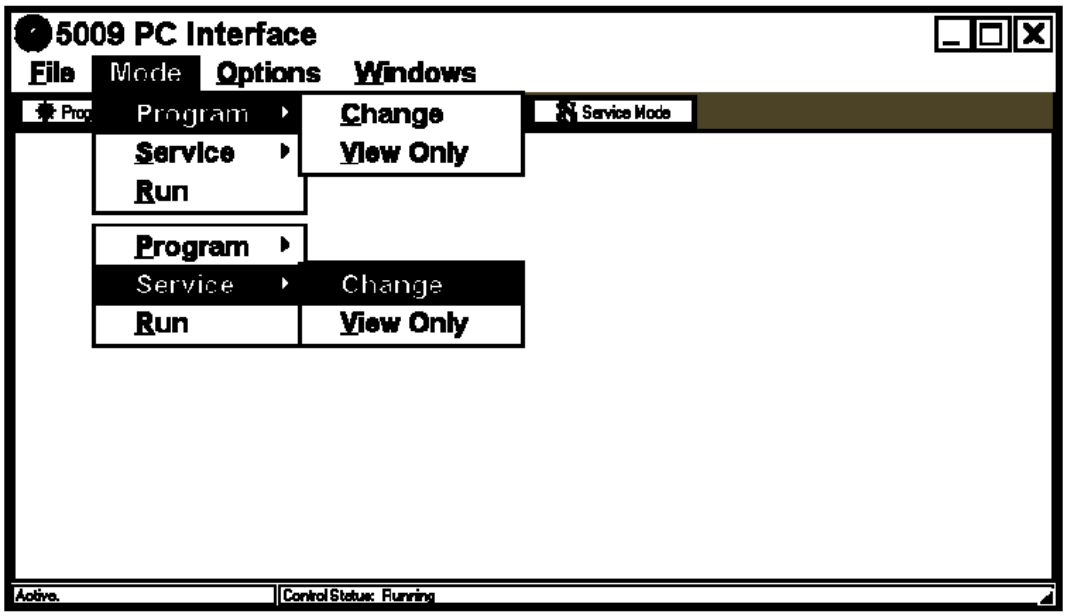
Entering Modes

To enter one of the most commonly used modes of the PCI, the tool bar shown below can be used. Simply click on the appropriate button and the PCI will automatically initialize into the selected mode.

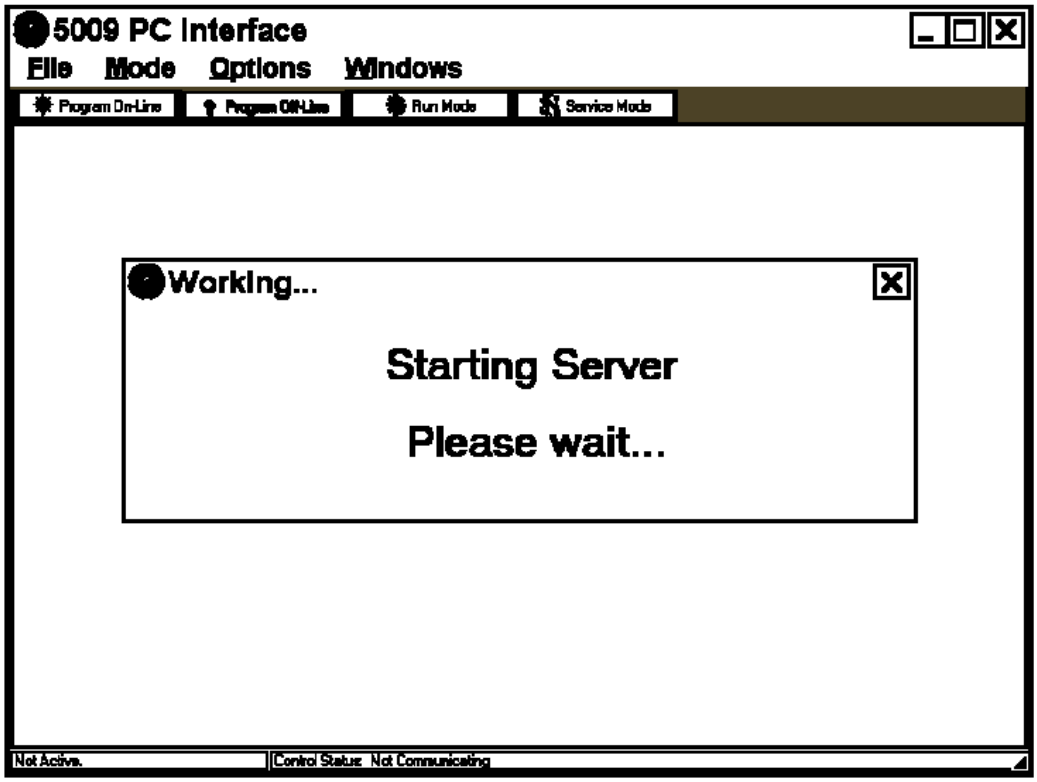


Program On-Line Run Service Change

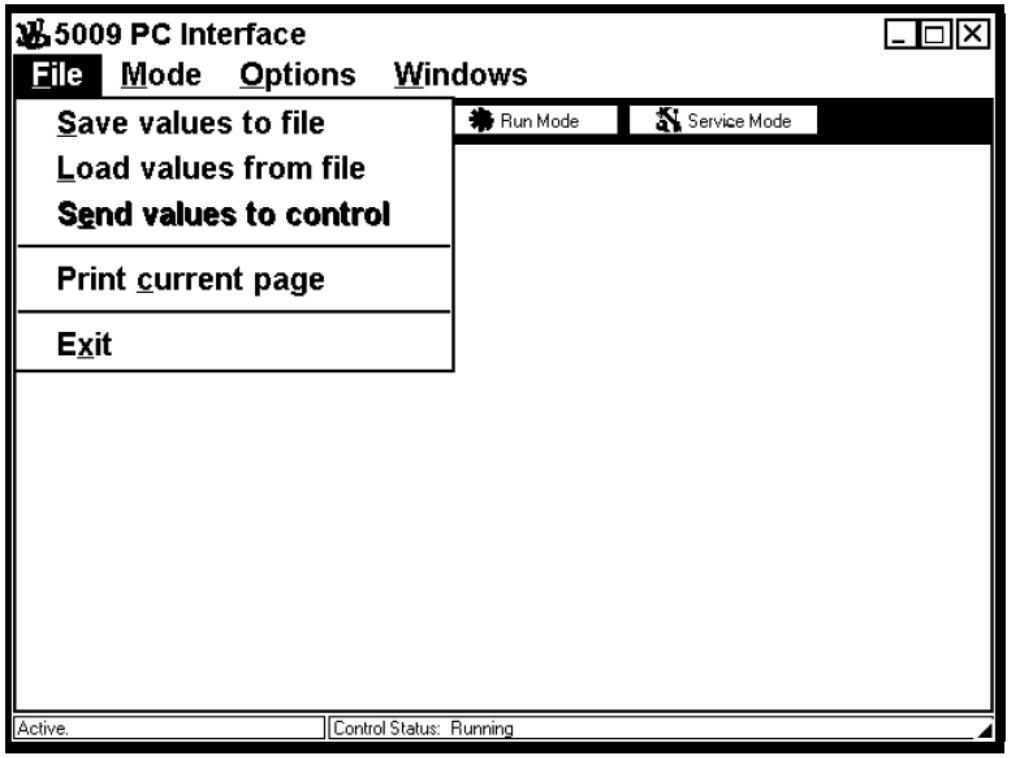
If a user wants to only view the 5009 control settings and not make any changes, both the Program and Service Modes offer View Only modes. The folder below shows all of the available modes of the PCI. Use the Mode pull-down menu of the PCI toolbar to select which mode you wish to use.



Once a mode has been selected, the PCI will open and start the Servlink program as shown below. It may take several seconds before the selected mode is activated and the PCI program begins communicating to the 5009 control.



For further information on the different modes and how each mode effects the 5009 control, see Chapter 3 for the Program Mode, Chapter 4 for the Run Mode, and Chapter 5 for the Service Mode.



Chapter 3.
Program Mode Procedures

Overview

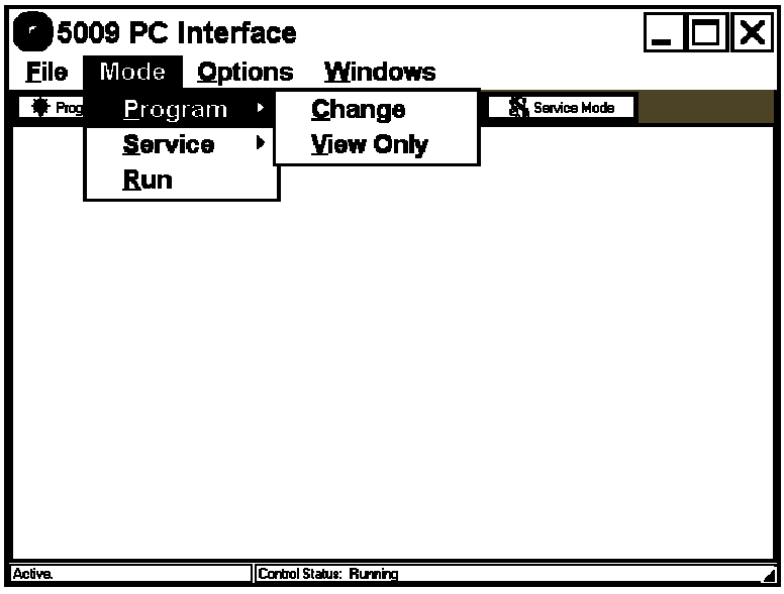
The Program Mode of the PC Interface program is a step by step procedure to program the MicroNet TMR® 5009 control. A series of folders are used to allow the user to answer questions to every option the 5009 control contains. The following screens will step a user through all of the programmable features 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.

Opening the Program Mode

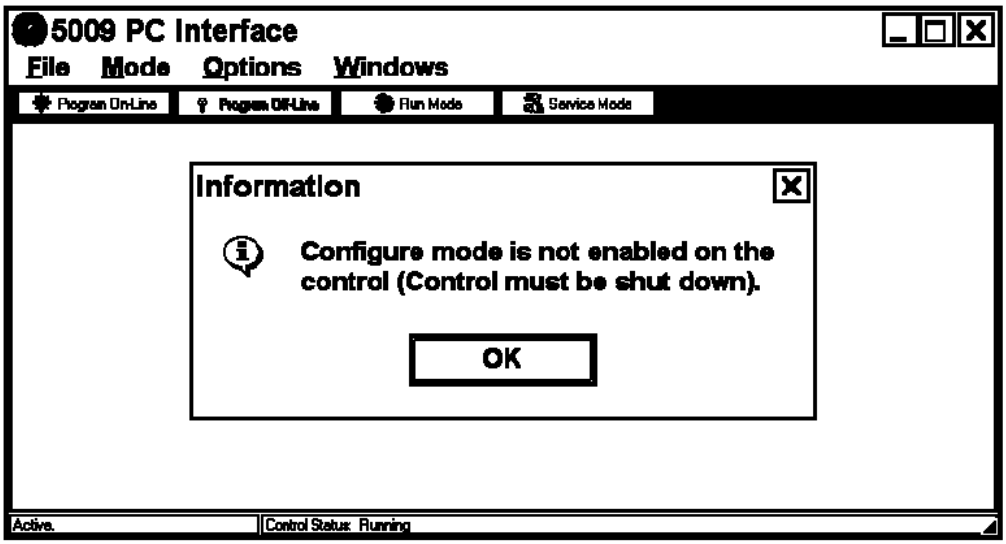
Two Program mode options are offered within the PCI software program (Program-Change, Program-View Only). The Program-Change mode is used to configure the control to the application, and is only accessible when the turbine is shutdown. The Program-View Only mode is used to view control configuration settings, with the turbine running or shutdown, but does not allow any settings to be changed.

The 5009 control and PCI host computer must be connected (via a serial RS-232 cable) before the PCI Program mode can be opened. Trying to open the PCI Program mode without a serial connection will result in a communications error.

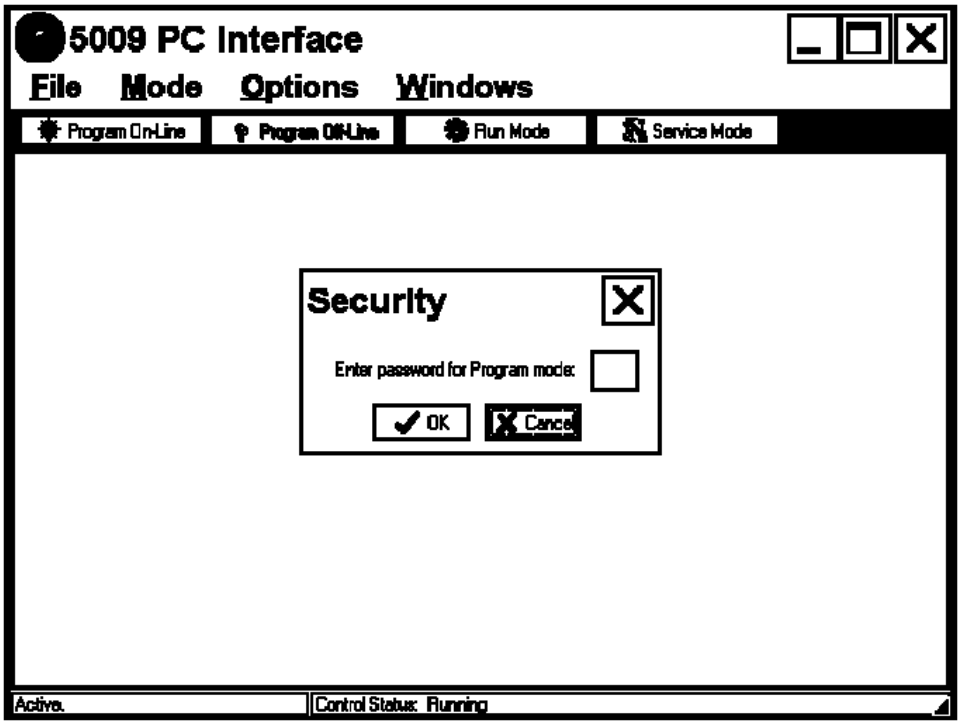
To enter the “Program Change” Mode click on the “Program On-Line” button on the program’s main tool bar in the screen below. If the PCI program has established communications with the control, when an open Program Mode request is made, the Program Mode opens immediately. If the PCI program is not communicating with the control, when an open Program Mode request is made, the program will make communication with the control via the Servlink program, then open the Program Mode. During the time the Server program is establishing communications with the control, a “Starting Server” indication box will appear.



In order to open the Program-Change mode, the 5009 control must be running and the turbine must be shutdown. In the event the turbine is not in a shutdown mode, the following screen will be displayed, and the 5009 control will not accept program changes.



If a program change is necessary, shutdown the turbine and try again. For security purposes the program-change mode is password protected. The correct password must be entered before the program-change mode can be opened. The password for the program-change mode is located in Appendix A at the back of this manual. This allows Appendix A to be removed from the manual to limit access to the 5009 control.



Program—Change Mode Procedure

1. Verify that the turbine is shutdown.

2. Select the Program-Change mode by double-clicking on the “Program On-Line” button or via the “Mode”—“Program” menus, selecting the “Change” option.

3. Enter the correct password (refer to Appendix A of this volume)

4. Configure the control by stepping through each setting on each folder of the mode, starting with the Application folder (The Application folder settings determine the options and visibility of all other program folders). Refer to this chapter for an explanation on each setting.

5. When all configuration settings are complete select the “Save To Control” button by clicking on it.
   - At this point if any configuration errors were detected the program will display an error box with a list of the errors detected and a brief explanation of each. By selecting the error (line), then clicking on the branch button the program will step you to the page where the error was detected. (The error box may need to be moved or closed to view/modify the program settings.) When all errors are corrected close the error box and select the “Save To Control” button again.
   - At this point if no configuration errors were detected, a pop-up box displaying “Program Configuration has passed the error check. Re-initialize Control? Yes/Cancel” will appear.

6. Click on the “Yes” button to exit the program mode and initialize the control for system start-up. A pop-up box will then momentarily appear displaying “Performing Control Initialization”.
7. At this point the PCI program can be closed or any PCI mode entered. The “RUN” mode can be entered to start and operate the turbine.

Program-View Mode Procedure

1. At any time select the Program-View Only mode via the “Mode”—“Program” menus, then select the “View Only” option.

2. View any settings desired.

3. This mode can be minimized or closed at any point by using the Window’s option buttons in the screen’s upper right hand corner.

Program Mode Screen

PCI Mode & Folder Panel

This panel is located at the top of the PCI program screen and indicates the PCI mode and folder that is opened and currently being displayed. An indication of “5009 PC Interface—[Program Mode—Speed Control]” indicates that the PCI’s Program mode is opened and the Speed Control folder is currently being viewed.

Control Status Panel

This panel is located in the PCI screen's lower most left corner and displays the status of the control.

Control Mode—Communications Status Panel

This panel is located at the bottom and middle of the PCI screen, and displays the control's current mode of operation, and the status of the Servlink program and communication link.

Option Bar

The screen's Option Bar, can be used like any Window's based program's option bar to select different program functionality through pull-down menus.

File—This menu is used to select, file saving, uploading, and print current page routines.

Mode—This menu allows a user access to open the different PCI program's modes.

Options—The routines associated with this menu are not complete or accessible

Windows—This menu is used to select the window's layout, when multiple modes are open.

Tool Bar

The screen's Tool bar has Program Mode specific command buttons, which are accessible from all folders.

Save To Control Button

This button is used after all Program mode parameters have been configured, to save the configuration settings to the control. Before configuration settings are saved, they are checked to verify that there are no configuration conflicts. Refer to the "Save to Control" section of this chapter, for more information on this button's functionality.

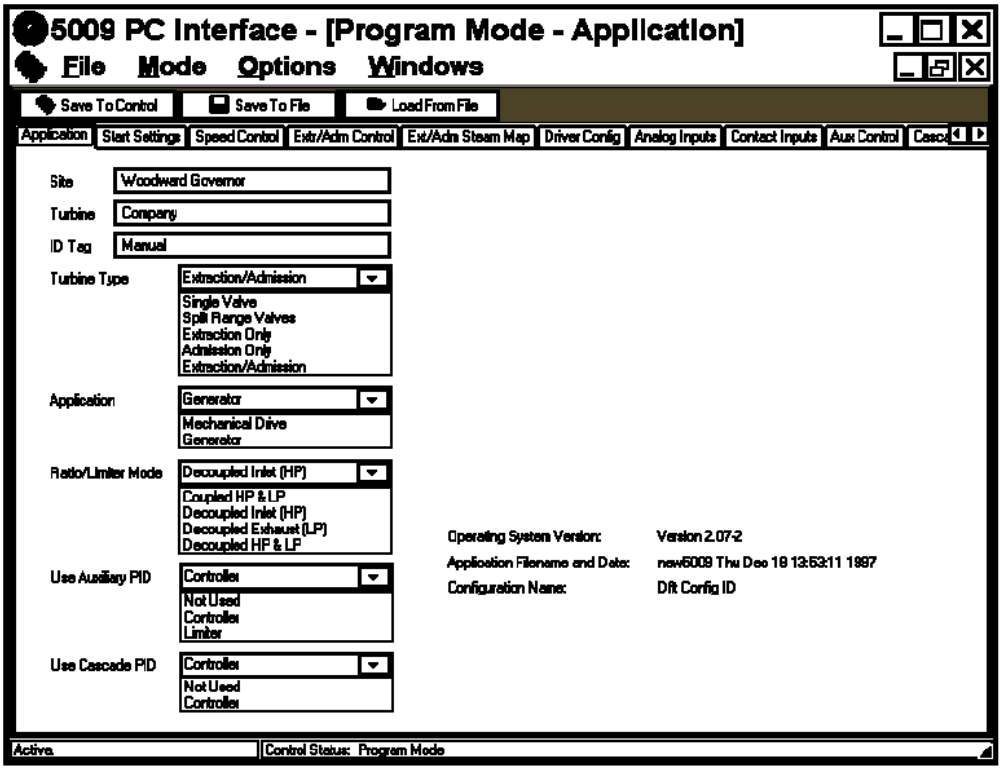
Save To File Button

This button can be used to save the configuration settings to a file, for backup purposes. Refer to the "Saving the Control's Configuration to a File" section of this chapter for more information on this button's functionality.

Load From File Button

This button can be used to upload a previously saved configuration file into the PCI program. Refer to the "Uploading a Configuration File to the Control" section of this chapter for more information on this button's functionality.

Application Page



The Applications page is the first page or screen that appears upon entering the program mode and is used to match the control functionality to the application. The Application page settings determine the options and visibility of other program pages. The above screen is shown with all options and drop-down menu options are displayed for explanation reasons only.

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 Type **dflt = Single Valve**

Single Valve

Select this option if the turbine being controlled is a basic steam turbine with only one steam valve.

Split Range Valves

Select this option if the turbine being controlled has two inlet steam valves with or without an offset between them. The two valves are controlled together to control only one parameter at a time.

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).

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.

Application **dflt = Mechanical Drive**

Generator

Select this option if the turbine is driving a generator. (This option requires two contact inputs to be configured as generator and utility tie breaker position inputs).

Mechanical Drive

Select this option if the turbine is not driving a generator.

Ratio/Limiter Mode **dflt = 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/load, 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 5009'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).

Decoupled Inlet (HP)

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

Decoupled Exhaust (LP)

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

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).

Auxiliary Controller **dflt = Not Used**

Select the Auxiliary PID's functionality by configuring it as a Limiter or 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.

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.

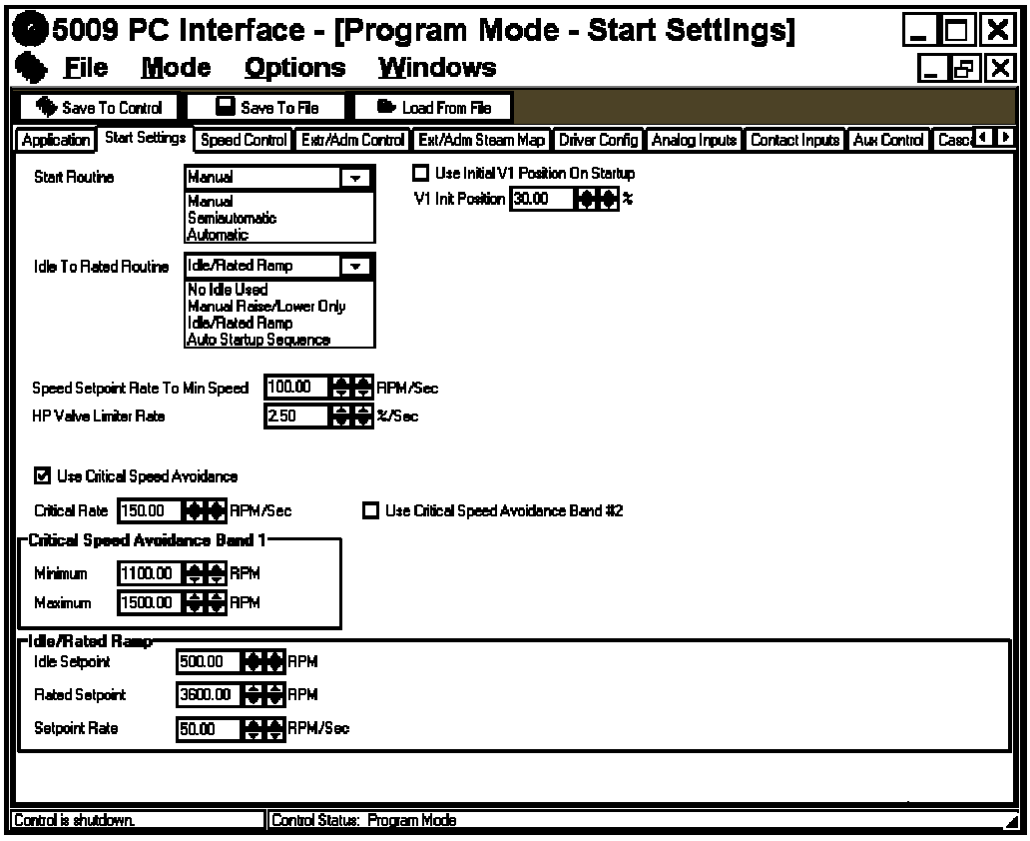
Cascade Controller **dflt = Not Used**

Controller

Select the Cascade PID's functionality by configuring it as a Controller. 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. 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.

Program Information—Additional program information is displayed on the screen. This information displays the version of the 5009's operating software, application software, and what configuration file is being used. The software version information is for Woodward documentation and troubleshooting purposes only. The configuration file information allows the user to verify which configuration file the 5009 is using. Reference the "Saving the control's configuration to a file" and "Uploading a Configuration File to the Control" sections of this chapter for more information on configuration files.

Start Modes Page



Start Settings **dflt = Manual Start**

As different routines are selected, different options will become available. In the figure above all options have been displayed for ease of explanation.

Start Routine (*One of the three start modes must be selected before the unit will run*)

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 max position. Lastly, the operator slowly opens the trip-throttle valve until the governor takes control.

Semiautomatic Start

When configured, the 5009s 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 Semi-automatic Start Sequence would be: Open the T&T valve, then issue a Start Command. The 5009 control's valve limiter must then be raised by the operator until governor takes control.

Automatic Start

When configured for an automatic start mode, the 5009 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.

V1 Initial Position **dflt = Not Used or dflt = 30% (0, 100)**

This option is only available when the control is configured for a manual start routine. If used this value will determine what percentage the inlet control (HP) valve limiter is initialized to when a Start command is given. From this position the limiter can be raised or lowered as desired. With this option, the HP Limiter will need to be raised to 100% after the unit is started.

Idle To Rated Routine **dflt = Idle/Rated Ramp**

No Idle Used

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.

Manual Raise/Lower Only

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 to the turbine's rated speed range. Critical avoidance bands can be used with this routine. Reference this Volume's Service mode descriptions for options on allowing the re-selection of idle speed.

Idle/Rated Ramp

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

Auto Start Sequence

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

Speed Setpoint Rate to Min Speed **dflt = 100.0 (.01, 500)**

Enter the speed setpoint acceleration rate to minimum. This is the rate the setpoint moves from zero to the lowest controlling speed on a start command (assuming the turbine is at zero speed). The minimum controlling speed will be either 'idle' if idle/rated is used or 'low idle' if the auto start sequence is used. If neither of these start-up features is used, the min speed will be the minimum governor speed setpoint.

HP Valve Limiter Rate **dflt = 2.5 (0.01, 25)**

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%/sec. When using a manual start, this setting is less critical and can be left at the default of 5% / sec.

Critical Speed Avoidance(s)

When checked, allows up to two critical speed avoidance bands to be programmed. Within the band, the speed setpoint cannot be stopped. These bands are used to protect the turbine and driven device from speeds that result in inherently high vibration.
(Must program either 'Idle/Rated' or 'Auto Start Sequence' to use critical speed avoidance. The lowest critical speed min has to be greater than idle or low idle.)

Critical Rate **dflt = 150.0 (1.0, 2000)**

Set the rate that the speed setpoint will move through the critical speed avoidance ranges (in rpm/second)
(Must be greater than the 'Speed Setpt Slow Rate' Setting)

Critical Speed Avoidance Bands

Minimum dflt = 1100 (1.0, 25000)

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

Maximum dflt = 1500 (1.0, 25000)

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

Idle/Rated Ramp Settings

Idle Setpoint dflt = 500 (0.0, 25000)

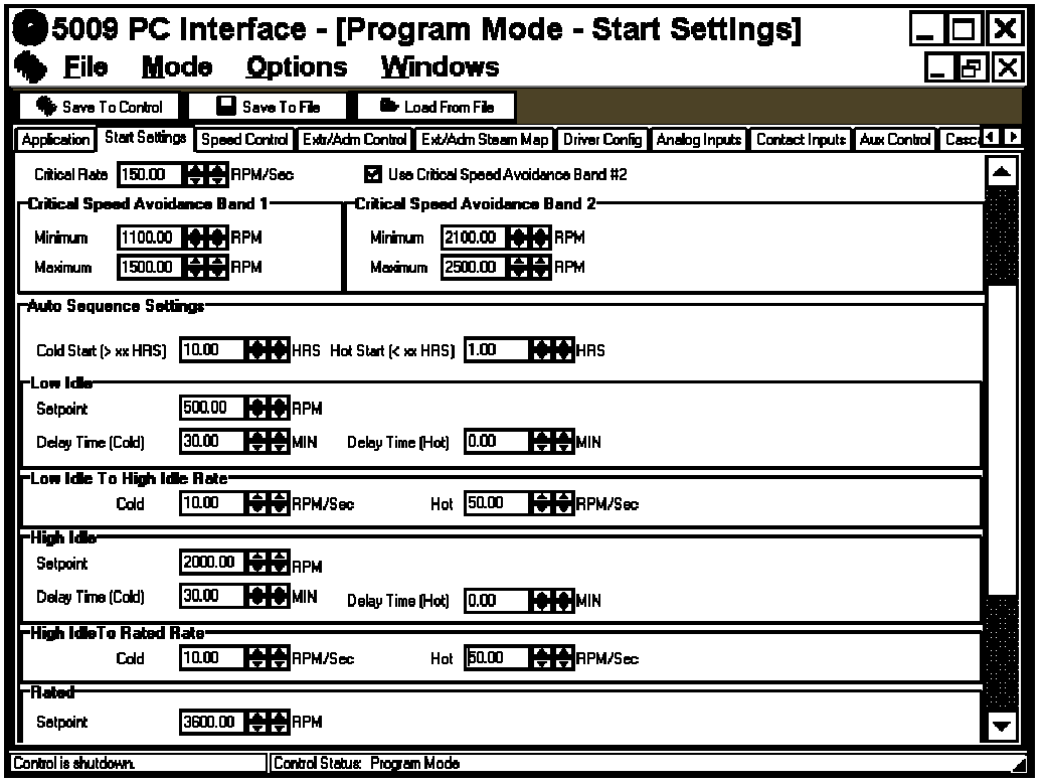
Enter the Idle Speed setpoint desired. This is the lowest speed control setpoint when using the Idle/Rated function.

Rated Setpoint dflt = 3600 (0.0, 25000)

Enter the Rated Speed setpoint desired. This is the speed control setpoint that the unit accelerates to when using the Idle/Rated function.
(Must be greater than or equal to the 'Minimum Control Setpoint' Setting)

Setpoint Rate dflt = 5.0 (0.1, 2100)

Enter the Idle/Rated rate (rpm/second). This is the rate at which the speed setpoint moves between Idle and Rated speed setpoints when using the Idle/Rated commands.



Auto Sequence Settings

Cold Start (Hours) dflt = 10 (0.0, 200)

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 (Hours) dflt = 1.0 (0.0, 200)

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)

Low Idle dflt = 500 (0.0, 25000)
Setpoint

Enter the Low Idle Speed Setting. This is the first hold speed when using the automatic start sequence. The speed setpoint will remain at this setting until the low idle delay/hold time has expired.

Delay Time (Cold)—Minutes 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.

Delay Time (Hot)—Minutes dflt = 0.10 (0.0, 500)

Enter the hot start hold time at low idle. This is the programmable time, in minutes, that the turbine will wait/hold at the low idle speed when a hot start is determined. If the turbine has been shutdown for longer than the Hot time but shorter than the Cold time, the control will interpolate between the Hot and Cold delays to determine the low idle hold time.
(Must be less than or equal to the 'Low Idle Delay Time—Cold' Setting)

Low Idle To High Idle Rate

Cold (rpm/sec) dflt = 5 (0.1, 500)

Enter the cold start rate to high idle. This is the programmable rate, in rpm per second, that the speed setpoint will accelerate at when moving to high idle when a cold start is determined.

Hot (rpm/sec) dflt = 25 (0.1, 500)

Enter the hot start rate to high idle. This is the programmable rate, in rpm per second, that the speed setpoint will accelerate at when moving to high idle 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 rates to determine the acceleration rate to the hi idle setpoint.
(Must be greater than or equal to the 'Rate to Hi Idle—Cold' Setting)

High Idle

Setpoint (rpm) dflt = 2000 (0.0, 25000)

Enter the Hi Idle Speed Setting. This is the second hold speed when using the automatic start sequence. The speed setpoint will remain at this setting until the High Idle Delay/hold time has expired.
(Must be greater than the 'Low Idle' Setting)

Delay Time(Cold)—Minutes 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.

Delay Time(Hot)—Minutes dflt = 0.1 (0.0, 500)

Enter the hot start hold time desired at high idle. This is the programmable time, in minutes, that the turbine will wait/hold at the hi 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)

High Idle To Rated Rate

Cold (rpm/sec) dflt = 5.0 (0.1, 500)

Enter the cold start rate to the rated speed setpoint. This is the programmable rate, in rpm per second, that the speed setpoint will accelerate at when moving to rated from High Idle when a cold start is determined.

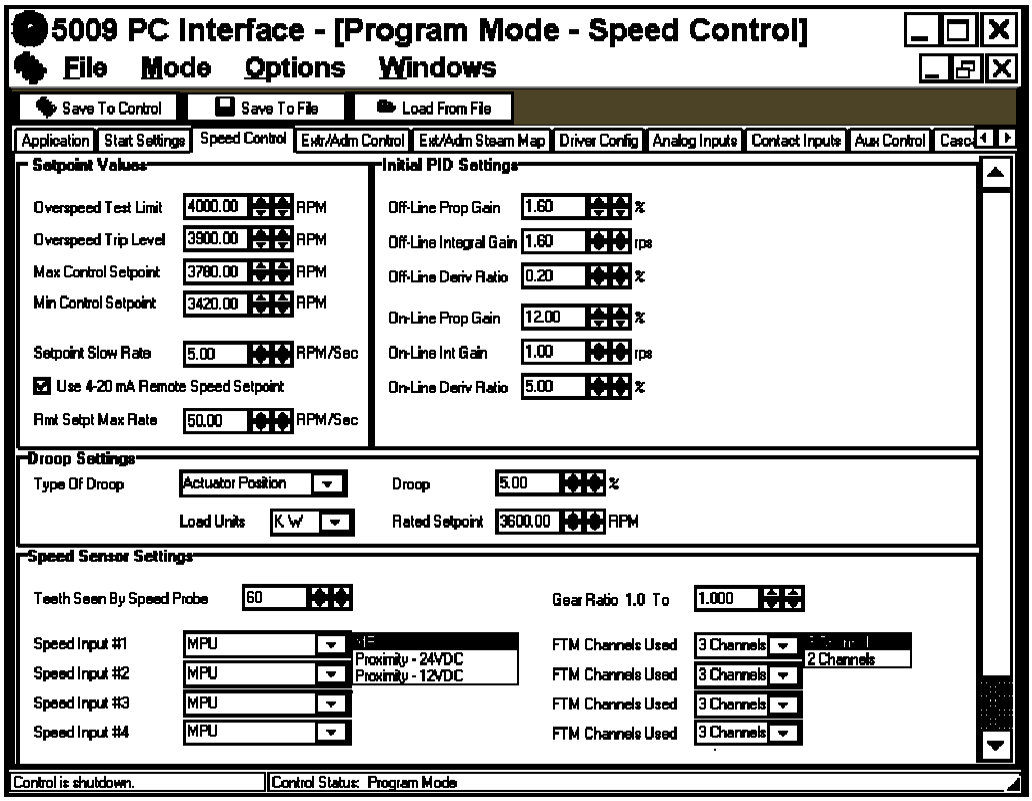
Hot (rpm/sec) dflt = 25.0 (0.1, 500)

Enter the hot start rate to the rated speed setpoint. This is the programmable rate, in rpm per second, that the speed setpoint will accelerate at when moving to rated speed from High Idle 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 rates to determine the acceleration rate to the rated speed setpoint.
(Must be greater than or equal to the 'Rate to Rated—Cold' Setting)

Rated Speed (rpm) dflt = 3600 (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)

Speed Control Page



Setpoint Values

Overspeed Test Limit dflt = 4000 (0.0, 25000)

Set the overspeed test limit (in rpm). This is the maximum speed setpoint the control will increase to when overspeed testing the unit. The setpoint can only be raised to this level when the overspeed test function is being performed.

Overspeed Trip Level dflt = 3900 (0.0, 25000)

Set the 5009's overspeed trip level (in rpm). This is the governor overspeed trip setpoint only and is not to be used as ultimate overspeed protection.
(Must be less than the 'Overspeed Test Limit' Setting)

Maximum Control Setpoint dflt = 3780 (0.0, 25000)

Set the maximum governor control speed. This is the normal governor operation upper limit. For turbine/generator applications, this value must be at least equal to [Rated Speed + (Droop % x Rated Speed)].
(Must be less than the 'Overspeed Trip Level' Setting)

Minimum Control Setpoint dflt = 3420 (0.0, 25000)

Set the minimum governor control speed. This is the normal governor operation lower limit.
(Must be less than the 'Maximum In Control Setpoint')

Setpoint Slow Rate dflt = 5 (0.0, 100)
Enter the speed setpoint slow rate in rpm per second. This is the rate of speed change for normal operation.

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

Rmt Setpt Max Rate dflt = 50 (0.1, 500)
Enter the Maximum Rate of speed change for Remote Speed Setpoint operation. This will determine the maximum rate at which the Speed Control Setpoint will follow the Remote Speed Setting Input.

Initial PID Settings

For a description of PID Settings and their effect on turbine operation, see Volume 1.

Off-Line Proportional Gain dflt = 1.0 (0.0, 100)
Enter the off-line PID proportional gain percentage. This value is used to set speed/load control response when the Generator and Utility Tie breaker contacts are open (if the unit is a generator) or if the turbine speed is below minimum governor speed (if the unit is not a generator) or when the Select Dynamics function is used and the contact is open. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 5%.

Off-Line Integral Gain dflt = 1.0 (.01, 50)
Enter the off-line PID integral gain in repeats-per-second (rps). This value is used to set speed/load control response when the Generator and Utility Tie breaker contacts are open (if the unit is a generator) or if the turbine speed is below minimum governor speed (if the unit is not a generator) or when the Select Dynamics function is used and the contact is open. 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 5.0 (0.0, 100)
Enter the off-line PID derivative ratio. This value is used to set speed/load control response when the Generator and Utility Tie breaker contacts are open (if the unit is a generator) or if the turbine speed is below minimum governor speed (if the unit is not a generator) or when the Select Dynamics function is used and the contact is open. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 5%.

On-Line Proportional Gain dflt = 1.0 (0.0, 100)
Enter the on-line PID proportional gain percentage. This value is used to set speed/load control response when the Generator and Utility Tie breaker contacts are closed (if the unit is a generator) or if the turbine speed is above minimum governor speed (if the unit is not a generator) or when the Select Dynamics function is used and the contact is closed. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 5%.

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 Generator and Utility Tie breaker contacts are closed (if the unit is a generator) or if the turbine speed is above minimum governor speed (if the unit is not a generator) or when the Select Dynamics function is used and the contact is closed. 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 dflt = 5.0 (0.0, 100)

Enter the on-line PID derivative ratio. This value is used to set speed/load control response when the Generator and Utility Tie breaker contacts are closed (if the unit is a generator) or if the turbine speed is above minimum governor speed (if the unit is not a generator) or when the Select Dynamics function is used and the contact is closed. This value can be changed in the Run Mode while the turbine is operating. A recommended starting value is 5%.

Droop Settings

Type of Droop dflt = Actuator Position

(This setting is only selectable for generator applications.)

Actuator Position

Select this option to have Speed PID, control valve position (actuator driver output) position when the turbine generator set is tied to the utility grid. It is recommended that this option be selected whenever using a Decoupling Ratio/Limiter Mode.

KW / Unit Load

Select this option to have Speed PID control generator output power when the turbine generator set is tied to the utility grid. This option requires an analog input to be configured as “KW\Unit load Input”, and an external Watt transducer, sensing generator output power, to be wired to the respective input.

Droop dflt = 5.0 (0.0, 10)

Enter the droop percentage. Typically set between 4-6% and not more than 10%. If droop is required, the unit must be programmed as a ‘Generator Application’.

Maximum Load (Not Shown)

This setting limits the maximum load the turbine/generator can carry, and must be less than or equal to the “KW input at 20mA” setting.

Units dflt = KW

Select MW for Megawatt or KW for Kilowatt.

Rated Setpoint dflt = 3600 (0.0, 25000)

Enter the generator’s rated speed setpoint.

(Must be greater than or equal to the ‘Minimum Control Setpoint’ Setting)

Speed Sensor Settings

Teeth Seen By Speed Probe dflt = 60 (1.0, 300)

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

Gear Ratio 1 to x.x dflt = 1.0 (0.05, 100

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.

Speed Input #1—4 **dflt = MPU**

MPU—(Magnetic Pickup Unit)

The speed sensor used is passive probe.

Proximity—24Vdc

The speed sensor used is an active probe powered by 24Vdc.

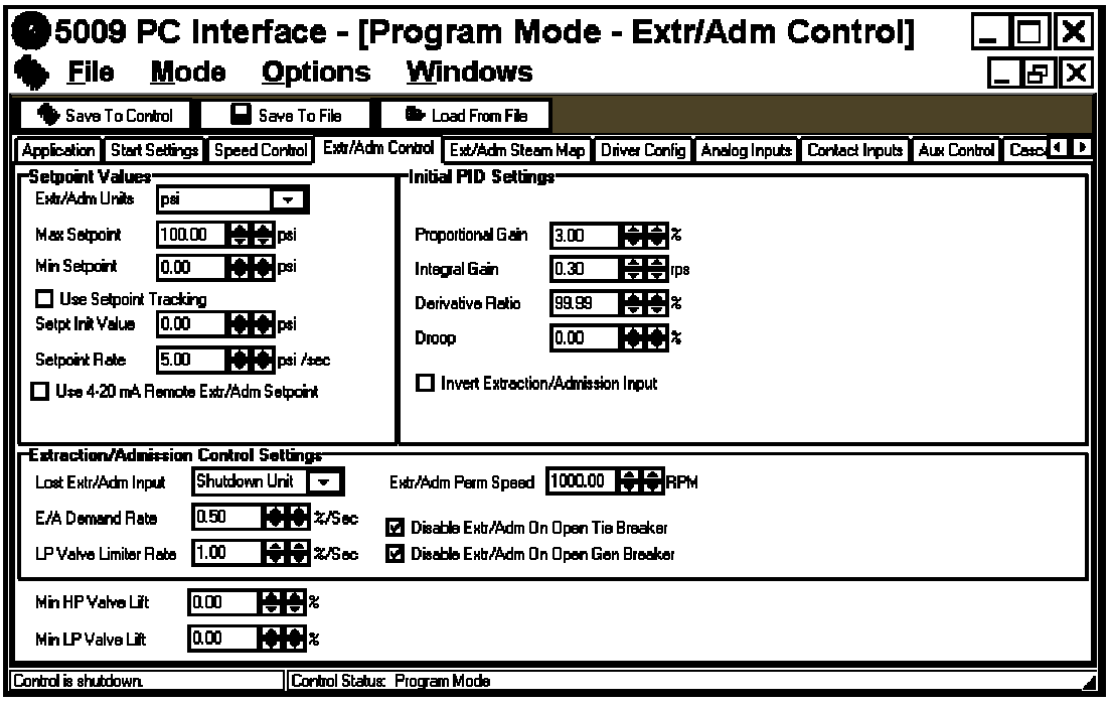
Proximity—12Vdc

The speed sensor used is an active probe powered by 12Vdc.

FTM Channels Used

Select the number of input channels used (A,B,C). 3 channels are used when the Cin terminals are jumpered to the Ain & Bin terminals on the ATM. 2 channels are used when the Cin terminals are not jumpered to the other ATM terminals. Unless a MPU loading problem occurs it is recommended for TMR redundancy issues that all three channels be used.

Extraction, Admission, and Extraction/Admission Folders



The 5009 can be configured for extraction, admission, or extraction/admission types of steam turbines. Following are examples for each of these configurations. Please proceed to the appropriate configuration for your application.

Due to the similarities in the Extraction, Admission, and Extr/Adm Folders, the separate pages are displayed below, however the folder's option descriptions are combined.

Setpoint Values

Units	Select one of the following:	dflt = None
psi	#/hr	
kPa	kg/hr	
kg/cm2	bar	
t/h	atm	
k#/hr	(none)	

Maximum Setpoint dflt = 0.0 (-325000, 325000)

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)*

Minimum Setpoint dflt = 0.0 (-325000, 325000)
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).

Use Setpoint Tracking dflt = Yes
If checked, the extraction/admission setpoint tracks the input to provide bumpless transfer to extraction/admission control when it is enabled. If not checked, the setpoint remains at the last in control position, except on power-up or exiting the program mode at which point it will go to the Setpoint Initial Value.

Setpoint Initial Value dflt = 0.0 (-325000, 325000)
Enter the setpoint initialization value for the extraction/admission setpoint. When not using the Setpoint Tracking function, 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)

Setpoint Rate—(Slow) dflt = 5.0 (0.01, 10000)
Enter the extraction/admission setpoint slow rate (in units per second) at which extraction/admission setpoint moves when adjusted for less than 3 seconds. After 3 seconds the rate will increase to 3 times this rate. The slow rate, fast rate time delay (defaulted to 3 seconds), and fast rate settings are all adjustable in the PCI's Service mode.

Use 4–20 mA Remote Extraction/Admission Setpoint dflt = No
If checked, an external 4-20mA signal can be used (configure in Analog Input page) to change the extraction/admission setpoint. The extraction/ admission control setpoint will move to this input signal whenever the Remote Extraction/Admission Setpoint is enabled.

Remote Setpoint Maximum Rate dflt = 50 (0.01, 10000)
Enter the maximum desired rate that the extraction/admission setpoint will change for a large step change in the Remote Extraction/Admission Setpoint signal.

Initial PID Settings

Proportional Gain dflt = 3.0 (0.0, 99.99)
Enter the Extraction/admission PID proportional gain value. This value is used to set extraction/admission control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 1%.

Integral Gain dflt = 0.3 (0.001, 50)
Enter the Extraction/admission PID integral gain value, in repeats-per-second (rps). This value is used to set extraction/admission control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 0.3 rps.

Derivative Ratio dflt = 99.99 (0.01, 99.99)
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%.

Droop dflt = 0.0 (0.0, 100)
Enter the droop percentage. If required, typically set between 4-6% and not more than 10%.

Use Automatic Enable (Used with "Extraction Only" turbines) dflt = Yes
Select this box if it is desired to have the operator issue an enable command and have the LP valve limiter automatically lower to enable extraction control (or issue a disable command to have the LP limiter automatically raise to disable extraction control). With this option selected the operator can choose to manually or automatically lower the LP valve. Extraction control can be enabled through the PCI, a contact input or a Modbus command. If this option is not selected, the LP valve limiter will need to be manually lowered\raised to enable\disable Extraction control.

Invert Extraction/Admission Input dflt = No

Check this box if the extraction/admission control action required is reverse acting. If selected this option will result in the LP valve being opened to increase extraction/admission pressure/flow.

Extraction/ Admission Control Settings

Lost Extraction/Admission Input dflt = Shutdown

Select the type of action desired if all extraction/admission inputs are lost: Shutdown the Turbine, Ramp LP valve to its minimum (0%) position, Ramp the LP Valve to its maximum (100%) position, Hold the LP valve at its last position. In all cases a loss of the extraction/admission input signal is alarmed.

Extraction/Admission Perm Speed dflt = 1000 (0.0, 25000)

Enter the turbine speed at which it will be permissible to enable extraction/admission control. The speed of the turbine must be above this speed for extraction/admission control to be enabled.

Extraction/Admission Demand Rate dflt = 0.5 (0.01, 10)
(not used with “Extraction Only” turbines)

Enter the rate (%/second) that the extraction/admission Demand will ramp when issuing raise and lower commands. The Demand setpoint is used during enabling and disabling extraction/admission control.

LP Valve Limiter Rate dflt = 1.0 (0.01, 50)

Enter the rate (%/second) at which the LP valve limiter will ramp when raise and lower commands are given. For “Extraction Only” turbines, this value is also the rate that the LP valve limiter will be raised and lowered when enabling and disabling extraction control. Care should be taken to make sure that this rate is not set faster then the plant’s letdown station (turbine bypass valve) can move.

Disable Extraction/Admission On Open Tie Breaker dflt = Yes

If checked extraction/admission control will be disabled when the utility tie breaker opens. If not checked, then extraction/admission control will not be disabled when the utility tie breaker is opened.

Disable Extraction/Admission On Open Generator Breaker dflt = Yes

Select if the extraction/admission control will be disabled when the generator breaker opens. If not checked, then extraction/admission control will not be disabled when the generator breaker is opened.

Min HP Valve Lift (Not used by “Extraction Only” turbines) dflt = 0.0 (0.0, 40)

This value will determine what the Minimum HP Valve position will be. It is measured in % opened. Typically used to guarantee some steam flow (cooling steam).

Min LP Valve Lift dflt = 0.0 (0.0, 40)

This value will determine what the Minimum LP Valve position will be. It is measured in % opened. Typically used to guarantee some steam flow (cooling steam).

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

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

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

Extraction Only Steam Map—Before a turbine's extraction steam map can be programmed into the control, it must have the intersection points A, B, & C (refer to figure 3-1).

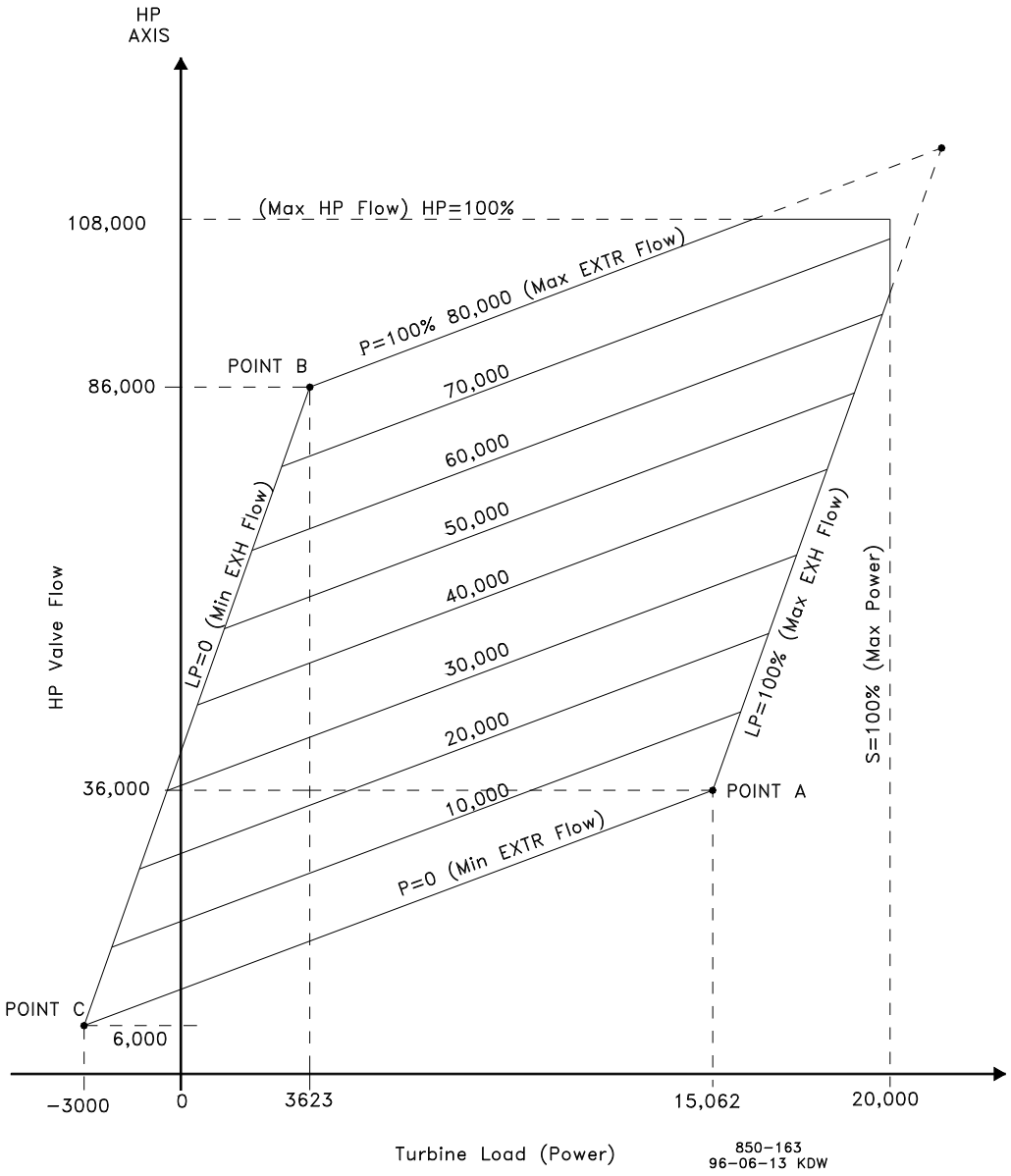


Figure 3-1. Typical Extraction Steam Map

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 3-1:

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).

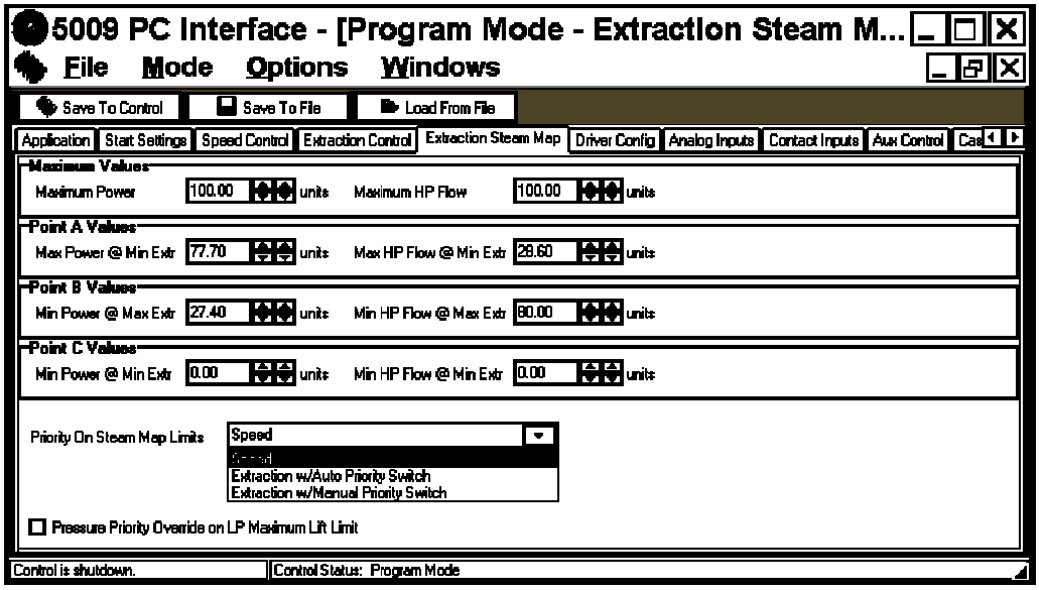
Point A is where the P=0 and LP=100 lines intersect (MAX POWER @ MIN EXTRACTION = about 15,062 KW; HP FLOW @ MIN EXTRACTION = about 36,000 lbs/hr).

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).

In the folder below values have been entered as a percentage. 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.

Extraction Steam Map Page



Extraction Steam Map Values

Maximum Values

Maximum Power dflt = 100 (0.0, 999999)

Enter the Maximum Rated turbine Power.

Maximum HP Flow dflt = 100 (0.0, 999999)

Enter the Maximum Rated HP Valve Flow.

Point A Values

Maximum Power @ Minimum Extraction dflt = 77.7 (0.0, 999999)

Enter the maximum power attainable at zero extraction flow.

Maximum HP Flow @ Minimum Extraction dflt = 28.6 (1.0, 999999)

Enter the maximum HP Valve Flow attainable at zero extraction flow.

Point B Values

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

Enter the minimum power attainable at 100% or maximum extraction flow.

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

Enter the minimum HP Valve Flow at 100% or maximum extraction flow.

Point C Values

Minimum Power @ Minimum Extraction dflt = 0.0 (-99999, 999999)

Enter the minimum power attainable at zero extraction flow.

Minimum HP Flow @ Minimum Extraction dflt = 0.0 (-99999, 999999)

Enter the minimum HP Valve Flow at zero extraction flow.

Priority On Map Limits **dflt = Speed**

(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 in Frequency control.

Speed

Select this option to control turbine speed/load when the turbine is on an operating limit.

Extraction/Admission w/Auto Priority Switching

Select this option to control turbine extraction/admission pressure/flow when the turbine is on an operating limit. The control will switch from speed to extraction/admission priority as soon as the LP valve limiter is at its minimum position, both the gen and tie breakers are closed (if programmed as a generator), and the unit is not already at a limit.

Ext/Adm w/Manual Priority Switching

Select this option to control turbine extraction/admission pressure/flow when the turbine is on an operating limit. The control will allow extraction/admission priority to be enabled as soon as the LP valve limiter is at its minimum position, both the gen and tie breakers are closed (if programmed as a generator), and the unit is not already at a limit. The priority must be manually switched from speed to extraction/admission once the above conditions are met and can be preformed from the Run Mode of the PCI, a contact input, and from a Modbus command.

Pressure Priority Override on LP Maximum Lift Limit dflt = No

Check this box to have the control switch to extraction/admission priority whenever the LP valve is on its maximum limit regardless of the priority selected or enabled.

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 3-2).

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).

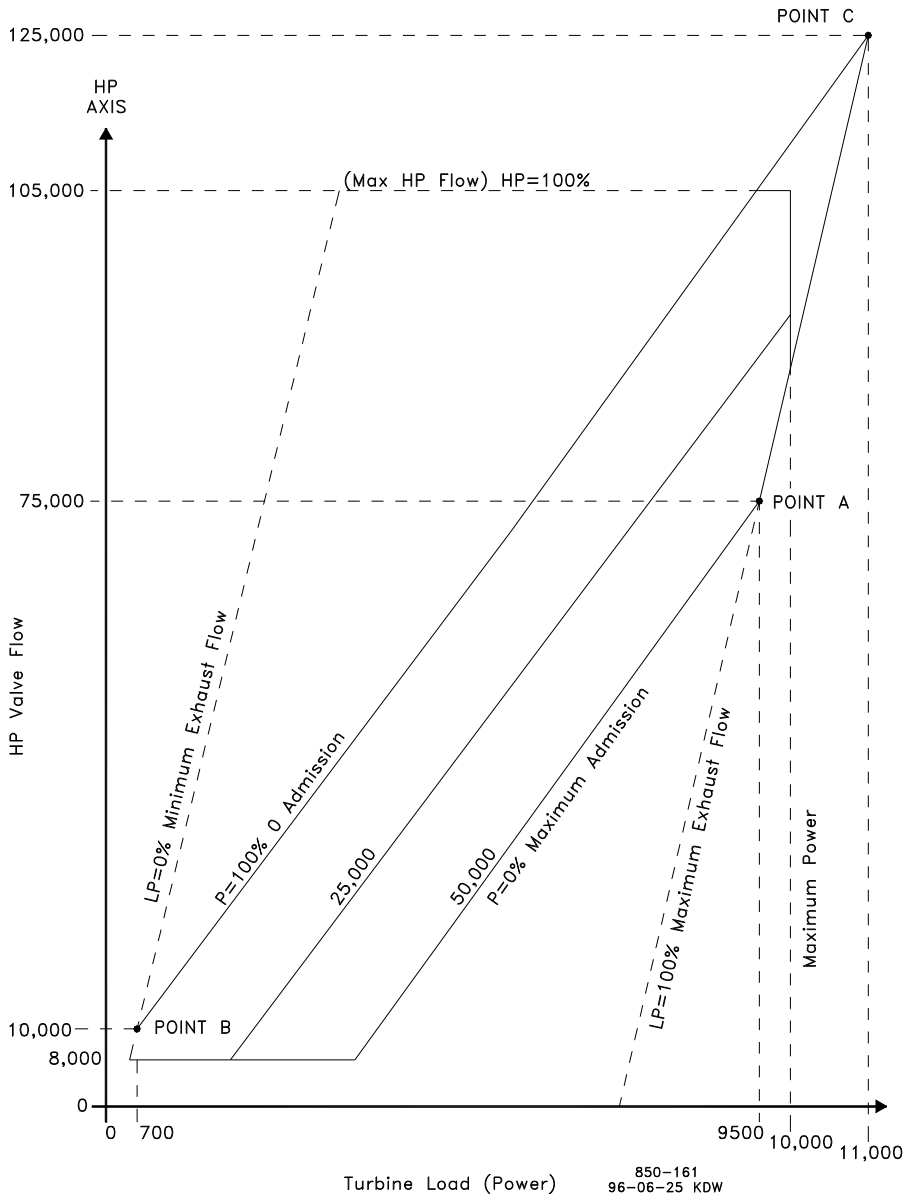


Figure 3-2. Typical Admission Steam Map

If only point A exists, your map will have to be modified to include points B & C. The LP=0 line will need to be created. To create the LP=0 line you must know the minimum required steam flow through the back-end of the turbine. In our example steam map (figure 3-2) the minimum required flow was 10,000 lbs/hr.

1. Extend the zero admission (or induction) line (p=100%). Refer to figure 3-2.

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

3. 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.

4. 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.

5. 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 3-2.

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.

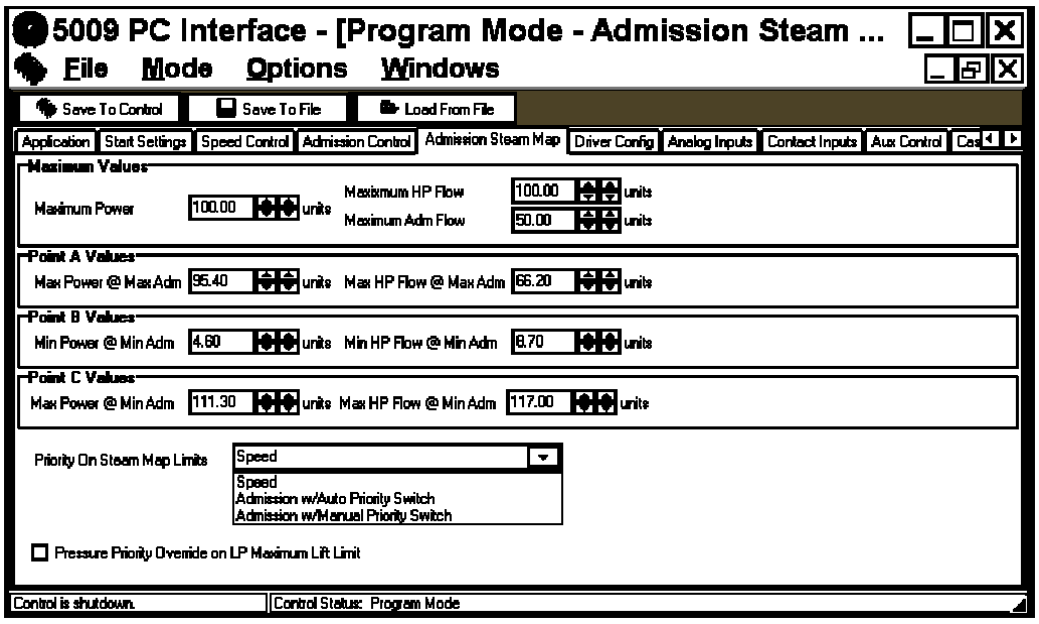
Point B is where the LP=0 and P=100 lines intersect (MIN POWER @ MIN ADMISSION = about 700 kW; HP FLOW @ MIN ADMISSION = about 10,000 lbs/hr). This point was used because 10,000 lbs/hr is the minimum back-end cooling steam flow required by the turbine.

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%.

In the folder below values have been entered as a percentage. 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.

Admission Steam Map Page



Admission Steam Map Values

Maximum Values
Maximum Power
Enter the Maximum Rated Turbine Power.
Maximum HP Flow
Enter the Maximum Rated HP Valve Flow.
Maximum Admission Flow
Enter the Maximum Rated Low Pressure(Admission) Flow for the turbine.

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—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 3-3).

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 3-3) the minimum required flow was 8,000 lbs/hr.

1. Extend the maximum extraction line. Refer to figure 3-3.

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.

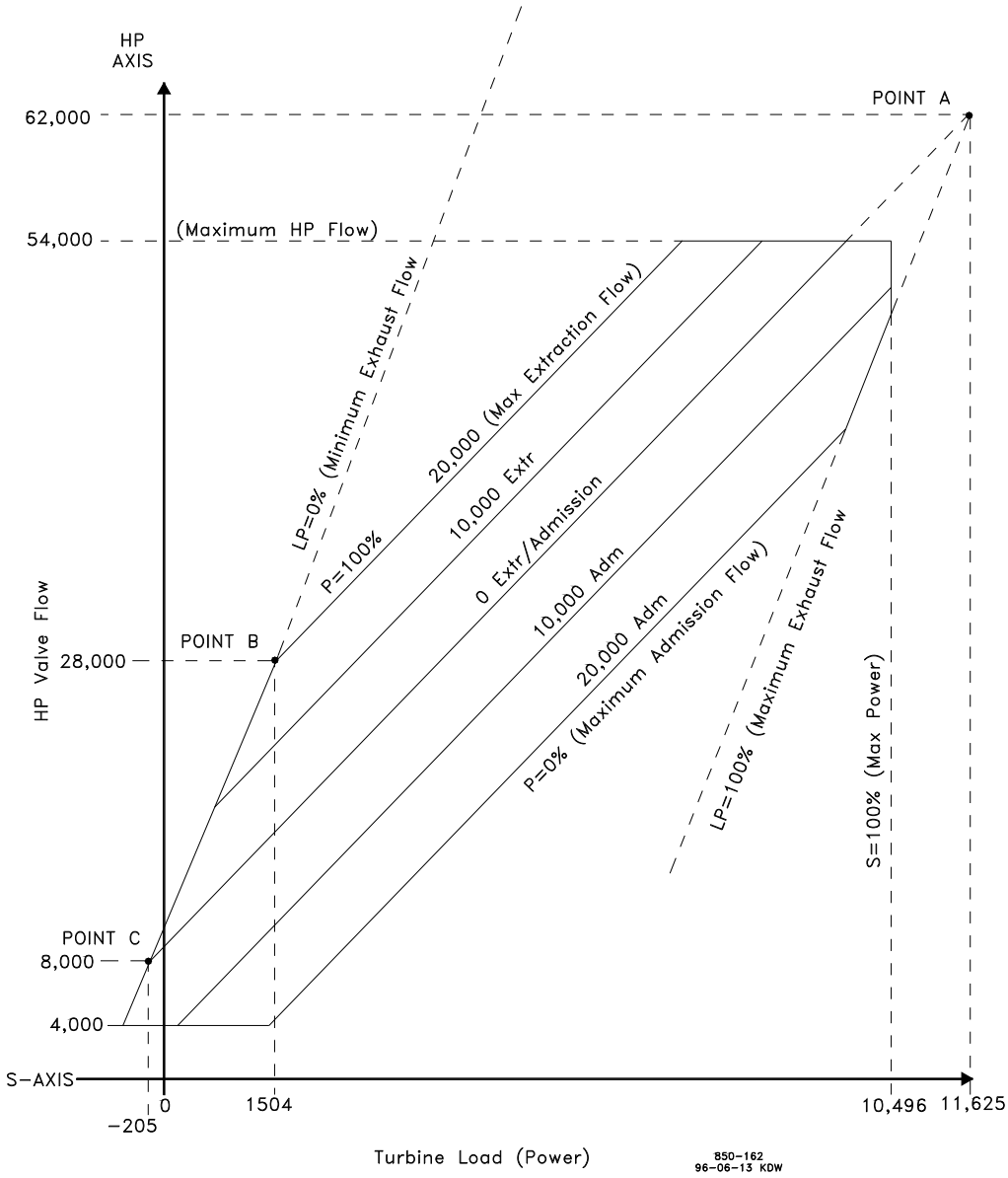


Figure 3-3. Typical Extraction & Admission Steam Map

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

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.

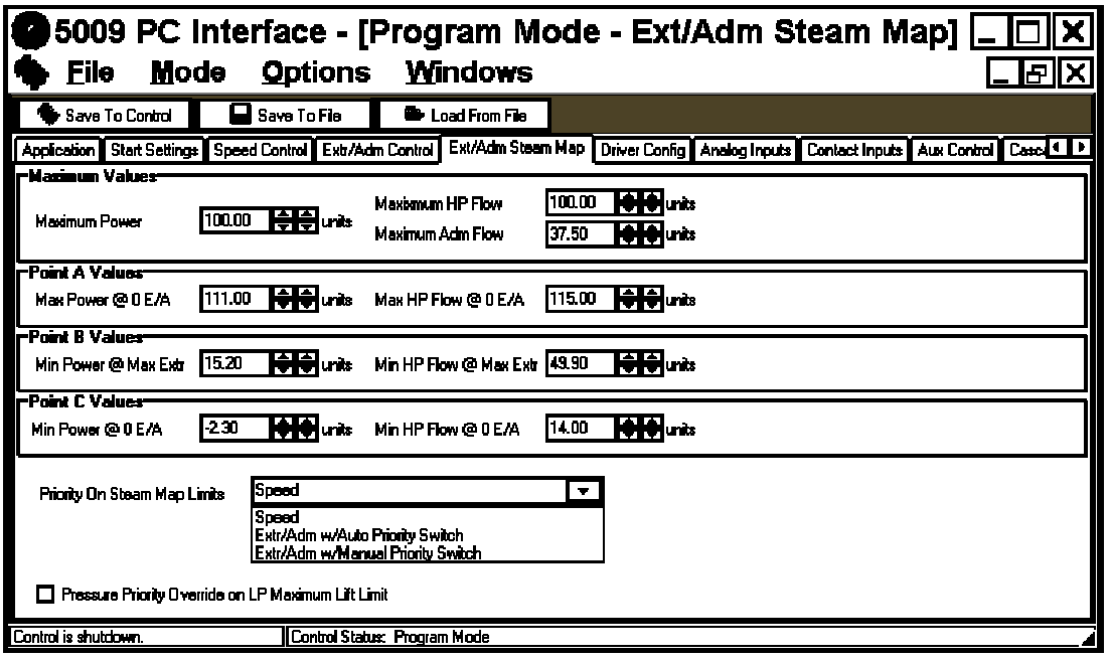
Point B is where the LP=0 and P=100 lines intersect (MIN POWER @ MAX EXTRACTION = about 1504 kW; MIN HP FLOW @ MAX EXTRACTION = about 28,000 lbs/hr).

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%.

In the folder below values have been entered as a percentage. 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.

Extraction/Admission Steam Map Folder



Extraction/ Admission Steam Map Values

Maximum Values

Maximum Power dflt = 100 (0.0, 999999)

Enter the Maximum Rated Turbine Power.

Maximum HP Flow dflt = 100 (0.0, 999999)

Enter the Maximum Rated HP Valve Flow for the turbine.

Maximum Admission Flow dflt = 0.0 (0.0, 999999)

Enter the Maximum Rated Low Pressure Valve Flow (Admission) for the turbine.

Point A Values

Maximum Power @ 0 E/A dflt = 77.7 (1.0, 999999)

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

Maximum HP Flow @ 0 E/A dflt = 28.6 (1.0, 999999)

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

Point B Values

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

Enter the minimum power attainable at maximum extraction flow.

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

Enter the minimum HP Valve Flow at maximum extraction flow.

Point C Values

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

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

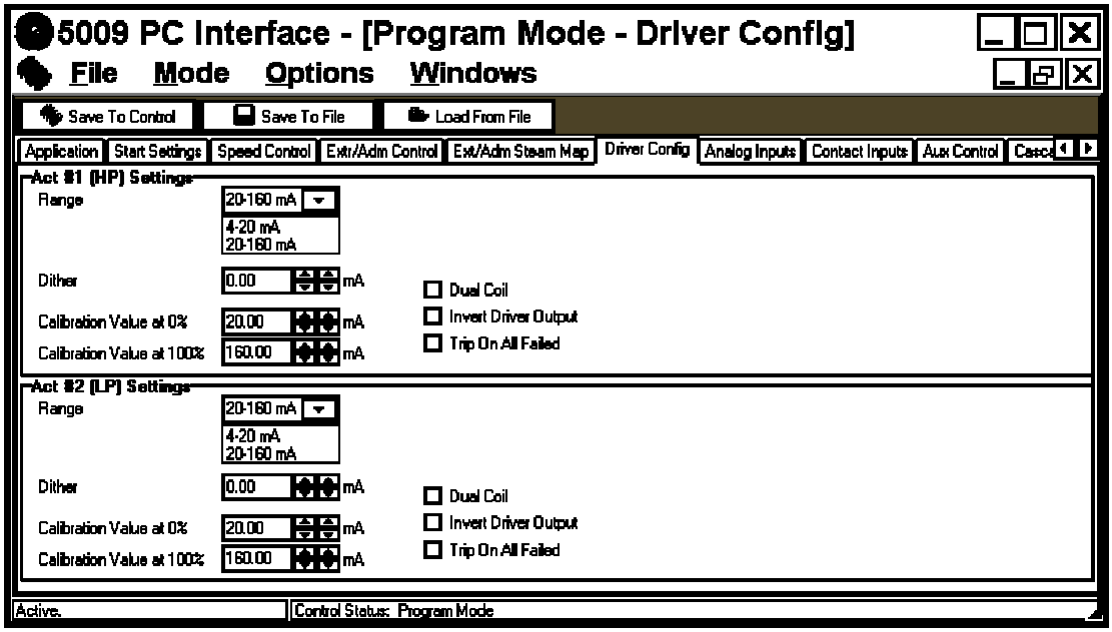
Minimum HP Flow @ 0 E/A dflt = 0.0 (-99999, 999999)

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

Priority On Map Limits **dflt = Speed**

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.

Driver Folder



Settings

Identical settings are used for both the HP valve and the LP valve, Act #1 and Act #2.

Range dflt = 20—160 mA

Select either a 4—20 mA driver range or a 20—160 mA driver range. Typically Woodward actuators have a 20—160 mA range.

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 Run Mode.

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

Enter the milliamp setting that corresponds to 100% flow. This number can be tuned in Run Mode.

Dual Coil dflt = No

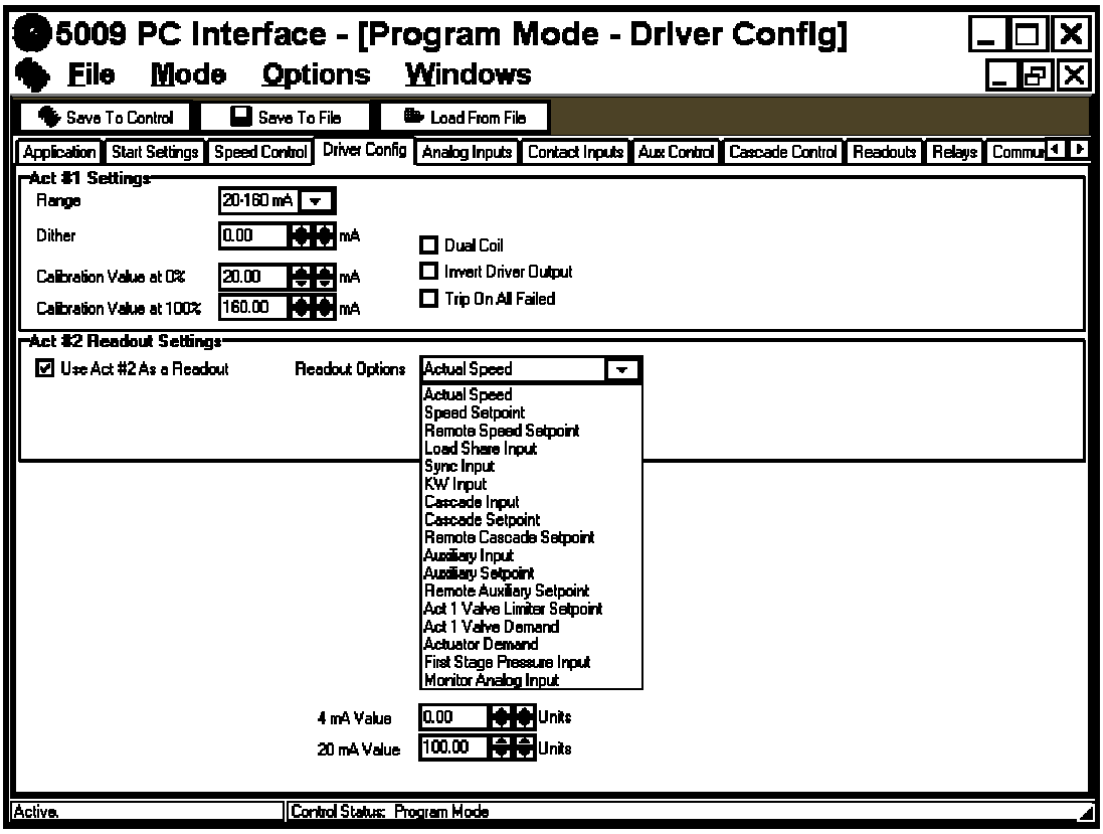
Check this box if the actuator being used has a dual coil. Reference the Hardware Installation section of Volume 2 for the proper wiring of the dual coil actuator.

Invert Output dflt = No

Check this box if the actuator requires an inverted driver. (Opens on a decrease in current to the actuator)

Trip On All Failed

Check this box if the 5009 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'.



Act #2 Offset (Not Shown) **dflt= 0.0(0.0, 100)**
When the control is configured for a split-range turbine type this setting is visible, and Act #2 can be configured to begin opening at an offset value of Act#1 position. If this setting is 50%, then Valve #2 will begin opening when Valve #1 reaches 50%. The control will continue to open both valves to 100%, with a position difference of 50%.

ACT #2 Readout Settings
If the application has been programmed for a Single valve Turbine type, Act #2 can be programmed for a 4—20 mA analog Readout. Select this option by clicking on the check box to the left of the Use Act #2 As a Readout text.

Readout Options **dflt = Actual Speed**
Select from the list of options below:

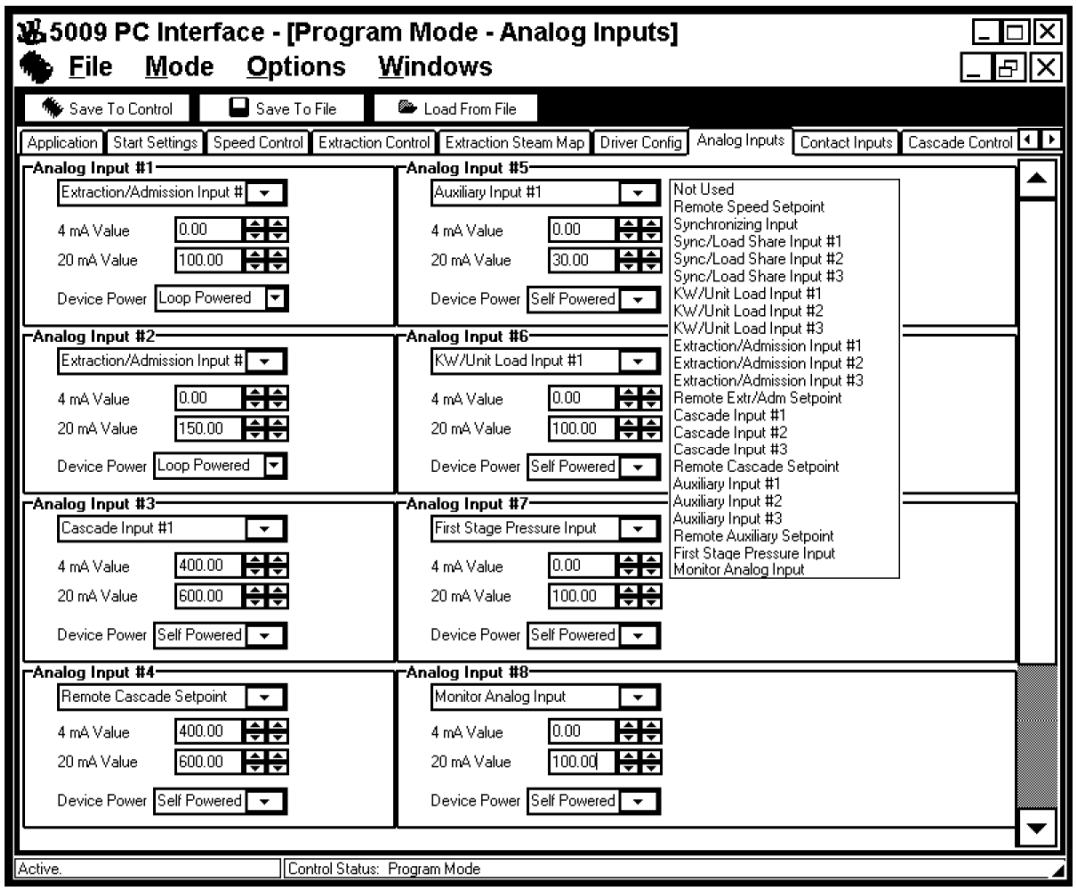
1. Actual Speed
2. Speed Setpoint
3. Remote Speed Setpt
4. Load Share Input
5. Sync Input
6. KW Input
7. Cascade Input
8. Cascade Setpoint
9. Rmt Cascade Setpt
10. Auxiliary Input
11. Auxiliary Setpoint
12. Rmt Auxiliary Setpt
13. Act 1 Valve Limiter Setpt
14. Act 1 Valve Demand
15. Actuator Demand
16. First Stg Press Input
17. Monitor Analog Input

4 mA Value dflt = 0.0 (-325000, 325000)
Enter the value (in engineering units) that corresponds to 4 milliamps (mA) on the analog output.
20 mA Value dflt = 100 (-325000, 325000)
Enter the value (in engineering units) that corresponds to 20 milliamps (mA) on the analog output.
(Must be greater than the '4 mA Value' Setting)

Analog Inputs Folder

Analog Input #X

All Analog Inputs are entered in the same way. As functions are defined in the 5009 control, Analog Inputs are needed to read parameters and close the control loop. If a function is defined, but a needed analog input is not provided, the completeness check at the end of programming will inform the user and bring him back to this page to enter the appropriate analog input. Up to eight analog inputs can be programmed.



Input Option dflt = Not Used

Select one from the following list. If more than one input is needed for one function,(i.e. Cascade Input) use a different numbered selection for each analog function(i.e. Cascade Input #1, Cascade Input #2, Cascade Input #3)

Not Used
Remote Speed Setpoint
Synchronizing Input
Sync/Load Share Input #1
Sync/Load Share Input #2
Sync/Load Share Input #3
KW/Unit Load Input #1
KW/Unit Load Input #2
KW/Unit Load Input #3
Extraction/Admission Input #1
Extraction/Admission Input #2
Extraction/Admission Input #3
Remote Extraction/Admission Setpoint
Cascade Input #1
Cascade Input #2
Cascade Input #3
Remote Cascade Setpoint
Auxiliary Input #1
Auxiliary Input #2
Auxiliary Input #3
Remote Auxiliary Setpoint
First Stage Pressure Input
Monitor Analog Input

Value at 4 mA dflt = 0.0 (-325000, 325000)

Set the value (in engineering units) that corresponds to 4 milliamps (mA) on the analog input.

Value at 20 mA dflt = 100 (-325000, 325000)

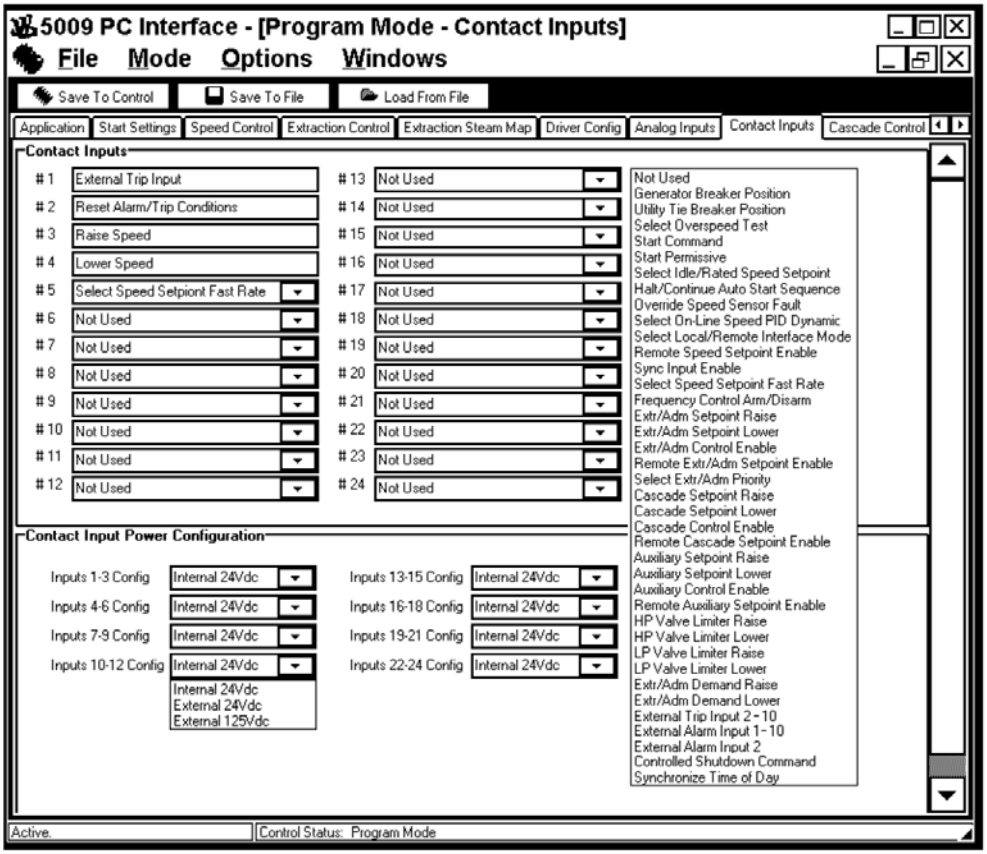
Set the value (in engineering units) that corresponds to 20 milliamps (mA) on the analog input.

(Must be greater than the 'Value at 4 mA' Setting)

Device Power

Select the power configuration used by the input device (Self Powered or Loop Powered). Select the "Self Powered" setting if the input device has its own power. Select the "Loop Powered" setting if the input device is powered by the 5009 control.

Contact Inputs Folder



Contact Inputs

(Except for the External Trip and External Alarm contacts, each contact input option may be configured only once. In addition, the function that the contact input uses must be programmed or a completeness check error message will occur. For example, to use the Cascade Control Enable contact input, the 'Use Cascade' function must be programmed.)

Contact Input Power dflt = Internal 24 Vdc

Select the power source that will be used to drive the contact inputs.

External Trip

Contact Input #1 is dedicated as an External Trip input. If the contact is open (power removed) the Control will issue a fail safe shutdown.

Reset
Contact Input #2 is dedicated as a Control Reset input. If the contact is closed (power applied) the Control will issue a reset command.
Raise Speed
Contact Input #3 is dedicated as a Raise Speed Setpoint command. If the contact is closed (power applied) the Control will raise the speed setpoint.
Lower Speed
Contact Input #4 is dedicated as a Lower Speed Setpoint command. If the contact is closed (power applied) the Control will lower the speed setpoint.

Contact Input X

Function
Scroll through the option list and select an option by clicking on it.

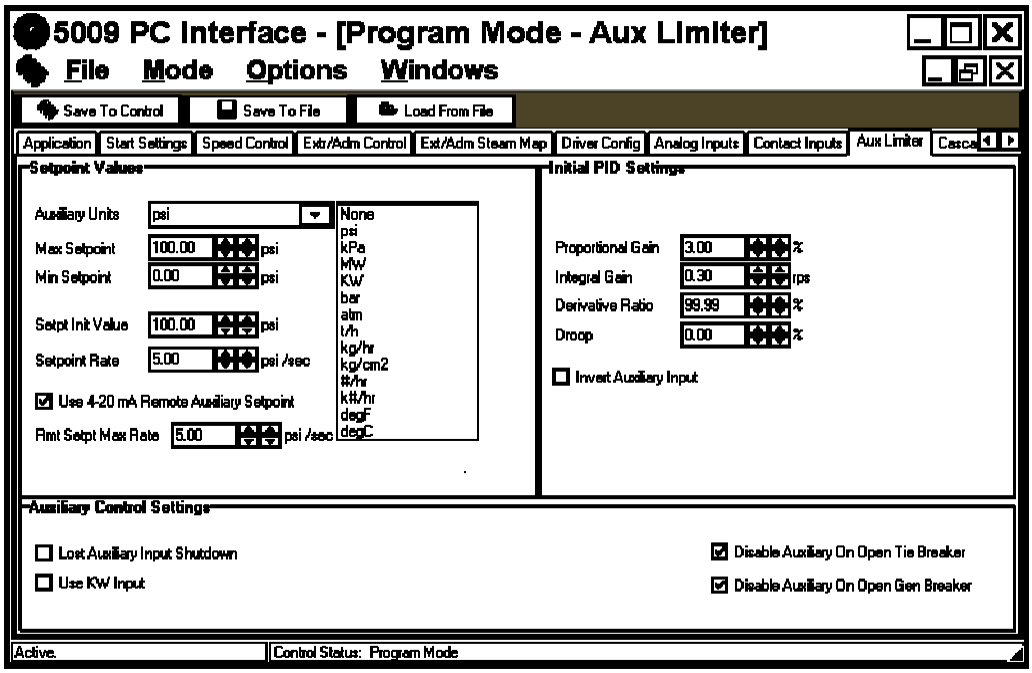
CONTACT INPUT OPTIONS

(Not Used)
Generator Breaker
Utility Tie Breaker
Select Overspeed Test
Start Command
Start Permissive
Select Idle / Rated Speed Setpoint
Halt / Continue Auto Start Sequence
Override Speed Sensor Fault
Select On-Line Speed PID Dynamics
Select Local / Remote Interface Mode
Remote Speed Setpt Enable
Sync Input Enable
Select Speed Setpoint Fast Rate
Frequency Control Arm/Disarm
Extr/Adm Setpt Raise
Extr/Adm Setpt Lower
Extr/Adm Control Enable
Remote Extr/Adm Setpoint Enable
Select Extr/Adm Priority
Casc Setpt Raise
Casc Setpt Lower
Casc Control Enable
Remote Casc Setpt Enable
Auxiliary Setpt Raise
Auxiliary Setpt Lower
Auxiliary Control Enable
Remote Auxiliary Setpt Enable
HP Valve Limiter Raise
HP Valve Limiter Lower
LP Valve Limiter Raise
LP Valve Limiter Lower
Extr/Adm Demand Raise
Extr/Adm Demand Lower
External Trip 2—10
External Alarm 2—10
Controlled Shutdown Command
Synchronize Time of Day

Contact Input Power Configuration
Inputs X-X Config dflt = Internal 24Vdc
Select the contact input circuit wetting voltage used by each set of contact inputs. Select the “Internal 24Vdc” setting if the 5009 control is supplying the circuit’s contact input wetting voltage.

Auxiliary Folder (Limiter and Controller)

The difference between Auxiliary as a Limiter and Auxiliary as a Controller is in how they function and are enabled/disabled. There are no programming differences, besides the “Setpoint Init Value” option. Because the Auxiliary Controller uses setpoint tracking when disabled, the Setpoint Init Value option is not used.



Auxiliary Setpoint Values

Units: Select one of the following: dflt = None

psi	#/hr
KW	MW
kPa	kg/hr
degF	degC
kg/cm²	bar
t/h	atm
k#/hr	(none)

Maximum Setpoint dflt = 0.0 (-325000, 325000)

Set the maximum auxiliary setpoint. This value is the maximum setpoint value that the auxiliary setpoint can be increased/raised to (upper limit of auxiliary control).

(Must be greater than the 'Min Aux Setpt' Setting)

Minimum Setpoint dflt = 0.0 (-325000, 325000)

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

Setpoint Initial Value (Limiter Only) dflt = 0.0 (-325000, 325000)

Enter the setpoint initialization value. When not using the Aux Enable function, this is the value that the auxiliary setpoint initializes to upon power-up or exiting the program mode.

(Must be less than or equal to the 'Max Aux Setpoint' Setting)

Setpoint Rate (Slow) dflt = 5.0 (0.01, 10000)

Enter the auxiliary setpoint slow rate (in units per second) at which auxiliary 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.

Use 4-20mA Remote Auxiliary Setpoint dflt = No

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

Remote Setpoint Maximum Rate dflt = 5.0 (0.1, 10000)

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

Initial PID Settings

Proportional Gain dflt = 3.0 (0.0, 99.99)

Enter the aux 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 1%.

Integral Gain dflt = 0.3 (0.001, 99.99)

Enter the aux 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 0.3 rps.

Derivative Ratio dflt = 99.99 (0.01, 99.99)

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

Droop dflt = 0.0 (0.0, 100)

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

Invert Auxiliary dflt = No

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

Auxiliary Control Settings

Lost Auxiliary Input Shutdown dflt = No

Check this box if you want the 5009 to trip or go to a failed safe condition on loss of the auxiliary analog input signal. If not checked, the control will only issue an alarm if the Aux input fails.

Use KW Input dflt = No

If checked, allows the auxiliary control PID will use the KW Unit Load Input programmed in the analog input folder as the control input parameter. When checked, no auxiliary analog input is used or needed.

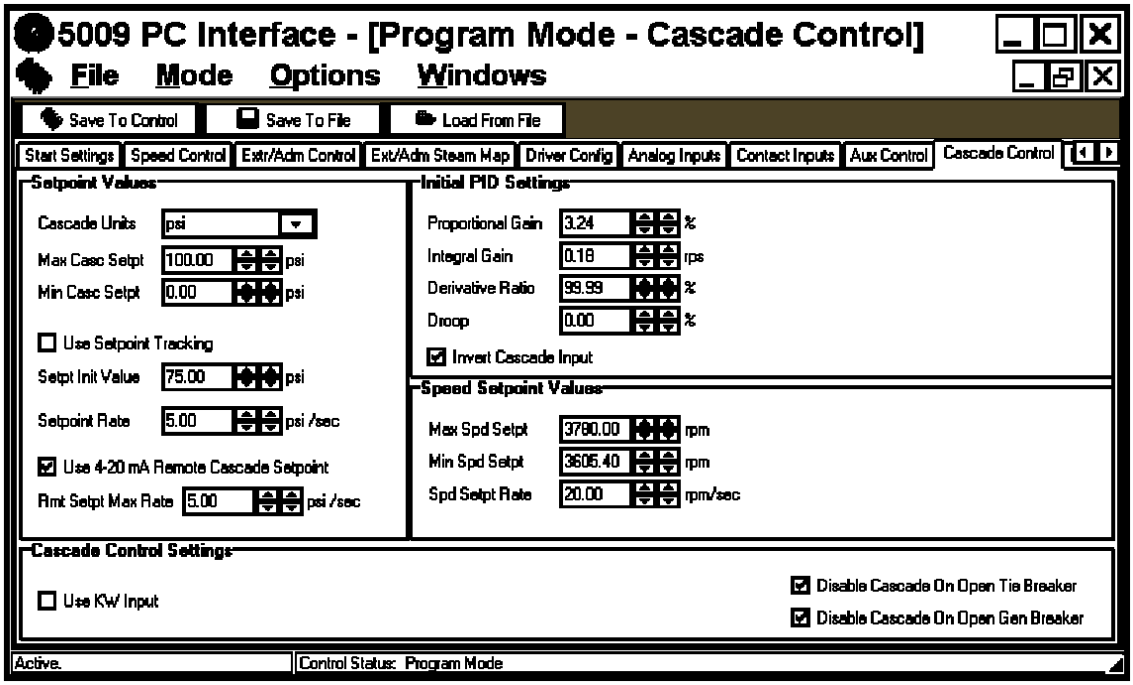
Disable Auxiliary On Open Tie Breaker dflt = Yes

Select to disable the Auxiliary control when the utility tie breaker opens. If not checked, then Auxiliary control will not be disabled when the utility tie breaker is opened.

Disable Auxiliary On Open Generator Breaker dflt = Yes

Select to disable the Auxiliary control when the generator breaker opens. If not checked, then Auxiliary control will not be disabled when the generator breaker is opened.

Cascade Folder



Cascade Setpoint Values

Units: Select one of the following: dflt = None

psi	#/hr
KW	MW
kPa	kg/hr
degF	degC
kg/cm²	bar
t/h	atm
k#/hr	(none)

Maximum Setpoint dflt = 0.0 (-325000, 325000)

Enter 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 Cascade Setpt' Setting)

Minimum Setpoint dflt = 0.0 (-325000, 325000)

Enter 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).

Use Setpoint Tracking? dflt = No

If checked, the cascade setpoint tracks the cascade input to provide bumpless transfer to cascade control when it is enabled. If not checked, the cascade setpoint remains at the last in control position, except on power-up or exiting the program mode at which point it will go to the Setpoint Initial Value.

Setpoint Initial Value dflt = 0.0 (-325000, 325000)

Enter the setpoint initialization value. When not using the Setpoint Tracking function, this is the value that the cascade setpoint initializes to upon power-up or exiting the program mode.

(Must be less than or equal to the 'Max Cascade Setpt' Setting)

Setpoint Rate (Slow) dflt = 5.0 (0.01, 10000)
Enter the Cascade setpoint slow rate (in units per second) at which cascade 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.

Use 4-20mA Remote Cascade Setpoint dflt = No
If checked, an external 4-20mA 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 Setpoint Maximum Rate dflt = 5.0 (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.

Initial PID Settings

Proportional Gain dflt = 3.0 (0.0, 99.99)
Enter the cascade PID proportional gain value. This value is used to set cascade control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 1%.

Integral Gain dflt = 0.3 (0.001, 50)
Enter the cascade PID integral gain value, in repeats-per-second (rps). This value is used to set cascade control response. This value can be changed in the Run Mode while the turbine is operating. If unknown, a recommended starting value is 0.3 rps.

Derivative Ratio dflt = 99.99 (0.01, 99.99)
Enter the cascade PID derivative ratio. This value is used to set cascade control response. This value can be changed in the Service Mode while the turbine is operating. If unknown, a recommended starting value is 100%.

Droop dflt = 0.0 (0.0, 100)
Enter the droop percentage. If needed, typically set between 4-6% and not more than 10%.

Invert Cascade Input dflt = No
Select this box if the cascade control will be reverse acting. If not checked, the control will be forward acting. If selected, this option will result in the HP Valve (S-Term) decreasing, to increase the Cascade input parameter. An example of when the input would be inverted is when the Cascade PID is being used for turbine inlet pressure control.

Speed Setpoint Values

Maximum Speed Setpoint dflt = 3780 (0.0, 25000)
Enter the maximum speed setpoint that the Cascade controller can raise the speed setpoint to. This value is used to limit the Cascade PID from over powering the unit. (Must be less than or equal to the 'Maximum Control Speed Setpt' Setting)

Minimum Speed Setpoint dflt = 3600 (0.0, 25000)
Enter the minimum speed setpoint that the Cascade controller can lower the speed setpoint to. This value is used to limit the Cascade PID from reverse powering a unit. To protect the unit, this value should be at or above rated speed if the unit is a generator. (Must be greater than or equal to the 'Minimum Control Speed Setpt' Setting)

Speed Setpoint Rate (Maximum) dflt = 20 (0.1, 500)
Enter the maximum desired rate at which the cascade control can vary the speed setpoint.

Cascade Control Settings

Use KW Input dflt = No

If checked, allows the Cascade control PID will use the KW/Unit Load Input programmed in the analog input folder. When checked, no Cascade analog input is needed as the control input parameter.

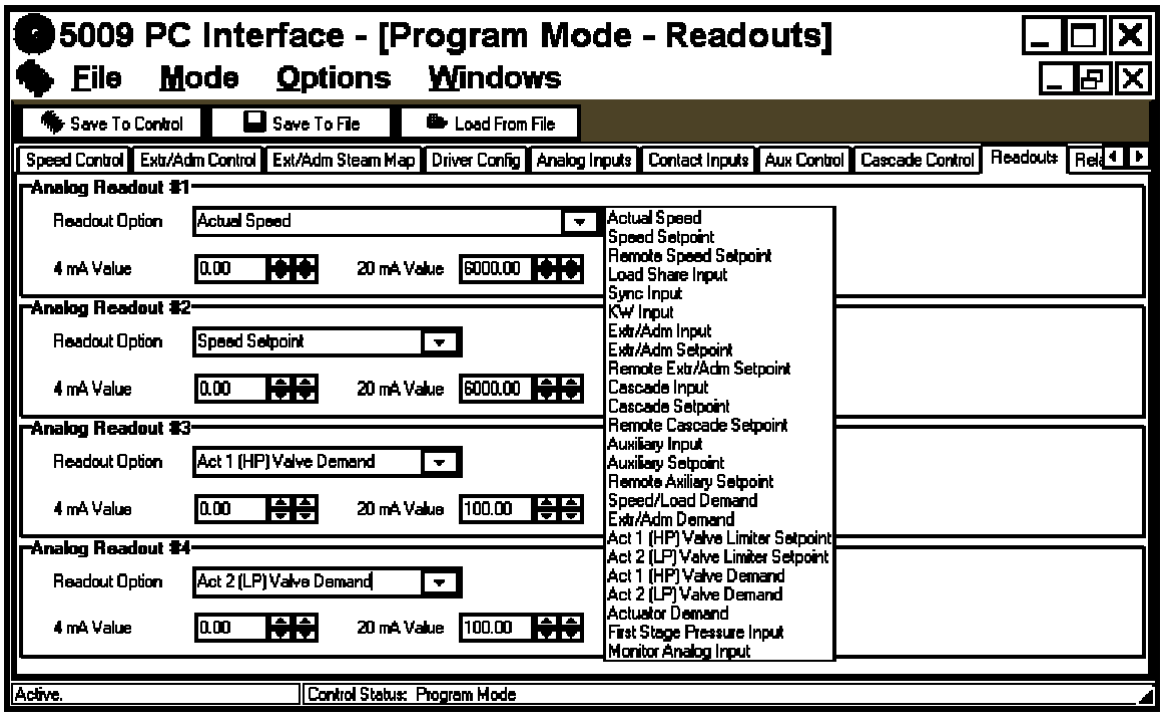
Disable Cascade On Open Tie Breaker dflt = Yes

Select to disable Cascade control when the utility tie breaker opens. If not checked, then Cascade control will not be disabled when the utility tie breaker is opened.

Disable Cascade On Open Generator Breaker dflt = Yes

Select disable Cascade control when the generator breaker opens. If not checked, then Cascade control will not be disabled when the generator breaker is opened.

Analog Readouts Folder



Analog Readout #X

All four 4-20 mA analog readouts may be configured in the same way. The function that the readout uses must be programmed or a completeness check error message will occur. For example, to use the Cascade Setpoint readout, the 'Use Cascade' function must be programmed.

Output Option **dflt = Not Used**

Select one of the following:

(Not Used)

Actual Speed	Auxiliary Input
Speed Setpoint	Auxiliary Setpoint
Remote Speed Setpt	Rmt Auxiliary Setpt
Sync/Load Share Input	Speed/Load Demand
Sync Input	Extr/Adm Demand
KW Input	ACT 1 (HP) Valve Limiter Setpt
Extr/Adm Input	ACT 2 (LP) Valve Limiter Setpt
Extr/Adm Setpt	ACT 1 (HP) Valve Demand
Rmt Extr/Adm Setpt	ACT 2 (LP) Valve Demand
Cascade Input	Actuator Demand
Cascade Setpoint	First Stage Press Input
Rmt Cascade Setpt	Monitor Analog Input

Value at 4 mA dflt = 0.0 (-325000, 325000)

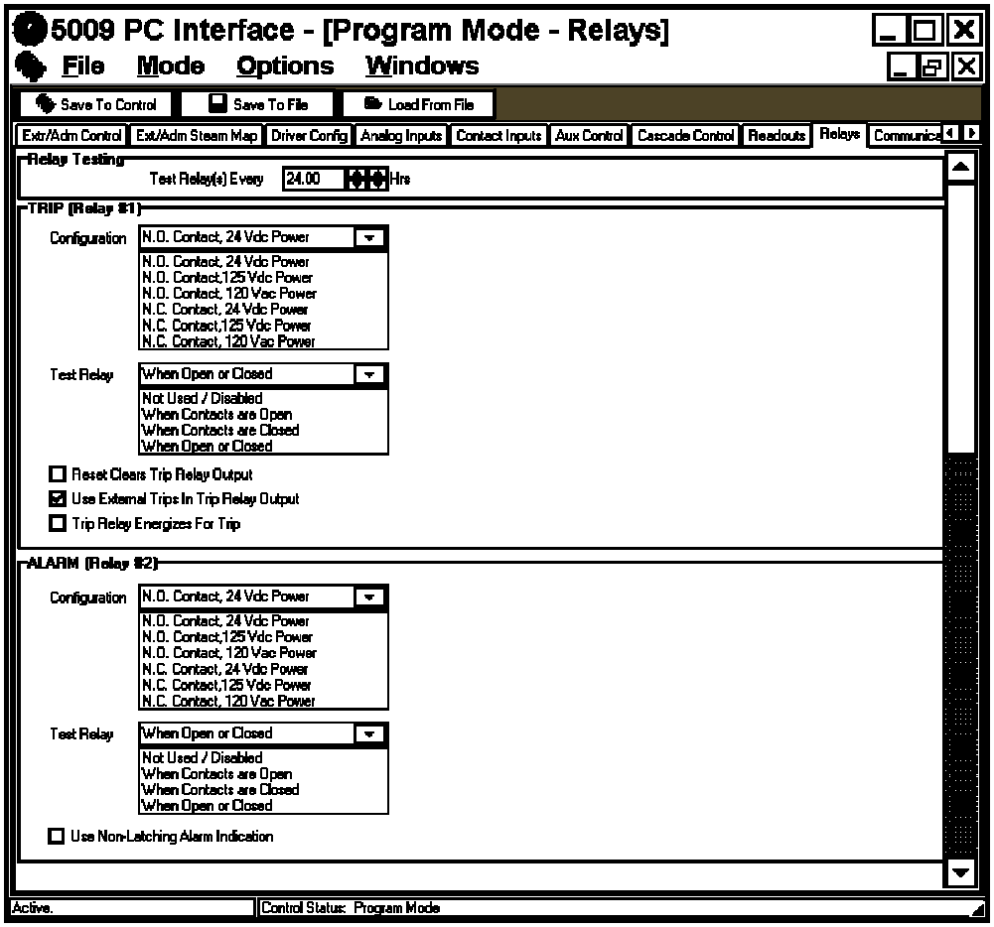
Enter the value (in engineering units) that corresponds to 4 milliamps (mA) on the analog output.

Value at 20 mA dflt = 100 (-325000, 325000)

Enter the value (in engineering units) that corresponds to 20 milliamps (mA) on the analog output.

(Must be greater than the 'Readout 4mA Value' Setting)

Relay Folder



You may configure up to 10 relays in addition to the two pre-assigned relays (Trip, Alarm). Each relay can be configured to function as either 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).

Relay Testing

Test Relay(s) Every dflt = 24 (0.0, 1000)

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

Trip Relay #1

This relay is predefined as the control's trip command/indication output. This relay output can be configured to energize or de-energize on a trip condition.

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 (24Volts DC, 125Volts DC, 120 Volts AC). 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 for that test to be disabled or only preformed 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.

Reset Clears Output dflt = No

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.

Use External Trips dflt = Yes

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).

Energize on Trip dflt = No

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

Alarm Relay #2

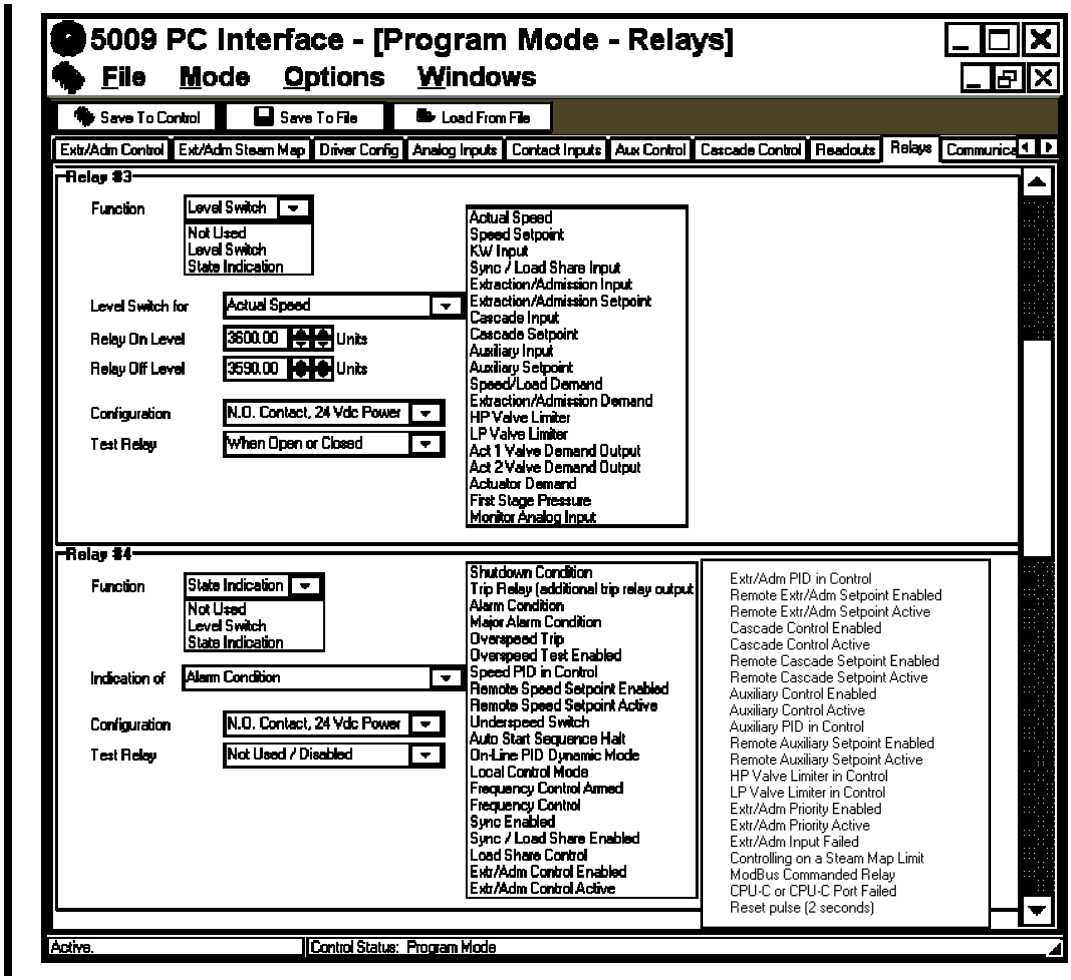
This relay is predefined for an alarm indication. When the 5009 control has sensed a control alarm, this relay is energized.

Configuration **dflt = N.O. Contact, 24Vdc 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 (24Volts DC, 125Volts DC, 120 Volts AC). 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.

Testing Configuration **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 for that test to be disabled or only preformed 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.

Use Non-Latching Alarm Indication dflt = No
When selected or checked, this option will energize the alarm relay when an alarm condition exists. When the alarm condition is removed the relay will de-energize. If this option is not checked, any alarm indication will energize the alarm relay and the relay will remain "latched" until a control reset command is received.

Relay Folder



Relay (#3—#12) Level Switch

Function

Level Switch

The level switch option allows the relay to change state above a certain level. For the example above, the relay will energize once the actual sensed turbine speed goes above 3600 RPM. It will remain energized as long as the speed remains above 3590 RPM. Once the speed drops below 3590 RPM the relay will de-energize and remain de-energized until the speed once again reaches above 3600 RPM. This provides a level of hysteresis.

Output Option

OPTIONS FOR RELAYS IF USED TO INDICATE A LEVEL

Actual Speed	Auxiliary Setpoint
Speed Setpoint	Speed/Load Demand
KW Input	Extr/Adm Demand
Sync/Load Share Input	HP Valve Limiter
Extr/Adm Input	LP Valve Limiter
Extr/Adm Setpoint	Act 1 Valve Demand Output
Cascade Input	Act 2 Valve Demand Output
Cascade Setpoint	Actuator Demand
Auxiliary Input	First Stage Pressure
	Monitor Analog Input

Relay On Level dflt = 1.0 (-325000, 325000)

Enter the level (in the configured parameter's units) at which the relay is to be energized. The relay will energize once the selected parameter's level is at or above this setting.

Relay Off Level dflt = 0.0 (-325000, 325000)

Enter the level (in the configured parameter's units) at which the relay will de-energize (must be at or below the On Level). This setting determines the switch's hysteresis value. The relay will remain energized until the parameter's level lowers to a level at or below this setting.

Configuration **dflt = N.O. Contact, 24Vdc 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 (24Volts DC, 125Volts DC, 120 Volts AC). 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.

Testing Configuration **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 for that test to be disabled or only preformed 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.

Relay (#3—#12) State Indication

Function

State Indication

The State Indication option provides a True/False indication for any of the options below. In the figure above, the relay will be energized whenever the Control senses an Alarm Condition.

Indication of:

OPTIONS FOR RELAYS IF USED TO INDICATE STATE

Shutdown Condition	Extr/Adm PID in Control
Trip Relay (add'l trip relay output)	Remote Extr/Adm Setpt Enabled
Alarm Condition	Remote Extr/Adm Setpt Active
Major Alarm Condition	Cascade Control Enabled
Overspeed Trip	Cascade Control Active
Overspeed Test Enabled	Remote Casc Setpt Enabled
Speed PID in Control	Remote Casc Setpt Active
Remote Speed Setpt Enabled	Aux Control Enabled
Remote Speed Setpt Active	Aux Control Active
Underspeed Switch	Auxiliary PID in Control
Auto Start Sequence Halted	Remote Aux Setpt Enabled
On-Line Spd PID Dynamics Mode	Remote Aux Setpt Active
Local Interface Mode Selected	HP Valve Limiter in Control
Frequency Control Armed	LP Valve Limiter in Control
Frequency Control	Extr/Adm Priority Enabled
Sync Input Enabled	Extr/Adm Priority Active
Sync / Load Share Input Enabled	Extr/Adm Input Failed
Load Share Mode Active	Controlling on a Steam Map Limit
Extr/Adm Control Enabled	Modbus Commanded Relay
Extr/Adm Control Active	CPU-C Module or Port Failed
	Reset Pulse: 2 Seconds

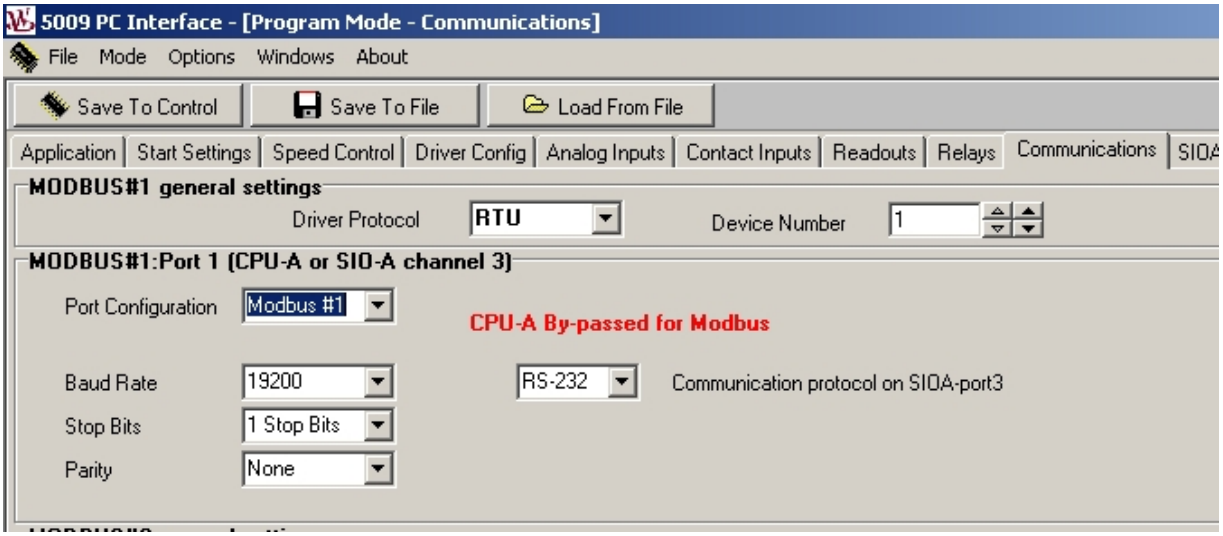
Configuration **dflt = N.O. Contact, 24 Vdc Power**

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 (24Volts DC, 125Volts DC, 120 Volts AC). 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.

Testing Configuration **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 for that test to be disabled or only preformed 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.

Communications Folder



Port 1 (CPU-A) Modbus Settings

Port Configuration Not Used

Port 1 or the CPU A communications port is a Modbus port for the 5009 control. If the control is talking to the OpView or to any other Modbus device, it can be connected through this port.

Driver Protocol dflt = RTU

ASCII or RTU

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

Device Number dflt = 1.0 ((1.0, 246)

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

Baud Rate dflt = 19200

Select the Baud Rate that the external device will be using when communicating with the 5009 control. For the OpView 19200 is defaulted. In the event it is unknown, this field can be tuned in the Service mode to establish communications.

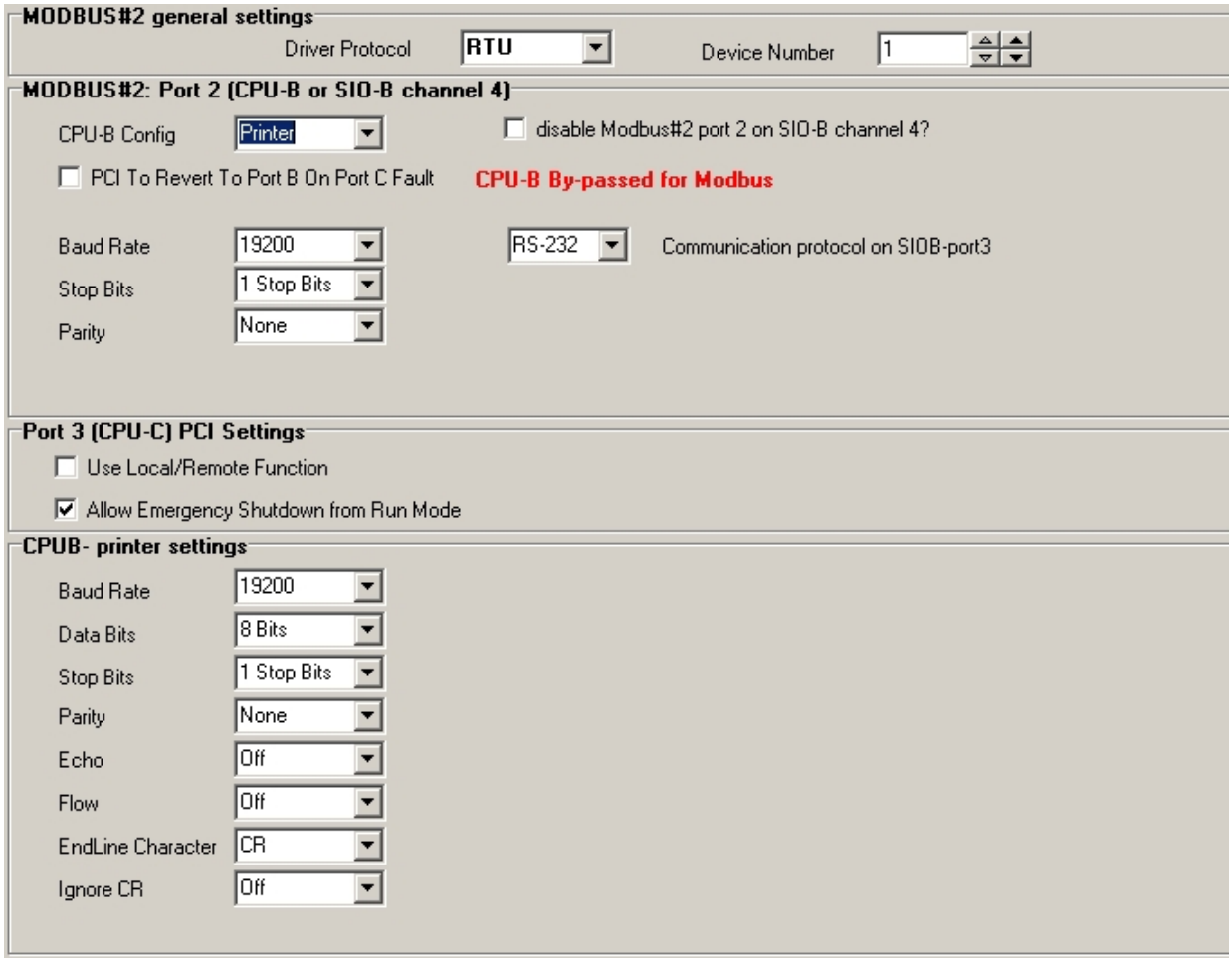
Stop Bits dflt = 1 Stop Bit

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

Parity dflt = None

Select the Parity setting that the external device will be using when communicating with the 5009 control. For the OpView None is defaulted. In the event it is unknown, this field can be tuned in the Service mode to establish communications.

Communications Folder



Port 2 (CPU-B) Settings

Port Type dflt = Not Used

Port 2 or the CPU-B communications port can be configured to function as a Modbus Port or a printer port. The CPU-B port is the only port which has the capability to interface with a printer.

Modbus #2

When configured as a Modbus #2 port the control can communicate with the OpView or any other Modbus device connected to this port.

Printer

When configured as a printer port, a line printer can be utilized with the 5009 control to print alarms and trips as they occur. Reference Volume 2 of this manual for printer connection instructions. Once connected match the printer communication settings to the CPU-B port's settings or vice- versa.

A typical Alarm line would appear on a line printer as:
Alarm—Casc Input #2 Failed 1997/8/18 10:58:29.724

PCI To revert to Port B On Port C Fault dflt = No

In addition to the Port Type options above, port 2 can also be configured to function as a backup PCI port, in the event that the Kernel-C CPU fails. If this option is selected or checked, any fault to the Kernel-C CPU will cause port 2 to stop any Modbus or printer communications and function as a PCI port. This option allows a user to access the 5009 control through the PCI program in the event that the Kernel-C CPU fails.

Once the Kernel-C CPU is restored and reset, the CPU-B port will revert back the its original functionality (Modbus or Printer communications).

Driver Protocol dflt = RTU

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

Device Number dflt = 1.0 (1.0, 246)

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

Baud Rate dflt = 38400

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

Stop Bits dflt = 1 Stop Bit

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

Parity dflt = None

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

Port 3 (CPU-C) PCI Settings

Use Local/Remote dflt = No

Check this option to select the control's Local/Remote control logic. This logic permits a user to lock out all control commands from one or several of the control's interfaces (Modbus Port 1, Modbus Port 2, contact inputs). If not checked, the commands from all interfaces are active at all times.

When in the REMOTE control mode, the commands from all interfaces are acted upon by the control. When in the LOCAL control mode only commands from the control interfaces, which have been configured to have access are acted upon. Each interface group (Modbus Port 1, Modbus Port 2, contact inputs) can be independently configured for access when LOCAL mode is selected. The PCI program commands are active at all times and can not be locked out. Access configuration prompts for each interface are only visible in the PCI when the "Use Local/Remote" option is selected. Refer to Volume 1 for more information on Local/Remote logic.

Allow Emergency Shutdown from Run Mode dflt = Yes

If this option is selected/checked, the user will be able to initiate an emergency stop from the PCI Run Mode. If selected, a two step process is used to avoid unwanted trips. If not selected, only a controlled shutdown is available from the Run Mode.

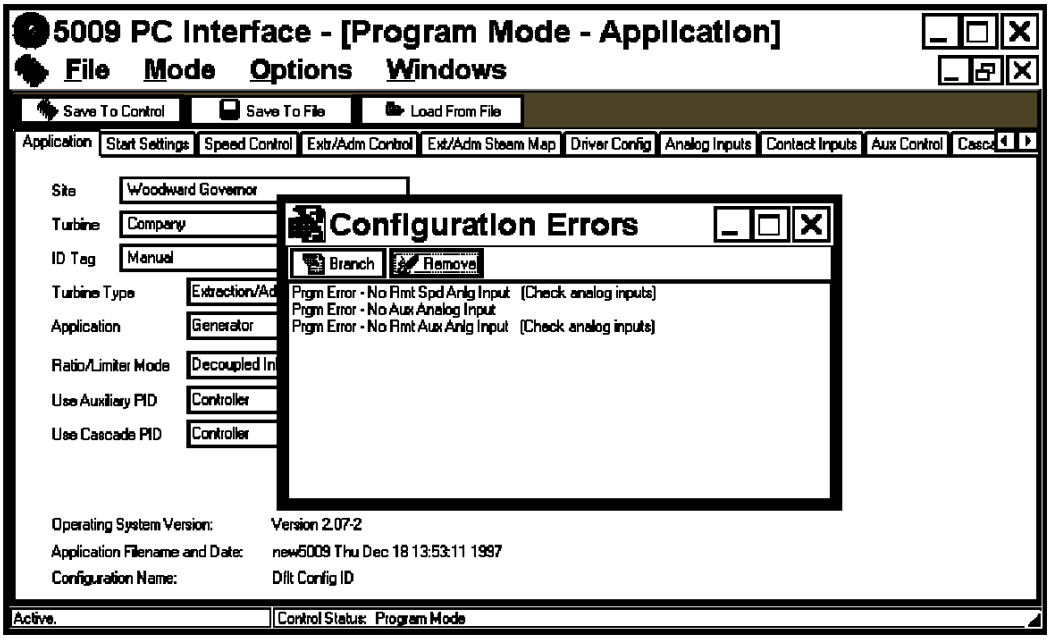
Save to Control

Once all the program settings have been configured, they can be saved to the control. Click on the “Save to Control” button to initiate the save routine. When a Save to Control command is issued, the PCI program performs a configuration error check before any values are saved. If no configuration errors were found, a pop-up box appears and displays “Program Configuration has passed the error check.” and asks if you want to Re-initialize the control. Click on the “Yes” button to exit the Program mode and initialize the control for start-up, or click the “Cancel” button to stay in the Program mode.

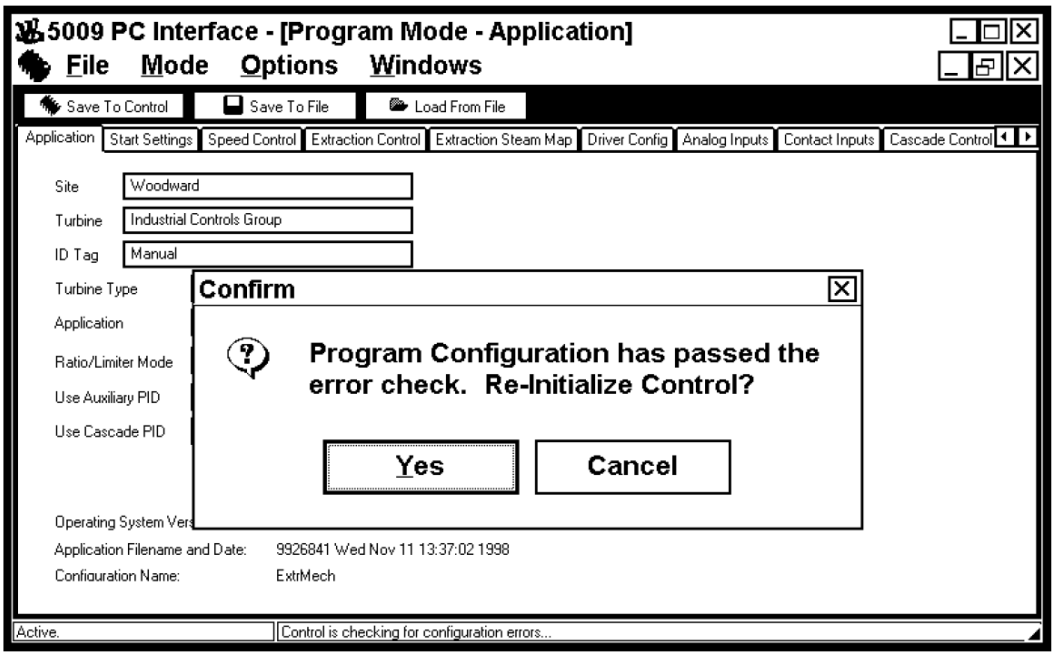
If any configuration errors were detected by the save routine, the program will display a Configuration Error box with a list of the errors detected and a brief explanation of each. By selecting the error (line), then clicking on the “Branch” button the program will step you to the page where the error was detected. Double-clicking on the error will perform the same function. (The error box may need to be moved or closed to view/modify the program settings.)

If desired once an error has been corrected it can be removed from the list by clicking on the “Remove” button. Once all errors have been corrected, close the Configuration Error Box by clicking on the “X” Button then try to save to the control again by clicking the “Save To Control” Button. Continue this process until the program informs you that the “Program Configuration has passed the error check.” and asks if you want to Re-initialize the control. Click on the “Yes” button to exit the Program mode and initialize the control for start-up.

In the example below three configuration errors were detected and displayed by the Error pop-up box. All detected errors will be listed in this folder.



On the Configuration box, being displayed below, the control's program has passed the program's error check routine, and the control can be re-initialized and put into operation. At this point, if Cancel is selected, the PCI program will remain in program mode and the 5009 will remain in a turbine shutdown mode. If a control reset or a control power down is experienced before the Program Mode is exited, all changes will be lost. If Yes is selected, the 5009 control will exit the program mode and be ready to operate the turbine. Once the 5009 control exists the program mode all the above program changes are saved in the control and they will take affect.



After the control leaves the program mode, the original screen reappears. The turbine is now ready to start and any of the PCI modes can be entered, including the program mode again. See Chapter 4 for information on entering the Run Mode and starting the turbine.

Saving the Control's Configuration to a File

At any time when the PCI program is open and communicating with the control, the control's configuration can be saved to a configuration file on the computer or to a disk.

To save the control's configuration settings to a file:

1. Select the "Save values to file" option from the screen's "File" menu, or from the Program mode click on the "Save To File" button.

2. A confirmation box will then appear, asking the user to confirm this action, and informing the user that saving the configuration file may take up to 5 minutes and that during this time exiting/entering the program mode or making configuration changes is not recommended.

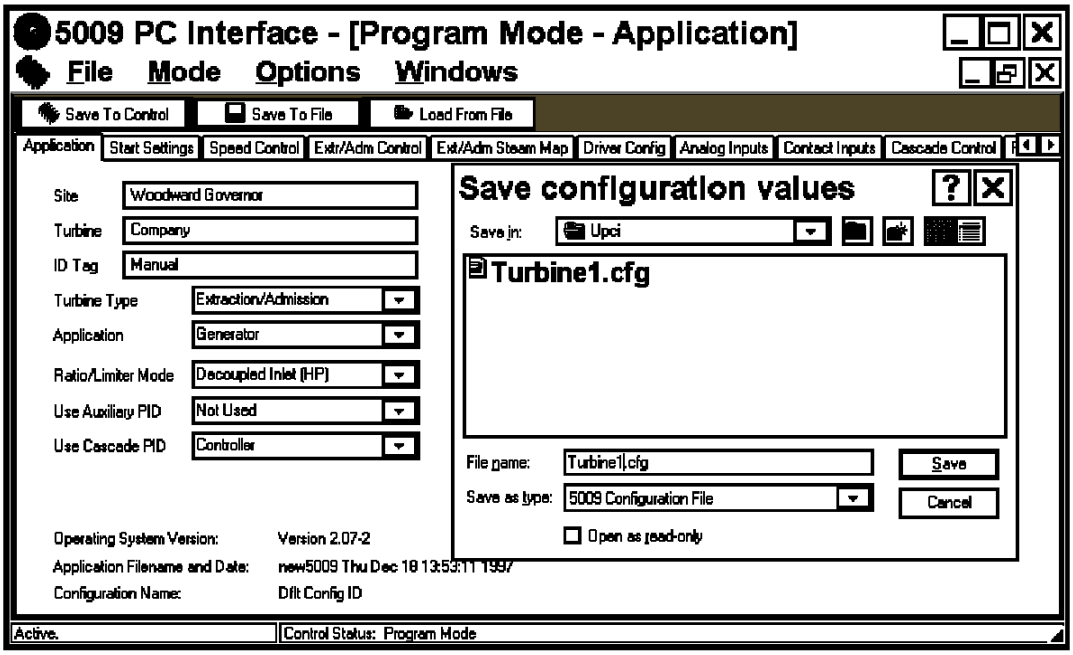
3. Once the Save request is confirmed a “Save Configuration values” box will then appear. At this point if desired, change the save-to file name and location (computer directory or disk), then click on the box’s “Save” button to begin the save routine.

IMPORTANT

The name applied to the “.cfg” file cannot contain more than 5 characters before the “.cfg” (XXXXX.cfg) unless saved to a different directory on the computer.

4. The PCI program’s status panel (located in the screen’s lower left corner) will display the different stages of the Save routine (i.e. Reading File, Reading Configuration Values, etc.). The program will save this configuration file with a “.cfg” extension. During the Save routine, all PCI modes can be monitored, and any Run mode command given. It is recommended that during this routine no Program or Service mode changes be made.

5. When the Save Routine is finished a “XXX.cfg save Complete” message box appears.



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 5009’s 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 stored configuration file into the control:

1. Open the PCI’s Program-Change mode

2. Click on the “Load From File” button. A confirmation box will then appear notifying the user that this function may take up to 5 minutes, and asking for confirmation to Load anyway. Confirm the request by clicking on the box’s “Yes” button.

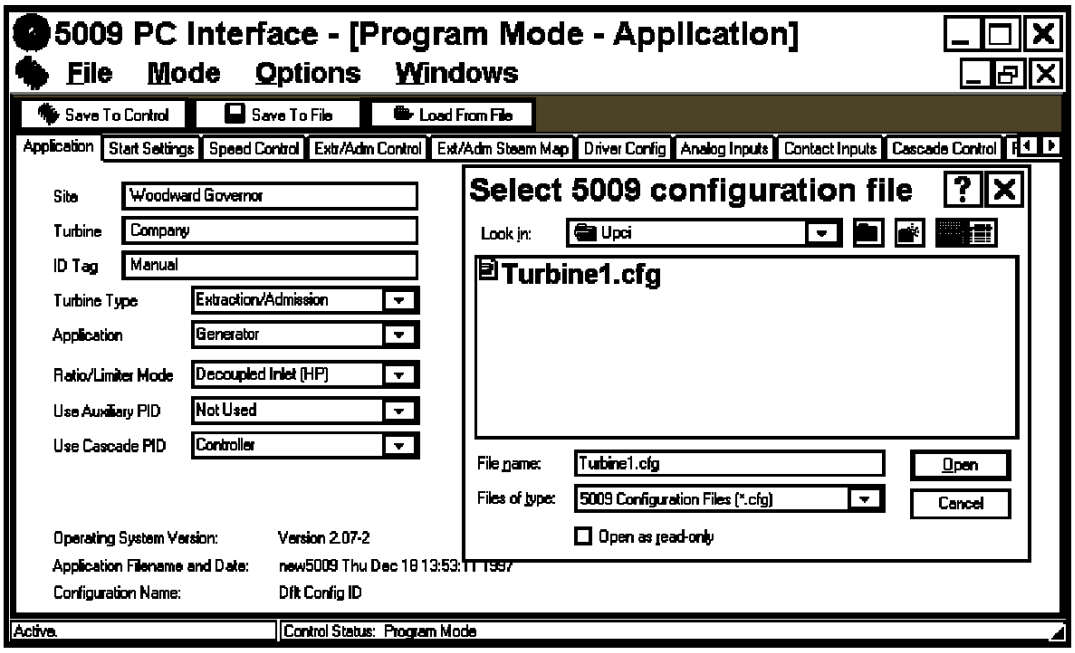
3. At this point a “Select 5009 Configuration file” box appears. Use the box’s directory tools to locate and select the file, then click on the box’s “Open” button to initiate the Upload routine.

4. A “Loading Values to control, Please wait” message box will appear during the load routine’s operation, and the PCI program’s status panel (located in the screen’s lower left corner) will display the different stages of the upload routine (i.e. Reading File, Configuring Control, etc.). This step may take several minutes.

5. When the Upload Routine is finished a “XXX.cfg load Complete” message box appears. The configuration file loaded and used by the control is displayed in the Program mode’s Application Folder.

6. Perform any needed program changes.

7. After any or all configuration changes have been made save the new configuration settings to the control, by clicking on the “Save To Control” button. Refer to the Program-change mode procedure for detailed instructions on saving a configuration to the control.

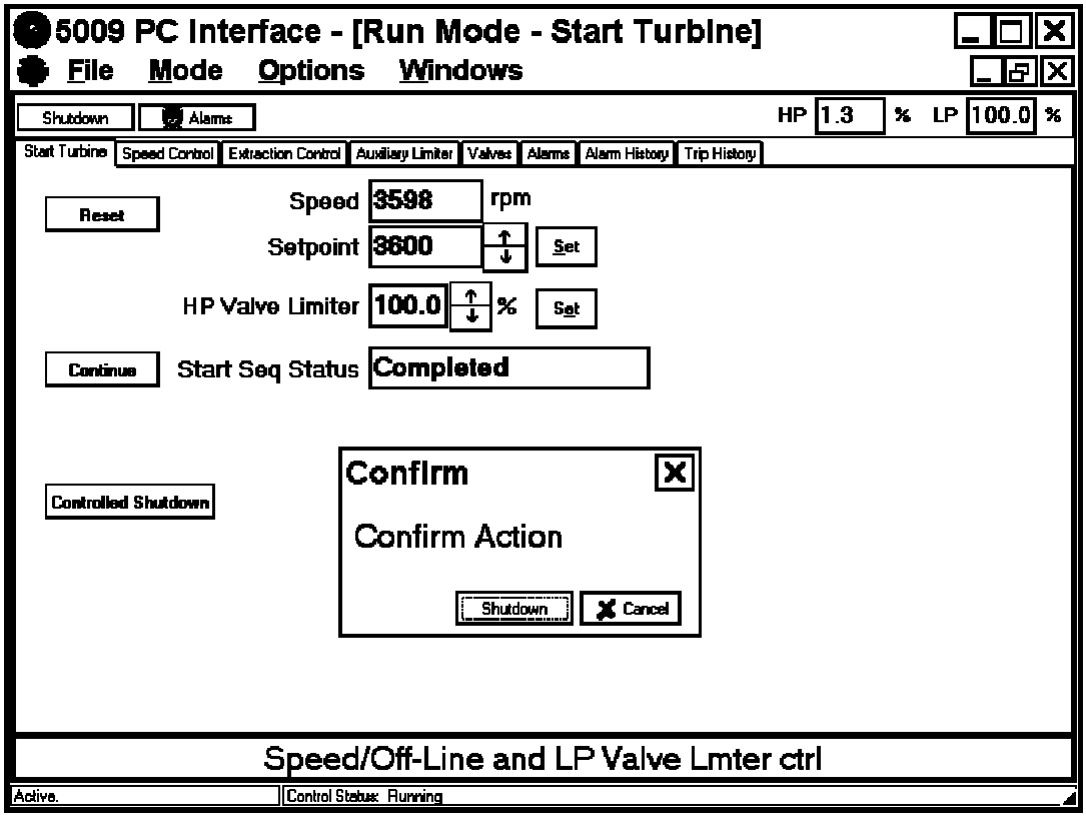


Chapter 4.
Run Mode Procedures

Opening the Run Mode

The PCI program's Run Mode functions as an operator interface to allow a user to start, stop, and operate the turbine. To enter the Run Mode click on the "Run Mode" button on the program's main tool bar in the screen below. If the PCI program has established communications with the control, when an open Run Mode request is made, the Run Mode opens immediately. If the PCI program is not communicating with the control, when an open Run Mode request is made, the program will make communication with the control via the Server program, then open the Run Mode. During the time the Server program is establishing communications with the control, a "Starting Server" indication box will appear.

RUN MODE Screen



PCI Mode & Folder Panel

This panel is located at the top of the PCI program screen and indicates the PCI mode and folder that is opened and currently being displayed. An indication of "5009 PC Interface—[Run Mode—Start Turbine]" indicates that the PCI program's RUN mode is opened and the Start Turbine folder is currently being viewed.

Controlling Parameters Panel

The panel is located at the bottom of every folder, just above the Mode and Servlink status panels and displays the control's mode(s) of operation, and reason(s) for shutdown.

Mode Status Panel

This panel is located in the PCI screen's lower most left corner and displays the status of the PCI's PROGRAM, RUN, and SERVICE modes.

Servlink—Communications Status Panel

This panel is located at the bottom and middle of the PCI screen, and displays the status of the Servlink program and communication link.

Run Mode—Tool Bar

The Run Mode tool bar has Run Mode specific command buttons and valve position information. The Tool Bar is accessible from all Run Mode folders. The valve position information displays position in percent open for one control valve or two depending on the configuration. The number and type of buttons which appear in this tool bar also depend on the control's configuration. The following is a list of all possible tool bar buttons:

Emergency Shutdown Button

If the control is configured to allow an Emergency Shutdown to be performed via the PCI program's Run Mode (set in the Communications Folder in Program or Service Modes) the Emergency Shutdown Button will appear in the tool bar. If configured, this shutdown command uses a two step approach. When the Emergency Shutdown Button is selected a confirmation pop-up box will appear (shown below). The user must then confirm the shutdown command by clicking on the "Emergency Shutdown" button in the pop-up confirmation box, or Cancel the command with the "Cancel" button. After an Emergency Shutdown confirmation is given the control will immediately trip the turbine to a failed-safe condition.

Local/Remote Button

If the control is programmed to allow the PCI to perform a Local/Remote switch (Communications Folder in Program Mode), the Remote Button will appear in the tool bar. The name in the button dictates what mode the control will go to if selected. i.e. If the button says Remote, the control is in Local Mode and will go to Remote Mode only if the button is clicked or selected. At that time the button will switch to say Local. For a full description of the Local/Remote function, see Volume 1.

Alarms Button

This button allows the user to go to the Alarms folder and will appear anytime an alarm condition is present. It performs the same function as clicking on the Alarms folder.

Security Button

The Security button allows users to secure and unsecure critical RUN mode settings (PID, valve calibration, and control time settings). This button is defaulted to its locked (secured) position when the RUN mode is opened, and must be unlocked (unsecured) before any control PID setting, valve calibration setting, or control time adjustment can be performed.

To unlock RUN mode security, click on the Security Button. At this command, a pop-up “Password entry” box then appear. Enter the correct password. (located in Appendix A at the end of this manual), and select the box’s “OK” button. This action will allow all critical RUN mode settings to be adjusted.

To lock RUN mode security, click on the Security Button. At this command, a confirmation pop-up box will appear. Confirm the command by selecting the box’s “OK” button. This action will secure all PID, valve calibration, and control time settings

The Security Button changes appearance according to what state the Run Mode security logic is in. If the RUN mode security logic is locked the “lock” in the picture is closed. If the Run Mode security logic is unlocked, the “lock” in the picture is opened.

LOCKED Mode UNLOCKED Mode

Overspeed Button

This button only appears in the Speed Control folder. The Overspeed Test button is used to display a pop-up Overspeed Test box from which an Overspeed test can be performed. 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. Reference Volume 1 Chapter 5 for overspeed testing procedures.

Set Time/Date Button

This button only appears in the Alarms folder. The Set Time/Date button is used to pop-up a “Set Time and Date” box from which the control’s time and date can be set. Reference the Setting Time & Date procedure located in this chapter for time and date setting instructions.

Reset Alarms Button

This button only appears on the Alarms folder, and is used to Reset alarm and trip conditions. All trip conditions must be reset before the control will allow the unit to be started. Once an alarm condition has been corrected, an Alarm can be reset at any time during operation.

Run Mode Folders

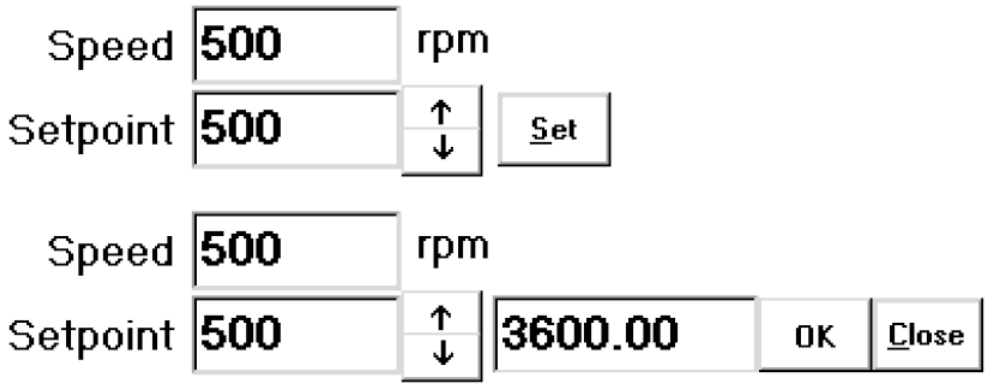
The Run Mode consists of a series of folders that allow a user to view and manipulate the turbine and its parameters. Each folder is labeled according to it's basic functions. The following is a description of the functions that can be preformed from each folder. To get a better idea of the functions available and a complete description on their purposes, see Volume 1 and the sample application section at the back of this manual. To move between folders click on the folder title. The first folder to appear on the screen will be the Start Turbine folder.

Set Button

Control setpoint values can be directly entered when in the RUN mode by the use of the "Set" button (located next to every applicable setpoint display). When selected or clicked, this button opens an edit box that a number can be directly entered into (as shown below). After a number has been typed in, a <CR> or "enter" command must be pressed on the PC's keyboard to have the number accepted. The number must be within the configured limits set forth in the Program Mode as described in Chapter 3.

After the entered number has been accepted by the program as a valid setting, the "OK" button must be selected before the setpoint will begin ramping to this new setpoint level. The "Setpoint entered rate" value located in the PCI's Service mode, in the respective folder (Speed, Aux, Cascade. etc.) sets the rate at which a setpoint ramps to the newly entered value. The defaulted rate is the "setpoint slow rate" value programmed in the PCI's Program mode. The "OK" button can be selected at any time when the control mode is enable or active, to have the setpoint ramp to the edit box's "displayed setpoint value".

If desired, the "Close" button can be selected/clicked-on at any time to close/hide the setpoint's direct entry edit box.

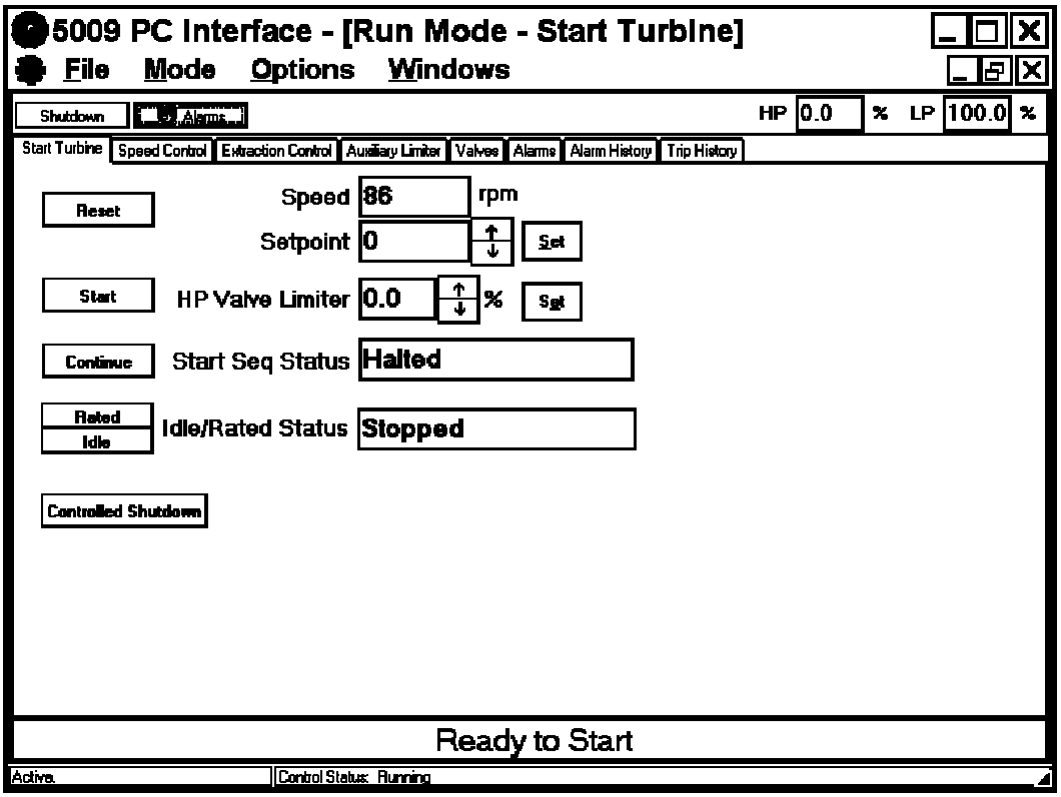


Setting Time & Date

From the Run Mode's Alarms folder, system time and date settings can be changed by selecting the tool bar's "Set Time/Date" button. This button opens a Time & Date edit box, from which all settings can be individually or collectively set. If the RUN mode's Security logic is locked the "Set Time/Date" button can not be accessed. If the RUN mode's Security logic is unlocked, the "Set Time/ Date" button can be accessed, and all clock settings changed. Reference the Security Button section of this chapter for instructions on locking and unlocking the Run Mode's Security logic.

From the Set Time & Date edit box, directly enter the time or date setting, then click the respective parameter's Save button at the exact time (setting) that you have entered. At this point the control's Real Time clock will be updated, and the edit box's "Control Time of Day" display will reflect the change(s). Click the "Close" or "X" buttons to close the Time and Date display box. The control's Real Time Clock output is also displayed at the top of the folder, after the "Current Alarms" title.

START TURBINE Folders



Start Turbine Features

The Start Turbine folder is used primarily to bring the turbine up to rated speed. Once that has been accomplished, the remaining folders are used to bring other controlling parameters into control. The Start Turbine folder allows the user to change the 5009 control's Speed settings and start parameters from their PC. The Speed input is displayed in the Speed display box at all times. The 5009 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 effect whether the setpoint can be adjusted or not. The setpoint can also be manually set to a value by using the Set button to the right of the arrow keys as described earlier. The rate at which the setpoint can change is set in the Program mode as Setpoint Rate. 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 box or by using the Set button as described earlier.

Reset Button

Clicking on, or selecting, the Reset button issues a reset command to the 5009 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.

Start Button

Clicking or selecting the Start button is used to issue a start command to the 5009 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. This button will disappear after the start procedure is complete.

Continue/Halt Button

This button only appears if the Auto Start Sequence option is configured. Clicking or selecting the Halt button is used to issue a halt command to the 5009 control. This command is identical to the Contact input or Modbus Continue/Halt commands. This is used to stop the 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 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.

Rated/Idle Button

This button only appears when the Idle/Rated Start Sequence is configured. Clicking or selecting the Rated or Idle button is used to issue a rated or idle command to the 5009 control. This command is identical to the Contact input or the Modbus Rated/Idle command. This command is used to ramp the turbine speed from idle to rated if the Rated button is selected, or to ramp the turbine speed from rated to idle if the button is selected.

Open Limiter Button

This button only appears when the Manual Start and the Use Initial V1 position on Startup functions are configured. Clicking or selecting the Open Limiter button is used to initiate the 5009 to open the HP Limiter at the HP Valve Limiter Rate as configured in the Program Mode of the Start Turbine folder.

Start Mode Configurations

In the above folder the turbine has been issued a Reset command, is at 86 rpm and is waiting for a Start command to initiate the Start Procedure. There are three basic types of start mode procedures. 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.

Manual Or No Idle Start

With these start routines, once a Start command is issued, the control will ramp the inlet (HP) valves open, ramp the speed setpoint from zero to its min setting, and when turbine speed increases above its speed PID's setpoint begin controlling turbine speed. The turbine's Trip & Throttle valve (T&T) can be opened before or after a control Start Command is issued, it makes no difference to the control.

If a Semi-automatic startup is being used, the HP valve limiter, will have to be raised to allow steam flow into the turbine. As turbine speed reaches the control's setpoint it will begin controlling turbine speed via the turbine control (throttle) valves. At this point the speed of the turbine can be manually adjusted as desired. If configured, Critical Speed ranges will be avoided and ramped through at the rates configured. Once turbine speed is at or above the Min Control Setpoint setting, the turbine is considered to be started and other PCI folders can be accessed from which to control turbine operation.

Idle/Rated Start

With this start routine, once a Start command is issued, the control will ramp the inlet (HP) valves open, ramp the speed setpoint from zero to the idle speed setting, and when turbine speed increases above its Speed PID's setpoint begin controlling turbine speed. The turbine's Trip & Throttle valve (T&T) can be opened before or after a control Start Command is issued, it makes no difference to the control.

If a Semi-automatic startup is being used, the HP valve limiter, will have to be raised to allow steam flow into the turbine. From the Idle speed setting, the speed setpoint can be manually or automatically ramped to the turbine's rated speed setting. 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). If configured, Critical Speed ranges will be avoided and ramped through at the rates configured. Reference this Volume's Service mode descriptions for options on allowing the re-selection of idle speed.

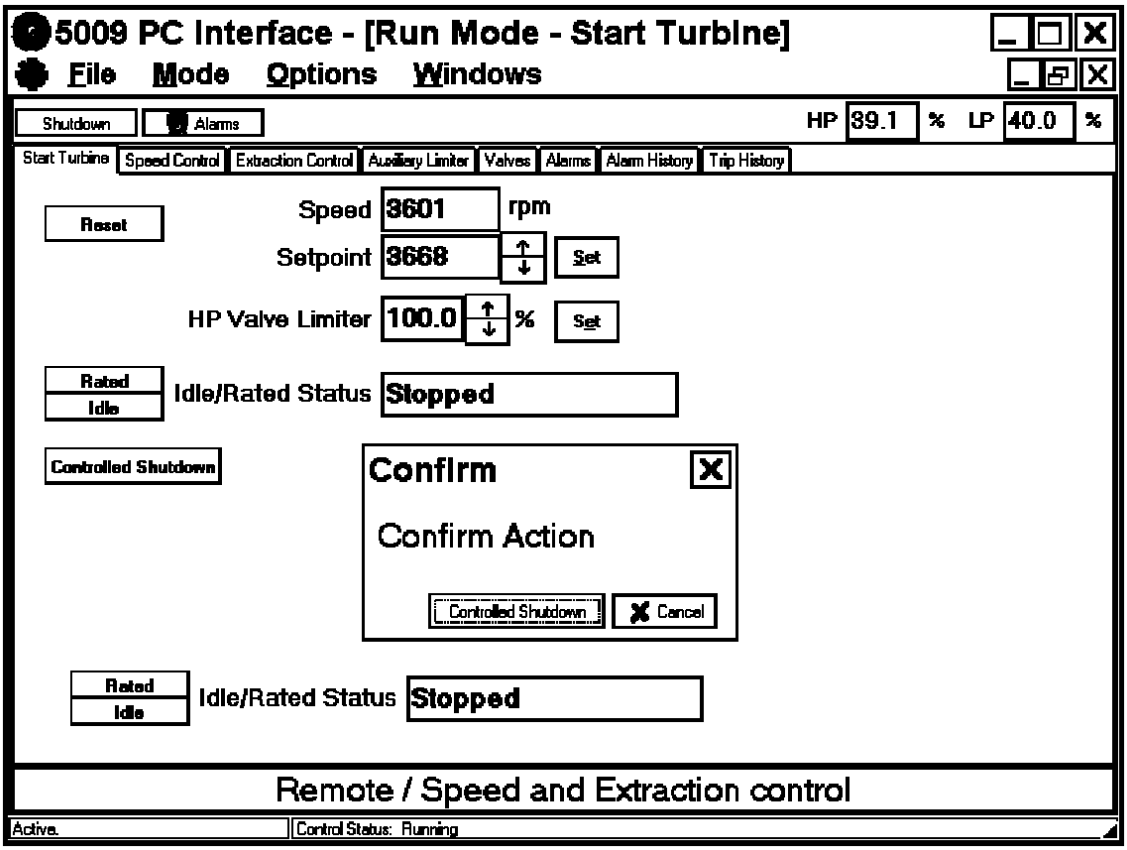
Once turbine speed is at or above the Rated Speed setting, the turbine is considered to be started and other PCI folders can be accessed from which to control turbine operation.

Automatic Start Sequence

With this start routine, once a Start command is issued, the control will ramp the inlet (HP) valves open, ramp the speed setpoint from zero to the low idle speed setting, and when turbine speed increases above its Speed PID's setpoint begin controlling turbine speed. The turbine's Trip & Throttle valve (T&T) can be opened before or after a control Start Command is issued, it makes no difference to the control. If a Semi-automatic startup is being used, the HP valve limiter, will have to be raised to allow steam flow into the turbine.

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. This routine ramps the speed setpoint to a low idle speed setting, verifies that turbine speed is at or above the low idle setting, holds for a set delay time, ramps the speed setpoint to a high idle speed setting, verifies 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 PCI, Modbus or external contact input commands. Even though configured for an automatic start, and operator can at any time choose to raise or lower the speed setpoint manually to complete a system startup.

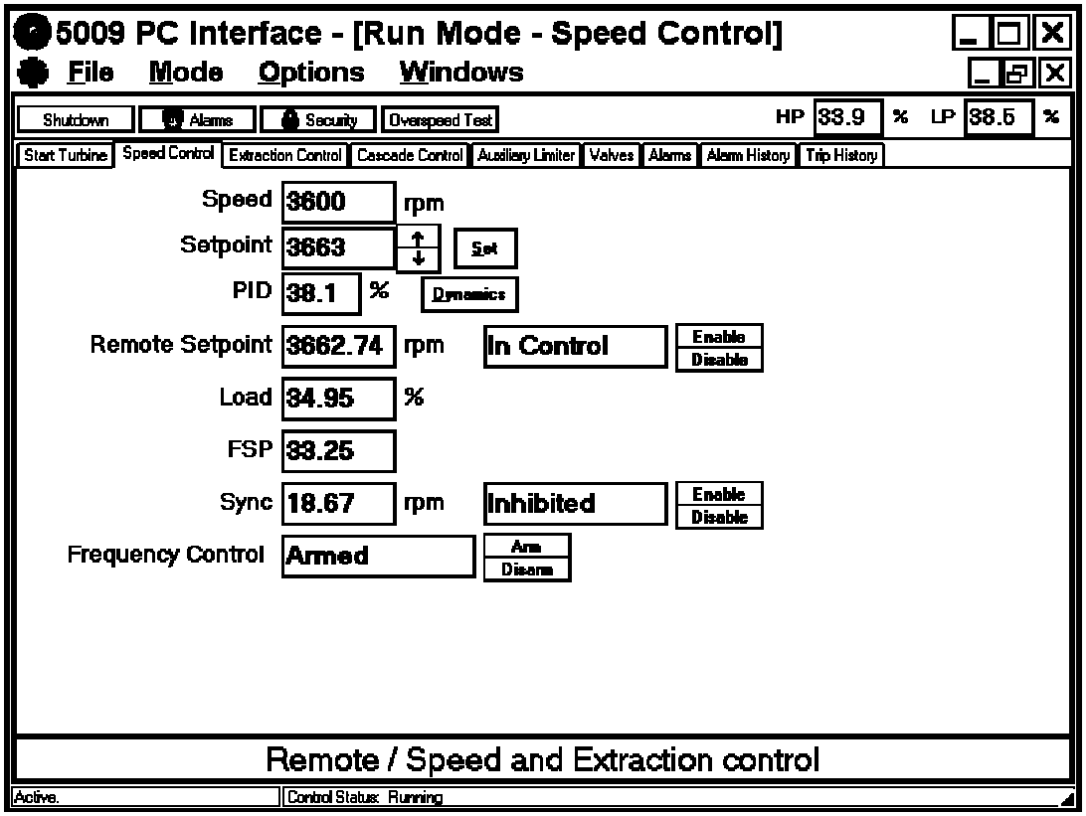
If configured, Critical Speed ranges will be avoided and ramped through at the rates configured. Once turbine speed is at or above the Rated Speed setting, the turbine is considered to be started and other PCI folders can be accessed from which to control turbine operation. The above folder shows the status of the start sequence and the remaining time that the turbine will remain at Low Idle. Once the timer counts down to zero minutes the turbine will ramp to High Idle at the configured rate.



Controlled Shutdown

The Controlled Shutdown button allows a user to stop the turbine in a controlled manner. The 5009 control can be configured to ramp all controlling parameters down to a controlled turbine stop. The 5009 uses a two step process to initiate the controlled shutdown. When the main Controlled Shutdown button is selected a separate Confirm display box will appear. The Controlled Shutdown button in the Confirm box must be selected to initiate the controlled shutdown. If at any time during the controlled shutdown, the operator wishes to discontinue the shutdown, the Halt button (not shown) will return the turbine to a run mode.

Speed Control Folder



Speed Control Features

The Speed Control folder is available for viewing under any configuration of the 5009 control. The Speed folder allows the user to change the 5009 control's Speed settings from their PC. The Speed input is displayed in the Speed display box at all times. The 5009 control will attempt to control the turbine such that the Speed input matches the Speed Setpoint. Once the Generator Tie Breaker closes, the Speed setpoint can be increased above the actual speed input to increase the load of the turbine. The Speed Control function is active at all times. Another control function (Auxiliary Limiter) can take control of the valves, however, the Speed Control function is still active and will regain control as soon as the actual speed plus the load is greater than the setpoint. The Controlling Parameters box will display what mode the Speed Control function is in at all times.

The Speed Setpoint can be manually changed by pressing the arrow keys to the right of the Setpoint display box. The setpoint can also be manually set to a value by using the Set button to the right of the arrow keys as described earlier. The rate at which the setpoint can change is set in the Program mode and adjustable in the Service Mode. The output of the PID controller is 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.

The Speed setpoint can also be turned over to the Remote Speed Setpoint by enabling that function. The Enable/Disable button to the right of the Remote Setpoint Status display box will enable and disable the remote setpoint function. When the Remote Setpoint function is enabled, the Speed Setpoint will move to the Remote Setpoint at the programmed Rmt Setpt Not Matched Rate. The status of the Remote function is continually displayed in the Remote Status display box if the Remote Speed function is configured in the 5009 control.

Load

In applications where the turbine is configured as a generator, the Load display box will display the amount of load the 5009 control is sensing. If the 5009 is configured for a KW Load input, that analog input will be displayed here. If not, the valve position will be used to calculate the perceived amount of load. The Maximum Load in the Droop Settings portion of the Program Mode Speed Control folder will determine the value displayed.

First Stage Pressure

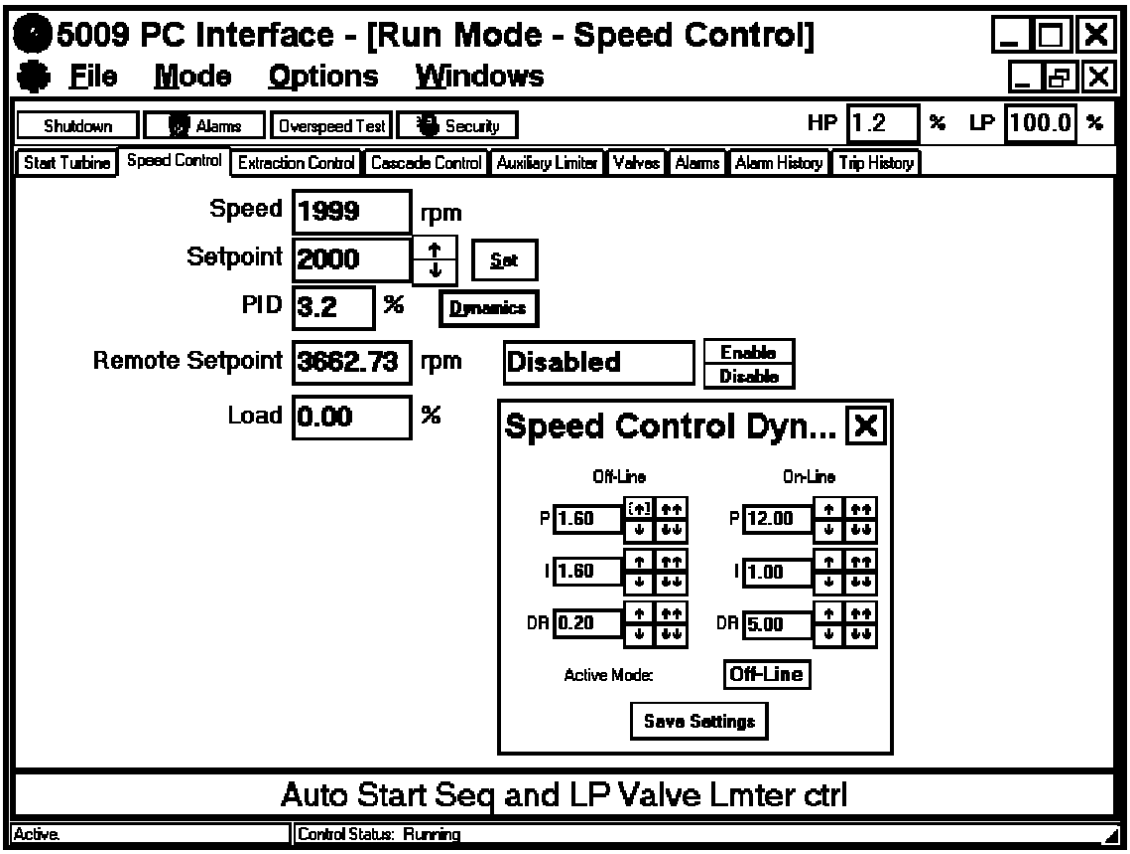
In applications where First Stage Pressure (FSP) is configured to be an input, FSP is displayed in the FSP display box. It may be necessary to monitor the FSP while making changes to the speed and loading of the turbine/generator.

Frequency Control

To use this feature, a Frequency Arm/Disarm contact input must be programmed. When the programmed contact input is closed the unit's Frequency control mode is Armed. When the programmed contact input is open the unit's Frequency control mode is Disarmed. In addition, the Frequency Control can be armed or disarmed by clicking on the Arm/Disarm button to the right of the Frequency Control display box. The status of the Frequency Control function is always displayed in the status display box. For a further description of Frequency Control see Volume 1.

Sync Speed

To use this feature, an Analog Input must be programmed for a Synchronizing input. When the Enable button is selected to the right of the Sync status display box, the synchronizing input (normally from a DSLC) will bias the internal speed setpoint to allow synchronization. When the Disable button is selected to the right of the Sync status display box, the synchronizing function will be disabled and the setpoint bias will be zero. The status display box will show the status of whether the synchronizer can be enabled or not, and the Sync display box will show the synchronous input in the form of how much it will bias the speed setpoint.



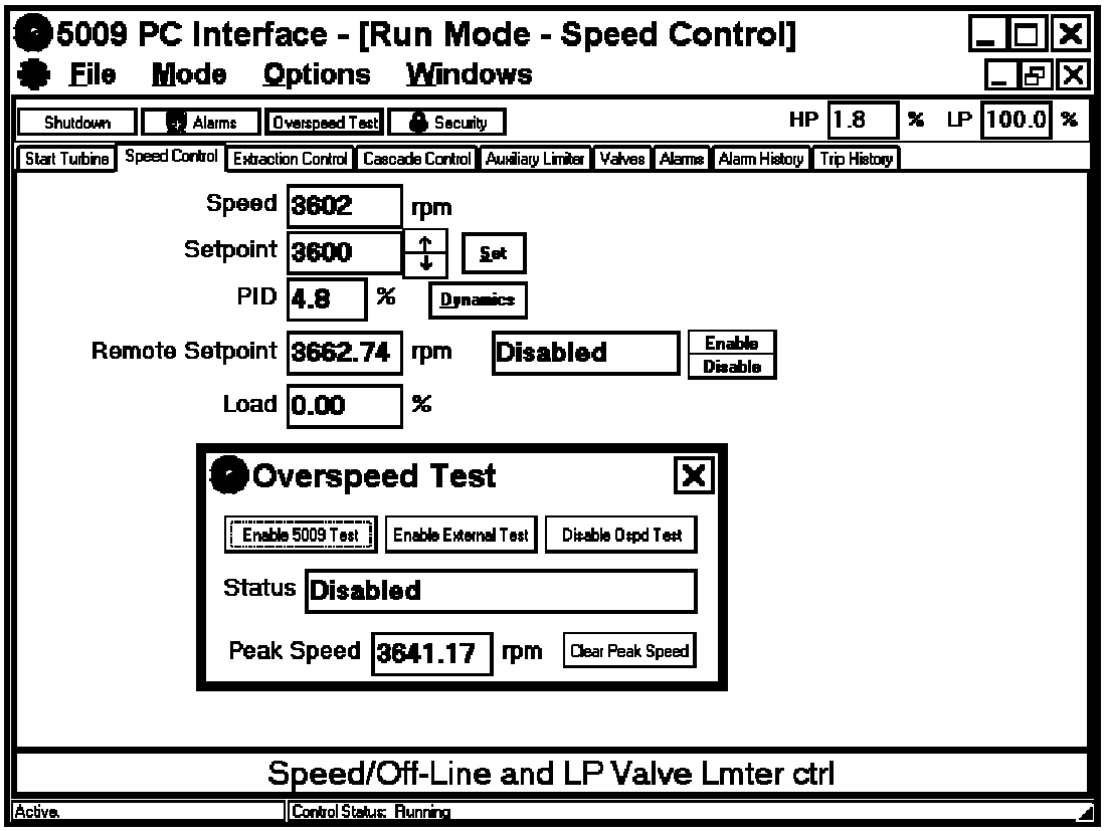
Speed Control Dynamics

The Speed 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 Speed Control folder will allow access to the Dynamics display box. This Speed Control Dynamics display box displays the Speed PID dynamic settings. The Controlling Parameter display at the bottom of the folder will inform the user when the Speed PID is in control. The Speed Control's P, I, and D terms can be adjusted with the arrow buttons to the right of each term.

The Speed PID uses the settings displayed in the Dynamics Display box to determine PID response; any change to these setting will immediately effect PID response (when the Speed 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 insures 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.

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 effect the turbines 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 startup, to adjust dynamic settings before they take effect to insure 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.



Overspeed Test

An internal or external overspeed test can be performed from this folder. The above folder shows an example of the Overspeed Test display box. This box is displayed by selecting the “Overspeed Test” button on the Tool Bar. In order to initiate the test, the speed set point must be at the maximum controllable setpoint as configured in the 5009 control. The turbine must be in speed control, and all auxiliary control functions must be disabled. At that time, the Status edit box in the Overspeed Test display box will indicate a permissible status.

Clicking the Disable Ospd 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 5009 control. Once the speed reaches the electrical overspeed set point the 5009 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 5009 control. The mechanical or external overspeed protection of the turbine should trip during this test. The speed of the turbine can not be increased past the Overspeed Test Limit.

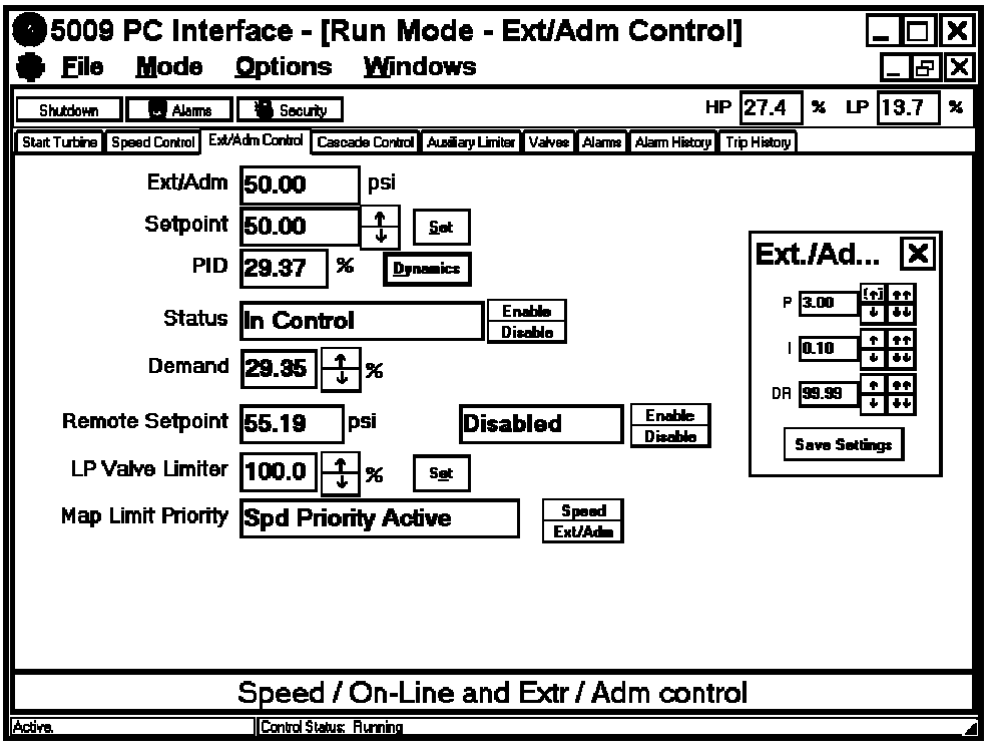
If the speed setpoint is not changed within 60 seconds during either of the tests, the control automatically discontinues the overspeed test. At that time, if the speed of the turbine is above the electrical overspeed setpoint, the turbine will trip. If it is below the electrical trip setpoint it will 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.

Extraction And Admission Folders

These folders are only visible when the control is configured for Extraction, Admission, or Extr/Adm types of turbines. Because there is very little difference in the options between these folders the, descriptions for all three folders have been combined. Depending on the type of turbine configured, the folder and gauge titles will change from Extraction Control, Admission Control, or Extr/Adm Control. For description purposes the Extr/Adm Folder is displayed below.

Extraction\ Admission Control Folder



Extraction/Admission Control Features

The Extraction/Admission folder allows an operator to start, operate and stop the control's Extraction/Admission control. The Extraction/Admission input is displayed in the Extraction/Admission display box at all times.

When configured for Extraction only turbines, Extraction control can be enabled and disabled manually by lowering and raising the LP valve limiter, respectively, or automatically (if so configured) by selecting the folder's Enable/Disable buttons to the right of the Status gauge.

When configured for Admission or Extr/Adm type turbines, Adm or Ext/Adm control is enabled/disabled by selecting the Enable/Disable buttons to the right of the Status display gauge. The status gauge displays the Extraction/Admission Control status at all times. It is recommended with Adm or Extr/Adm turbines that the Demand Setpoint be used to match pressure across the Adm header's T&T valve, and the T&T valve opened, before Extr/Adm control is enabled. Reference Volume 1 for all control enabling/disabling procedures.

The control setpoint will determine what level the Extraction/Admission controller will maintain the turbine at once enabled. The setpoint can also be manually set to a value by using the Set button to the right of the arrow keys as described earlier. The rate at which the setpoint can change is set in the Service mode.

When the Extraction/Admission Controller is disabled the setpoint will remain at the last valid setpoint and will control at that setpoint when the Extraction/ Admission controller is again enabled. If the control mode's Setpoint Tracking feature is configured, the setpoint will track the input whenever the Extraction/ Admission Controller is disabled, allowing a "bumpless" transfer of control when enabling this control mode.

The Extraction/Admission setpoint can also be varied by a 4-20mA Remote Extraction/Admission Setpoint signal. The 4-20mA Remote Extraction/ Admission 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 4-20mA Remote Ext/Adm function is continually displayed in the Remote Status display gauge.

The output of the PID controller is displayed in the PID display gauge. This output can be used to determine if the PID is in control or if there are stability problems.

The LP Valve Limiter can be manipulated from this screen. The LP Limiter can be raised and lowered by selecting the arrows to the right of the LP Valve Limiter display box or by using the Set button as described earlier.

Demand Setting

The Demand setting is used with Admission or Ext/Adm turbines to allow admission (extr/adm) control to be enabled and disabled bumplessly. The Demand signal as shown in the Demand display gauge, represents admission input flow demand ("P term"). By manually adjusting this Demand setpoint, the user can manipulate the turbine valves to create an internal pressure at the turbine's admission entry point that is identical to the pressure on the other side of the admission header's T&T valve. Once pressure is matched across the admission T&T valve, the valve can be opened, and Adm or Ext/Adm control enabled.

Refer to Volume 1, Chapter 4 for a detailed instructions on enabling and disabling the extraction/admission control.

Map Limit Priority

The priority of the control's Ratio/Limiter is displayed and (if so configured) manually changeable from this folder. This priority is the controlling parameter which will be controlled when the turbine reaches and operating limit (HP or LP mechanical stop). The two options displayed (Speed and Extraction/Admission) represent the Ratio/Limiter's input demand signals. Speed priority as displayed refers to the PID controlling the Ratio/Limiter's "S" demand. The "S" demand may be speed, load, Cascade PID input, or Auxiliary PID input, depending on the control's configuration. Extraction/Admission priority refers to the Extraction/ Admission PID input parameter only.

The priority select buttons (Speed, Ext/Adm) will only appear/function if Ext/ Adm priority switching is configured/selected in the control's Program mode.

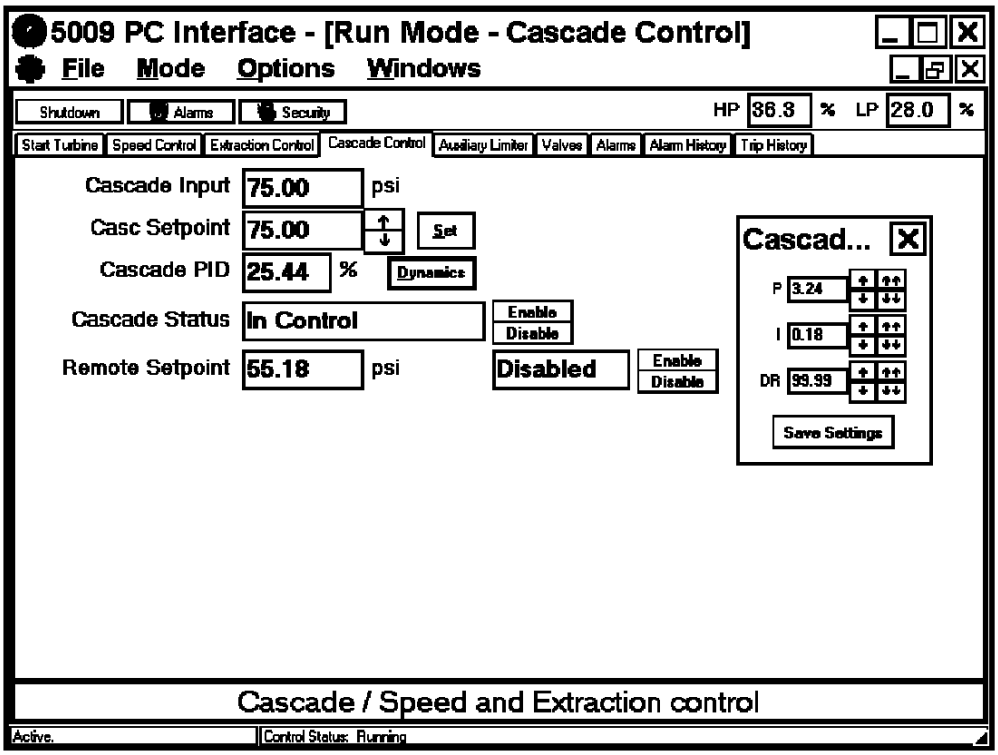
Extraction/ Admission Control Dynamics

The Extraction/Admission 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 Extraction/Admission Control folder will allow access to the Dynamics display box. This Extraction/Admission Control Dynamics display box displays the Extraction/Admission PID dynamic settings. The Controlling Parameter display at the bottom of the folder 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 effect 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 insures 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.

Cascade Control Folder



Cascade Control Features

The Cascade Control folder is visible only when Cascade Control is configured into the 5009 control. The Cascade folder allows the user to change the 5009 control's cascade settings from their PC. The Cascade input is displayed in the Cascade Input display box at all times. The 5009 control will attempt to control the turbine such that the Cascade input matches the Cascade Setpoint whenever the Cascade Controller has been enabled. The Cascade Control function can be enabled and disabled by manually selecting the Enable/Disable buttons to the right of the Cascade Status display box. The status box will display what mode the Cascade Control function is in at all times. The Cascade Setpoint can be manually changed by pressing the arrow keys to the right of the Casc Setpoint display box. The status of the Cascade controller does not effect whether the setpoint can be adjusted or not. The setpoint will determine what level the Cascade controller will maintain the turbine at once enabled. The setpoint can also be manually set to a value by using the Set button to the right of the arrow keys as described earlier. The rate at which the setpoint can change is set in the Program mode as Setpoint Rate. The output of the PID controller will be displayed in the Cascade PID display box. This output can be used to determine if the PID is in control or if there are stability problems.

When the Cascade Controller is disabled the setpoint will remain at the last valid setpoint and will control at that setpoint when the Cascade controller is again enabled. If the Setpoint Tracking feature is configured into the Cascade portion of the 5009 control, the setpoint will track the input whenever the Cascade Controller is disabled and when enabled will allow a "bumpless" transfer to control.

The Cascade setpoint can also be varied by a 4-20mA Remote Cascade Setpoint signal. The 4-20mA Remote Cascade 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 4-20mA Remote Cascade function is continually displayed in the Remote Status display gauge.

Cascade Control Dynamics

The Cascade 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.

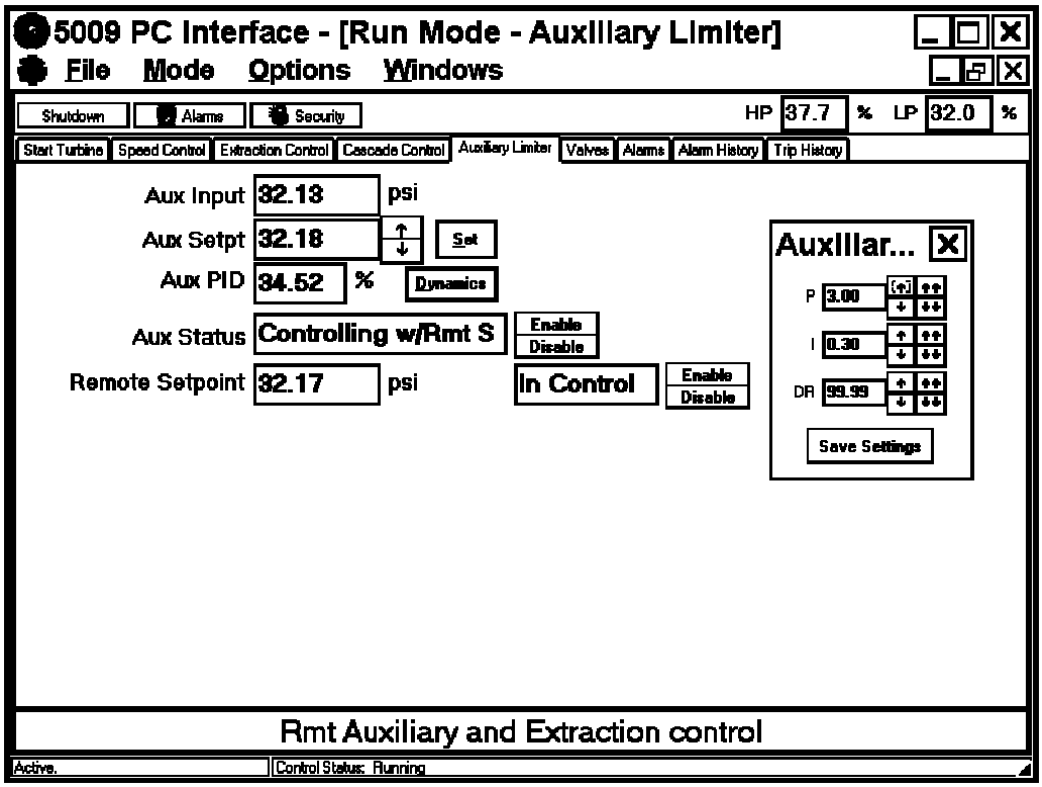
Selecting the "Dynamics button on the Cascade Control folder will allow access to the Dynamics display box. This Cascade Control Dynamics display box displays the Cascade PID dynamic settings. The Controlling Parameter display at the bottom of the folder will inform the user when the Cascade PID is in control. The Cascade Control's P, I, and D terms can be adjusted with the arrow buttons to the right of each term.

The Cascade PID uses the settings displayed in the Dynamics Display box to determine PID response; any change to these setting will immediately effect PID response (when the Cascade 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 insures 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.

Auxiliary Control/Limiter Folder

Auxiliary Control Features

The Auxiliary folder is visible only when Auxiliary Control is configured into the 5009 control. The Auxiliary Control folder and the Auxiliary Limiter folder look identical and perform the same functions as each other. The difference between the two is in the way they are implemented in the 5009 control loops. The Auxiliary Controller will take control of the valves any time it is enabled and in control. The Auxiliary Limiter will wait for the Auxiliary Input to meet the Auxiliary Setpoint before it "limits" the valve from traveling any further. The PID settings and the control loop is the same for both types.



The Auxiliary folder allows the user to change the 5009 control's auxiliary settings from their PC. The Auxiliary input is constantly displayed in the Aux Input display box. Once Auxiliary Control is enabled, the 5009 will be attempting to match the input to the setpoint if the Auxiliary Controller is configured as a controller. If configured as a limiter the 5009 will not use the Auxiliary controller until the input is greater than the setpoint. The Auxiliary Control function can be enabled and disabled by manually selecting the Enable/Disable buttons to the right of the Auxiliary Status display box. The status box will display what mode the Auxiliary Control function is in at all times. The Auxiliary Setpoint can be manually changed by pressing the arrow keys to the right of the Aux Setpt display box. The status of the Auxiliary controller does not effect whether the setpoint can be adjusted or not. The setpoint will determine what level the Auxiliary controller will maintain or limit the turbine to once enabled. The setpoint can also be manually set to a value by using the Set button to the right of the arrow keys as described earlier. The rate at which the setpoint can change is set in the Program mode as Setpoint Rate. The output of the Aux 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 Aux Limiter, the PID will ramp out of he way until the input matches the setpoint.

When the Auxiliary Controller is disabled the setpoint will remain at the last valid setpoint and will control at that setpoint when the Auxiliary controller is again enabled. If the Setpoint Tracking feature is configured into the Auxiliary portion of the 5009 control, the setpoint will track the input whenever the Auxiliary Controller is disabled and when enabled will allow a "bumpless" transfer to control.

The Auxiliary setpoint can also be varied by a 4-20mA Remote Auxiliary Setpoint signal. The 4-20mA Remote Auxiliary 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 4-20mA Remote Auxiliary function is continually displayed in the Remote Status display gauge.

Auxiliary Control Dynamics

The Auxiliary 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 Auxiliary Control folder will allow access to the Dynamics display box. This Auxiliary Control Dynamics display box displays the Auxiliary PID dynamic settings. The Controlling Parameter display at the bottom of the folder will inform the user when the Auxiliary PID is in control. The Auxiliary Control's P, I, and D terms can be adjusted with the arrow buttons to the right of each term.

The Auxiliary PID uses the settings displayed in the Dynamics Display box to determine PID response; any change to these setting will immediately effect PID response (when the Auxiliary 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 insures 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.

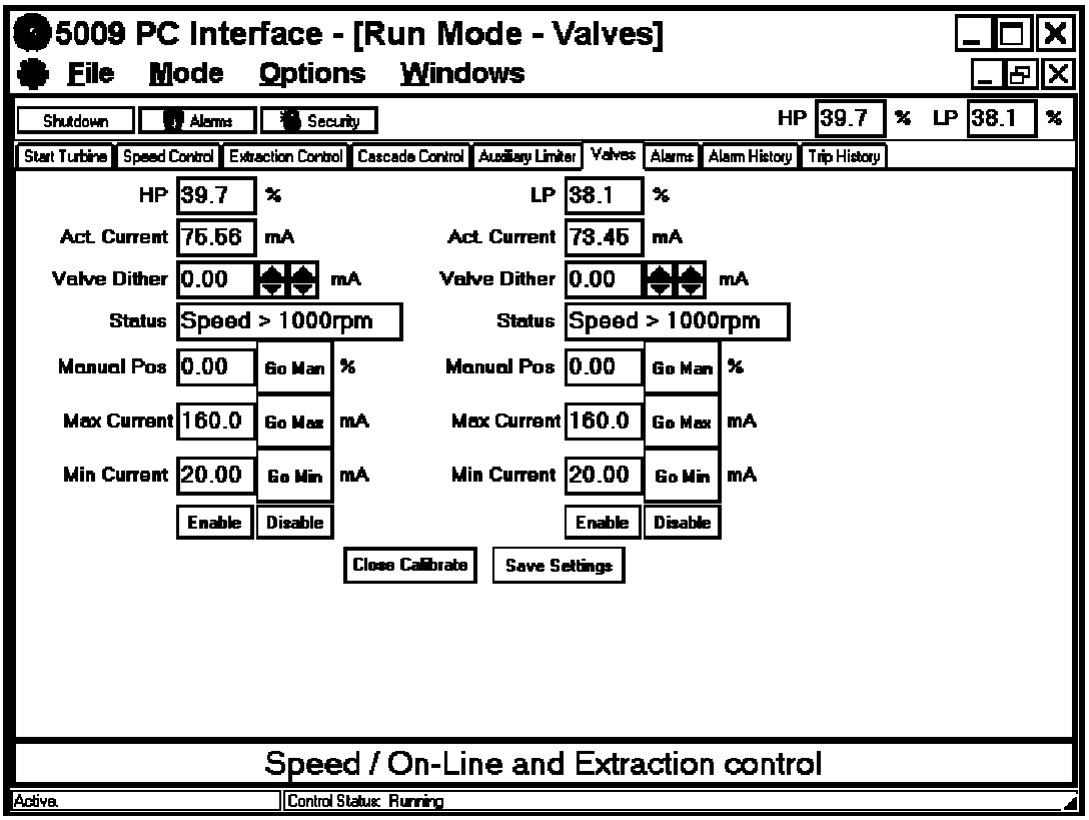
Valve Calibration Folder

Before initial operation or after a turbine overhaul where any actuator or valve travel may have been affected, the control must be calibrated or re-calibrated to the turbine valves.

⚠WARNING

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

Valve Calibration is performed via this folder. The above folder shows an example of the Valve Calibration folder. The screen will show either one valve, or both the HP valve and the LP valve, depending on how the 5009 is configured. The valve calibration settings can be monitored and changed by selecting the "Calibrate" button. If the RUN mode's Security logic is locked the settings can only be monitored. If the RUN mode's Security logic is unlocked, the 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.



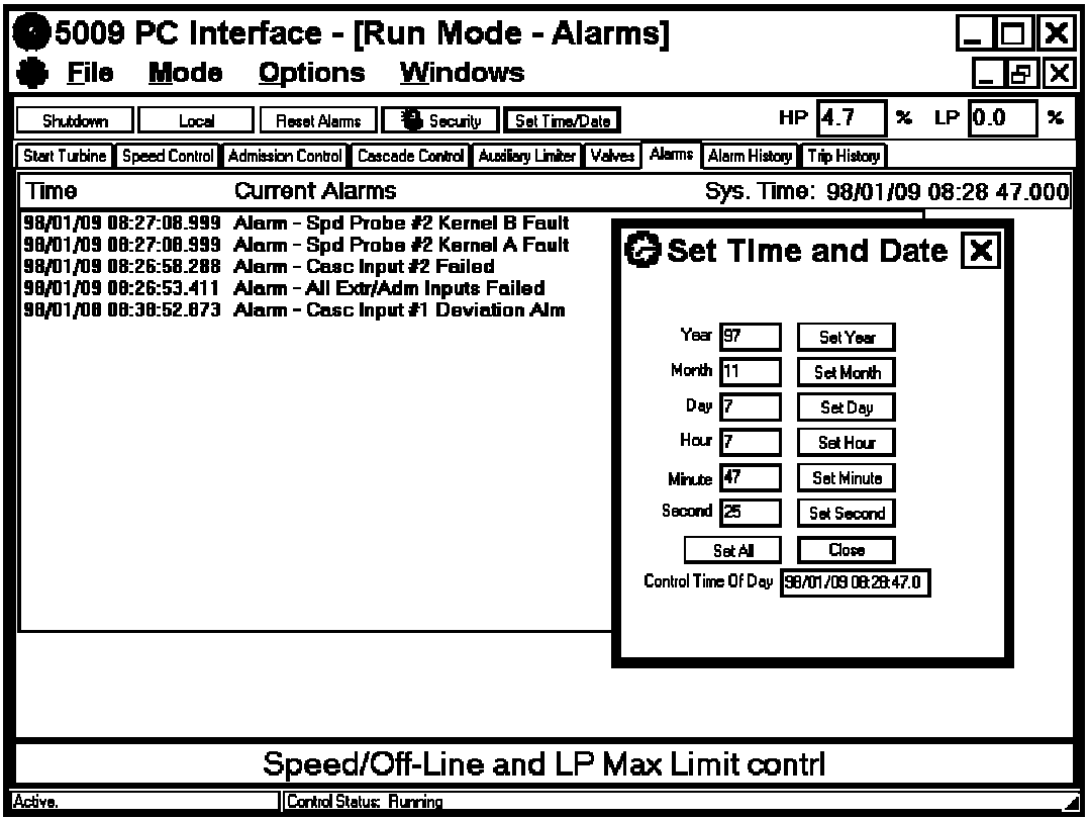
In order for the actuator valves to be calibrated, the turbine must be shutdown and turbine speed must be below 1000 RPM. The valve calibration status gauge displays mode status at all times. If calibration permissives are met the calibration mode can be enabled by clicking the Enable button. One or both valves can be calibrated at the same time.

By raising and lowering the Min and Max mA settings for each valve, the valve can be adjusted to be at its minimum stop setpoint (normally 0 steam flow at 0%) and at its maximum stop setpoint (normally full steam flow at 100%). To go to the maximum mA setpoint click on the Go Max button. Once selected, a set of arrows will appear and allow the user to increase or decrease the mA setting until 100% flow or 100% open has been reached. The same procedure can be followed to set the minimum mA setting. The Go Man button can be selected to manual adjust the valve from 0% open to 100 % open.

Upon completion of the valve calibration routine, it is recommended/expected that the control's valve position demand accurately reflect turbine valve position/ flow (within 1%). It is also recommended/expected that turbine valve over travel on mechanical stops be no greater than 2%. The control is only as accurate as the valves it is interfacing with. Valve linearity issues can be corrected via valve linearization settings in the program's Service mode.

The calibration 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 insures that if all power to the control is lost the 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 valve stroking instructions.

Alarm Folder



Alarm Features

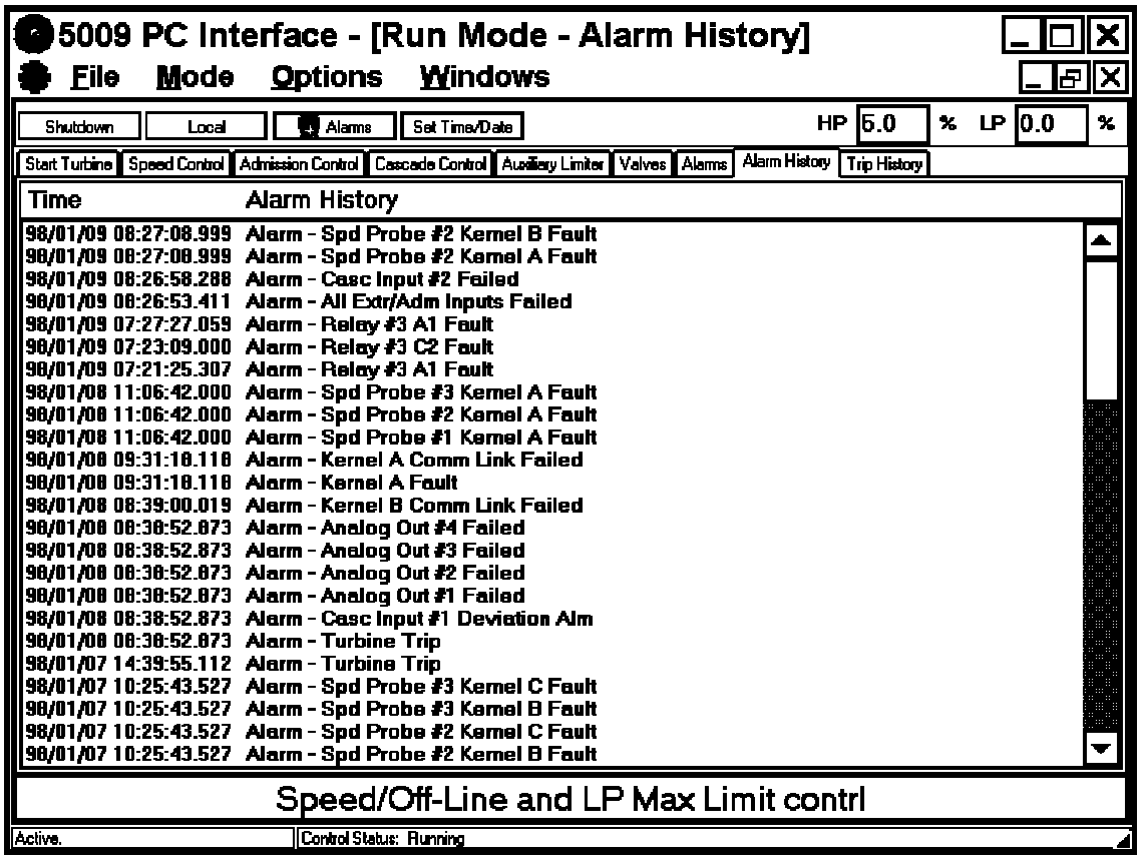
The above folder shows an example of the Alarm folder. Alarms are generated from the control and represent a condition that the 5009 application considers to be wrong but not dangerous enough to initiate an emergency shutdown.

The alarms in the Alarm folder are listed in the order that they occurred. The first column is the date the alarm occurred, the second column is the time the alarm occurred, and the third is a description of the alarm. A reset command is issued by selecting the Reset Alarms button in the main tool bar. Once the reset has been initiated, all alarms listed in this folder will be erased and only the alarms that are still active will return. The last 100 “alarms” are archived in the Alarm History folder.

The control’s Real Time Clock can be set from this folder. The controls Real Time Clock output is displayed at the top of the folder, after the “Current Alarms” title. The time and date settings can be changed by selecting the tool bar’s “Set Time/Date” button. This button opens a Time & Date edit box, from which all settings can be individually or collectively set. If the RUN mode’s Security logic is locked the “Set Time/Date” button can not be accessed. If the RUN mode’s Security logic is unlocked, the “Set Time/Date” button can be accessed, and all clock settings changed. Reference the Security Button section of this chapter for instructions on locking and unlocking the Run Mode’s Security logic.

Enter the new time and date in the edit boxes provided, then click on the respective Set “Value” button at the exact time that you have entered. The “Cancel” button will restore the current settings. Click the “X” button to close the Time and Date display box.

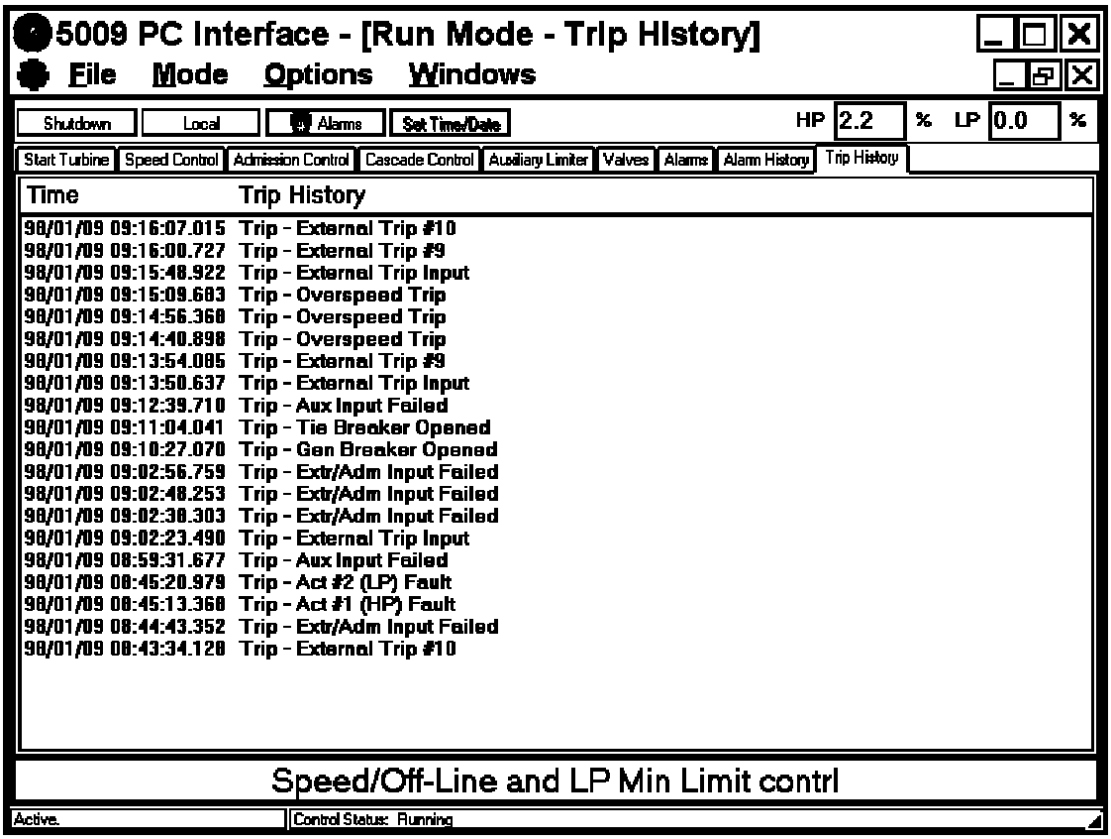
Alarm History Folder



Alarm History Features

The above folder shows an example of the Alarm History folder. The alarms are listed in the order that they occurred. The first column is the date the alarm occurred, the second column is the time the alarm occurred, and the third is a description of the alarm. The 5009 control has the ability to store up to 100 alarms. The last 100 alarms are available to the user. An alarm reset will not clear the Alarm History folder as in the Alarms folder. The last 100 alarms are displayed in the order that they occurred.

Trip History Folder



Trip History Features

The above folder shows example trip conditions indications. Trips are listed in the order that they occurred. The first column is the date the trip occurred, the second column is the time the trip occurred, and the third is a description of the trip. A trip is considered to be any condition that causes the 5009 control to immediately take the turbine to a failed safe condition (Emergency Shutdown). The 5009 control has the ability to store up to 20 trips. The last 20 trips are available to the user.

Chapter 5.
Service Mode Procedures

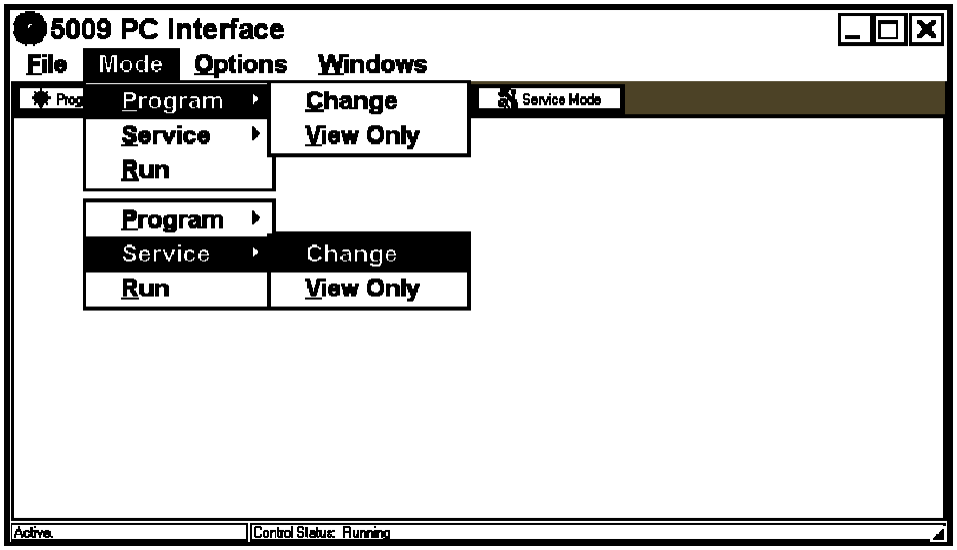
Overview

The Service mode is accessed through the PC interface and has the same easy to follow format as the program mode. 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 can not be used to operate the turbine or to perform Run Mode functions. The Service Mode is to be used for internal adjustments only.

IMPORTANT

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

The PCI's service mode can be accessed at any time the control is powered up. In order to enter the Service mode click on the Service Mode button or select the appropriate Service option from the Mode pull down menu as shown below.



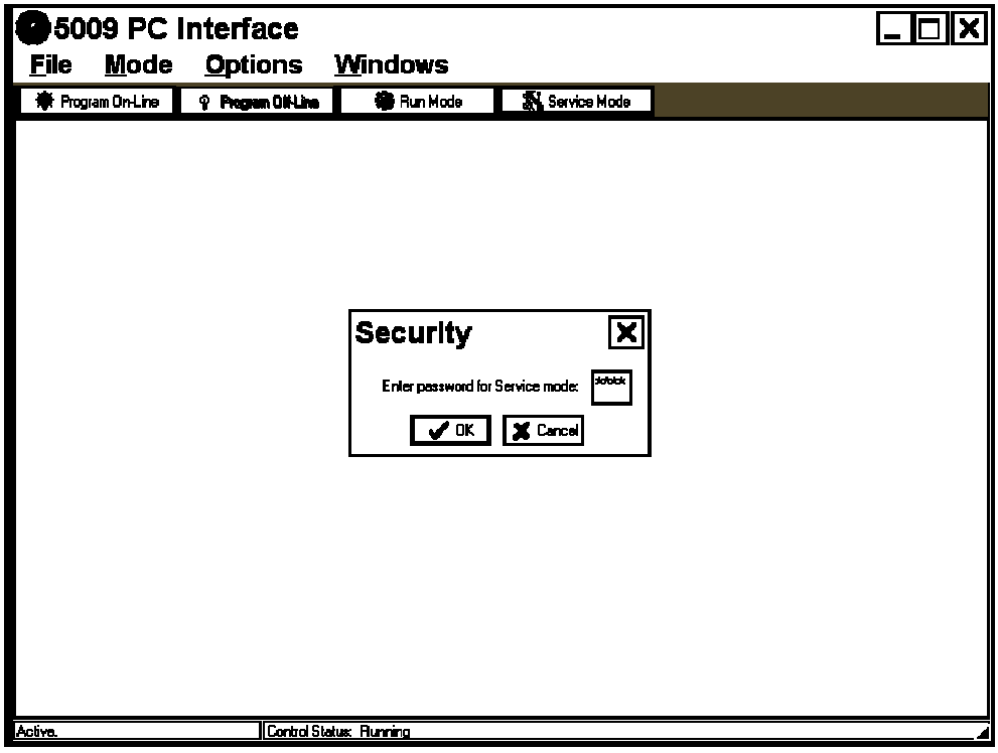
Opening the Service Mode

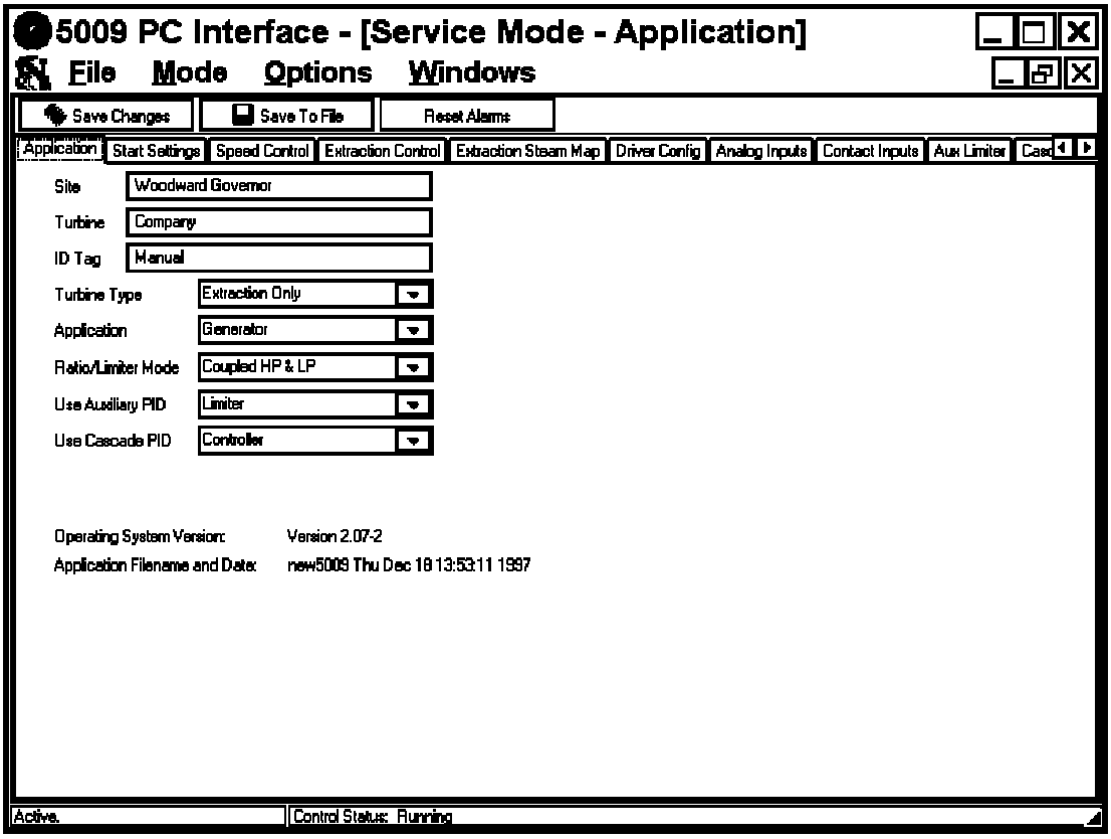
Two Service mode options are offered within the PCI program (Service-Change, Service-View Only). The Service-Change mode is used to change control settings, test control hardware, and calibrate control I/O, while the turbine is in operation or shutdown. For security purposes, the Service-Change mode is password protected. The Service-View Only mode is used to only view Service mode settings, while the turbine is in operation or shutdown. No Service mode settings can be changed via the View Only mode.

The 5009 control and PCI host computer must be connected (via a serial RS-232 cable) before the PCI Program mode can be opened. Trying to open the PCI Program mode without a serial connection will result in a communications error.

To enter the “Service-Change” mode click on the “Mode” button on the program’s main tool bar, or use the program’s Mode—Service menus. Once communications with the control has been established, the mode’s “Security Password entry box” will appear. At this point enter the Service mode password (reference Appendix A of this Volume).

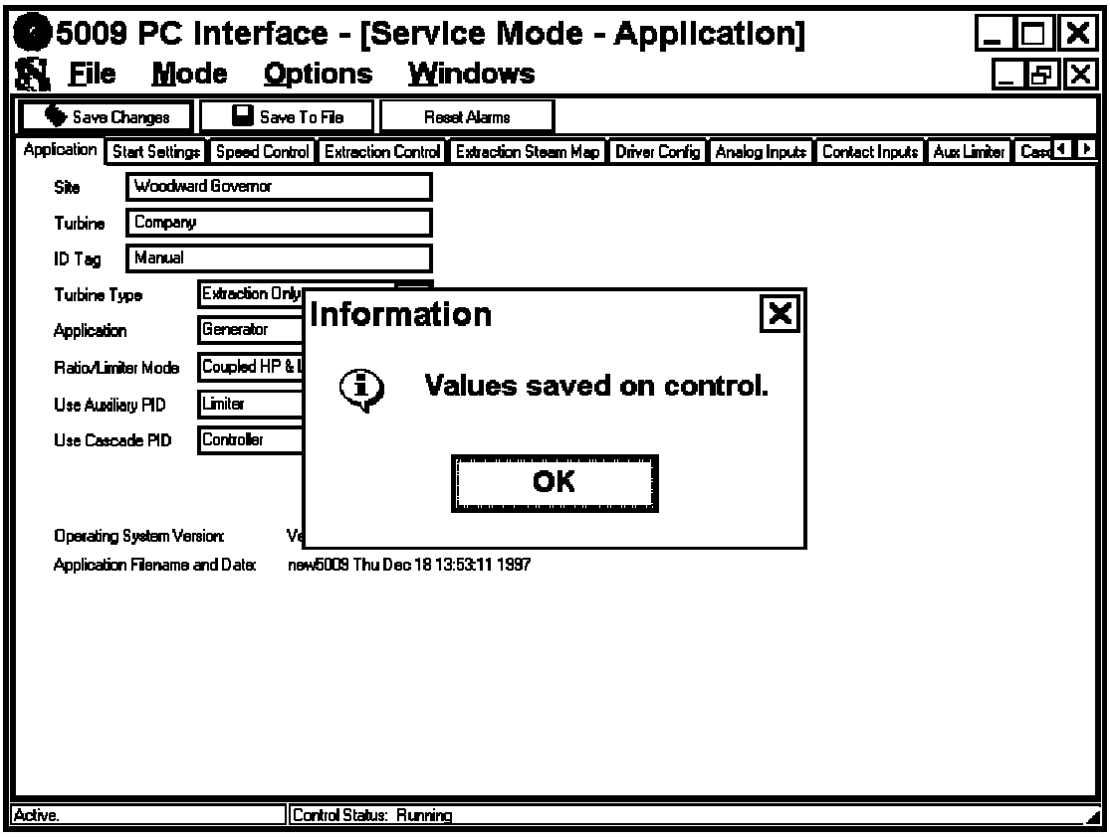
If the PCI program is not communicating with the control, when an open Service mode request is made, the program will make communication with the control via the Servlink program, then open the Service mode and its Security password box. During the time the Server program is establishing communications with the control, a “Starting Server” indication box will appear.





Save Changes

The Service Mode allows the user to change values internal to the 5009 control. The 5009 has two copies of the internal values. One it keeps in SRAM and the other it keeps in Non-volatile EEPROM, both on the CPU modules. When the 5009 control is powered up or reset it transfers the values from EEPROM to the SRAM and uses the values in SRAM. When the user makes changes in the Service Mode, he is making changes to the SRAM values. If the 5009 control is powered down or reset before the new values are stored into the EEPROM on the CPU modules the changes are lost and cannot be retrieved. Clicking the Save Changes button will store the new values into the EEPROM of the 5009 control. When the control has finished the save procedure, the display box shown below will appear. If the “Save Changes” button is not selected, the control will automatically save these values within 15 minutes.



Save To File

Reference the “Saving the Controls Configuration to a file” section in Chapter 3 of this volume.

Reset Alarms

This button allows the user to issue a Reset Alarms command without switching modes on the PCI program. This feature is useful when removing inputs or outputs the reactivating them. a Reset command is required to reactivate an input or output.

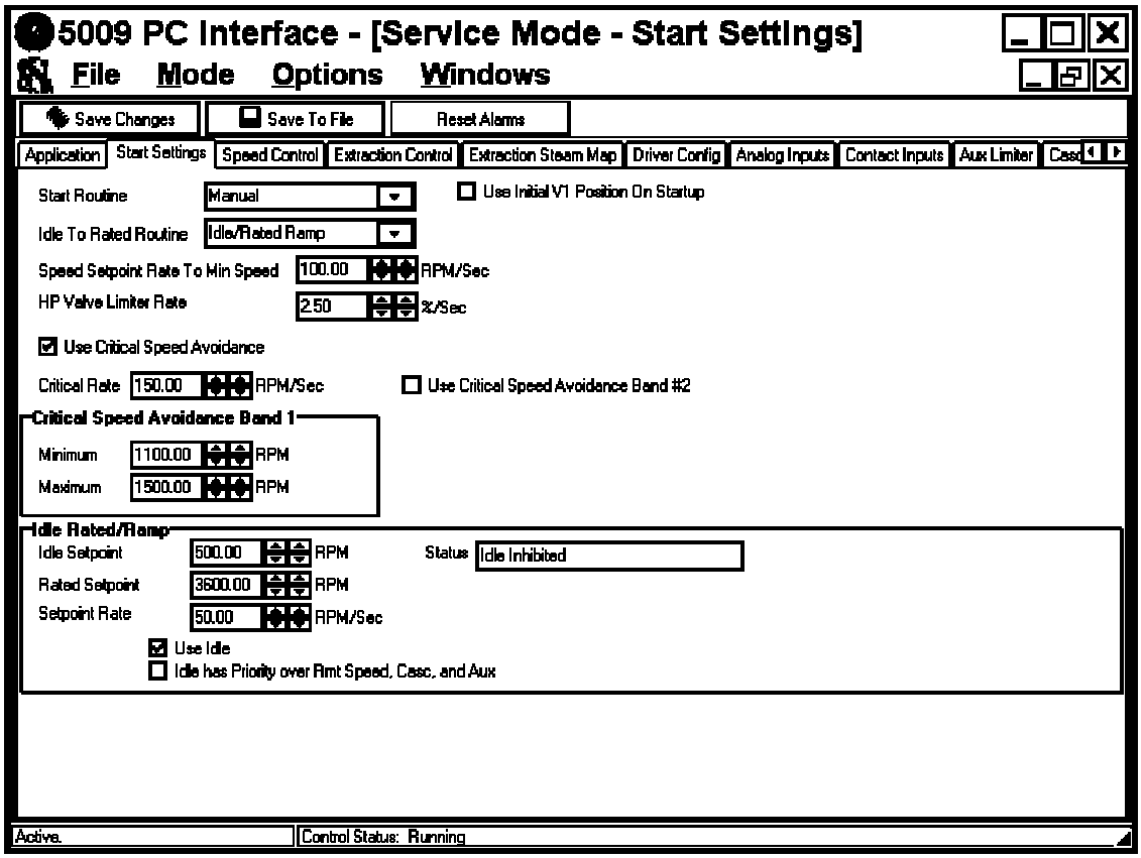
Service Mode Folders

The Service Mode consists of a series of folders that allow a user to manipulate the internal control parameters. Each folder is labeled according to it’s basic functions. To get a better idea of the functions available and a complete description on their purposes, see Volume 1. To move between folders, click on the folder title. As mentioned in the other modes, only the folders and the options that are relevant will appear visible. i.e. if the application is programmed for a single valve turbine, the extraction or admission folders will not be visible.

Application Folder

The Application folder has no tunable parameters available to the user. All values are entered in the Program Mode and can not be changed. This folder also displays the version of the 5009's operating software, application software, and what configuration file is being used. The software version information is for Woodward documentation and troubleshooting purposes only. The configuration file information allows the user to verify which configuration file the 5009 is using. Reference the "Saving the control's configuration to a file" and "Uploading a Configuration File to the Control" sections of this chapter for more information on configuration files.

Start Settings Folder



Start Settings

The start settings determine many of the parameters that are available on this folder. The Start Routine and the Idle to Rated Routine are set in the Program

mode and can not be changed. Any of the functions associated with those routines can be adjusted, but they can not be omitted if programmed or used if not programmed. The arrow keys to the right of each parameter will adjust it either up or down.

Common parameters to change during initial start up, is the HP Valve Limiter Rate and the V1 initial Position. They can be adjusted for a smooth and steady transition from zero speed to governor control.

Critical Speed Avoidance Bands

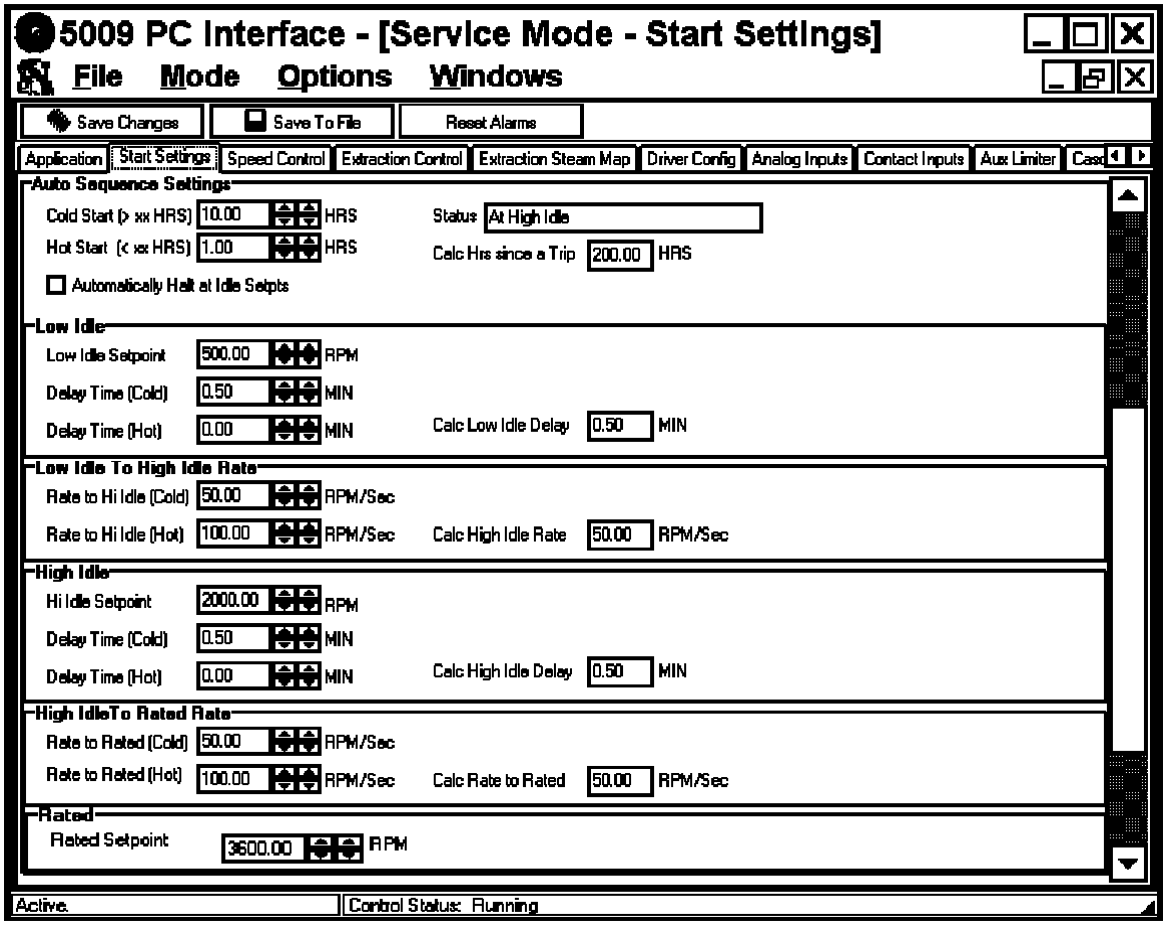
Critical speed avoidance settings can be tuned at all times. If turbine vibrations are such that a smaller or larger critical window is required, the arrow buttons to the right of each setting can be used to adjust the values either up or down.

Idle Rated/Ramp

The Idle/Rated ramp routine is used to take the turbine from an idle speed to a rated speed. The three parameters shown can be adjusted with the arrow keys to the right of the parameter.

Use Idle—The Use Idle option is selected if the user wishes to return to an idle speed whenever a Go To Idle command has been received. If not selected, the turbine will not go to Idle speed once rated speed has been reached. The Idle/Rated contact will have two functions depending on this option. If Use Idle is selected, a closed contact will ramp the turbine to rated speed and an open contact will ramp the turbine to idle speed. If Use Idle is not selected, a closed contact will ramp the turbine to rated speed and an open contact will have no effect.

Idle Has Priority Over Rmt Speed, Casc, and Aux—This option when checked, will override some of the permissives on the Go To Idle command. If selected the turbine will go to an Idle speed even if the Rmt Speed input, Cascade Controller, or Auxiliary Controller has been enabled.



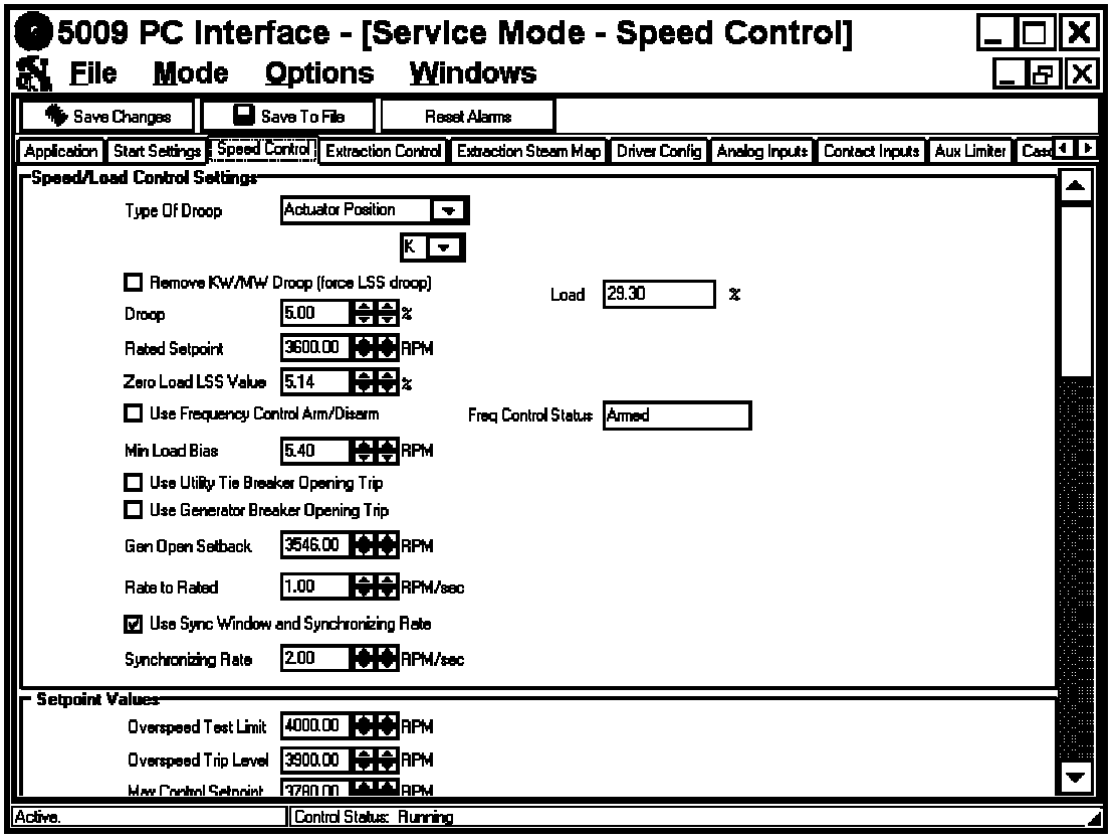
Auto Sequence Settings

The Auto Sequence Settings become visible only if the Auto Start Sequence is programmed. The Automatic Start Sequence parameters can be modified at all times with the arrow keys to the right of each parameter, and their functions are the same as described in the Program Mode. The display boxes to the right of the first section shows the status of the entire start procedure. The remaining display boxes show the time that each function of the start up procedure will take. As described in the Program Mode, if the turbine has been shut down longer than the “hot” time and has not been shut down for the full “cold” time, the 5009 control interpolates between the two and displays the calculated times in these display boxes.

Automatically Halt at Idle Setpoints **dflt = No**
This option when checked will cause the Auto Start Sequence to Halt at each idle setting, even after the elapsed delay time has expired. A “Continue” command must be issued to allow the Auto Start Sequence to continue.

Calc Hrs Since a Trip—This display box will display a running time of the hours that have elapsed since the last turbine trip.

Speed Control Folder



Speed/Load Control Settings

The Speed/Load Control Settings that are configured into the 5009 control are also tunable in the Service Mode. The parameters can be modified at all times with the arrow keys to the right of each parameter, and their functions are the same as described in the Program Mode. The display boxes to the right of the parameters shows the status of the turbine parameter.

Remove KW/MW Droop **dflt = No**
This option will change the droop type from an external input Load signal to the internal valve position droop. This is very useful in determining if stability problems are being caused by the external Load signal. By using this option the external signal can be momentarily taken out of the control loop.

Zero Load LSS Value **dflt = 0.0 (0.0, 100)**
This value is re-saved each time the Generator breaker closes, and is an indication of where the Speed PID's output level was when the Generator Breaker closed. It is used by the control to determine where zero load is when using "Actuator Position" droop. This value is tunable only because if inlet header pressure was below rated conditions by a large margin, and increased after the Generator Breaker closes this value will be invalid since the zero load position has changed. For most cases this value will not have a large enough effect on turbine operation to warrant a change.

Use Frequency Control Arm/Disarm **dflt = No**
This option will display the Frequency Arm/Disarm option on the Speed Control folder of the Run Mode. If used, it will allow the operator to enable and disable the Frequency Control function as described in Volume1. Frequency control must be armed before the unit will switch into frequency control. If not selected, frequency control is always armed and the unit will go into frequency control whenever the generator breaker is closed and the utility tie breaker is open.

Min Load Bias **dflt = 0.0 (0.0, 500)**
This Bias Load is added to the Speed Setpoint as soon as the Generator Breaker closes. It is defaulted to 3% of the total load. When the Generator Breaker closes it is useful to add a small amount of load to keep the generator from reverse powering.

Use Utility Tie Breaker Opening as a Trip **dflt = No**
This option when selected will trip the turbine if the Utility Tie Breaker is opened once it has been closed.

Use Generator Breaker Opening as a Trip **dflt = No**
This option when selected will trip the turbine if the Generator Breaker is opened once it has been closed.

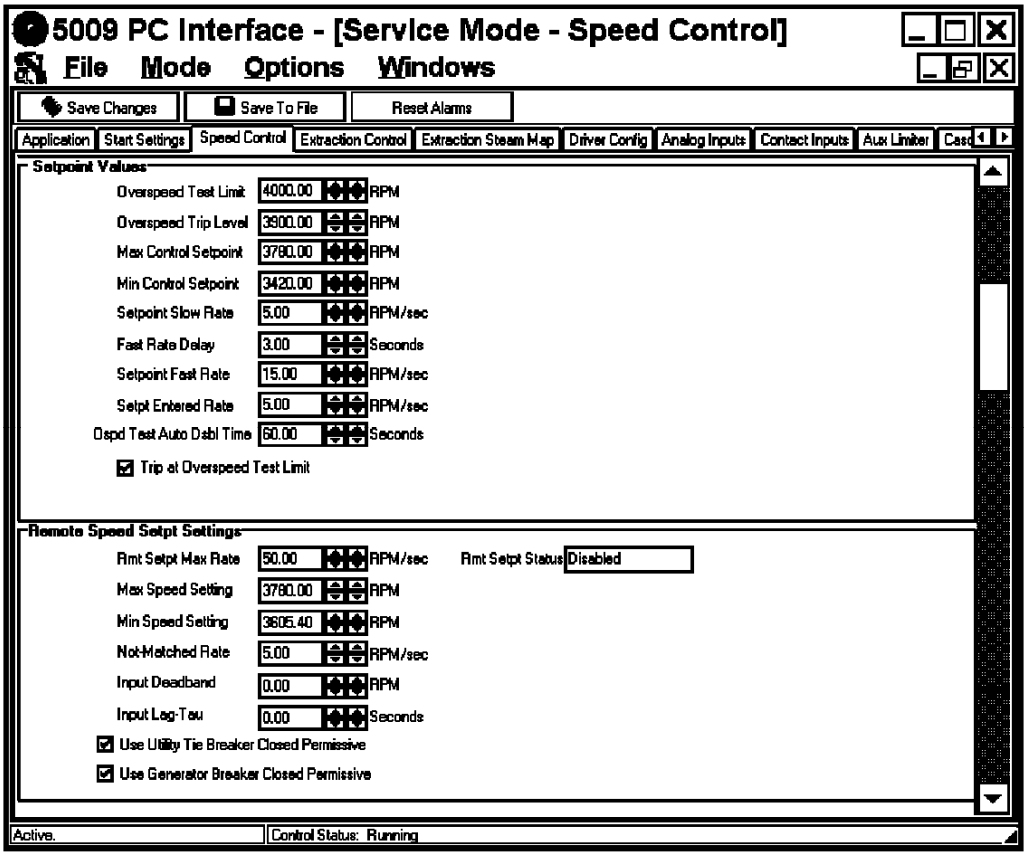
Generator Open Setback **dflt = 0.985 of Rated Spd (1.0, 25000)**
This value will determine what speed setpoint the 5009 control will revert to if the Generator Breaker contact input opens. During a load rejection, it may be necessary to lower the speed setpoint quickly in order to keep the turbine from overspeeding. This value can be tuned lower until satisfactory results are achieved.

Rate to Rated **dflt 1.0 (0.099, 2000)**

This option is used in conjunction with the Generator Open and Tie Breaker functions Setback. Once the turbine speed setpoint has been quickly dropped to the Setback setting, it will automatically ramp back up to the turbines rated speed. If it ramps up to quickly, it will defeat the purpose of the Generator Open Setback function. The Rate to Rated setting can be adjusted to bring the turbine back up to synchronous (rated) speed as fast as desired. It is defaulted to 1 RPM/sec.

Use Sync Window and Synchronizing Rate **dflt = Yes or dflt = 2.0 (0.1, 100)**

This option will only be displayed if a Synchronizing Analog Input or Sync/Load Share analog input is configured. If used, this feature forces the speed setpoint to change at the Synchronizing Rate when within ±10 RPM of the rated speed setting with the Generator Breaker open.



Setpoint Values

The Speed Setpoint Values that are configured into the 5009 control are also tunable in the Service Mode except for the Overspeed Test Limit setting. These parameters can be modified at all times with the arrow keys to the right of each parameter. The display boxes to the right of the parameters shows the status of the turbine parameter.

Fast Rate Delay **dflt = 3.0 (0.0, 100)**

This value will determine how long the Setpoint Slow Rate will have to be selected before the Setpoint Fast Rate is engaged. It is defaulted for 3 seconds. This implies that if a Raise speed setting command is continually given, the speed reference will raise at the slow rate for 3 seconds and then raise at the fast rate after that.

Setpoint Fast Rate **dflt = 3 x Setpt Slow Rate (0.088, 500)**
This value will determine how fast the speed setpoint will raise or lower when the Fast Rate is initiated. This rate is defaulted to three times the Slow Rate.

Setpoint Entered Rate **dflt = Setpt Slow Rate (0.1, 30)**
This value will determine how fast the speed setpoint will raise or lower when the setpoint is entered using the Set button of the Run Mode. This rate is defaulted to the Slow Rate.

Ovsp Test Auto Disable Time **dflt = 60 (0.0, 1000)**
This value will determine how long the user can keep the 5009 Overspeed Tests enabled without making an adjustment to the speed setpoint. This time is defaulted to 60 seconds.

Trip at Overspeed Test Limit **dflt = Yes**
This option will trip the turbine when the turbine speed reaches the Overspeed Test Limit. The 5009 control will trip the turbine at the Overspeed Trip Level at all times unless an External Overspeed Test has been initiated. This option provides a fail-safe condition in case the external device does not trip before the Overspeed Test Limit.

Underspeed Setting **dflt = Setpt Min Gov—100 (0.0, 25000)**
This value will determine at what speed the Underspeed Relay is energized. It is only visible when the Underspeed Relay is configured in the Program Mode.

Max Speed Setting **dflt = Max Speed Setpt (0.0, 25000)**
This value will determine the maximum setting the speed setpoint is allowed to be moved to, by the remote input. 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. The default setting is the Max Control Setpoint.

Min Speed Setting **dflt = Min Gov Setpt (0.0, 25000)**
This value will determine the minimum setting the speed setpoint is allowed to be moved to, by the remote input. The default setting is the Min Control Setpoint.

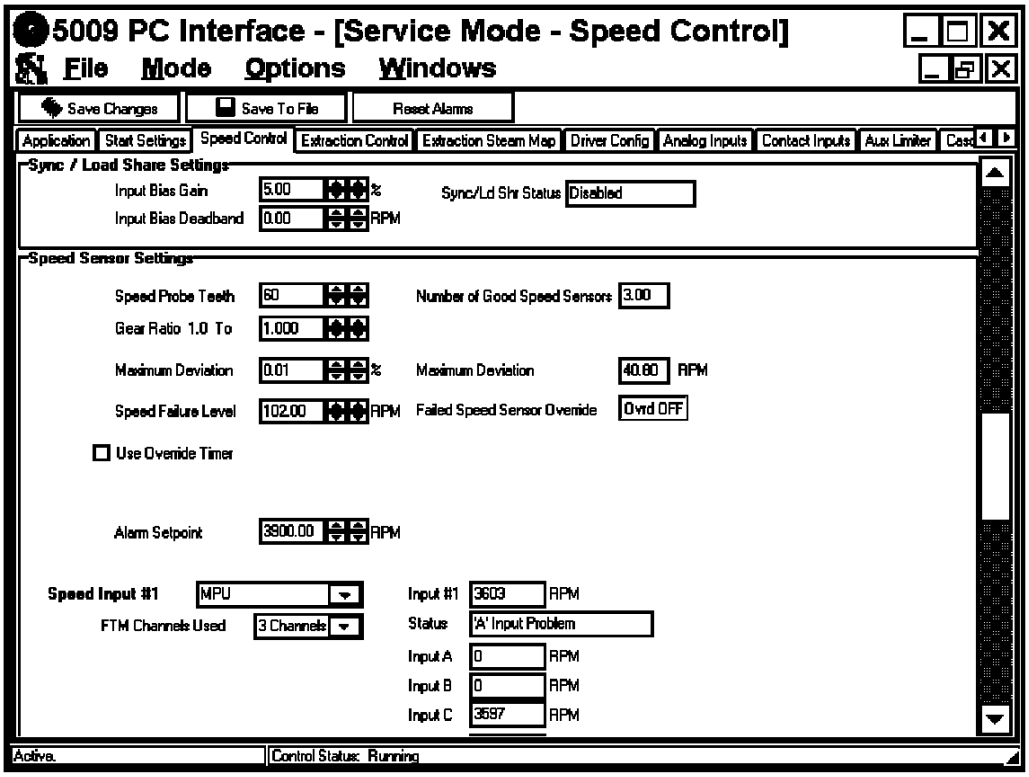
Not-Matched Rate **dflt = Speed Setpt Stow Rate (0.1, 500)**
This value determines the rate the setpoint moves when remote is enabled and the remote input doesn't match the actual speed setpoint. The default setting is the Slow Setpoint Rate.

Input Deadband **dflt = 0.0 (0.0, 100)**
This value will determine the deadband in the Remote Speed Input controller. The default value is set to zero. In the event that the input signal is noisy, or drifts, a small deadband value can be added to allow stability during normal operation and still permit movement when needed.

Input Lag-Tau **dflt = 0.0 (0.0, 10)**
This value will determine the Lag delay of the Remote Speed Input. The default value is zero. This value acts as a filter to filter out noise on the Remote input.

Use Utility Tie Breaker Closed as a Permissive **dflt = Yes**
This option will not allow the Remote Speed Input to be enabled if the Utility Tie Breaker contact input is not closed.

Use Generator Breaker Closed as a Permissive **dflt = Yes**
This option will not allow the Remote Speed Input to be enabled if the Generator Breaker contact input is not closed.



Synch/Loadshare Settings

These settings are only visible when one of the control's Analog inputs is configured as a "Synchronizing Input", or a "Sync/Load Share Input".

Input Bias Gain **dflt = Droop Setting (0.0, 100)**
This setting is the percent bias that the "Synchronizing" and "Sync/Load Share" inputs have on the Speed Setpoint. The bias is calculated as a percent of rated speed. This setting is defaulted to the Speed PID's Droop(%) value or 3% whichever is higher. For a setting of 5%, the Speed Setpoint will be biased by a (-)5% for an input of 4mA, and (+)5% for an input of 20mA; a 12mA input represents 0% bias.

Input Bias Deadband **dflt = 0.0 (0.0, 100)**
This value will determine the deadband in the "Synchronizing" and "Sync/Load Share" inputs. The default value is set to zero. In the event that a the input signal is noisy or drifts, a small deadband value can be added to allow stability during normal operation, and still permit a bias when needed.

Speed Sensor Settings

The Speed Sensor Settings that are configured into the 5009 control are not tunable in the Service Mode. The options are listed for display purposes only. Their functions are the same as described in the Program Mode. The display boxes to the right of the parameters shows the status of the speed sensor inputs.

Number of Good Speed Sensors
Displays the number of speed sensors that the 5009 control still views as having a valid input.

Maximum Deviation **dflt = 0.01 x Ovspd Limit (0.0001, 0.2)**
This value will determine the maximum difference between the three inputs before an alarm is given. If one input has a value that is less or greater than the voted-good value by the entered maximum deviation amount, that input will be alarmed.

Speed Failure Level **dflt = 0.0255 x Ovspd Limit (50, 15000)**
This value will determine at what speed a sensor is to be determined as failed. When all four sensors read at or below this value, the turbine will shutdown.

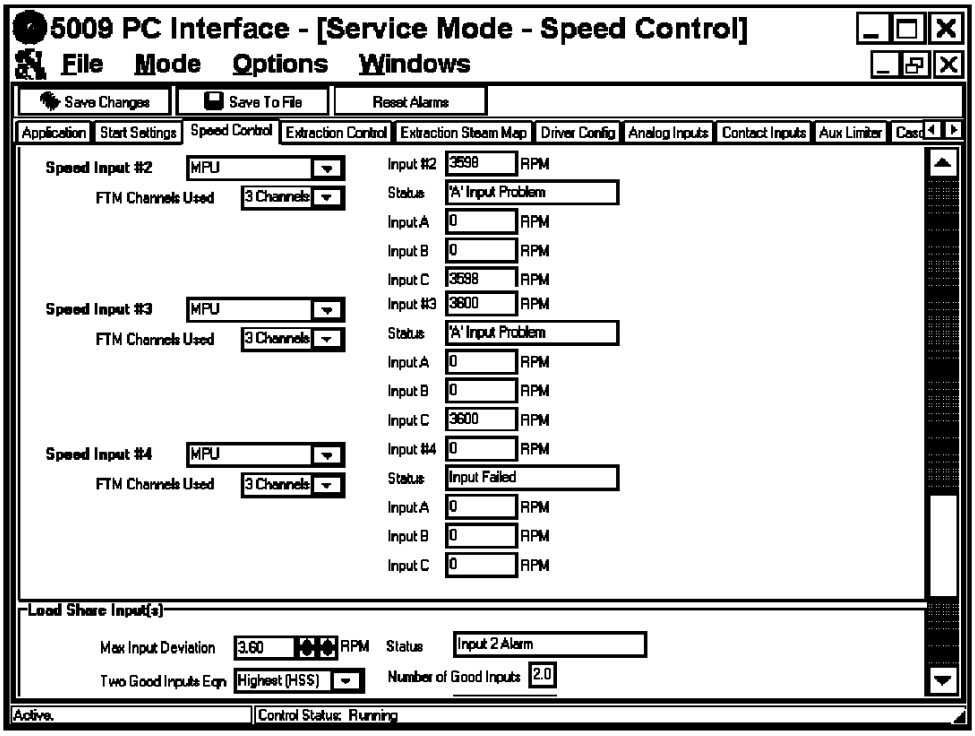
Use Override Timer/Max Override Time **dflt = No, dflt = 60 (0.0, 60)**
If a contact input is configured as an Override Speed Sensor Fault input, then this option allows a timer to disable the input after a set amount of time. The override timer function allows the turbine's fail-safe logic to protect the turbine in case the Override Speed Sensor Fault input is left closed for an extended length of time and all turbine speed sensors fail during this time. The override timer begins when a turbine start command is given and is defaulted to 60 Minutes (Max Override time). The status of the Failed Speed Sensor Override is displayed to the right of the Speed Failure Level input box.

Alarm Setpoint **dflt = Ovspd Trip Level (0.0, 25000)**
This value will determine at what point the overspeed alarm is initiated. This has no effect on the overspeed trip function or level.

Speed Inputs

For each of the four speed sensor inputs the following information is displayed on this folder.

- Type of speed sensor
- Number of FTM channels used
- Value read by CPU A
- Value read by CPU B
- Value read by CPU C
- Value used by 5009 control
- Status of Input



KW or Load Share Inputs

These inputs are visible only when configured in the Program Mode. The display boxes to the right show the status of the control function and the individual inputs as they are read from the control. The 5009 control can take up to three separate inputs, and each of the three are read from all three CPUs.

Maximum Deviation **dflt = 1% of Input Range (0.0, 20000)**
This value will determine the maximum difference between the three inputs before an alarm is given. If one input has a value that is less or greater than the voted-good value by the entered maximum deviation amount, that input will be alarmed.

Number of Good Inputs
Displays the number of Analog Inputs that the 5009 control still views as having a valid input.

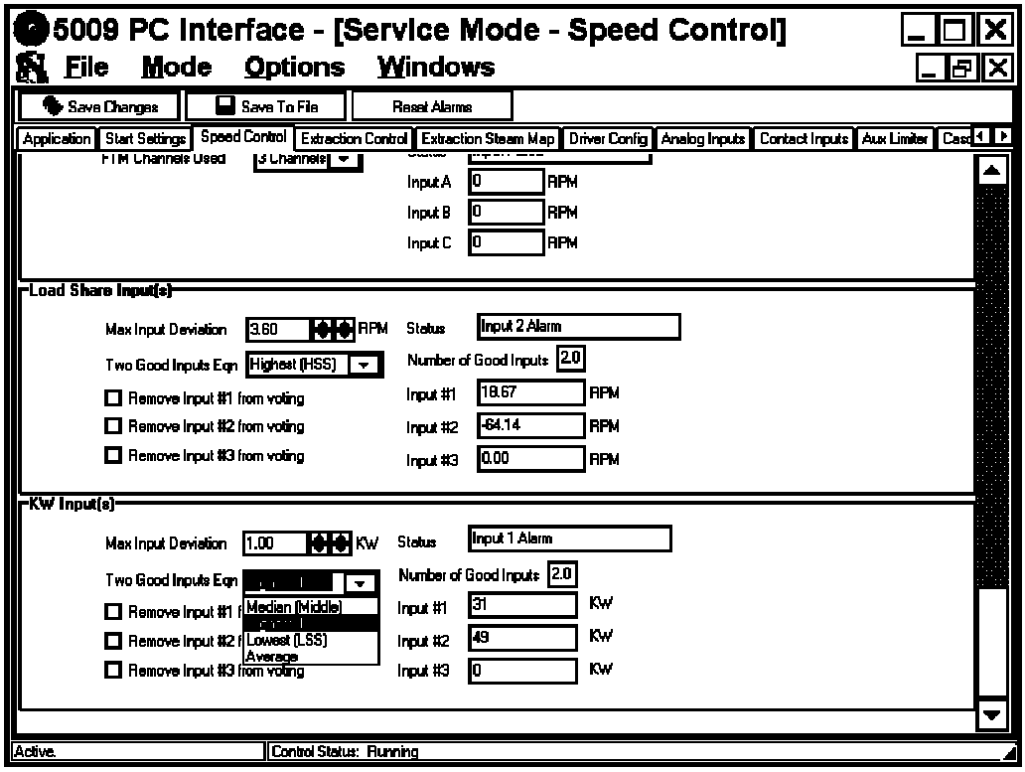
Two Good Inputs Equation **dflt = HSS**
If three good inputs are available, the 5009 control will select the Median Value (the one in the middle). If only one good input is available the 5009 control will use it . In the instance where one input fails and the 5009 control has two inputs to choose from, the user must select from one of the following options:

Median	If the failed input fails low the lower value of the two
	If the failed input fails high the higher value of the two
Highest	Higher value of the two inputs.
Lowest	Lower value of the two input
Average	Average of the two (Input X + Input Y)/2

Remove from Voting **dflt = No**
If a single input seems to be disrupting the operation of the 5009 control, the Remove From Voting option can be used to isolate it from the system. By clicking or selecting the check box to the left of the text, Inputs 1,2, or 3 can be removed from the voting and thereby removed from the 5009 controls input. This can be a good troubleshooting or maintenance tool. If a sensor has failed and is acting inconsistent, it can be removed from voting. A new sensor can then be installed and verified to be operating correctly before it is replaced into the control's voting logic. If a sensor's value is to far off from the others it can indicate a need for calibration.

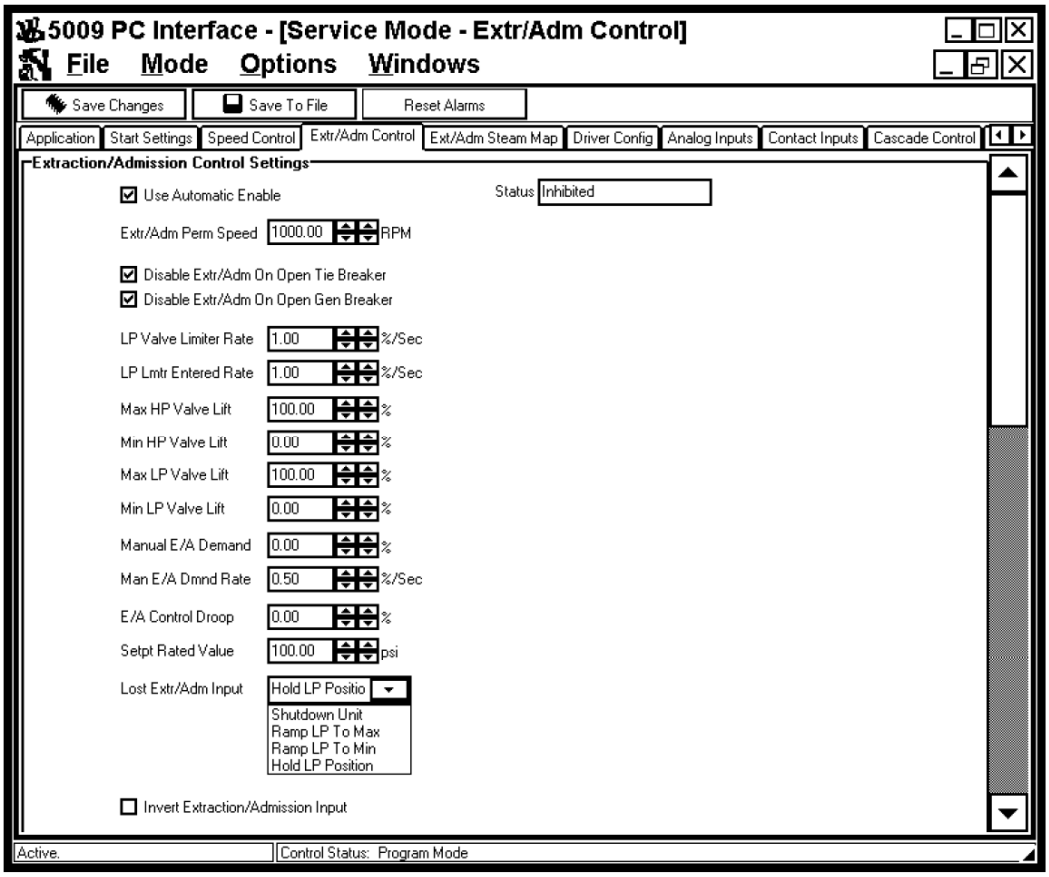
IMPORTANT

Don't confuse the three separate inputs with the three separate CPUs. The CPUs read each input and vote them transparent to the application. By removing input #X you are removing Analog Input #X. You are not eliminating one of the CPUs.



Extraction/Admission Control Folder

These folders are only visible when the control is configured for Extraction, Admission, or Extr/Adm types of turbines. Because there is very little difference between these folders, the descriptions for all three folders have been combined. Depending on the type of turbine configured, the folder and gauge titles will change from Extraction Control, Admission Control, or Extr/Adm Control. For description purposes the Extr/Adm Folder is displayed below.



Extraction/Admission Control Settings

Many of the Extr/Adm Control Settings that were Programmed are also tunable in the Service Mode. The parameters can be modified at all times with the arrow keys to the right of each parameter, and their functions are the same as described in the Program Mode of Chapter 3. Many of the settings can be changed by directly entering a number into the parameter's edit box. The display box to the right of the folder shows the status of the Extr/Adm parameter.

LP Lmtr Entered Rate **dflt = LP Valve Limiter Rate (0.01, 25)**
This value will determine how fast the LP Valve Limiter will raise or lower when the setpoint is entered using the Set button of the Run Mode. This rate is defaulted to the LP Valve Limiter Rate.

Max HP Valve Lift **dflt = 100 (55, 101)**
This value is only used/visible with admission or ext/adm turbines, and is identical to the Min HP Valve Lift except that it limits how open the HP Valve gets. This value will allow the user to compensate for an incorrectly calibrated Steam Map, on-line. It will allow the user to restrict the Max HP Flow or Power output of the turbine.

Min HP Valve Lift **dflt = 0.0 (0.0, 40)**
This value is only used/visible with admission or ext/adm turbines, and determines what the Minimum HP Valve position will be. It is measured in % opened. Typically used to guarantee some steam flow (cooling steam).

Max LP Valve Lift **dflt = 100 (55, 101)**

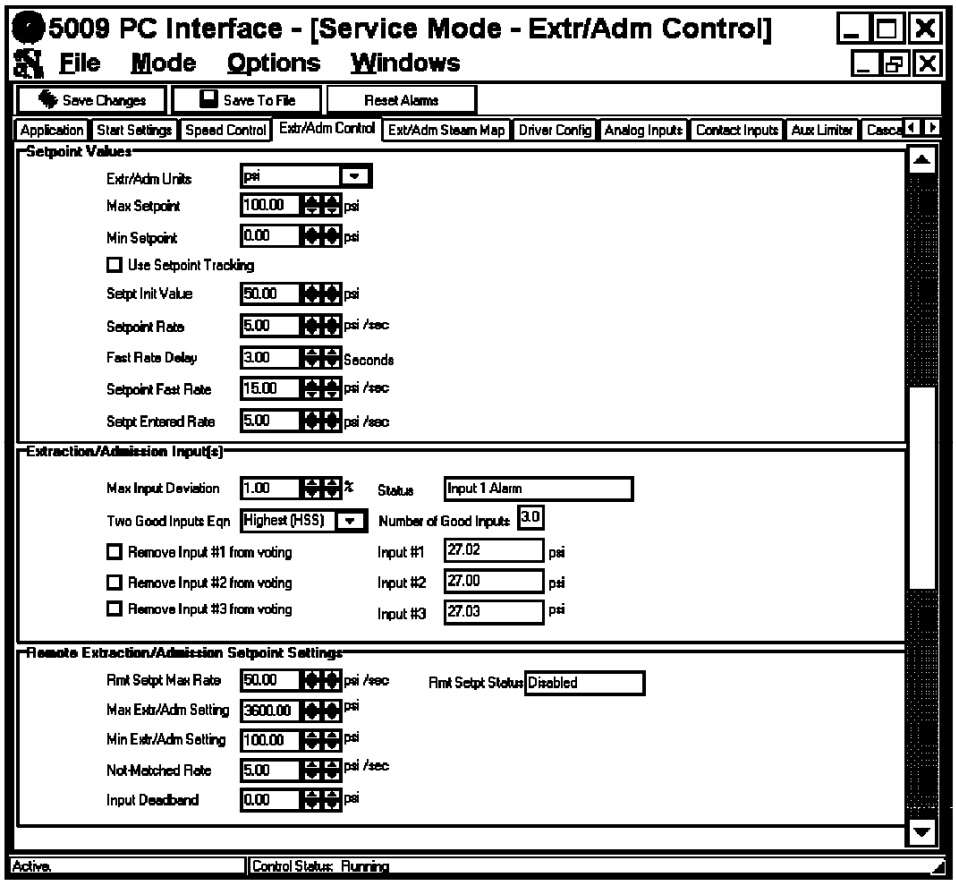
This value is identical to the Min LP Valve Lift except that it limits how open the LP Valve gets. This value will allow the user to compensate for an incorrectly calibrated Steam Map. It will allow the user to restrict the Max LP Flow or Extr/Adm output of the turbine.

Manual E/A Demand **dflt = 0 if Ext, 100 if Adm**
Zero Flow Calc if E/A (-25, 125)

This value is only used/visible with admission or ext/adm turbines, and determines the Demand setpoint when Ext/Adm control is not enabled. The demand setting allows a user to manually vary ext/adm flow. For admission turbines a value of “0%” is equal to 100% flow and a value of “100%” is equal to “0% flow. For Ext/Adm turbines a value of “0%” is equal to 100% admission flow, and a value of “100” is equal to “100%” extraction flow. For Ext/Adm turbines, the control calculates the Manual E/A Demand value depending on where the zero flow point is (typically near the mid range). It is recommended that this value be adjusted for a setting that is close to the turbine’s actual zero ext/adm flow point, then not changed again unless system parameters change.

Setpoint Rated Value **dflt = E/A Max Setpt (0.0, 325000)**

This value is used to calculate the droop and PID settings used in the Extr/Adm Controller. It is defaulted to the Maximum Extr/Adm Setpoint and it should not need to be changed unless the resolution of the PID settings or the Droop percentage needs to be higher.



Fast Rate Delay **dflt = 3 (0.0, 100)**
This value will determine how long the Setpoint Slow Rate will have to be selected before the Setpoint Fast Rate will be engaged. It is defaulted for 3 seconds. This implies that if a Raise Extr/Adm Setpoint command is continually given, the Extr/Adm Setpoint will raise at the slow rate for 3 seconds and then raise at the fast rate after that.

Setpoint Fast Rate **dflt = 3 x Setpt Slow Rate (0.01, 50000)**
This value will determine how fast the Extr/Adm setpoint will raise or lower when the Fast Rate is initiated. This rate is defaulted to three times the Setpoint Slow Rate.

Setpoint Entered Rate **dflt = Setpt Slow Rate (0.01, 10000)**
This value will determine how fast the Extr/Adm setpoint will raise or lower when the setpoint is entered using the Run Mode “Set” button. This rate is defaulted to the Setpoint Slow Rate.

Max Extr/Adm Setting **dflt = Max Setpt or Anin 20 mA (-325000, 325000)**
This value will determine the maximum setting the Extr/Adm setpoint is allowed to be moved to, by the remote input. If the Remote Input is ranged to go from 0 to 25,000 PSI by an external device, but the user desires the PSI to be limited to 10,000—20,000 PSI, this option will allow for it. The default setting is the Max Extr/Adm Setpoint or the entered Remote Input 20 mA value, whichever is lower.

Min Extr/Adm Setting **dflt = Min Setpt on Anin 4 mA (-325000, 325000)**
This value will determine the minimum setting the Extr/Adm setpoint is allowed to be moved to, by the remote input. The default setting is the Min Extr/Adm Setpoint or the entered Remote Input 4 mA value, whichever is higher.

Not-Matched Rate **dflt = Extr Slow Setpt (0.01, 10000)**
This value determines the rate the setpoint moves when remote is enabled and the remote input doesn’t match the actual Extr/Adm setpoint.

Input Deadband **dflt = 0.0 (0.0, 1000)**
This value will determine the deadband for the Remote Extr/Adm Setpoint input. The default value is set to zero. In the event that the input signal is noisy or drifts, a small deadband value can be added to allow stability during normal operation, and still permit movement on the Extr/Adm Setpoint when needed.

Max Input Deviation **dflt = 1% of Input Range (-325000, 325000)**
This value will determine the maximum difference between the three inputs, before an alarm is given. If one input has a value that is less or greater than the voted-good value by the entered maximum deviation amount, that input will be alarmed.

Number of Good Inputs
Displays the number of Extr/Adm Inputs that the 5009 control still views as having a valid input.

Two Good Inputs Equation **dflt = HSS**
If three good inputs are available, the 5009 control will select the Median Value (the one in the middle). If only one good input is available the 5009 control will use it . In the instance where one input fails and the 5009 control has two inputs to chose from, the user must select from one of the following options:

Median	If the failed input fails low the lower value of the two If the failed input fails high the higher value of the two
Highest	Higher value of the two inputs.
Lowest	Lower value of the two input
Average	Average of the two (Input X + Input Y)/2

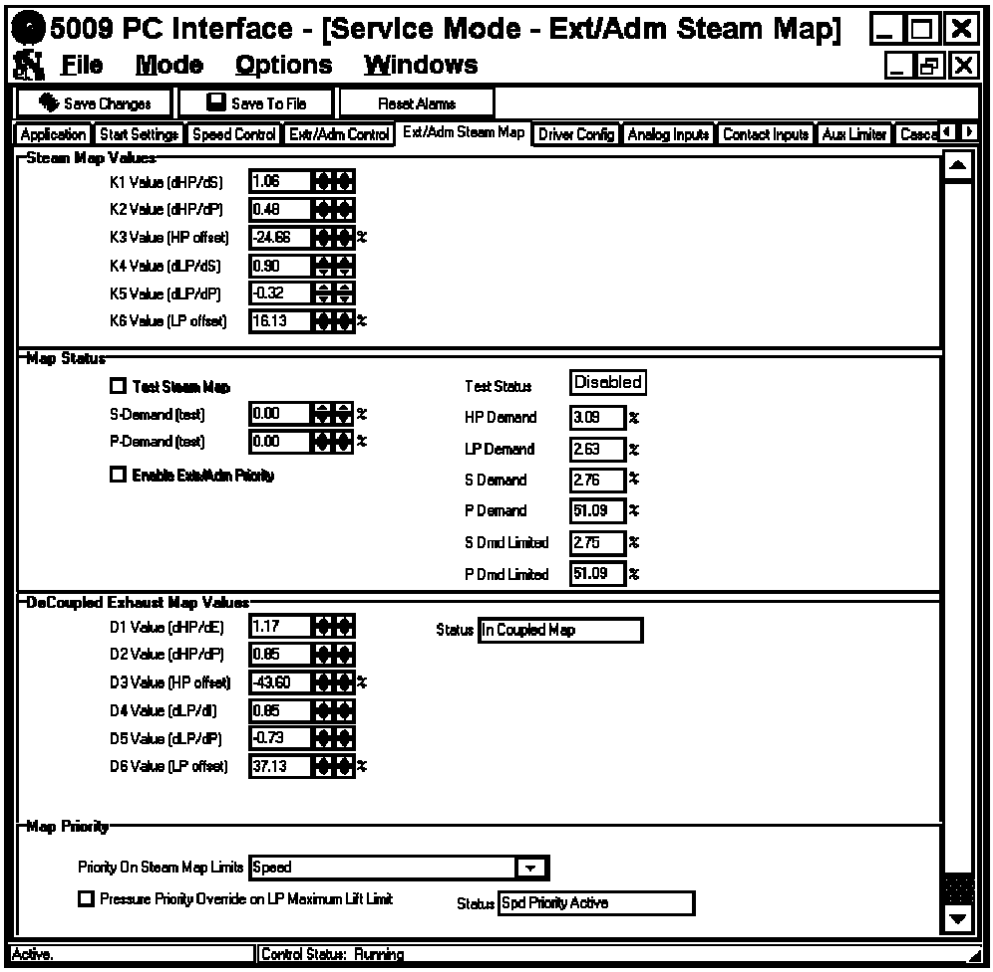
Remove Input # from Voting **dflt = No**

By clicking or selecting the check box to the left of the text, Inputs 1,2, or 3 can be removed from the input voting logic. This option, allows on-line transducer calibration and maintenance, without the worry of affecting system control. If a sensor has failed or is acting inconsistent, it can be removed from the voting logic, replaced or repaired, have its calibration verified, then placed back into the input's voting logic. To place the input back into the voting logic, click the respective box again, then the "Reset Alarms" button on the screen's tool bar. Use extreme caution when performing this test on-line; removing all three output at once could cause a system trip condition.

IMPORTANT

Don't confuse the three separate inputs with the three separate CPUs. The CPUs read each input and vote them transparent to the application. By removing input #X you are removing Extr/Adm Input #X. You are not eliminating one of the CPUs.

Extraction/Admission Steam Map Folder



Extraction/Admission Steam Map

The Extr/Adm Steam Map settings are fully tunable from the Service Mode. The parameters can be modified at all times with the arrow keys to the right of each parameter. Some of the parameters listed are different than the parameters that are described in the Program Mode, Chapter 3. The values entered in the Steam Map folders are used by the 5009 control to calculate the ratios used in the ratioing between the HP and LP valves. Those ratios are listed in the above folder as K# Values. The decoupled version of the ratio parameters are D# Values. Only an experienced operator with an understanding of the steam map ratios should attempt to tune these values. It is recommended that a change in the steam map be entered in the Program Mode and then allow the 5009 to manipulate these ratios. If a different set of algorithms is wanted, it is possible to adjust these ratio parameters to obtain the desired results. Care should be taken in directly manipulating these parameters.

Steam Map Values

K1 Value (delta HP/ delta Load)	dflt= Calc (0, 4)
K2 Value (delta HP/ delta Ext/Adm Flow)	dflt= Calc (0, 4)
K3 Value (HP Offset at zero Load and zero E/A Flow)	dflt= Calc (-300, 30)
K4 Value (delta LP/ delta Load)	dflt= Calc (0, 4)
K5 Value (delta LP/ delta Ext/Adm Flow)	dflt= Calc (-4, 4)
K6 Value (LP offset at zero Load and zero E/A Flow)	dflt= Calc (-300, 300)

Decoupled Exhaust Values

D1 Value (delta HP/ delta Exhaust Flow)	dflt= Calc (0, 4)
D2 Value (delta HP/ delta Ext/Adm Flow)	dflt= Calc (0, 4)
D3 Value (HP Offset at 0 Exhaust Flow & 0 E/A Flow)	dflt= Calc (-300, 30)

Decoupled Inlet Values

D4 Value (delta LP/ delta Inlet Flow)	dflt= Calc (0, 4)
D5 Value (delta HP/ delta Ext/Adm Flow)	dflt= Calc (-4, 4)
D6 Value (LP offset at 0 Load & 0 E/A Flow)	dflt= Calc (-300, 300)

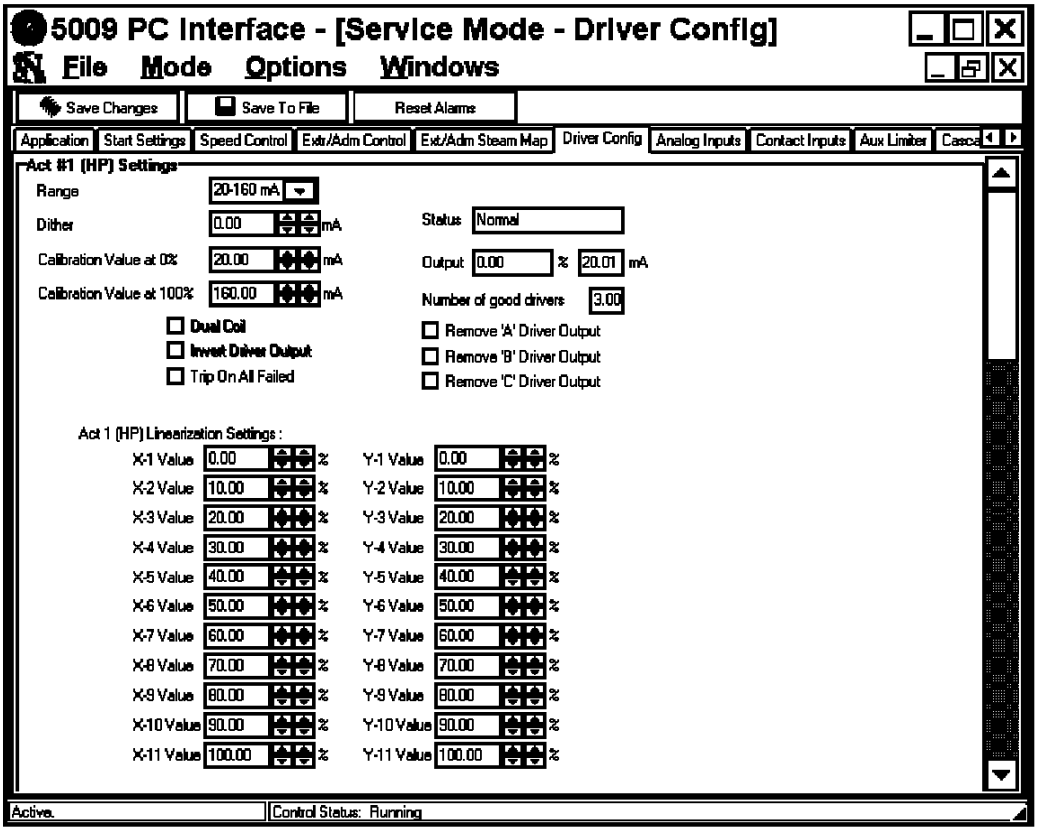
Testing the Extr/Adm Steam Map

Testing the Extr/Adm steam map can only be done when the 5009 control is in a shutdown condition. Select or click on the Test Steam Map check box to enable the testing procedure once the turbine is shut down. The Test Enable display box will display Enabled when the test has begun. When the Test Steam Map is disabled, the display boxes to the right of the folder will display the active condition of the Steam Map parameters (HP Demand, LP Demand, Flow Demand, Speed/Load Demand, HP Limiter, and the LP Limiter). However, once the Test Steam Map has been enabled, the parameters will be under the control of the test.

A user can change the (S-Demand(test)) and the (P-Demand(test) by directly entering a number or using the arrow keys to the right of the two display boxes. Changing these input values, changes the inputs to the Ratio/Limiter internal to the 5009 control. By moving these values up and down, the user can move the controlling point of the steam turbine up to and across the boundaries of the Steam Map. The display boxes to the right of the folder will display the output of the HP Demand and the LP Demand. The Limiters can be monitored to verify that they are limiting at the correct values.

This procedure is normally done prior to start-up. First the Steam Map data must be correctly entered using the Program Mode, then these Service Mode settings can be used to verify that the control is correctly positioning the HP and LP valves based on the entered power and ext/adm flow demands. This test only allows you to test the Coupled HP & LP Ratio/Limiter mode.

Driver Configuration Folder



Act #1 (HP) Settings

The actuator driver settings are identical for both the HP and the LP drivers. Most of the options that have been configured in the Program Mode are not adjustable in the Service Mode. Once entered by way of the Program Mode into the 5009 control, the system must be shutdown and reprogrammed in order to enter new settings. The parameters shown are the same parameters that are listed and described in the Program Mode. The status of the drivers is displayed to the right of the settings in the driver status display box. The 0—100% output of the driver is also displayed along with the milliamps that the driver output corresponds too.

Dither **dflt = 0.0 (0.0, 10)**

The amount of dither present is the only option that can be adjusted from the Service Mode.

Number of Good Drivers

Displays the number of Driver “legs” that the 5009 control still views as having a valid output.

Remove 'X' Driver Output (from Voting) **dflt = No**

If a single leg of the drivers output seams to be disrupting the operation of the 5009 control, the Remove From Voting option can be used to isolate it from the system. By clicking or selecting the check box to the left of the text, Output A,B, or C can be removed from the voting and thereby removed from the 5009 controls output. To place the output back into the voting logic, click on the respective box again, then select the "Reset Alarms" button on the screen's tool bar. Use extreme caution when performing this test on-line; removing all three output at once could cause a system trip condition.

IMPORTANT

Don't confuse the three separate inputs option described earlier with the "Legs" of the output driver. The three CPUs each contribute one leg of the drivers output. By removing Driver Output '?' you are eliminating one of the CPUs from the output.

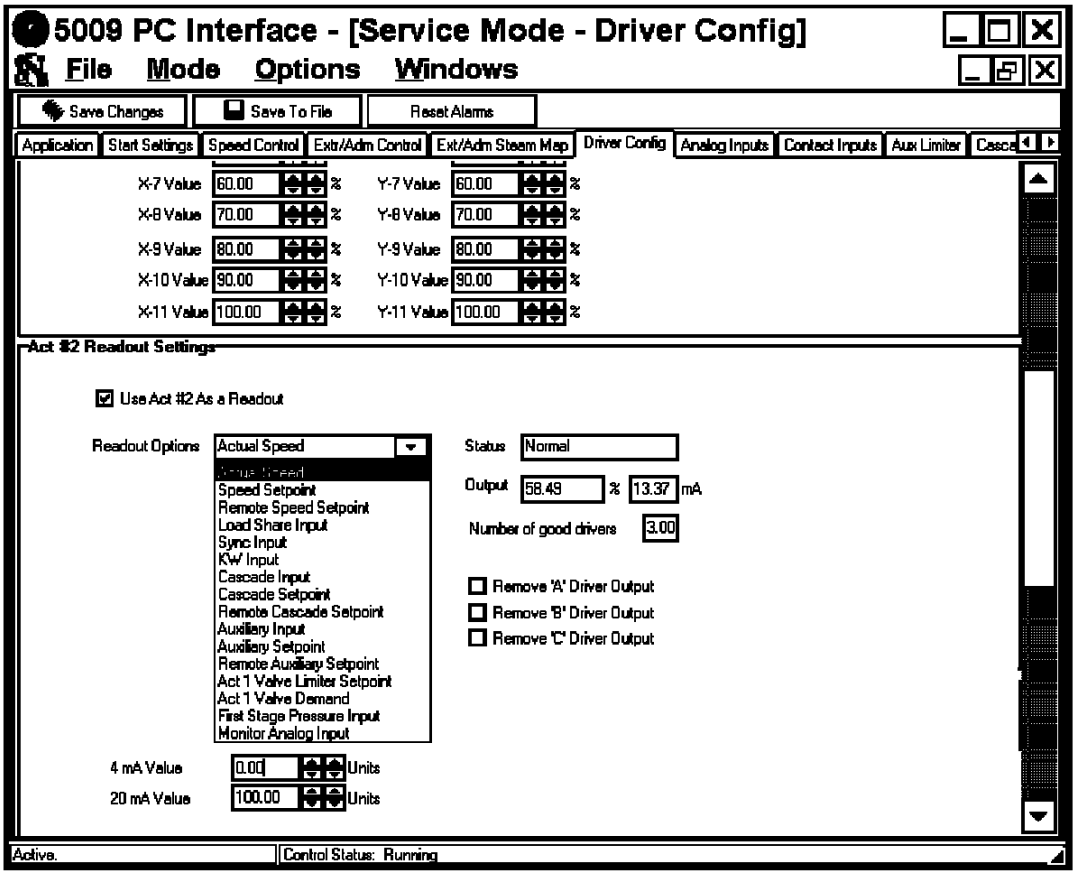
Act #2 Offset (Not Shown) **dflt = 0.0 (0.0, 10)**

If the application has been programmed for a split-range turbine type, Act #2 will be programmed for an offset and will be adjustable from the Service Mode. The status and display of Act #2 will be the same as described above. For a full explanation see Volume 1 and the Program Mode description in Chapter 3 of this manual.

Act Linearization Settings **dflt = (Shown in Driver Conf Folder)**

The linearization of the actuators is a vital feature of the 5009 control system. The ratio/limiting that occurs internal to the 5009 is dependent on the valves being linear in nature. Most Woodward Governor Company 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.



Act #2 Readout **dflt = Not Used**

If the application has been programmed for a single valve Turbine type, Act #2 can be programmed for a 4—20 mA analog output and will be adjustable from the Service Mode. The status and display of Act #2 will be the same as described above. For a full explanation see Volume 1 and the Program Mode description in Chapter 3 of this manual.

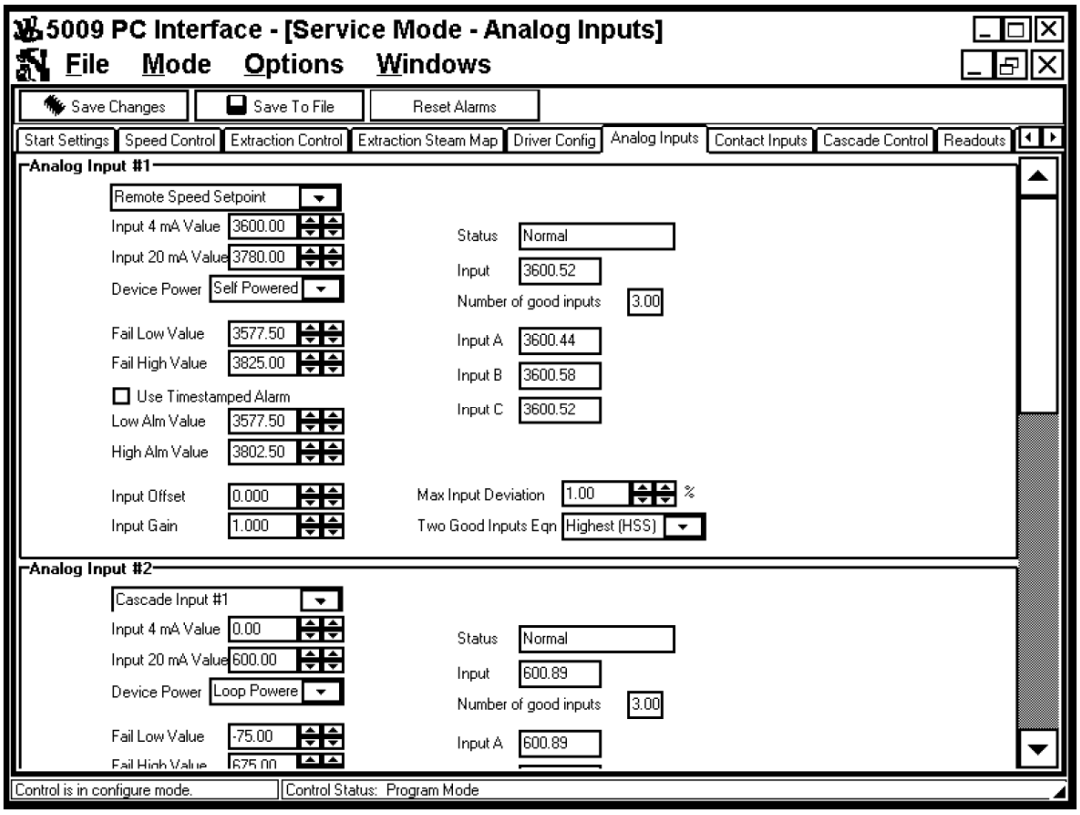
Act #2 Readout — 4 mA Value **dflt = 0.0 (-325000, 325000)**

The Act #2 driver will drive 4 mA whenever the selected output is at this entered value.

Act #2 Readout—20 mA Value **dflt = 100 (-325000, 325000)**

The Act #2 driver will drive 20 mA whenever the selected output is at this entered value.

Analog Input Folder



Analog Inputs **dflt = Not Used**

The Analog Input function is set in the Program Mode and can not be changed from the Service Mode. However, the values associated with that function can be adjusted. The arrow keys to the right of each parameter will adjust it either up or down. Each Analog Input #1 through #8 is programmed in the same way. The parameters shown are the same parameters that are listed and described in the Program Mode. The status of the Input is displayed to the right of the folder along with the actual input as seen by the 5009 control. The number of valid inputs as well as the input as seen from all three CPUs A,B, &C is displayed below it.

Fail Low Value **dflt = 12.5% of Input Range (-487500, 487500)**

If the Analog Input ever registers a value below this limit, the input will be alarmed as failed. Typically set to a value that would correspond to 2mA.

Fail High Value **dflt = 112.5% of Input Range (-487500, 487500)**

If the Analog Input ever registers a value above this limit, the input will be alarmed as failed. Typically set to a value that would correspond to 22mA.

Number of Good Inputs

Displays how many of the three legs of the Analog Input is a valid input.

Maximum Deviation **dflt = 1% of Input Range (0.1, 10%)**

This value will determine the maximum difference between the three inputs. If one input has a value that is less or greater than the voted-good value by the entered maximum deviation amount, that input will be alarmed.

Two Good Inputs Equation **dflt = HSS**

If three good inputs are available, the 5009 control will select the Median Value (the one in the middle). If only one good input is available the 5009 control will use it . In the instance where one input fails and the 5009 control has two inputs to chose from, the user must select from one of the following options:

Median	If the failed input fails low the lower value of the two If the failed input fails high the higher value of the two
Highest	Higher value of the two inputs.
Lowest	Lower value of the two input
Average	Average of the two (Input X + Input Y)/2

Use Timestamped Alarm **dflt = No**

If this option is selected, the Analog Input will timestamp a high level and a low level down to a 5 millisecond resolution. The Alarm folders and the printer output will display when the high level or the low level alarm occurred.

Low Alarm Value **dflt = 12.5% of Input Range (-487500, 487500)**

This is the value that sets the Low Alarm Level. When the input value reaches this level or below, the time is stored, up to a 5 millisecond resolution and an alarm condition is issued.

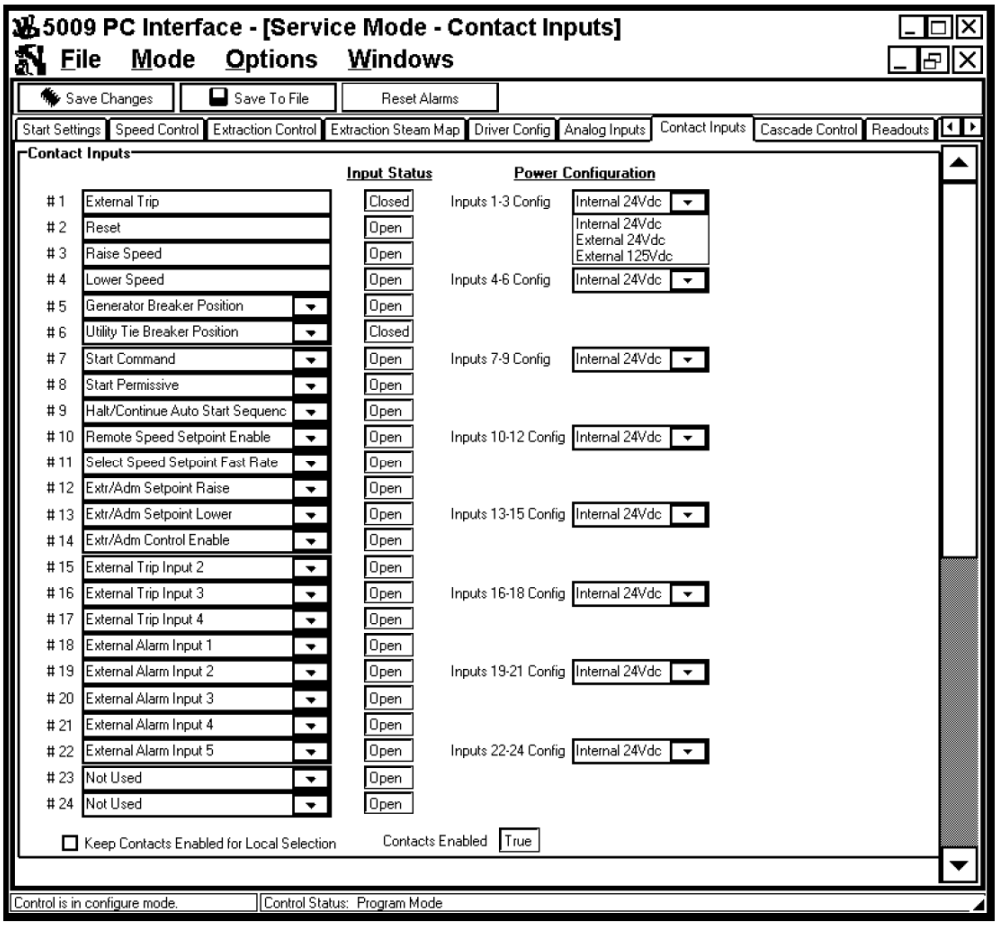
High Alarm Value **dflt = 112.5% of Input Range (-487500, 487500)**

This is the value that sets the High Alarm Level. When the input value reaches this level or above, the time is stored, up to a 5 millisecond resolution and an alarm condition is issued.

Input Offset/Input Gain **Offset dflt = 0.0 (-487500, 487500)**
Gain dflt = 1.0 (0.0, 2)

These values represent the offset and gain of the input signal. These values are used to calibrate the input signal if required.

Contact Input Folder



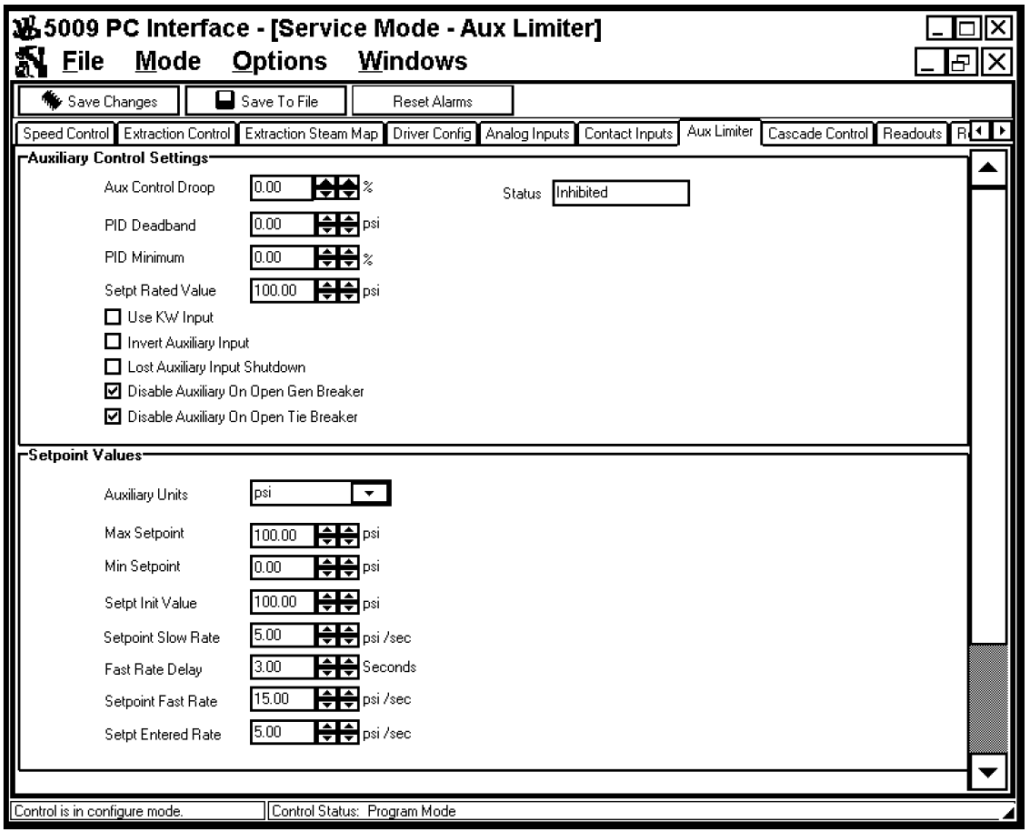
Contact Inputs

The Contact Input functions are set in the Program Mode and can not be changed from the Service Mode. See Volume 1 and the descriptions in Chapter 3 for a further explanation of functions. This folder is used mainly as an Input Status monitor function except for the following.

Keep Contacts Enabled for Local Selection **dflt = No**
This option is only visible when the Local/Remote function is configured. When selected, the contacts are always active regardless of the Local/Remote selection. When not selected, the contact inputs are disabled when the local mode is selected.

Contacts Enabled
This display box is only visible when the Local/Remote function is configured. It displays the status of the contact inputs in relationship with the Local/Remote function. If Contact Enabled is True the contact inputs are enabled.

Auxiliary Controller/Limiter Folder



Auxiliary Settings

The Auxiliary Control Settings that are configured into the 5009 control are also tunable in the Service Mode. The parameters can be modified at all times with the arrow keys to the right of each parameter, and their functions are the same as described in the Program Mode of Chapter 3. The display boxes to the right of the parameters shows the status of the turbine parameter. The difference between the Auxiliary Controller and the Auxiliary Limiter is discussed in Volume 1 and does not effect the function of the options discussed here.

PID Deadband **dflt = 0.0 (0.0, 100**
This value will determine the deadband in the Auxiliary controller. The default value is set to zero. In the event that a rapid change is necessary, but stability problems occur with such rapid changes, a deadband can be added to allow stability during normal operation, and still permit fast movement when needed.

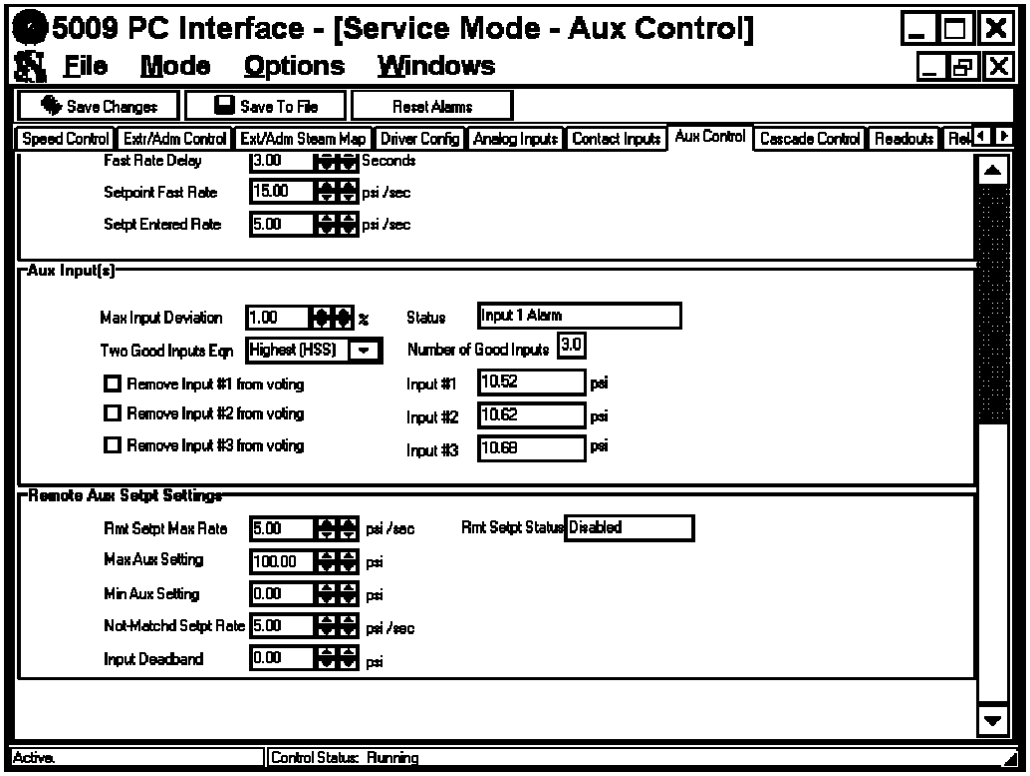
PID Minimum **dflt = 0.0 (0.0, 100)**
The Auxiliary PID can not output a lower value to the LSS than the value entered here. This setting can be used to stop the Aux PID from taking the LSS low enough to take the unit off-line or below min governor. The default setting is zero.

Setpoint Rated Value **dflt = Aux Max Setpt (-325000, 325000)**
This value is used to calculate the Auxiliary PIDs droop setting. It is defaulted to the Maximum Auxiliary Setting and it should not need to be changed. Unless the resolution of the PID or the Droop percentage need to be higher.

Fast Rate Delay **dflt = 3.0 (0.0, 100)**
This value will determine how long the Setpoint Slow Rate will have to be selected before the Setpoint Fast Rate will be engaged. It is defaulted for 3 seconds. This implies that if a Raise Auxiliary Setpoint command is continually given, the Auxiliary Setpoint will raise at the slow rate for 3 seconds and then raise at the fast rate after that.

Setpoint Fast Rate **dflt = 3 x Aux Slow Rate (0.01, 50000)**
This value will determine how fast the Auxiliary setpoint will raise or lower when the Fast Rate is initiated. This rate is defaulted to three times the Slow Rate.

Setpoint Entered Rate **dflt = Aux Slow Rate (0.01, 10000)**
This value will determine how fast the Auxiliary setpoint will raise or lower when the setpoint is entered using the Set button of the Run Mode. This rate is defaulted to the Slow Rate.



Max Aux Setting **dflt = Max Aux Setpt or Input (-325000, 325000)**
This value will determine the maximum setting the auxiliary setpoint is allowed to be moved to, by the remote input. If the Remote Input is ranged to go from 0 to 25,000 PSI by an external device, but the user wishes the PSI to be limited to 10,000—20,000 PSI, this option will allow for it. The default setting is the Max Auxiliary Setpoint or Aux Input 20 mA value; whichever is lower.

Min Aux Setting **dflt = Min Aux Setpt or Input (-325000, 325000)**
This value will determine the minimum setting the auxiliary setpoint is allowed to be moved to, by the remote input. The default setting is the Min Auxiliary Setpoint or Aux Input 4mA value; whichever is higher.

Not-Matched Rate **dflt = Aux Slow Rate (0.01, 10000)**
This value determines the rate the setpoint moves when remote is enabled and the remote input doesn't match the actual auxiliary setpoint. The default setting is the Slow Setpoint Rate.

Input Deadband **dflt = 0.0 (0.0, 100)**
This value will determine the deadband in the Remote Auxiliary Setpoint input. The default value is set to zero. In the event that a the input signal is noisy or drifts, a small deadband value can be added to allow stability during normal operation, and still permit movement on the Auxiliary Setpoint when needed.

Max Input Deviation **dflt = 1% of Input Range (-325000, 325000)**
This value will determine the maximum difference between the three inputs before an alarm is given. If one input has a value that is less or greater than the voted-good value by the entered maximum deviation amount, that input will be alarmed.

Number of Good Inputs
Displays the number of Auxiliary Inputs that the 5009 control still views as having a valid input.

Two Good Inputs Equation **dflt = HSS**
If three good inputs are available, the 5009 control will select the Median Value (the one in the middle). If only one good input is available the 5009 control will use it . In the instance where one input fails and the 5009 control has two inputs to chose from, the user must select from one of the following options:

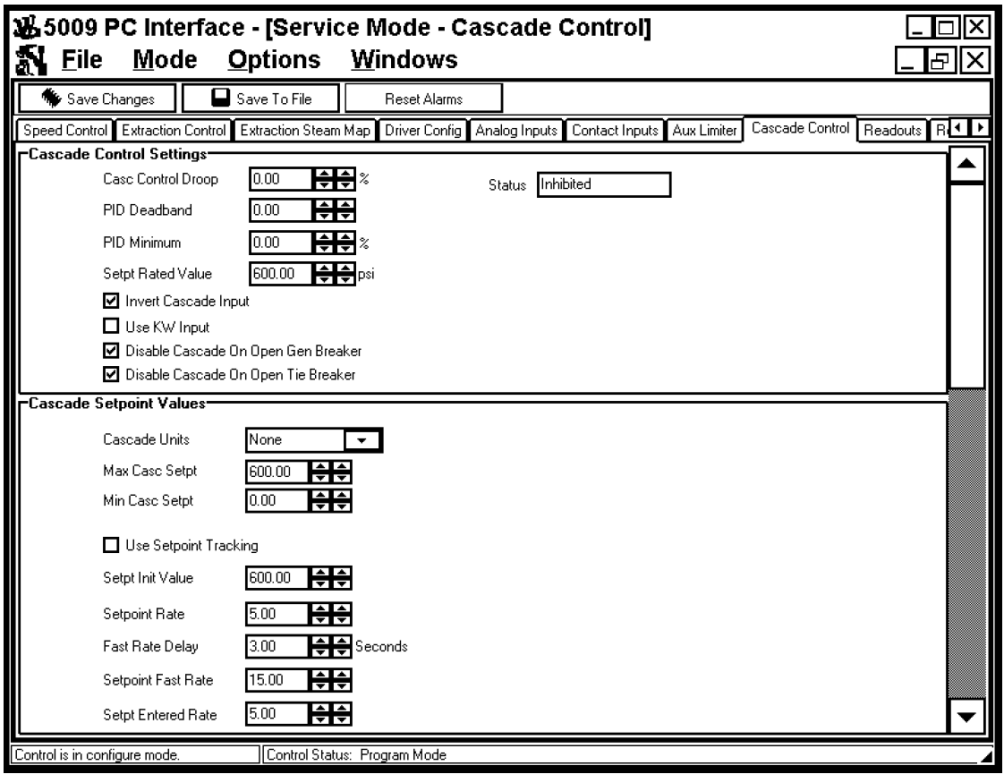
Median	If the failed input fails low the lower value of the two If the failed input fails high the higher value of the two
Highest	Higher value of the two inputs.
Lowest	Lower value of the two input
Average	Average of the two (Input X + Input Y)/2

Remove Input 'X' from Voting **dflt = No**
By clicking or selecting the check box to the left of the text, Inputs 1,2, or 3 can be removed from the input voting logic. This option allows on-line transducer calibration and maintenance, without the worry of affecting system control. If a sensor has failed or is acting inconsistent, it can be removed from the voting logic, replaced or repaired, have its calibration verified, then placed back into the input's voting logic. To place the input back into the voting logic, click the respective box again, then the "Reset Alarms" button on the screen's tool bar. Use extreme caution when performing this test on-line; removing all three output at once could cause a system trip condition.

IMPORTANT

Don't confuse the three separate inputs with the three separate CPUs. The CPUs read each input and vote them transparent to the application. By removing input #X you are removing Auxiliary Input #X. You are not eliminating one of the CPUs.

Cascade Controller Folder



Cascade Settings

The Cascade Control Settings that are configured into the control are also tunable in the Service Mode. The parameters can be modified at all times with the arrow keys to the right of each parameter, and their functions are the same as described in the Program Mode of Chapter 3. The display boxes to the right of the parameters shows the status of the turbine parameter.

PID Deadband **dflt = 0.0 (0.0, 100)**
This value will determine the deadband in the Cascade controller. The default value is set to zero. In the event that a rapid change is necessary, but stability problems occur with such rapid changes, a deadband can be added to allow stability during normal operation, and still permit fast movement when needed.

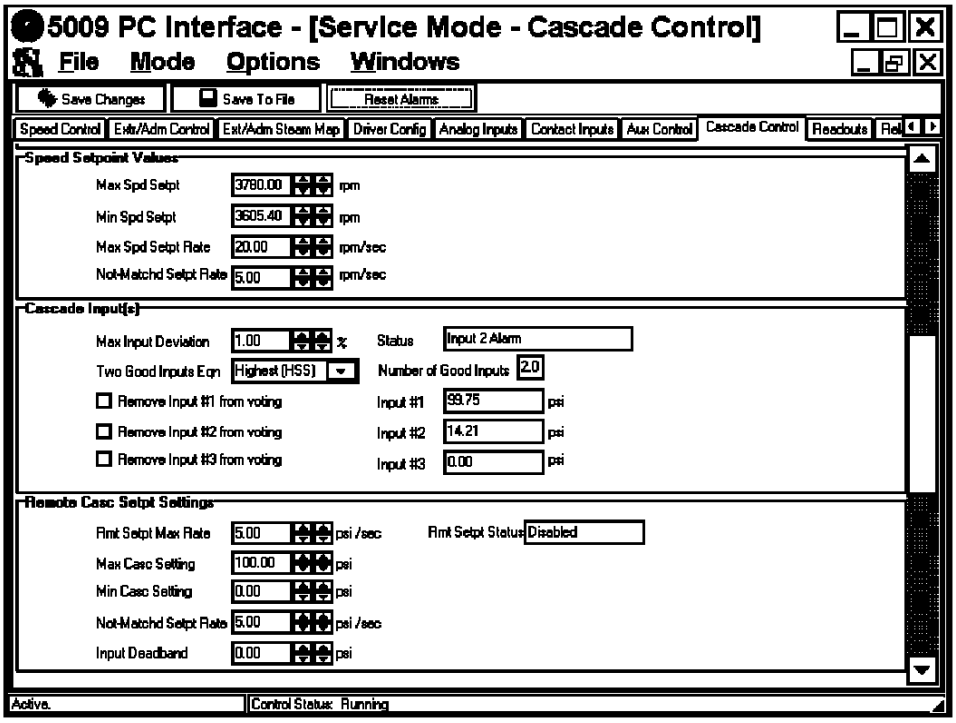
PID Minimum **dflt = 0.0 (0.0, 100)**
The Cascade PID can not output a lower value to the LSS than the value entered here. This can be used to stop the Cascade PID from taking the LSS low enough to take the unit off-line or below min governor. The default setting is zero.

Setpoint Rated Value **dflt = Casc Max Setpt (-325000, 325000)**
This value is used to calculate the Cascade PIDs droop setting. It is defaulted to the Maximum Cascade Setting and should not need to be changed. Unless the resolution of the PID settings or the Droop percentage need to be a higher.

Fast Rate Delay **dflt = 3.0 (0.0, 100)**
This value will determine how long the Setpoint Slow Rate will have to be selected before the Setpoint Fast Rate will be engaged. It is defaulted for 3 seconds. This implies that if a Raise Cascade Setpoint command is continually given, the Cascade Setpoint will raise at the slow rate for 3 seconds and then raise at the fast rate after that.

Setpoint Fast Rate **dflt = 3 x Casc Slow Rate (0.01, 50000)**
This value will determine how fast the Cascade setpoint will raise or lower when the Fast Rate is initiated. This rate is defaulted to three times the Slow Rate.

Setpoint Entered Rate **dflt = Casc Slow Rate (0.01, 50000)**
This value will determine how fast the Cascade setpoint will raise or lower when the setpoint is entered using the Set button of the Run Mode. This rate is defaulted to the Slow Rate.



Not-Matched Setpoint Rate **dflt = Speed Slow Rate (0.01, 10000)**
This value determines the rate the setpoint moves when cascade is enabled and the cascade input doesn't match the actual speed setpoint. The default setting is the Slow Setpoint Rate.

Max Casc Setting **dflt = Max Casc Setpt or Input 20mA (-325000, 325000)**
This value will determine the maximum setting the cascade setpoint is allowed to be moved to, by the remote input. If the Remote Input is ranged to go from 0 to 25,000 PSI by an external device, but the user desires the pressure to be limited to 10,000—20,000 PSI, this option will allow for it. The default setting is the Max Cascade Setpoint or analog Input 20 mA value, whichever is lower.

Min Casc Setting **dflt = Min Casc Setpt or Input 4mA (-325000, 325000)**
This value will determine the minimum setting the Cascade setpoint is allowed to be moved to, by the remote input. The default setting is the Min Cascade Setpoint or Analog Input 4 mA value, whichever is higher.

Remote Not-Matched Setpoint Rate **dflt = Casc Slow rate (0.01, 10000)**
This value determines the rate the setpoint moves when remote is enabled and the remote input doesn't match the actual cascade setpoint. The default setting is the Slow Setpoint Rate.

Input Deadband **dflt = 0.0 (0.0, 1000)**

This value will determine the deadband in the Remote Cascade Setpoint input. The default value is set to zero. In the event that a the input signal is noisy or drifts, a small deadband value can be added to allow stability during normal operation, and still permit movement on the Cascade Setpoint when needed.

Max Input Deviation **dflt = 1% of Input Range (-325000, 325000)**

This value will determine the maximum difference between the three inputs before an alarm is given. If one input has a value that is less or greater than the voted-good value by the entered maximum deviation amount, that input will be alarmed.

Number of Good Inputs

Displays the number of Cascade Inputs that the 5009 control still views as having a valid input.

Two Good Inputs Equation **dflt = HSS**

If three good inputs are available, the 5009 control will select the Median Value (the one in the middle). If only one good input is available the 5009 control will use it . In the instance where one input fails and the 5009 control has two inputs to chose from, the user must select from one of the following options:

Median	If the failed input fails low the lower value of the two If the failed input fails high the higher value of the two
Highest	Higher value of the two inputs.
Lowest	Lower value of the two input
Average	Average of the two (Input X + Input Y)/2

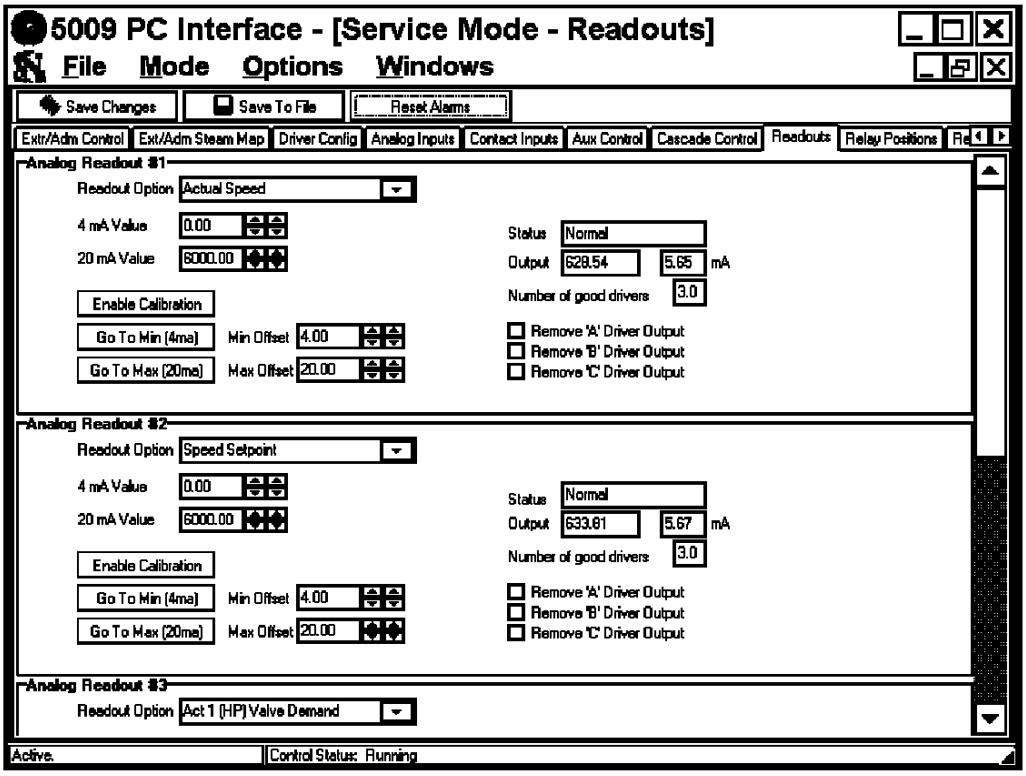
Remove Input 'X' from Voting **dflt = No**

By clicking or selecting the check box to the left of the text, Inputs 1,2, or 3 can be removed from the input voting logic. This option, allows on-line transducer calibration and maintenance, without the worry of affecting system control. If a sensor has failed or is acting inconsistent, it can be removed from the voting logic, replaced or repaired, have its calibration verified, then placed back into the input's voting logic. To place the input back into the voting logic, click the respective box again, then the "Reset Alarms" button on the screen's tool bar. Use extreme caution when performing this test on-line; removing all three output at once could cause a system trip condition.

IMPORTANT

Don't confuse the three separate inputs with the three separate CPUs. The CPUs read each input and vote them transparent to the application. By removing input #X you are removing Cascade Input #X. You are not eliminating one of the CPUs.

Analog Readout Folder



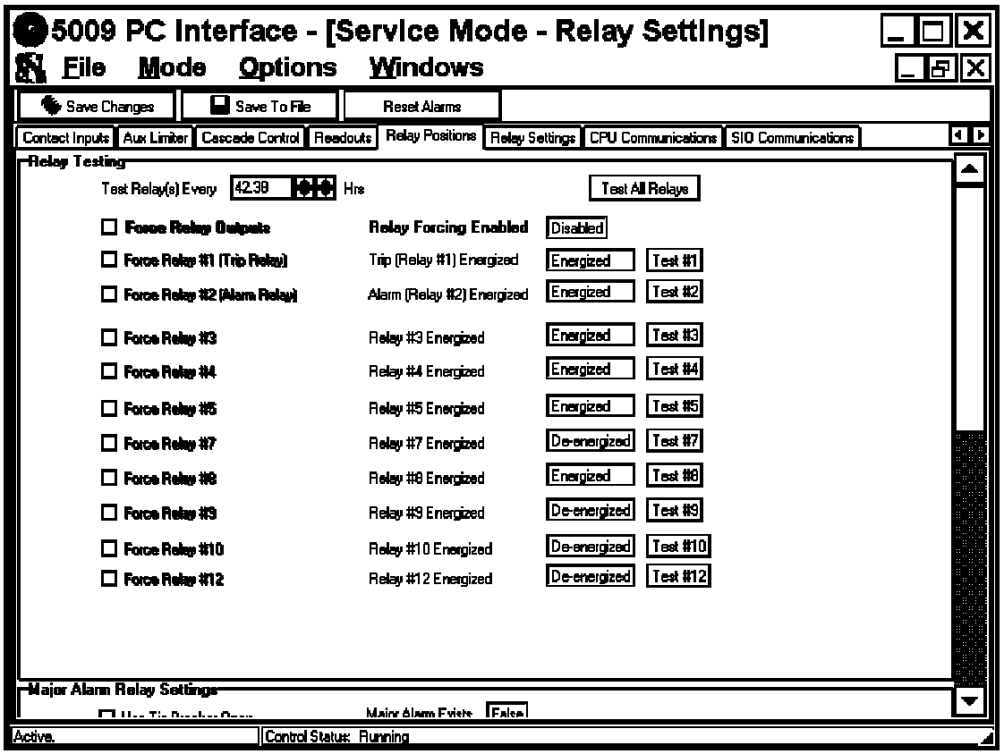
Analog Readouts **dflt = 4 (2.0, 12) or dflt = 20 (12, 24.9)**

Analog Readout functions can be set in the Program or Service Modes. The values associated with a function can also be adjusted. The arrow keys to the right of each parameter will adjust it either up or down. Each Analog Readout #1 through #4 is programmed and calibrated in the same way. The parameters shown are the same parameters that are listed and described in the Program Mode, Chapter 3. The status of the Output is displayed to the right of the folder along with the actual output as seen by the 5009 control in both units and in milliamps. The number of valid output “legs” as well as the value from all three CPUs A,B, &C is displayed below it.

Calibration

The calibration of the Analog Readout is similar to the calibration of the Actuator drivers. The output is put in calibration mode by clicking on the Enable Calibration button. The status display box will show In Calib Mode as shown above and the Enable Calibration button will change to the Disable Calibration button The Go To buttons can then be used to force the driver to output the minimum value and the maximum value. Simply adjust the Min Offset with the arrows to the right of the Min Offset display box for the Minimum current output desired when the readout has been forced to Min, and adjust the Max Offset for the Maximum current desired when the readout has been forced to Max. The defaults are 4mA and 20 mA and they can be adjusted between 0mA and 24mA.

Relay Position Folder

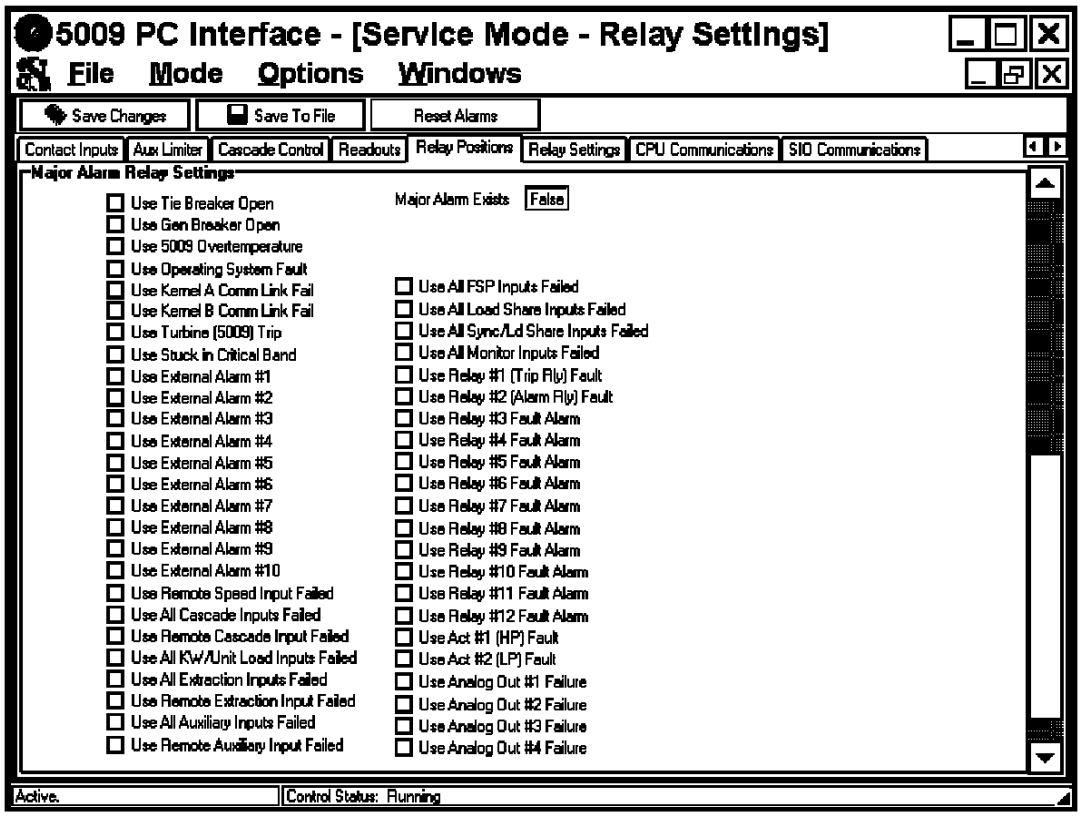


Relay Testing

The Relay Position folder is not available in the Program Mode. This folder allows the user to test the FT Relay assemblies in the 5009 control. It also gives access to the tunable parameter of Test Relay(s) Every X Hours found in the Program Mode of Chapter 3. The status display box to the right of each programmed relay will display the Energized/De-energized status of the relay assembly.

There are two types of tests available for every relay assembly. The Force Relay # test can be preformed only when the 5009 control has been shutdown and the turbine speed is less than 1000RPM. With these permissives true, select the Force Relay Outputs function. The Relay Forcing Enabled display box will show Enabled. When the check box to the right of the Force Relay # text is selected, the Relay selected will be forced to an energized state.

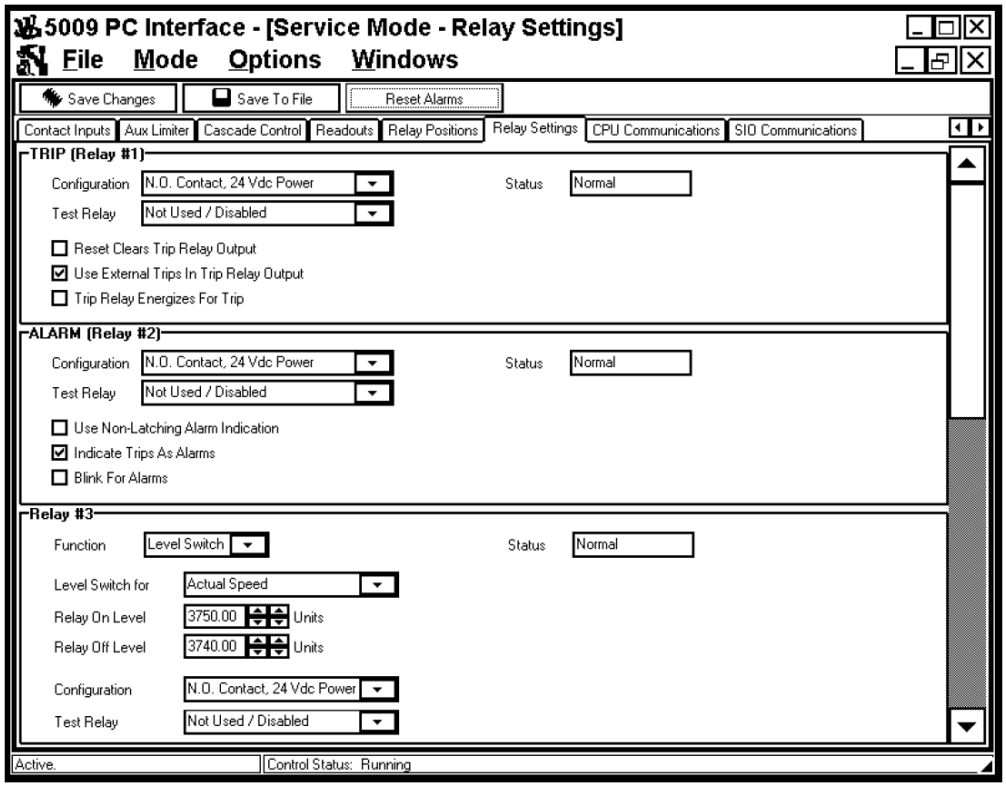
The second test will perform a Latent Fault detection test on each relay in the 6 relay FT assembly. By selecting the Test # button, the user will cause the Relay to bypass the Test Relay(s) Every timer and perform the LFD test immediately on that particular relay. For a detailed description of the relay assemblies, see Volume 1. When performing a Relay Test the individual relay timer is reset and will wait the entered period before performing another test.



Major Alarm Relay Settings **All selection dflts = No**

The 5009 control has a Relay Output option called the Major Alarm Relay. This relay is described in Volume 1 and can be used to externally inform any device of the existence of a Major Alarm inside the control. This folder is used to select which alarm conditions will initiate the Major Alarm. By clicking or selecting the check box to the left of the text in the above folder, that option is added to the list of conditions that will energize the Major Alarm Relay. Whichever Relay Output is configured for the Major Alarm Relay will then be energized. If this relay is fed back into the 5009 control as a trip contact input, this function can be used to shutdown the 5009 control for any of the above conditions.

Relays Settings Folder



Relays

The relay configurations and functions are set in the Program Mode and can not be changed from the Service Mode. However, the values associated with their function can be adjusted. The arrow keys to the right of each parameter will adjust it either up or down. The parameters shown are the same parameters that are listed and described in the Program Mode, Chapter 3 and in Volume 1. The status of the Relay is displayed to the right of the folder for monitoring purposes.

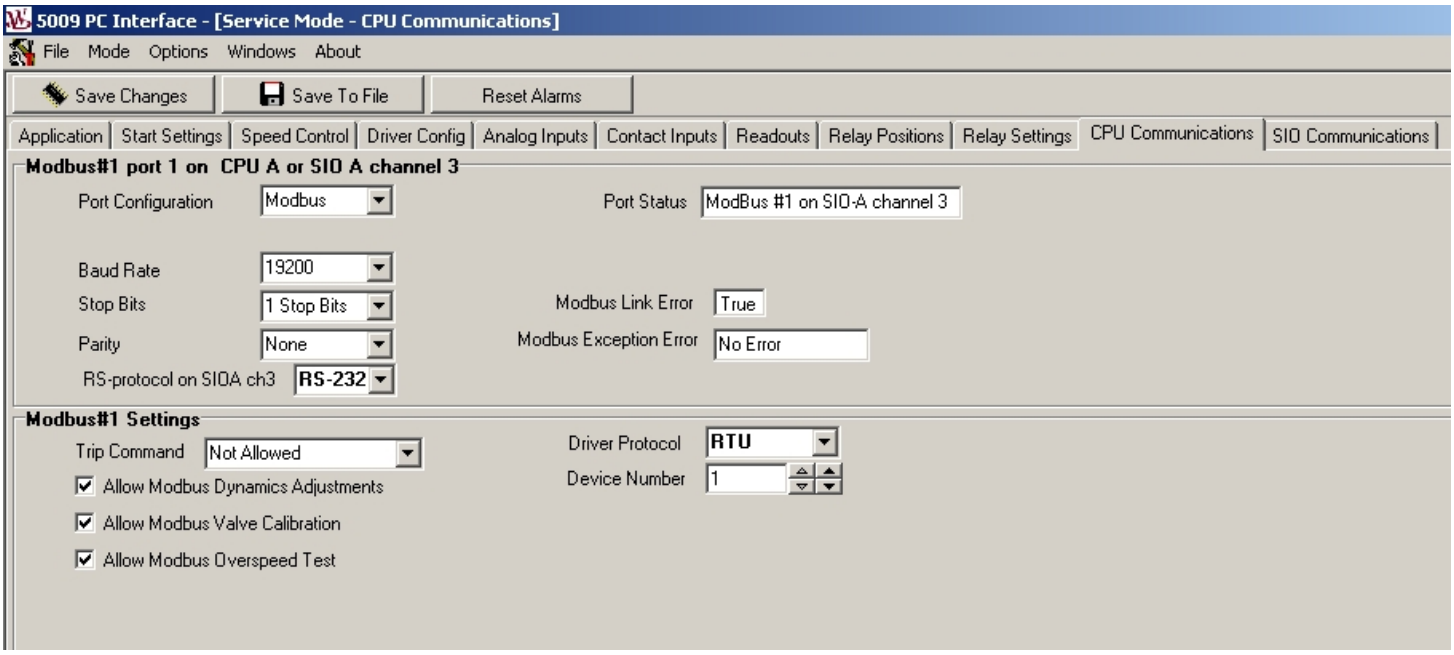
Indicate Trip as Alarms **dflt = Yes**
This option when selected will result in the Alarm relay energizing upon any Trip condition.

Blink For Alarms **dflt = No**
This option when selected will result in the Alarm relay toggling on and off repeatedly when an alarm condition has occurred. With this configuration if a reset command is given and the alarm condition still exist, the relay will stop toggling and stay energized.

IMPORTANT

The jumpers on the relay boxes must be set to agree with the selections made above.

CPU Communications Folder



Port CPU Settings

The port settings for each of the three CPU communication ports are set in the Program Mode and can be changed or adjusted from the Service Mode. The arrow keys to the right of each parameter will adjust it either up or down. The pull down boxes can be used to change the options for each function. The parameters shown are the same parameters that are listed and described in the Program Mode, Chapter 3 and in Volume 1. The status of the communication port and its function is displayed in the Port Configuration display box.

Port 1, 2 (CPU) Modbus Settings

Trip Command **dflt = Not Used**

The Trip Command is the option that determines how the Modbus Commands can trip the 5009 control. The user must select one of the three options:

Not Used	Cannot initiate a trip from a Modbus port.
One-Step	Will initiate a trip after receiving the Modbus port trip command.
Two-Step	Will initiate a trip after receiving the Modbus port confirm trip command.

Modbus Link Error

This gauge displays if the Modbus port has sensed a link error. Once the error has been corrected, the display box will show No Error. The alarm will remain until reset by the reset alarms command.

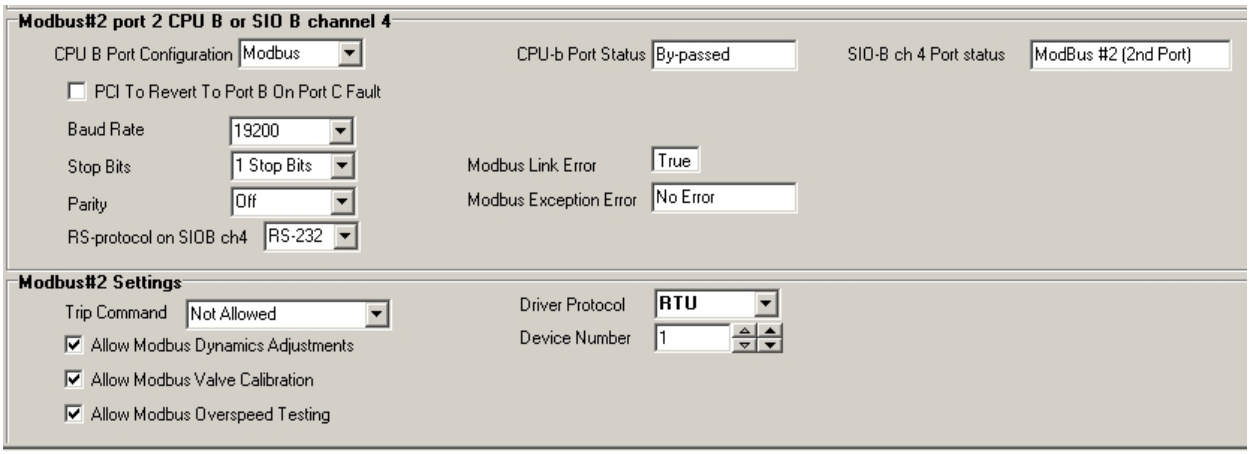
Modbus Exception Error

This gauge displays if the Modbus port has sensed an exception error. The Exception Error display box will display the type of error received. Once the error has been corrected, the display box will show No Error. The alarm will remain until reset by the reset alarms command.

Allow Modbus Dynamics Adjustments **dflt = Yes**
If selected, PID dynamic adjustments can be performed via the Modbus port. See Volume 1 for a Modbus description.

Allow Modbus Valve Calibration **dflt = Yes**
If selected, valve calibration adjustments can be performed via the Modbus port. See Volume 1 for a Modbus description.

Allow Modbus Overspeed Test **dflt = Yes**
If selected, overspeed tests can be performed via the Modbus port. See Volume1 for a Modbus description and a description of the Overspeed Test procedures.

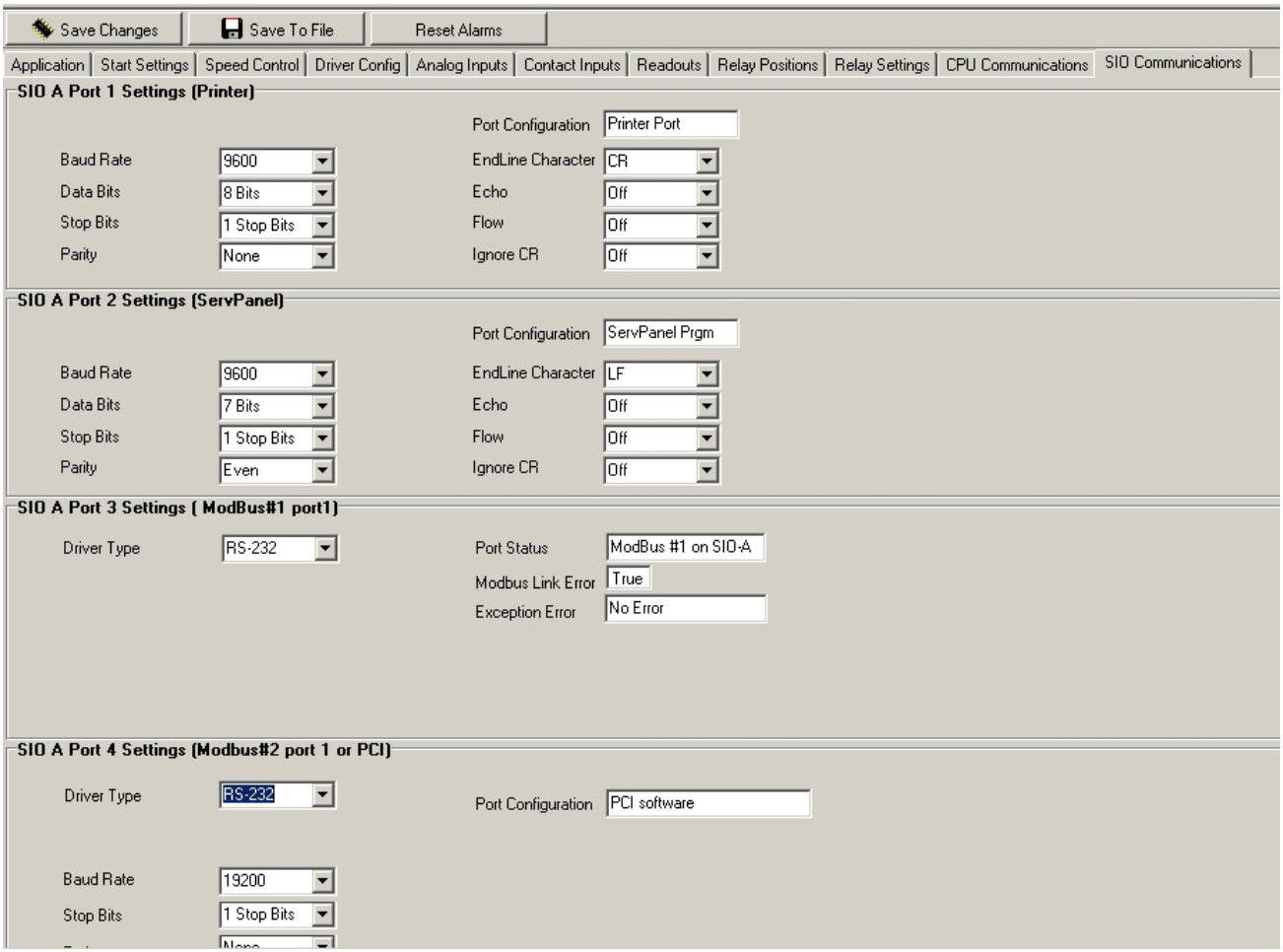


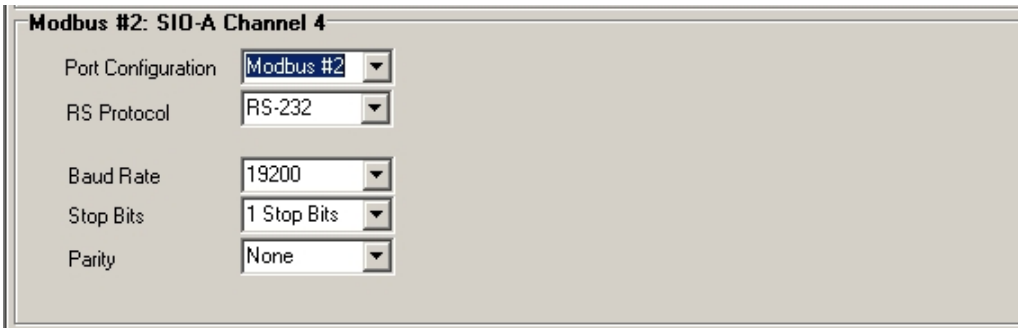
Modbus Scale Factors **dflt = 100 (0.1, 1.0,10, 100)**
The 5009 control uses scale factors for the Modbus ports. These scale factors are fully described in Volume 1 of this manual. The pull down menus are operable only in the Service Mode.

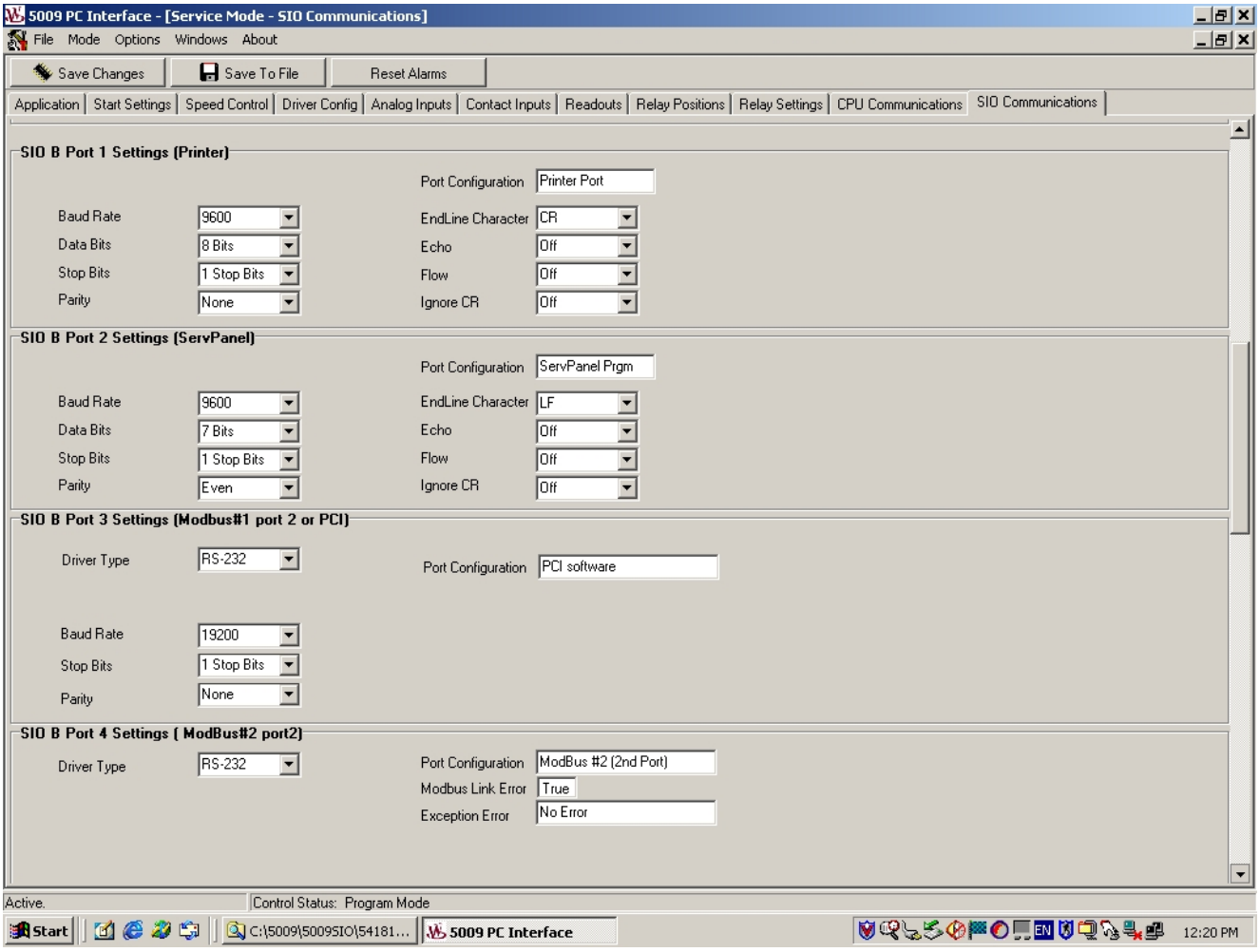
SIO Communications Folder

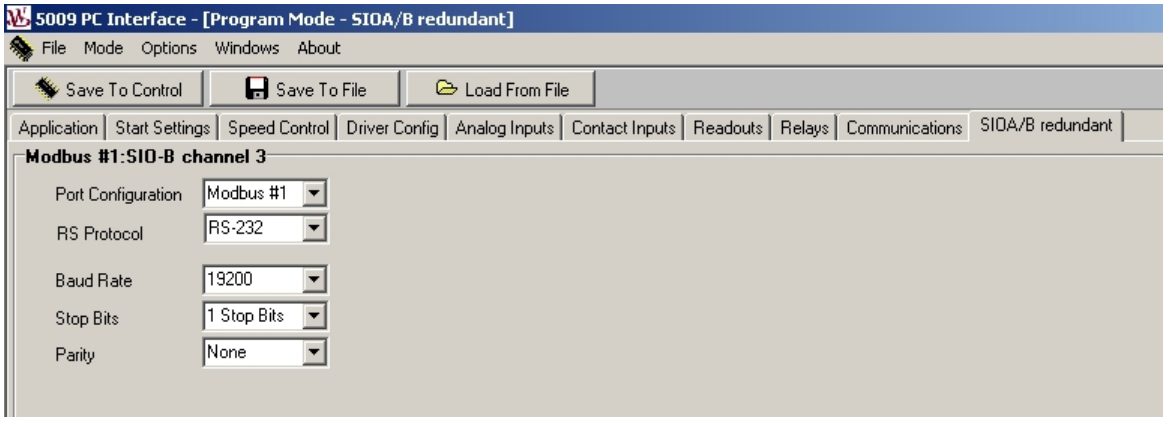
SIO Port Settings
Optionally Serial Input/Output (SIO) modules may be provided in the A and or B kernel sections (Slot A5) to increase communication redundancy and or the number of available communication ports. All SIO module ports are dedicated to a specific communication function. Refer to the list below to determine port functionality. Refer to Volume 1 of this manual for communications redundancy logic.

Port Configurations
- SIO Port 1 (RS-232) functions as an Alarm/Trip Printer driver port.
- SIO Port 2 (RS-232) functions as an interface port to Woodward's ServPanel program.
- SIO Port 3 (RS-232, RS-422, RS-485) functions as a redundant Modbus communications port.
- SIO Port 4 (RS-232, RS-422, RS-485) functions as a redundant DDE communications port (PCI).


Save Changes
Save To File
Reset Alarms
Application
Start Settings
Speed Control
Driver Config
Analog Inputs
Contact Inputs
Readouts
Relay Positions
Relay Settings
CPU Communications
SIO Communications
SIO A Port 1 Settings (Printer)
Port Configuration
Printer Port
Baud Rate
9600
EndLine Character
CR
Data Bits
8 Bits
Echo
Off
Stop Bits
1 Stop Bits
Flow
Off
Parity
None
Ignore CR
Off
SIO A Port 2 Settings (ServPanel)
Port Configuration
ServPanel Prgm
Baud Rate
9600
EndLine Character
LF
Data Bits
7 Bits
Echo
Off
Stop Bits
1 Stop Bits
Flow
Off
Parity
Even
Ignore CR
Off
SIO A Port 3 Settings (ModBus#1 port1)
Driver Type
RS-232
Port Status
ModBus #1 on SIO-A
Modbus Link Error
True
Exception Error
No Error
SIO A Port 4 Settings (Modbus#2 port 1 or PCI)
Driver Type
RS-232
Port Configuration
PCI software
Baud Rate
19200
Stop Bits
1 Stop Bits


Modbus #2: SIO-A Channel 4
Port Configuration
Modbus #2
RS Protocol
RS-232
Baud Rate
19200
Stop Bits
1 Stop Bits
Parity
None


5009 PC Interface - [Service Mode - SIO Communications]
File Mode Options Windows About
Save Changes
Save To File
Reset Alarms
Application
Start Settings
Speed Control
Driver Config
Analog Inputs
Contact Inputs
Readouts
Relay Positions
Relay Settings
CPU Communications
SIO Communications
SIO B Port 1 Settings (Printer)
Port Configuration
Printer Port
Baud Rate
9600
Data Bits
8 Bits
Stop Bits
1 Stop Bits
Parity
None
EndLine Character
CR
Echo
Off
Flow
Off
Ignore CR
Off
SIO B Port 2 Settings (ServPanel)
Port Configuration
ServPanel Prgm
Baud Rate
9600
Data Bits
7 Bits
Stop Bits
1 Stop Bits
Parity
Even
EndLine Character
LF
Echo
Off
Flow
Off
Ignore CR
Off
SIO B Port 3 Settings (Modbus#1 port 2 or PCI)
Driver Type
RS-232
Port Configuration
PCI software
Baud Rate
19200
Stop Bits
1 Stop Bits
Parity
None
SIO B Port 4 Settings (ModBus#2 port2)
Driver Type
RS-232
Port Configuration
ModBus #2 (2nd Port)
Modbus Link Error
True
Exception Error
No Error
Active.
Control Status: Program Mode
Start
C:\5009\5009SIO\54181...
5009 PC Interface
12:20 PM


5009 PC Interface - [Program Mode - SIOA/B redundant]
File Mode Options Windows About
Save To Control
Save To File
Load From File
Application
Start Settings
Speed Control
Driver Config
Analog Inputs
Contact Inputs
Readouts
Relays
Communications
SIOA/B redundant
Modbus #1:SIO-B channel 3
Port Configuration
Modbus #1
RS Protocol
RS-232
Baud Rate
19200
Stop Bits
1 Stop Bits
Parity
None

PCI Troubleshooting Guide

This guide is intended to help users troubleshoot typical PCI related problems, and give guidance in correcting them.

TAPI Error

If when attempting to initially open the Servlink program, a TAPI error is received, delete and re-install the computer's modem drivers, then try opening the Servlink program again. The Servlink program uses one of the computer's modem ".dll" library files which is loaded with the computer's modem drivers. A TAPI Error may be experienced, if when installing Windows on the respective computer, all modem drivers were not completely installed.

Access Violation Error

If an Access Violation Error is received during operation, select the message box's "OK" button to continue operation. If the error persists, close and re-open the PCI program. This error was detected and driven by Windows, and is the result of the PCI program trying to access a Window's routine at an incorrect time. This type of error is typically the result of the computer's resources being over utilized (to many programs open at once, for the amount of RAM available). To reduce or stop this type of error, close all other computer programs.

Chapter 6. Alarms/Trips

General

The 5009 Control System monitors all alarms and trips sends them to the PC Interface program and Modbus. This chapter includes a list of all alarms and shutdowns and possible causes of the alarm/trip. A Time Stamp resolution is given for each alarm/trip. When the alarm/trip is sent to the PC Interface program and to the Modbus ports, the time the alarm/trip occurred is sent with it (up to the resolution shown).

Trips

External Trip Input
Explanation—External Trip contact input was opened.
Time Stamp—1 ms resolution.

External Trip (2-10)
Explanation—External Trip (2-10) contact input was opened and the Fault light is off.
Time Stamp—1 ms resolution.

PC Program Trip
Explanation—Emergency Shutdown was selected from the PC programmer.
Time Stamp—10 ms resolution.

Kernel A (Link #1) Trip
Explanation—Modbus #1 communication link trip was commanded.
Time Stamp—10 ms resolution.

Kernel C (Link #2) Trip
Explanation—Modbus #2 communication link trip was commanded.
Time Stamp—10 ms resolution.

Overspeed Trip
Explanation—Turbine overspeed was sensed.
Time Stamp—10 ms resolution.

All Speed Probes Failed
Explanation—Loss of all speed probes was sensed.
Time Stamp—10 ms resolution.

All Analog I/O Mods Failed
Explanation—Loss of all Analog I/O Modules was detected.
Time Stamp—10 ms resolution.

All Discrete I/O Mods Failed
Explanation—Loss of all Discrete I/O Modules was detected.
Time Stamp—10 ms resolution.

Act #1 (HP) Fault
Explanation—All Actuator #1 outputs failed.(open circuit detected)
Time Stamp—10 ms resolution.

Act #2 (LP) Fault
Explanation—All Actuator #2 outputs failed.(open circuit detected)
Time Stamp—10 ms resolution.

Aux Input Failed
Explanation—All Auxiliary analog inputs failed.
Time Stamp—10 ms resolution.

Extraction Input Failed
Explanation—All Extraction analog inputs failed.
Time Stamp—10 ms resolution.

Tie Breaker Opened
Explanation—Utility tie breaker was opened after it was closed.
Time Stamp—1 ms resolution.

Generator Breaker Opened
Explanation—Generator breaker was opened after it was closed.
Time Stamp—1 ms resolution.

Power Up Trip
Explanation—Control lost power and CPU was reset or the Program mode was exited.
Time Stamp—10 ms resolution.

Controlled Shutdown Complete
Explanation—Controlled shutdown was performed and completed.
Time Stamp—10 ms resolution.

Configuration Error
Explanation—Configuration Error was detected.
Time Stamp—10 ms resolution.

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.
Time Stamp—40 ms resolution.

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.
Time Stamp—40 ms resolution.

Alarm—Kernel x Fault
Explanation—Kernel x CPU fault. Verify that the CPU is inserted and reset.
Time Stamp—40 ms resolution.

Alarm—Kernel x Overtemperature Alarm
Explanation—Kernel overtemperature detected x (A, B, C).
Time Stamp—40 ms resolution.

Alarm—Power Supply #x Fault
Explanation—Power supply #x (1,2) fault detected. Check input and output voltages of the supply.
Time Stamp—40 ms resolution.

Alarm—Operating System Fault
Explanation—Operating system alarm detected.
Time Stamp—40 ms resolution.

Application Alarms

Alarm—Start Perm Not Closed
Explanation—Start was selected while the Start Permissible contact input was not closed.
Time Stamp—40 ms resolution.

Alarm—Kernel x Comm Link Failed
Explanation—Kernel x (A, B, C) communications link was detected as failed.
Time Stamp—40 ms resolution.

Alarm—Turbine Trip
Explanation—Turbine has tripped.
Time Stamp—40 ms resolution.

Alarm—Overspeed
Explanation—Turbine speed is above trip level.
Time Stamp—40 ms resolution.

Alarm—Stuck in Critical Band
Explanation—Turbine speed was stuck or forced into a critical band too long.
Time Stamp—40 ms resolution.

Alarm—Tie Breaker Opened
Explanation—Utility Tie Breaker was opened after it was closed.
Time Stamp—1 ms resolution.

Alarm—Gen Breaker Opened
Explanation—Generator Breaker was opened after it was closed.
Time Stamp—1 ms resolution.

Alarm—Tie Breaker Open / No Casc
Explanation—Utility Tie Breaker was opened when Cascade was active.
Time Stamp—40 ms resolution.

Alarm—Gen Breaker Open / No Casc
Explanation—Generator Breaker was opened when Cascade was active.
Time Stamp—40 ms resolution.

Alarm—Tie Breaker Open / No Remote
Explanation—Utility Tie Breaker was opened when Remote Spd Setpt was active.
Time Stamp—40 ms resolution.

Alarm—Gen Breaker Open / No Remote
Explanation—Generator Breaker was opened when Remote Spd Setpt was active.
Time Stamp—40 ms resolution.

Alarm—Tie Breaker Open / No Aux
Explanation—Utility Tie Breaker was opened when Auxiliary was active.
Time Stamp—40 ms resolution.

Alarm—Gen Breaker Open / No Aux
Explanation—Generator Breaker was opened when Auxiliary was active.
Time Stamp—40 ms resolution.

Alarm—Tie Breaker Open / No Extr
Explanation—Utility Tie Breaker was opened when Extraction control was active.
Time Stamp—40 ms resolution.

Alarm—Gen Breaker Open / No Extr
Explanation—Generator Breaker was opened when Extraction control was active.
Time Stamp—40 ms resolution.

Alarm—External Alarm #x
Explanation—External Alarm #x (2-10) contact input was opened.
Time Stamp—1 ms resolution.

Alarm—Spd Setpt Entrd in Critical
Explanation—Speed setpoint was entered/set in a critical avoidance band.
Time Stamp—40 ms resolution.

Alarm—Configuration Error
Explanation—Invalid configuration.
Time Stamp—40 ms resolution.

Speed Probe Alarms

Alarm—Spd Probe #x Input Fld
Explanation—All Speed probe #x (1-4) inputs failed.
Time Stamp—5 ms resolution.

Alarm—Spd Probe #1 Deviation Alm
Explanation—Speed probe input is out of tolerance with other speed probes.
Time Stamp—40 ms resolution.

Alarm—Spd Probe #1 Ospd Alm
Explanation—Speed probe input is above overspeed alarm setting.
Time Stamp—5 ms resolution.

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).
Time Stamp—40 ms resolution.

Analog Input Alarm

Alarm—Anlg Input #x Kernel y Fault
Explanation—Input failure or input is out of tolerance from analog input #x (1-8) in kernel y (A,B,C).
Time Stamp—5 ms resolution.
Discrete Input Alarm

Alarm—Discrete In #x Kernel y Fault
Explanation—Input mismatch from other kernels from input #x (1-24) in kernel y (A,B,C).
Time Stamp—40 ms resolution.

Cascade Alarms

Alarm—All Cascade Inputs Failed
Explanation—All Cascade analog inputs failed.
Time Stamp—5 ms resolution.

Alarm—Casc Input #x Failed
Explanation—Cascade input #x (1,2,3) failure detected.
Time Stamp—5 ms resolution.

Alarm—Casc Input #x Deviation Alm
Explanation—Cascade input #x (1,2,3) is out of tolerance, but not failed.
Time Stamp—40 ms resolution.

Alarm—Casc Input #x High Alm
Explanation—Cascade input #x (1,2,3) above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Casc Input #x Low Alarm
Explanation—Cascade input #x (1,2,3) below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Rmt Casc Setpt Input Failed
Explanation—Remote Cascade Setpoint analog input failed.
Time Stamp—5 ms resolution.

Alarm—Rmt Casc Setpt Input High Alm
Explanation—Remote Cascade Setpoint input above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Rmt Casc Setpt Input Low Alarm
Explanation—Remote Cascade Setpoint input below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Extraction Alarms

Alarm—All Extraction Inputs Failed
Explanation—All Extraction analog inputs failed.
Time Stamp—5 ms resolution.

Alarm—Extraction Input #x Failed
Explanation—Extraction input #x (1,2,3) failure detected.
Time Stamp—5 ms resolution.

Alarm—Extraction Input #x Deviation Alm
Explanation—Extraction input #x (1,2,3) is out of tolerance, but not failed.
Time Stamp—40 ms resolution.

Alarm—Extraction Input #x High Alm
Explanation—Extraction input #x (1,2,3) above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Extraction Input #x Low Alarm
Explanation—Extraction input #x (1,2,3) below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Rmt Extr Setpt Input Failed
Explanation—Remote Extraction Setpoint analog input failed.
Time Stamp—5 ms resolution.

Alarm—Rmt Extr Setpt Input High Alm
Explanation—Remote Extraction Setpoint input above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Rmt Extr Setpt Input Low Alarm
Explanation—Remote Extraction Setpoint input below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Auxiliary Alarms

Alarm—All Aux Inputs Failed
Explanation—All Aux analog inputs failed.
Time Stamp—5 ms resolution.

Alarm—Aux Input #x Failed
Explanation—Aux input #x (1,2,3) failure detected.
Time Stamp—5 ms resolution.

Alarm—Aux Input #x Deviation Alm
Explanation—Aux input #x (1,2,3) is out of tolerance, but not failed.
Time Stamp—40 ms resolution.

Alarm—Aux Input #x High Alm
Explanation—Aux input #x (1,2,3) above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Aux Input #x Low Alarm
Explanation—Aux input #x (1,2,3) below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Rmt Aux Setpt Input Failed
Explanation—Remote Auxiliary Setpoint analog input failed.
Time Stamp—5 ms resolution.

Alarm—Rmt Aux Setpt Input High Al
Explanation—Remote Auxiliary Setpoint input above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Rmt Aux Setpt Input Low Alarm
Explanation—Remote Auxiliary Setpoint input below the low alarm setpoint level.
Time Stamp—5 ms resolution.

KW Alarms

Alarm—All KW Inputs Failed
Explanation—All KW analog inputs failed.
Time Stamp—5 ms resolution.

Alarm—KW Input #x Failed
Explanation—KW input #x (1,2,3) failure detected.
Time Stamp—5 ms resolution.

Alarm—KW Input #x Deviation Alm
Explanation—KW input #x (1,2,3) is out of tolerance, but not failed.
Time Stamp—40 ms resolution.

Alarm—KW Input #x High Alm
Explanation—KW input #x (1,2,3) above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—KW Input #x Low Alarm
Explanation—KW input #x (1,2,3)below the low alarm setpoint level.
Time Stamp—5 ms resolution.

FSP (First Stage Pressure) Alarms

Alarm—FSP Input Failed
Explanation—FSP analog input failed.
Time Stamp—5 ms resolution.

Alarm—FSP Input High Alm
Explanation—FSP input above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—FSP Input Low Alarm
Explanation—FSP input below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Speed Setpoint Alarms

Alarm—Rmt Spd Setpt Input Failed
Explanation—Remote Speed Setpoint input failure detected.
Time Stamp—5 ms resolution.

Alarm—Rmt Spd Setpt Input High Alm
Explanation—Remote Speed Setpoint input above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Rmt Spd Setpt Input Low Alarm
Explanation—Remote Speed Setpoint input below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Load Share Alarms

Alarm—All Load Share Setpt Inputs Failed
Explanation—All Load Share Setpoint analog inputs failed.
Time Stamp—5 ms resolution.

Alarm—Load Share Setpt Input #x Failed
Explanation—Load Share Setpoint input #x (1,2,3) failure detected.
Time Stamp—5 ms resolution.

Alarm—Load Share Setpt Input #x Deviation Alm
Explanation—Load Share Setpoint input #x (1,2,3) is out of tolerance, but not failed.
Time Stamp—40 ms resolution.

Alarm—Load Share Setpt Input #x High Alm
Explanation—Load Share Setpoint input #x (1,2,3) above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Load Share Setpt Input #x Low Alarm
Explanation—Load Share Setpoint input #x (1,2,3) below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Synchronizing Alarms

Alarm—Sync Input Failed
Explanation—Synchronizing input failure detected.
Time Stamp—5 ms resolution.

Alarm—Sync Input High Alm
Explanation—Synchronizing input above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Sync Input Low Alarm
Explanation—Synchronizing input below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Monitor Input Alarms

Alarm—Monitor Input Failed
Explanation—Monitor input failure detected.
Time Stamp—5 ms resolution.

Alarm—Monitor Input High Alm
Explanation—Monitor input above the high alarm setpoint level.
Time Stamp—5 ms resolution.

Alarm—Monitor Input Low Alarm
Explanation—Monitor input below the low alarm setpoint level.
Time Stamp—5 ms resolution.

Driver Alarms

Alarm—Act #1 (HP) Failed
Explanation—All HP (Actuator #1) (open circuit detected).
Time Stamp—40 ms resolution.

Alarm—Act #1 Driver x Fault
Explanation—HP (Actuator #1) Kernel x (A,B,C) fault detected.
Time Stamp—40 ms resolution.

Alarm—Act #1 (HP) Load Fault
Explanation—HP (Actuator #1) Load/Coil Fault detected (single coil/load).
Time Stamp—40 ms resolution.

Alarm—Act #1 (HP) Load 'A/B' Fault
Explanation—HP (Act #1) Load/Coil from Kernel A/B Fault detected (dual coil/load).
Time Stamp—40 ms resolution.

Alarm—Act #1 (HP) Load 'C' Fault
Explanation—HP (Act #1) Load/Coil from Kernel C Fault detected (dual coil/load).
Time Stamp—40 ms resolution.

Alarm—Act #2 (LP) Failed
Explanation—All LP (Actuator #2) (open circuit detected).
Time Stamp—40 ms resolution.

Alarm—Act #2 Driver x Fault
Explanation—LP (Actuator #2) Kernel x (A,B,C) fault detected.
Time Stamp—40 ms resolution.

Alarm—Act #2 (LP) Load Fault
Explanation—LP (Actuator #2) Load/Coil Fault detected (single coil/load).
Time Stamp—40 ms resolution.

Alarm—Act #2 (LP) Load 'A/B' Fault
Explanation—LP (Act #2) Load/Coil from Kernel A/B Fault detected (dual coil/load).
Time Stamp—40 ms resolution.

Alarm—Act #2 (LP) Load 'C' Fault
Explanation—LP (Act #2) Load/Coil from Kernel C Fault detected (dual coil/load).
Time Stamp—40 ms resolution.

Relay Alarms

IMPORTANT **Relays 1-3 are in DTM #1, 4-6 in DTM #2, 7-9 in DTM #3, and 10-12 in DTM #4.**

Alarm—Relay #x y1 Driver Fault
Explanation—Fault in the y (A,B,C)1 driver of Relay #x (1-12).
Time Stamp—40 ms resolution.

Alarm—Relay #x y2 Driver Fault
Explanation—- Fault in the y (A,B,C)2 driver of Relay #x (1-12).
Time Stamp—40 ms resolution.

Alarm—Relay #x y1 Fault
Explanation—Fault in the y (A,B,C)1 relay of Relay #x (1-12).
Time Stamp—40 ms resolution.

Alarm—Relay #x y2 Fault
Explanation—Fault in the y2 relay of Relay #x (1-12).
Time Stamp—40 ms resolution.

Alarm—Relay #x A1 or B1 Fault
Explanation—Fault in either A1 or B1 relays of Relay #x (1-12).
Time Stamp—40 ms resolution.

Alarm—Relay #x C2 or A2 Fault
Explanation—Fault in either C2 or A2 relays of Relay #x (1-12).
Time Stamp—40 ms resolution.

Alarm—Relay #x B2 or C1 Fault
Explanation—Fault in either B2 or C1 relays of Relay #x (1-12).
Time Stamp—40 ms resolution.

Analog Output Alarms

Alarm—Analog Out #x Failed
Explanation—All Analog Output #x (1-4) drivers or load has failed.
Time Stamp—40 ms resolution.

Alarm—Anlg Out #x Drvr y Fault
Explanation—Analog Output #x (1-4) Kernel y (A,B,C) fault detected
Time Stamp—40 ms resolution.

Alarm—Anlg Out #x Load Fault
Explanation—Analog Output #x (1-4) Load Fault detected.
Time Stamp—40 ms resolution.

Major Alarm Indication

A Major Alarm indication is available to the Modbus communication devices and as a programmable relay option. This major alarm feature is programmable and has both dedicated (fixed) alarms and optional inputs as follows:

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.

Optional/Programmable Major Alarms

Tie Breaker Opened	Utility Tie breaker was opened after it was closed.
Gen Breaker Opened	Generator breaker was opened after it was closed.
5009 Overtemperature	Control's Fan Failure Detected.
Operating System Alarm	Operating System Alarm Detected.
Kernel x Comm Link Failed	Kernel x communications link was detected as failed.
Turbine Trip	Turbine tripped alarm indication.
Stuck In Critical Band	Turbine speed was stuck or forced into the critical band too long.
External Alarm x	External Alarm #x (1-10) contact input was opened.
All Cascade Inputs Failed	All Cascade analog inputs failed.
All Extraction Inputs Failed	All Extraction analog inputs failed.
All Aux Inputs Failed	All Aux analog inputs failed.
All KW Inputs Failed	All KW analog inputs failed.
FSP Input Failed	FSP analog input failed.
All Rmt Spd Setpt Inputs Failed	All Rmt Spd Setpt analog inputs failed.
All Rmt Casc Setpt Inputs Failed	All Rmt Casc Setpt analog inputs failed.
All Rmt Aux Setpt Inputs Failed	All Rmt Aux Setpt analog inputs failed.
All Rmt Extraction Setpt Inputs Fld	All Rmt Extraction Setpt analog inputs failed.
All Sync/Load Share Inputs Failed	All Sync/Load Share analog inputs failed.
Monitor Analog Input Failed	Monitor Analog input failed.
Act #1 (HP) Fault	All HP (Actuator #1) drivers are failed.
Act #2 (LP) Fault	All LP (Actuator #2) drivers are failed.
Analog Out # x Failed	All Analog Output #x (1-4) drivers are failed.
Relay #1 (Trip Relay) Fault	Relay #1 Internal Fault Detected
Relay #2 (Alarm Relay) Fault	Relay #2 Internal Fault Detected
Relay #3 (3-12) Fault	Relay #3-12 Internal Fault Detected

Chapter 7.
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 CPU based ports only support RS-232 communications. However the system's SIO modules (optional) utilize Modbus based ports that can communicate via 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 5009 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 which 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, OpView, etc.). This allows a Modbus compatible device to monitor and perform all 5009 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 5009 Modbus port to monitor and operate the 5009 Control, program the desired port(s) 'Use Modbus Port' setting to 'Modbus'.

Modbus Communication

The 5009 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)

Table 7-1. ASCII vs. RTU Modbus

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).

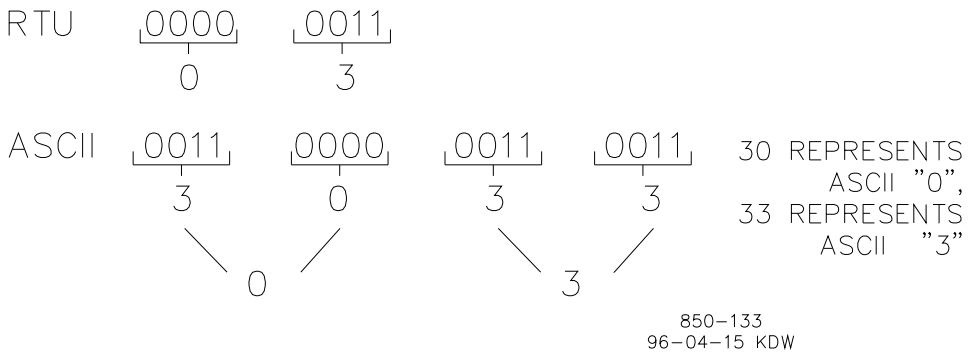


Figure 7-1. ASCII/RTU Representation of 3

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 communication ports are configured for RS-232 communications only. 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 an RS-232-to-RS-422 converter, RS-232-to-RS-485 converter, or a Woodward SIO Module be used. Each SIO module has four ports, with one port dedicated for Modbus communications and configurable for RS-232, RS-422, or RS-485 communications. 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. Alternatively one or two SIO modules may be installed within the control's chassis.

A Model 285 Superverter from Telebyte Technology Inc. of Greenlawn N.Y., or equivalent can be used as an interface converter. RS-422 and RS-485 communications also support multidropping (multiple slaves on a single communications line); RS-232 communications does not.

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 (5009 units or other customer devices) can be connected to one Master device on a single network. The device number for each port can be set in the Program or Service modes.

Each message to or from a master has a defined structure called the message "frame". A frame consists of the slave device address, a code defining the requested data, and error checking information. See Figure 7-2.

	BEGINNING OF FRAME	SLAVE ADDRESS	FUNCTION CODE	DATA	ERROR CHECK CODE	END OF FRAME
ASCII	:	2 CHARS 8 BITS	2 CHARS 8 BITS	4 BITS DATA PER CHAR	2 CHAR 8 BITS	CR LF
RTU	3–CHAR DEAD TIME	1 CHAR 8 BITS	1 CHAR 8 BITS	8 BITS DATA PER CHAR	2 CHAR 16 BITS	3 CHAR DEAD TIME

855–382
93–09–27 DAR

Figure 7-2. 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 (Raise/Lower and Enable/Disable Commands)	0XXXX
02	Read Digital Inputs (Status Indications / Alarms and Trips)	1XXXX
03	Read Analog Outputs	4XXXX
04	Read Analog Inputs (Speed, Setpt, etc.)	3XXXX
5	Write Single Discrete Output (Raise/Lower and Enable/Disable Commands)	0XXXX
6	Write Single Register (Enter Setpt Directly)	4XXXX
8	Loopback Diagnostic Test (supports subfunction 0 only)	N/A
15	Write Digital Outputs	0XXXX
16	Write Analog Outputs	4XXXX

Table 7-2. Modbus Function Codes

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).

Modbus Slave Exception Error Codes

CODE	ERROR MESSAGE	TO MASTER	DESCRIPTION
0	No Error	0	No Error
1	Bad Modbus function	1	The specified function is not supported for this control
2	Bad Modbus data address	2	The Modbus value addressee is not valid for this control
3	Bad Modbus data value	3	Too many values requested or the on/off indicator in function code 5 is invalid.
9	Bad Modbus checksum	None	Message checksum did not match.
10	Bad Modbus message	None	Message could not be decoded.
n/a	Lost Modbus link	None	No messages received for the configured time- out period.

Table 7-3. Modbus Error Codes

Port Adjustments

Before the 5009 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 5009 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 also 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 5009 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 5009 Control. See Tables 7-7 &7-8 (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.

MODE OF TRANSMISSION	MAX DISCRETES	MAX REGISTERS
ASCII	944	59
RTU	1188	118

Table 7-4. Maximum Modbus Discrete and Analog Values

Boolean Writes (Holding Coils)

Holding coils are logical signals that are both readable from and writable to the 5009 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 5009 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 5009 Control. An example of an 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 5009 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 5009 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 5009 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 5009 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 5009 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 are 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 5009 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 7-8, under Analog Writes. The following tables give the address and description of all boolean and analog, reads and writes.

Addr	Description	Addr	Description
0:0001	Emergency Shutdown	0:0023	Overspeed Test Disable
0:0002	Emergency Shutdown Acknowledge	0:0024	
0:0003	Controlled Shutdown	0:0025	Arm Frequency Control
0:0004	Abort Controlled Shutdown	0:0026	Disarm Frequency Control
0:0005		0:0027	Sync Enable
0:0006	System Reset	0:0028	Sync Disable
0:0007	Start / Run	0:0029	Enable Cascade Control
0:0008	HP Valve Limiter Raise	0:0030	Disable Cascade Control
0:0009	HP Valve Limiter Lower	0:0031	Lower Cascade Setpoint
0:0010		0:0032	Raise Cascade Setpoint
0:0011	Lower Speed Setpoint	0:0033	Enable Remote Cascade Setpoint Control

0:0012	Raise Speed Setpoint	0:0034	Disable Remote Cascade Setpoint Control
0:0013	Go To Rated (Idle / Rated)	0:0035	Go To Modbus Entered Cascade Setpt
0:0014	Go To Idle (Idle / Rated)	0:0036	
0:0015	Halt Auto Start Seq	0:0037	Enable Aux Control
0:0016	Continue Auto Start Seq	0:0038	Disable Aux Control
0:0017	Enable Remote Speed Setpoint Control	0:0039	Lower Aux Setpoint
0:0018	Disable Remote Speed Setpoint Control	0:0040	Raise Aux Setpoint
0:0019	Go To Modbus Entered Speed Setpt	0:0041	Enable Remote Aux Setpoint Control
0:0020	Clear Highest / Max Speed Hold Value	0:0042	Disable Remote Aux Setpoint Control
0:0021	External Overspeed Test Enable	0:0043	Go To Modbus Entered Auxiliary Setpt
0:0022	5009 Overspeed Test Enable	0:0044	
0:0045	Select Remote Ctrl (Remote/Local)	0:0077	Enable Remote Extr Setpoint Control
0:0046	Select Local Ctrl (Remote/Local)	0:0078	Disable Remote Extr Setpoint Control
0:0047		0:0079	Go To Modbus Entered Extraction Setpt
0:0048	Modbus Alarm Acknowledge	0:0080	LP Valve Limiter Raise
0:0049	Energize Relay 3	0:0081	LP Valve Limiter Lower
0:0050	De-Energize Relay 3	0:0082	Decrease Extr/Adm Demand
0:0051	Energize Relay 4	0:0083	Increase Extr/Adm Demand
0:0052	De-Energize Relay 4	0:0084	Enable Extr/Adm Priority
0:0053	Energize Relay 5	0:0085	Disable Extr/Adm Priority
0:0054	De-Energize Relay 5	0:0086	
0:0055	Energize Relay 6	0:0087	Display On-Line Dynamics
0:0056	De-Energize Relay 6	0:0088	Display Off-Line Dynamics
0:0057	Energize Relay 7	0:0089	Spd PID—Lower Off-Line P-gain
0:0058	De-Energize Relay 7	0:0090	Spd PID—Lower Off-Line P-gain Fast
0:0059	Energize Relay 8	0:0091	Spd PID—Raise Off-Line P-gain
0:0060	De-Energize Relay 8	0:0092	Spd PID—Raise Off-Line P-gain Fast
0:0061	Energize Relay 9	0:0093	Spd PID—Lower On-Line P-gain
0:0062	De-Energize Relay 9	0:0094	Spd PID—Lower On-Line P-gain Fast
0:0063	Energize Relay 10	0:0095	Spd PID—Raise On-Line P-gain
0:0064	De-Energize Relay 10	0:0096	Spd PID—Raise On-Line P-gain Fast
0:0065	Energize Relay 11	0:0097	Spd PID—Lower Off-Line I-gain
0:0066	De-Energize Relay 11	0:0098	Spd PID—Lower Off-Line I-gain Fast
0:0067	Energize Relay 12	0:0099	Spd PID—Raise Off-Line I-gain
0:0068	De-Energize Relay 12	0:0100	Spd PID—Raise Off-Line I-gain Fast
0:0069		0:0101	Spd PID—Lower On-Line I-gain
0:0070	Synchronize Internal Time-of-Day	0:0102	Spd PID—Lower On-Line I-gain Fast
0:0071		0:0103	Spd PID—Raise On-Line I-gain
0:0072		0:0104	Spd PID—Raise On-Line I-gain Fast
0:0073	Enable Extraction Control	0:0105	Spd PID—Lower Off-Line SDR
0:0074	Disable Extraction Control	0:0106	Spd PID—Lower Off-Line SDR Fast
0:0075	Lower Extraction Setpoint	0:0107	Spd PID—Raise Off-Line SDR
0:0076	Raise Extraction Setpoint	0:0108	Spd PID—Raise Off-Line SDR Fast
0:0109	Spd PID—Lower On-Line SDR	0:0141	Extr PID—Lower I-gain
0:0110	Spd PID—Lower On-Line SDR Fast	0:0142	Extr PID—Lower I-gain Fast
0:0111	Spd PID—Raise On-Line SDR	0:0143	Extr PID—Raise I-gain
0:0112	Spd PID—Raise On-Line SDR Fast	0:0144	Extr PID—Raise I-gain Fast
0:0113	Casc PID—Lower P-gain	0:0145	Extr PID—Lower SDR
0:0114	Casc PID—Lower P-gain Fast	0:0146	Extr PID—Lower SDR Fast
0:0115	Casc PID—Raise P-gain	0:0147	Extr PID—Raise SDR
0:0116	Casc PID—Raise P-gain Fast	0:0148	Extr PID—Raise SDR Fast
0:0117	Casc PID—Lower I-gain	0:0149	
0:0118	Casc PID—Lower I-gain Fast	0:0150	
0:0119	Casc PID—Raise I-gain	0:0151	
0:0120	Casc PID—Raise I-gain Fast	0:0152	
0:0121	Casc PID—Lower SDR	0:0153	
0:0122	Casc PID—Lower SDR Fast	0:0154	
0:0123	Casc PID—Raise SDR	0:0155	Lower V1 Actr Min Current
0:0124	Casc PID—Raise SDR Fast	0:0156	Raise V1 Actr Min Current
0:0125	Aux PID—Lower P-gain	0:0157	Lower V1 Actr Max Current
0:0126	Aux PID—Lower P-gain Fast	0:0158	Raise V1 Actr Max Current

0:0127	Aux PID—Raise P-gain	0:0159	Lower V1 Actr Stroke Position
0:0128	Aux PID—Raise P-gain Fast	0:0160	Lower Fast V1 Actr Stroke Position
0:0129	Aux PID—Lower I-gain	0:0161	Raise V1 Act Stroke Position
0:0130	Aux PID—Lower I-gain Fast	0:0162	Raise Fast V1 Actr Stroke Position
0:0131	Aux PID—Raise I-gain	0:0163	Enable V1 Stroking
0:0132	Aux PID—Raise I-gain Fast	0:0164	Disable V1 Stroking
0:0133	Aux PID—Lower SDR	0:0165	Lower V2 Actr Min Current
0:0134	Aux PID—Lower SDR Fast	0:0166	Raise V2 Actr Min current
0:0135	Aux PID—Raise SDR	0:0167	Lower Actr Max Current
0:0136	Aux PID—Raise SDR Fast	0:0168	Raise V2 Actr Max Current
0:0137	Extr PID Power P-gain	0:0169	Lower V2 Actr Stroke Position
0:0138	Extr PID—Lower P-gain Fast	0:0170	Lower Fast V2 Actr Stroke Position
0:0139	Extr PID -Raise P-gain	0:0171	Raise V2 Actr Stroke Position
0:0140	Extr PID—Raise P-gain Fast	0:0172	Raise Fast V2 Actr Stroke Position
0:0173	Enable V2 Stroking	0:0182	Momentarily Energize Modbus Relay 4
0:0174	Disable V2 Stroking	0.0183	Momentarily Energize Modbus Relay 5
0:0175	Save Program Changes to EEPROM	0.0184	Momentarily Energize Modbus Relay 6
0:0176		0.0185	Momentarily Energize Modbus Relay 7
0:0177		0.0186	Momentarily Energize Modbus Relay 8
0:0178		0.0187	Momentarily Energize Modbus Relay 9
0:0179		0.0188	Momentarily Energize Modbus Relay 10
0:0180		0.0189	Momentarily Energize Modbus Relay 11
0:0181	Momentarily Energize Modbus Relay 3	0.0190	Momentarily Energize Modbus Relay 12

Table 7-5. Boolean Writes

Boolean Read Address Overview:
Addresses 0001—0950 are designated for alarm indications.
Addresses 0951—1000 are designated for trip indications.
Addresses 1001—1180 are designated for status indications.
Addresses 1181—1225 are designated for control configurations.

Addr	Servlink Tag Name	Description
1:0001	Y_ALARMS.ALM.SEL_1	Alarm—Kernel A Analg I/O Module Flt
1:0002	Y_ALARMS.ALM.SEL_2	Alarm—Kernel B Analg I/O Module Flt
1:0003	Y_ALARMS.ALM.SEL_3	Alarm—Kernel C Analg I/O Module Flt
1:0004	Y_ALARMS.ALM.SEL_4	Alarm—Kernel A Discrete I/O Mod Flt
1:0005	Y_ALARMS.ALM.SEL_5	Alarm—Kernel B Discrete I/O Mod Flt
1:0006	Y_ALARMS.ALM.SEL_6	Alarm—Kernel C Discrete I/O Mod Flt
1:0007	Y_ALARMS.ALM.SEL_7	Alarm—Spare (Slot 3 A I/O Mod Flt)
1:0008	Y_ALARMS.ALM.SEL_8	Alarm—Spare (Slot 3 B I/O Mod Flt)
1:0009	Y_ALARMS.ALM.SEL_9	Alarm—Spare (Slot 3 C I/O Mod Flt)
1:0010	Y_ALARMS.ALM.SEL_10	Alarm—Spare (Slot 4 A I/O Mod Flt)
1:0011	Y_ALARMS.ALM.SEL_11	Alarm—Spare (Slot 4 B I/O Mod Flt)
1:0012	Y_ALARMS.ALM.SEL_12	Alarm—Spare (Slot 4 C I/O Mod Flt)
1:0013	Y_ALARMS.ALM.SEL_13	Alarm—Kernel A Fault
1:0014	Y_ALARMS.ALM.SEL_14	Alarm—Kernel B Fault
1:0015	Y_ALARMS.ALM.SEL_15	Alarm—Kernel C Fault
1:0016	Y_ALARMS.ALM.SEL_16	Alarm—Fan Fault
1:0017	Y_ALARMS.ALM.SEL_17	Alarm—Power Supply #1 Fault
1:0018	Y_ALARMS.ALM.SEL_18	Alarm—Power Supply #2 Fault
1:0019	Y_ALARMS.ALM.SEL_19	Alarm—Operating System Fault
1:0020	Y_ALARMS.ALM.SEL_20	Alarm—Start Perm Not Closed
1:0021	Y_ALARMS.ALM.SEL_21	Alarm—Kernel A Comm Link Failed
1:0022	Y_ALARMS.ALM.SEL_22	Alarm—Kernel B Comm Link Failed
1:0023	Y_ALARMS.ALM.SEL_23	Alarm—Kernel C Comm Link Failed
1:0024	Y_ALARMS.ALM.SEL_24	Alarm—Turbine Trip
1:0025	Y_ALARMS.ALM.SEL_25	Alarm—Overspeed
1:0026	Y_ALARMS.ALM.SEL_26	Alarm—Stuck in Critical Band
1:0027	Y_ALARMS.ALM.SEL_27	Alarm—Tie Breaker Opened

1:0028	Y_ALARMS.ALM.SEL_28	Alarm—Gen Breaker Opened
1:0029	Y_ALARMS.ALM.SEL_29	Alarm—Tie Breaker Open / No Case
1:0030	Y_ALARMS.ALM.SEL_30	Alarm—Gen Breaker Open / No Case
1:0031	Y_ALARMS.ALM.SEL_31	Alarm—Tie Breaker Open / No Remote
1:032	Y_ALARMS.ALM.SEL_32	Alarm—Gen Breaker Open / No Remote
1:0033	Y_ALARMS.ALM.SEL_33	Alarm—Tie Breaker Open / No Aux
1:0034	Y_ALARMS.ALM.SEL_34	Alarm—Gen Breaker Open / No Aux
1:0035	Y_ALARMS.ALM.SEL_35	Alarm—Tie Breaker Open / No Extr
1:0036	Y_ALARMS.ALM.SEL_36	Alarm—Gen Breaker Open / No Extr
1:0037	Y_ALARMS.ALM.SEL_37	Alarm—External Alarm #1
1:0038	Y_ALARMS.ALM.SEL_38	Alarm—External Alarm #2
1:0039	Y_ALARMS.ALM.SEL_39	Alarm—External Alarm #3
1:0040	Y_ALARMS.ALM.SEL_40	Alarm—External Alarm #4
1:0041	Y_ALARMS.ALM.SEL_41	Alarm—External Alarm #5
1:0042	Y_ALARMS.ALM.SEL_42	Alarm—External Alarm #6
1:0043	Y_ALARMS.ALM.SEL_43	Alarm—External Alarm #7
1:0044	Y_ALARMS.ALM.SEL_44	Alarm—External Alarm #8
1:0045	Y_ALARMS.ALM.SEL_45	Alarm—External Alarm #9
1:0046	Y_ALARMS.ALM.SEL_46	Alarm—External Alarm #10
1:0047	Y_ALARMS.ALM.SEL_47	Alarm—Spd Setpt Entrd in Critical
1:0048	Y_ALARMS.ALM.SEL_48	Alarm—Configuration Error
1:0049	Y_ALARMS.ALM.SEL_49	Alarm—SIOA Port 3 Failed
1:0050	Y_ALARMS.ALM.SEL_50	Alarm—SIOB Port 3 Failed
1:0051	Y_ALARMS.ALM.SEL_51	Alarm—5009 Kernel A Overtemp
1:0052	Y_ALARMS.ALM.SEL_52	Alarm—5009 Kernel B Overtemp
1:0053	Y_ALARMS.ALM.SEL_53	Alarm—5009 Kernel C Overtemp
1:0054	Y_ALARMS.ALM.SEL_54	Alarm—CPU A Time Fault
1:0055	Y_ALARMS.ALM.SEL_55	Alarm—CPU B Time Fault
1:0056	Y_ALARMS.ALM.SEL_56	Alarm—CPU C Time Fault
1:0057	Y_ALARMS.ALM.SEL_57	Alarm—Spd Probe #1 Input Fld
1:0058	Y_ALARMS.ALM.SEL_58	Alarm—Spd Probe #1 Deviation Alm
1:0059	Y_ALARMS.ALM.SEL_59	Alarm—Spd Probe #1 Ospd Alm
1:0060	Y_ALARMS.ALM.SEL_60	Alarm—Spd Probe #1 Kernel A Fault
1:0061	Y_ALARMS.ALM.SEL_61	Alarm—Spd Probe #1 Kernel B Fault
1:0062	Y_ALARMS.ALM.SEL_62	Alarm—Spd Probe #1 Kernel C Fault
1:0063	Y_ALARMS.ALM.SEL_63	Alarm—Spd Probe #2 Input Failed
1:0064	Y_ALARMS.ALM.SEL_64	Alarm—Spd Probe #2 Deviation Alm
1:0065	Y_ALARMS.ALM.SEL_65	Alarm—Spd Probe #2 Ospd Alm
1:0066	Y_ALARMS.ALM.SEL_66	Alarm—Spd Probe #2 Kernel A Fault
1:0067	Y_ALARMS.ALM.SEL_67	Alarm—Spd Probe #2 Kernel B Fault
1:0068	Y_ALARMS.ALM.SEL_68	Alarm—Spd Probe #2 Kernel C Fault
1:0069	Y_ALARMS.ALM.SEL_69	Alarm—Spd Probe #3 Input Failed
1:0070	Y_ALARMS.ALM.SEL_70	Alarm—Spd Probe #3 Deviation Alm
1:0071	Y_ALARMS.ALM.SEL_71	Alarm—Spd Probe #3 Ospd Alm
1:0072	Y_ALARMS.ALM.SEL_72	Alarm—Spd Probe #3 Kernel A Fault
1:0073	Y_ALARMS.ALM.SEL_73	Alarm—Spd Probe #3 Kernel B Fault
1:0074	Y_ALARMS.ALM.SEL_74	Alarm—Spd Probe #3 Kernel C Fault
1:0075	Y_ALARMS.ALM.SEL_75	Alarm—Spd Probe #4 Input Failed
1:0076	Y_ALARMS.ALM.SEL_76	Alarm—Spd Probe #4 Deviation Alm
1:0077	Y_ALARMS.ALM.SEL_77	Alarm—Spd Probe #4 Ospd Alm
1:0078	Y_ALARMS.ALM.SEL_78	Alarm—Spd Probe #4 Kernel A Fault
1:0079	Y_ALARMS.ALM.SEL_79	Alarm—Spd Probe #4 Kernel B Fault
1:0080	Y_ALARMS.ALM.SEL_80	Alarm—Spd Probe #4 Kernel C Fault
1:0081	Y_ALARMS.ALM.SEL_81	Alarm—Anlg Input #1 Kernel A Fault
1:0082	Y_ALARMS.ALM.SEL_82	Alarm—Anlg Input #1 Kernel B Fault
1:0083	Y_ALARMS.ALM.SEL_83	Alarm—Anlg Input #1 Kernel C Fault
1:0084	Y_ALARMS.ALM.SEL_84	Alarm—Anlg Input #2 Kernel A Fault
1:0085	Y_ALARMS.ALM.SEL_85	Alarm—Anlg Input #2 Kernel B Fault
1:0086	Y_ALARMS.ALM.SEL_86	Alarm—Anlg Input #2 Kernel C Fault
1:0087	Y_ALARMS.ALM.SEL_87	Alarm—Anlg Input #3 Kernel A Fault
1:0088	Y_ALARMS.ALM.SEL_88	Alarm—Anlg Input #3 Kernel B Fault

1:0089	Y_ALARMS.ALM.SEL_89	Alarm—Anlg Input #3 Kernel C Fault
1:0090	Y_ALARMS.ALM.SEL_90	Alarm—Anlg Input #4 Kernel A Fault
1:0091	Y_ALARMS.ALM.SEL_91	Alarm—Anlg Input #4 Kernel B Fault
1:0092	Y_ALARMS.ALM.SEL_92	Alarm—Anlg Input #4 Kernel C Fault
1:0093	Y_ALARMS.ALM.SEL_93	Alarm—Anlg Input #5 Kernel A Fault
1:0094	Y_ALARMS.ALM.SEL_94	Alarm—Anlg Input #5 Kernel B Fault
1:0095	Y_ALARMS.ALM.SEL_95	Alarm—Anlg Input #5 Kernel C Fault
1:0096	Y_ALARMS.ALM.SEL_96	Alarm—Anlg Input #6 Kernel A Fault
1:0097	Y_ALARMS.ALM.SEL_97	Alarm—Anlg Input #6 Kernel B Fault
1:0098	Y_ALARMS.ALM.SEL_98	Alarm—Anlg Input #6 Kernel C Fault
1:0099	Y_ALARMS.ALM.SEL_99	Alarm—Anlg Input #7 Kernel A Fault
1:0100	Y_ALARMS.ALM.SEL_100	Alarm—Anlg Input #7 Kernel B Fault
1:0101	Y_ALARMS.ALM.SEL_101	Alarm—Anlg Input #7 Kernel C Fault
1:0102	Y_ALARMS.ALM.SEL_102	Alarm—Anlg Input #8 Kernel A Fault
1:0103	Y_ALARMS.ALM.SEL_103	Alarm—Anlg Input #8 Kernel B Fault
1:0104	Y_ALARMS.ALM.SEL_104	Alarm—Anlg Input #8 Kernel C Fault
1:0105	Y_ALARMS.ALM.SEL_105	Alarm—Discrete In #1 Kernel A Fault
1:0106	Y_ALARMS.ALM.SEL_106	Alarm—Discrete In #1 Kernel B Fault
1:0107	Y_ALARMS.ALM.SEL_107	Alarm—Discrete In #1 Kernel C Fault
1:0108	Y_ALARMS.ALM.SEL_108	Alarm—Discrete In #2 Kernel A Fault
1:0109	Y_ALARMS.ALM.SEL_109	Alarm—Discrete In #2 Kernel B Fault
1:0110	Y_ALARMS.ALM.SEL_110	Alarm—Discrete In #2 Kernel C Fault
1:0111	Y_ALARMS.ALM.SEL_111	Alarm—Discrete In #3 Kernel A Fault
1:0112	Y_ALARMS.ALM.SEL_112	Alarm—Discrete In #3 Kernel B Fault
1:0113	Y_ALARMS.ALM.SEL_113	Alarm—Discrete In #3 Kernel C Fault
1:0114	Y_ALARMS.ALM.SEL_114	Alarm—Discrete In #4 Kernel A Fault
1:0115	Y_ALARMS.ALM.SEL_115	Alarm—Discrete In #4 Kernel B Fault
1:0116	Y_ALARMS.ALM.SEL_116	Alarm—Discrete In #4 Kernel C Fault
1:0117	Y_ALARMS.ALM.SEL_117	Alarm—Discrete In #5 Kernel A Fault
1:0118	Y_ALARMS.ALM.SEL_118	Alarm—Discrete In #5 Kernel B Fault
1:0119	Y_ALARMS.ALM.SEL_119	Alarm—Discrete In #5 Kernel C Fault
1:0120	Y_ALARMS.ALM.SEL_120	Alarm—Discrete In #6 Kernel A Fault
1:0121	Y_ALARMS.ALM.SEL_121	Alarm—Discrete In #6 Kernel B Fault
1:0122	Y_ALARMS.ALM.SEL_122	Alarm—Discrete In #6 Kernel C Fault
1:0123	Y_ALARMS.ALM.SEL_123	Alarm—Discrete In #7 Kernel A Fault
1:0124	Y_ALARMS.ALM.SEL_124	Alarm—Discrete In #7 Kernel B Fault
1:0125	Y_ALARMS.ALM.SEL_125	Alarm—Discrete In #7 Kernel C Fault
1:0126	Y_ALARMS.ALM.SEL_126	Alarm—Discrete In #8 Kernel A Fault
1:0127	Y_ALARMS.ALM.SEL_127	Alarm—Discrete In #8 Kernel B Fault
1:0128	Y_ALARMS.ALM.SEL_128	Alarm—Discrete In #8 Kernel C Fault
1:0129	Y_ALARMS.ALM.SEL_129	Alarm—Discrete In #9 Kernel A Fault
1:0130	Y_ALARMS.ALM.SEL_130	Alarm—Discrete In #9 Kernel B Fault
1:0131	Y_ALARMS.ALM.SEL_131	Alarm—Discrete In #9 Kernel C Fault
1:0132	Y_ALARMS.ALM.SEL_132	Alarm—Discrete In #10 Kernel A Fault
1:0133	Y_ALARMS.ALM.SEL_133	Alarm—Discrete In #10 Kernel B Fault
1:0134	Y_ALARMS.ALM.SEL_134	Alarm—Discrete In #10 Kernel C Fault
1:0135	Y_ALARMS.ALM.SEL_135	Alarm—Discrete In #11 Kernel A Fault
1:0136	Y_ALARMS.ALM.SEL_136	Alarm—Discrete In #11 Kernel B Fault
1:0137	Y_ALARMS.ALM.SEL_137	Alarm—Discrete In #11 Kernel C Fault
1:0138	Y_ALARMS.ALM.SEL_138	Alarm—Discrete In #12 Kernel A Fault
1:0139	Y_ALARMS.ALM.SEL_139	Alarm—Discrete In #12 Kernel B Fault
1:0140	Y_ALARMS.ALM.SEL_140	Alarm—Discrete In #12 Kernel C Fault
1:0141	Y_ALARMS.ALM.SEL_141	Alarm—Discrete In #13 Kernel A Fault
1:0142	Y_ALARMS.ALM.SEL_142	Alarm—Discrete In #13 Kernel B Fault
1:0143	Y_ALARMS.ALM.SEL_143	Alarm—Discrete In #13 Kernel C Fault
1:0144	Y_ALARMS.ALM.SEL_144	Alarm—Discrete In #14 Kernel A Fault
1:0145	Y_ALARMS.ALM.SEL_145	Alarm—Discrete In #14 Kernel B Fault
1:0146	Y_ALARMS.ALM.SEL_146	Alarm—Discrete In #14 Kernel C Fault
1:0147	Y_ALARMS.ALM.SEL_147	Alarm—Discrete In #15 Kernel A Fault
1:0148	Y_ALARMS.ALM.SEL_148	Alarm—Discrete In #15 Kernel B Fault
1:0149	Y_ALARMS.ALM.SEL_149	Alarm—Discrete In #15 Kernel C Fault

1:0150	Y_ALARMS.ALM.SEL_150	Alarm—Discrete In #16 Kernel A Fault
1:0151	Y_ALARMS.ALM.SEL_151	Alarm—Discrete In #16 Kernel B Fault
1:0152	Y_ALARMS.ALM.SEL_152	Alarm—Discrete In #16 Kernel C Fault
1:0153	Y_ALARMS.ALM.SEL_153	Alarm—Discrete In #17 Kernel A Fault
1:0154	Y_ALARMS.ALM.SEL_154	Alarm—Discrete In #17 Kernel B Fault
1:0155	Y_ALARMS.ALM.SEL_155	Alarm—Discrete In #17 Kernel C Fault
1:0156	Y_ALARMS.ALM.SEL_156	Alarm—Discrete In #18 Kernel A Fault
1:0157	Y_ALARMS.ALM.SEL_157	Alarm—Discrete In #18 Kernel B Fault
1:0158	Y_ALARMS.ALM.SEL_158	Alarm—Discrete In #18 Kernel C Fault
1:0159	Y_ALARMS.ALM.SEL_159	Alarm—Discrete In #19 Kernel A Fault
1:0160	Y_ALARMS.ALM.SEL_160	Alarm—Discrete In #19 Kernel B Fault
1:0161	Y_ALARMS.ALM.SEL_161	Alarm—Discrete In #19 Kernel C Fault
1:0162	Y_ALARMS.ALM.SEL_162	Alarm—Discrete In #20 Kernel A Fault
1:0163	Y_ALARMS.ALM.SEL_163	Alarm—Discrete In #20 Kernel B Fault
1:0164	Y_ALARMS.ALM.SEL_164	Alarm—Discrete In #20 Kernel C Fault
1:0165	Y_ALARMS.ALM.SEL_165	Alarm—Discrete In #21 Kernel A Fault
1:0166	Y_ALARMS.ALM.SEL_166	Alarm—Discrete In #21 Kernel B Fault
1:0167	Y_ALARMS.ALM.SEL_167	Alarm—Discrete In #21 Kernel C Fault
1:0168	Y_ALARMS.ALM.SEL_168	Alarm—Discrete In #22 Kernel A Fault
1:0169	Y_ALARMS.ALM.SEL_169	Alarm—Discrete In #22 Kernel B Fault
1:0170	Y_ALARMS.ALM.SEL_170	Alarm—Discrete In #22 Kernel C Fault
1:0171	Y_ALARMS.ALM.SEL_171	Alarm—Discrete In #23 Kernel A Fault
1:0172	Y_ALARMS.ALM.SEL_172	Alarm—Discrete In #23 Kernel B Fault
1:0173	Y_ALARMS.ALM.SEL_173	Alarm—Discrete In #23 Kernel C Fault
1:0174	Y_ALARMS.ALM.SEL_174	Alarm—Discrete In #24 Kernel A Fault
1:0175	Y_ALARMS.ALM.SEL_175	Alarm—Discrete In #24 Kernel B Fault
1:0176	Y_ALARMS.ALM.SEL_176	Alarm—Discrete In #24 Kernel C Fault
1:0177	Y_ALARMS.ALM.SEL_177	Alarm—All Cascade Inputs Failed
1:0178	Y_ALARMS.ALM.SEL_178	Alarm—Casc Input #1 Failed
1:0179	Y_ALARMS.ALM.SEL_179	Alarm—Casc Input #1 Deviation Alm
1:0180	Y_ALARMS.ALM.SEL_180	Alarm—Casc Input #1 High Alm
1:0181	Y_ALARMS.ALM.SEL_181	Alarm—Casc Input #1 Low Alarm
1:0182	Y_ALARMS.ALM.SEL_182	Alarm—Casc Input #2 Failed
1:0183	Y_ALARMS.ALM.SEL_183	Alarm—Casc Input #2 Deviation Alm
1:0184	Y_ALARMS.ALM.SEL_184	Alarm—Casc Input #2 High Alm
1:0185	Y_ALARMS.ALM.SEL_185	Alarm—Casc Input #2 Low Alarm
1:0186	Y_ALARMS.ALM.SEL_186	Alarm—Casc Input #3 Failed
1:0187	Y_ALARMS.ALM.SEL_187	Alarm—Casc Input #3 Deviation Alm
1:0188	Y_ALARMS.ALM.SEL_188	Alarm—Casc Input #3 High Alm
1:0189	Y_ALARMS.ALM.SEL_189	Alarm—Casc Input #3 Low Alarm
1:0190	Y_ALARMS.ALM.SEL_190	Alarm—All Extr/Adm Inputs Failed
1:0191	Y_ALARMS.ALM.SEL_191	Alarm—Extr/Adm Input #1 Failed
1:0192	Y_ALARMS.ALM.SEL_192	Alarm—Extr/Adm Input #1 Deviation Al
1:0193	Y_ALARMS.ALM.SEL_193	Alarm—Extr/Adm Input #1 High Alm
1:0194	Y_ALARMS.ALM.SEL_194	Alarm—Extr/Adm Input #1 Low Alarm
1:0195	Y_ALARMS.ALM.SEL_195	Alarm—Extr/Adm Input #2 Failed
1:0196	Y_ALARMS.ALM.SEL_196	Alarm—Extr/Adm Input #2 Deviation Al
1:0197	Y_ALARMS.ALM.SEL_197	Alarm—Extr/Adm Input #2 High Alm
1:0198	Y_ALARMS.ALM.SEL_198	Alarm—Extr/Adm Input #2 Low Alarm
1:0199	Y_ALARMS.ALM.SEL_199	Alarm—Extr/Adm Input #3 Failed
1:0200	Y_ALARMS.ALM.SEL_200	Alarm—Extr/Adm Input #3 Deviation Al
1:0201	Y_ALARMS.ALM.SEL_201	Alarm—Extr/Adm Input #3 High Alm
1:0202	Y_ALARMS.ALM.SEL_202	Alarm—Extr/Adm Input #3 Low Alarm
1:0203	Y_ALARMS.ALM.SEL_203	Alarm—All Aux Inputs Failed
1:0204	Y_ALARMS.ALM.SEL_204	Alarm—Aux Input #1 Failed
1:0205	Y_ALARMS.ALM.SEL_205	Alarm—Aux Input #1 Deviation Alm
1:0206	Y_ALARMS.ALM.SEL_206	Alarm—Aux Input #1 High Alm
1:0207	Y_ALARMS.ALM.SEL_207	Alarm—Aux Input #1 Low Alarm
1:0208	Y_ALARMS.ALM.SEL_208	Alarm—Aux Input #2 Failed
1:0209	Y_ALARMS.ALM.SEL_209	Alarm—Aux Input #2 Deviation Alm
1:0210	Y_ALARMS.ALM.SEL_210	Alarm—Aux Input #2 High Alm

1:0211	Y_ALARMS.ALM.SEL_211	Alarm—Aux Input #2 Low Alarm
1:0212	Y_ALARMS.ALM.SEL_212	Alarm—Aux Input #3 Failed
1:0213	Y_ALARMS.ALM.SEL_213	Alarm—Aux Input #3 Deviation Alm
1:0214	Y_ALARMS.ALM.SEL_214	Alarm—Aux Input #3 High Alm
1:0215	Y_ALARMS.ALM.SEL_215	Alarm—Aux Input #3 Low Alarm
1:0216	Y_ALARMS.ALM.SEL_216	Alarm—All KW Inputs Failed
1:0217	Y_ALARMS.ALM.SEL_217	Alarm—KW Input #1 Failed
1:0218	Y_ALARMS.ALM.SEL_218	Alarm—KW Input #1 Deviation Alm
1:0219	Y_ALARMS.ALM.SEL_219	Alarm—KW Input #1 High Alm
1:0220	Y_ALARMS.ALM.SEL_220	Alarm—KW Input #1 Low Alarm
1:0221	Y_ALARMS.ALM.SEL_221	Alarm—KW Input #2 Failed
1:0222	Y_ALARMS.ALM.SEL_222	Alarm—KW Input #2 Deviation Alm
1:0223	Y_ALARMS.ALM.SEL_223	Alarm—KW Input #2 High Alm
1:0224	Y_ALARMS.ALM.SEL_224	Alarm—KW Input #2 Low Alarm
1:0225	Y_ALARMS.ALM.SEL_225	Alarm—KW Input #3 Failed
1:0226	Y_ALARMS.ALM.SEL_226	Alarm—KW Input #3 Deviation Alm
1:0227	Y_ALARMS.ALM.SEL_227	Alarm—KW Input #3 High Alm
1:0228	Y_ALARMS.ALM.SEL_228	Alarm—KW Input #3 Low Alarm
1:0229	Y_ALARMS.ALM.SEL_229	Alarm—All Ld Shr Inputs Failed
1:0230	Y_ALARMS.ALM.SEL_230	Alarm—Ld Shr Input #1 Failed
1:0231	Y_ALARMS.ALM.SEL_231	Alarm—Ld Shr Input #1 Deviation Alm
1:0232	Y_ALARMS.ALM.SEL_232	Alarm—Ld Shr Input #1 High Alm
1:0233	Y_ALARMS.ALM.SEL_233	Alarm—Ld Shr Input #1 Low Alarm
1:0234	Y_ALARMS.ALM.SEL_234	Alarm—Ld Shr Input #2 Failed
1:0235	Y_ALARMS.ALM.SEL_235	Alarm—Ld Shr Input #2 Deviation Alm
1:0236	Y_ALARMS.ALM.SEL_236	Alarm—Ld Shr Input #2 High Alm
1:0237	Y_ALARMS.ALM.SEL_237	Alarm—Ld Shr Input #2 Low Alarm
1:0238	Y_ALARMS.ALM.SEL_238	Alarm—Ld Shr Input #3 Failed
1:0239	Y_ALARMS.ALM.SEL_239	Alarm—Ld Shr Input #3 Deviation Alm
1:0240	Y_ALARMS.ALM.SEL_240	Alarm—Ld Shr Input #3 High Alm
1:0241	Y_ALARMS.ALM.SEL_241	Alarm—Ld Shr Input #3 Low Alarm
1:0242	Y_ALARMS.ALM.SEL_242	Alarm—Rmt Spd Setpt Input Failed
1:0243	Y_ALARMS.ALM.SEL_243	Alarm—Rmt Spd Setpt Input High Alm
1:0244	Y_ALARMS.ALM.SEL_244	Alarm—Rmt Spd Setpt Input Low Alarm
1:0245	Y_ALARMS.ALM.SEL_245	Alarm—Rmt Casc Setpt Input Failed
1:0246	Y_ALARMS.ALM.SEL_246	Alarm—Rmt Casc Setpt Input High Alm
1:0247	Y_ALARMS.ALM.SEL_247	Alarm—Rmt Casc Setpt Input Low Alarm
1:0248	Y_ALARMS.ALM.SEL_248	Alarm—Rmt Aux Setpt Input Failed
1:0249	Y_ALARMS.ALM.SEL_249	Alarm—Rmt Aux Setpt Input High Alm
1:0250	Y_ALARMS.ALM.SEL_250	Alarm—Rmt Aux Setpt Input Low Alarm
1:0251	Y_ALARMS.ALM.SEL_251	Alarm—Rmt Extr Setpt Input Failed
1:0252	Y_ALARMS.ALM.SEL_252	Alarm—Rmt Extr Setpt Input High Alm
1:0253	Y_ALARMS.ALM.SEL_253	Alarm—Rmt Extr Setpt Input Low Alarm
1:0254	Y_ALARMS.ALM.SEL_254	Alarm—Sync Input Failed
1:0255	Y_ALARMS.ALM.SEL_255	Alarm—Sync Input High Alm
1:0256	Y_ALARMS.ALM.SEL_256	Alarm—Sync Input Low Alm
1:0257	Y_ALARMS.ALM.SEL_257	Alarm—FSP Input Failed
1:0258	Y_ALARMS.ALM.SEL_258	Alarm—FSP Input High Alm
1:0259	Y_ALARMS.ALM.SEL_259	Alarm—FSP Input Low Alm
1:0260	Y_ALARMS.ALM.SEL_260	Alarm—Monitor Input Failed
1:0261	Y_ALARMS.ALM.SEL_261	Alarm—Monitor Input High Alm
1:0262	Y_ALARMS.ALM.SEL_262	Alarm—Monitor Input Low Alm
1:0263		
1:0264	through 1:0331	Spare
1:0332		
1:0333	Y_ALARMS.ALM.SEL_333	Alarm—Act #1 (HP) Fault
1:0334	Y_ALARMS.ALM.SEL_334	Alarm—Act #1 Driver A Fault
1:0335	Y_ALARMS.ALM.SEL_335	Alarm—Act #1 Driver B Fault
1:0336	Y_ALARMS.ALM.SEL_336	Alarm—Act #1 Driver C Fault
1:0337	Y_ALARMS.ALM.SEL_337	Alarm—Act #1 Load Fault
1:0338	Y_ALARMS.ALM.SEL_338	Alarm—Act #1 Load A/B Fault

1:0339	Y_ALARMS.ALM.SEL_339	Alarm—Act #1 Load C Fault
1:0340	Y_ALARMS.ALM.SEL_340	Alarm—Act #2 (LP) Fault
1:0341	Y_ALARMS.ALM.SEL_341	Alarm—Act #2 Driver A Fault
1:0342	Y_ALARMS.ALM.SEL_342	Alarm—Act #2 Driver B Fault
1:0343	Y_ALARMS.ALM.SEL_343	Alarm—Act #2 Driver C Fault
1:0344	Y_ALARMS.ALM.SEL_344	Alarm—Act #1 (HP) Driver Alarm
1:0345	Y_ALARMS.ALM.SEL_345	Alarm—Act #2 (LP) Driver Alarm
1:0346	Y_ALARMS.ALM.SEL_346	Alarm—Relay #1 Kernel A Fault
1:0347	Y_ALARMS.ALM.SEL_347	Alarm—Relay #1 A1 Driver Fault
1:0348	Y_ALARMS.ALM.SEL_348	Alarm—Relay #1 A2 Driver Fault
1:0349	Y_ALARMS.ALM.SEL_349	Alarm—Relay #1 A1 Fault
1:0350	Y_ALARMS.ALM.SEL_350	Alarm—Relay #1 A1 Fault
1:0351	Y_ALARMS.ALM.SEL_351	Alarm—Relay #1 B1 Driver Fault
1:0352	Y_ALARMS.ALM.SEL_352	Alarm—Relay #1 B2 Driver Fault
1:0353	Y_ALARMS.ALM.SEL_353	Alarm—Relay #1 B1 Fault
1:0354	Y_ALARMS.ALM.SEL_354	Alarm—Relay #1 B2 Fault
1:0355	Y_ALARMS.ALM.SEL_355	Alarm—Relay #1 C1 Driver Fault
1:0356	Y_ALARMS.ALM.SEL_356	Alarm—Relay #1 C2 Driver Fault
1:0357	Y_ALARMS.ALM.SEL_357	Alarm—Relay #1 C1 Fault
1:0358	Y_ALARMS.ALM.SEL_358	Alarm—Relay #1 C2 Fault
1:0359	Y_ALARMS.ALM.SEL_359	Alarm—Relay #1 A1 or B1 Fault
1:0360	Y_ALARMS.ALM.SEL_360	Alarm—Relay #1 C2 or A2 Fault
1:0361	Y_ALARMS.ALM.SEL_361	Alarm—Relay #1 B2 or C1 Fault
1:0362	Y_ALARMS.ALM.SEL_362	Alarm—Relay #2 A1 Driver Fault
1:0363	Y_ALARMS.ALM.SEL_363	Alarm—Relay #2 A2 Driver Fault
1:0364	Y_ALARMS.ALM.SEL_364	Alarm—Relay #2 A1 Load Fault
1:0365	Y_ALARMS.ALM.SEL_365	Alarm—Relay #2 A2 Load Fault
1:0366	Y_ALARMS.ALM.SEL_366	Alarm—Relay #2 B1 Driver Fault
1:0367	Y_ALARMS.ALM.SEL_367	Alarm—Relay #2 B2 Driver Fault
1:0368	Y_ALARMS.ALM.SEL_368	Alarm—Relay #2 B1 Load Fault
1:0369	Y_ALARMS.ALM.SEL_369	Alarm—Relay #2 B2 Load Fault
1:0370	Y_ALARMS.ALM.SEL_370	Alarm—Relay #2 C1 Driver Fault
1:0371	Y_ALARMS.ALM.SEL_371	Alarm—Relay #2 C2 Driver Fault
1:0372	Y_ALARMS.ALM.SEL_372	Alarm—Relay #2 C1 Fault
1:0373	Y_ALARMS.ALM.SEL_373	Alarm—Relay #2 C2 Fault
1:0374	Y_ALARMS.ALM.SEL_374	Alarm—Relay #2 A1 or B1 Fault
1:0375	Y_ALARMS.ALM.SEL_375	Alarm—Relay #2 C2 or A2 Fault
1:0376	Y_ALARMS.ALM.SEL_376	Alarm—Relay #2 B2 or C1 Fault
1:0377	Y_ALARMS.ALM.SEL_377	Alarm—Relay #3 A1 Driver Fault
1:0378	Y_ALARMS.ALM.SEL_378	Alarm—Relay #3 A2 Driver Fault
1:0379	Y_ALARMS.ALM.SEL_379	Alarm—Relay #3 A1 Fault
1:0380	Y_ALARMS.ALM.SEL_380	Alarm—Relay #3 A2 Fault
1:0381	Y_ALARMS.ALM.SEL_381	Alarm—Relay #3 B1 Driver Fault
1:0382	Y_ALARMS.ALM.SEL_382	Alarm—Relay #3 B2 Driver Fault
1:0383	Y_ALARMS.ALM.SEL_383	Alarm—Relay #3 B1 Fault
1:0384	Y_ALARMS.ALM.SEL_384	Alarm—Relay #3 B2 Fault
1:0385	Y_ALARMS.ALM.SEL_385	Alarm—Relay #3 C1 Driver Fault
1:0386	Y_ALARMS.ALM.SEL_386	Alarm—Relay #3 C2 Driver Fault
1:0387	Y_ALARMS.ALM.SEL_387	Alarm—Relay #3 C1 Fault
1:0388	Y_ALARMS.ALM.SEL_388	Alarm—Relay #3 C2 Fault
1:0389	Y_ALARMS.ALM.SEL_389	Alarm—Relay #3 A1 or B1 Fault
1:0390	Y_ALARMS.ALM.SEL_390	Alarm—Relay #3 C2 or A2 Fault
1:0391	Y_ALARMS.ALM.SEL_391	Alarm—Relay #3 B2 or C1 Fault
1:0392	Y_ALARMS.ALM.SEL_392	Alarm—Relay #4 A1 Driver Fault
1:0393	Y_ALARMS.ALM.SEL_393	Alarm—Relay #4 A2 Driver Fault
1:0394	Y_ALARMS.ALM.SEL_394	Alarm—Relay #4 A1 Fault
1:0395	Y_ALARMS.ALM.SEL_395	Alarm—Relay #4 A2 Fault
1:0396	Y_ALARMS.ALM.SEL_396	Alarm—Relay #4 B1 Driver Fault
1:0397	Y_ALARMS.ALM.SEL_397	Alarm—Relay #4 B2 Driver Fault
1:0398	Y_ALARMS.ALM.SEL_398	Alarm—Relay #4 B1 Fault
1:0399	Y_ALARMS.ALM.SEL_399	Alarm—Relay #4 B2 Fault

1:0400	Y_ALARMS.ALM.SEL_400	Alarm—Relay #4 C1 Driver Fault
1:0401	Y_ALARMS.ALM.SEL_401	Alarm—Relay #4 C2 Driver Fault
1:0402	Y_ALARMS.ALM.SEL_402	Alarm—Relay #4 C1 Fault
1:0403	Y_ALARMS.ALM.SEL_403	Alarm—Relay #4 C2 Fault
1:0404	Y_ALARMS.ALM.SEL_404	Alarm—Relay #4 A1 or B1 Fault
1:0405	Y_ALARMS.ALM.SEL_405	Alarm—Relay #4 C2 or A2 Fault
1:0406	Y_ALARMS.ALM.SEL_406	Alarm—Relay #4 B2 or C1 Fault
1:0407	Y_ALARMS.ALM.SEL_407	Alarm—Relay #5 A1 Driver Fault
1:0408	Y_ALARMS.ALM.SEL_408	Alarm—Relay #5 A2 Driver Fault
1:0409	Y_ALARMS.ALM.SEL_409	Alarm—Relay #5 A1 Fault
1:0410	Y_ALARMS.ALM.SEL_410	Alarm—Relay #5 A2 Fault
1:0411	Y_ALARMS.ALM.SEL_411	Alarm—Relay #5 B1 Driver Fault
1:0412	Y_ALARMS.ALM.SEL_412	Alarm—Relay #5 B2 Driver Fault
1:0413	Y_ALARMS.ALM.SEL_413	Alarm—Relay #5 B1 Fault
1:0414	Y_ALARMS.ALM.SEL_414	Alarm—Relay #5 B2 Fault
1:0415	Y_ALARMS.ALM.SEL_415	Alarm—Relay #5 C1 Driver Fault
1:0416	Y_ALARMS.ALM.SEL_416	Alarm—Relay #5 C2 Driver Fault
1:0417	Y_ALARMS.ALM.SEL_417	Alarm—Relay #5 C1 Fault
1:0418	Y_ALARMS.ALM.SEL_418	Alarm—Relay #5 C2 Fault
1:0419	Y_ALARMS.ALM.SEL_419	Alarm—Relay #5 A1 or B1 Fault
1:0420	Y_ALARMS.ALM.SEL_420	Alarm—Relay #5 C2 or A2 Fault
1:0421	Y_ALARMS.ALM.SEL_421	Alarm—Relay #5 B2 or C1 Fault
1:0422	Y_ALARMS.ALM.SEL_422	Alarm—Relay #6 A1 Driver Fault
1:0423	Y_ALARMS.ALM.SEL_423	Alarm—Relay #6 A2 Driver Fault
1:0424	Y_ALARMS.ALM.SEL_424	Alarm—Relay #6 A1 Fault
1:0425	Y_ALARMS.ALM.SEL_425	Alarm—Relay #6 A2 Fault
1:0426	Y_ALARMS.ALM.SEL_426	Alarm—Relay #6 B1 Driver Fault
1:0427	Y_ALARMS.ALM.SEL_427	Alarm—Relay #6 B2 Driver Fault
1:0428	Y_ALARMS.ALM.SEL_428	Alarm—Relay #6 B1 Fault
1:0429	Y_ALARMS.ALM.SEL_429	Alarm—Relay #6 B2 Fault
1:0430	Y_ALARMS.ALM.SEL_430	Alarm—Relay #6 C1 Driver Fault
1:0431	Y_ALARMS.ALM.SEL_431	Alarm—Relay #6 C2 Driver Fault
1:0432	Y_ALARMS.ALM.SEL_432	Alarm—Relay #6 C1 Fault
1:0433	Y_ALARMS.ALM.SEL_433	Alarm—Relay #6 C2 Fault
1:0434	Y_ALARMS.ALM.SEL_434	Alarm—Relay #6 A1 or B1 Fault
1:0435	Y_ALARMS.ALM.SEL_435	Alarm—Relay #6 C2 or A2 Fault
1:0436	Y_ALARMS.ALM.SEL_436	Alarm—Relay #6 B2 or C1 Fault
1:0437	Y_ALARMS.ALM.SEL_437	Alarm—Relay #7 A1 Driver Fault
1:0438	Y_ALARMS.ALM.SEL_438	Alarm—Relay #7 A2 Driver Fault
1:0439	Y_ALARMS.ALM.SEL_439	Alarm—Relay #7 A1 Fault
1:0440	Y_ALARMS.ALM.SEL_440	Alarm—Relay #7 A2 Fault
1:0441	Y_ALARMS.ALM.SEL_441	Alarm—Relay #7 B1 Driver Fault
1:0442	Y_ALARMS.ALM.SEL_442	Alarm—Relay #7 B2 Driver Fault
1:0443	Y_ALARMS.ALM.SEL_443	Alarm—Relay #7 B1 Fault
1:0444	Y_ALARMS.ALM.SEL_444	Alarm—Relay #7 B2 Fault
1:0445	Y_ALARMS.ALM.SEL_445	Alarm—Relay #7 C1 Driver Fault
1:0446	Y_ALARMS.ALM.SEL_446	Alarm—Relay #7 C2 Driver Fault
1:0447	Y_ALARMS.ALM.SEL_447	Alarm—Relay #7 C1 Fault
1:0448	Y_ALARMS.ALM.SEL_448	Alarm—Relay #7 C2 Fault
1:0449	Y_ALARMS.ALM.SEL_449	Alarm—Relay #7 A1 or B1 Fault
1:0450	Y_ALARMS.ALM.SEL_450	Alarm—Relay #7 C2 or A2 Fault
1:0451	Y_ALARMS.ALM.SEL_451	Alarm—Relay #7 B2 or C1 Fault
1:0452	Y_ALARMS.ALM.SEL_452	Alarm—Relay #8 A1 Driver Fault
1:0453	Y_ALARMS.ALM.SEL_453	Alarm—Relay #8 A2 Driver Fault
1:0454	Y_ALARMS.ALM.SEL_454	Alarm—Relay #8 A1 Fault
1:0455	Y_ALARMS.ALM.SEL_455	Alarm—Relay #8 A2 Fault
1:0456	Y_ALARMS.ALM.SEL_456	Alarm—Relay #8 B1 Driver Fault
1:0457	Y_ALARMS.ALM.SEL_457	Alarm—Relay #8 B2 Driver Fault
1:0458	Y_ALARMS.ALM.SEL_458	Alarm—Relay #8 B1 Fault
1:0459	Y_ALARMS.ALM.SEL_459	Alarm—Relay #8 B2 Fault
1:0460	Y_ALARMS.ALM.SEL_460	Alarm—Relay #8 C1 Driver Fault

1:0461	Y_ALARMS.ALM.SEL_461	Alarm—Relay #8 C2 Driver Fault
1:0462	Y_ALARMS.ALM.SEL_462	Alarm—Relay #8 C1 Fault
1:0463	Y_ALARMS.ALM.SEL_463	Alarm—Relay #8 C2 Fault
1:0464	Y_ALARMS.ALM.SEL_464	Alarm—Relay #8 A1 or B1 Fault
1:0465	Y_ALARMS.ALM.SEL_465	Alarm—Relay #8 C2 or A2 Fault
1:0466	Y_ALARMS.ALM.SEL_466	Alarm—Relay #8 B2 or C1 Fault
1:0467	Y_ALARMS.ALM.SEL_467	Alarm—Relay #9 A1 Driver Fault
1:0468	Y_ALARMS.ALM.SEL_468	Alarm—Relay #9 A2 Driver Fault
1:0469	Y_ALARMS.ALM.SEL_469	Alarm—Relay #9 A1 Fault
1:0470	Y_ALARMS.ALM.SEL_470	Alarm—Relay #9 A2 Fault
1:0471	Y_ALARMS.ALM.SEL_471	Alarm—Relay #9 B1 Driver Fault
1:0472	Y_ALARMS.ALM.SEL_472	Alarm—Relay #9 B2 Driver Fault
1:0473	Y_ALARMS.ALM.SEL_473	Alarm—Relay #9 B1 Fault
1:0474	Y_ALARMS.ALM.SEL_474	Alarm—Relay #9 B2 Fault
1:0475	Y_ALARMS.ALM.SEL_475	Alarm—Relay #9 C1 Driver Fault
1:0476	Y_ALARMS.ALM.SEL_476	Alarm—Relay #9 C1 Driver Fault
1:0477	Y_ALARMS.ALM.SEL_477	Alarm—Relay #9 C1 Fault
1:0478	Y_ALARMS.ALM.SEL_478	Alarm—Relay #9 C2 Fault
1:0479	Y_ALARMS.ALM.SEL_479	Alarm—Relay #9 A1 or B1 Fault
1:0480	Y_ALARMS.ALM.SEL_480	Alarm—Relay #9 C2 or A2 Fault
1:0481	Y_ALARMS.ALM.SEL_481	Alarm—Relay #9 B2 or C1 Fault
1:0482	Y_ALARMS.ALM.SEL_482	Alarm—Relay #10 A1 Driver Fault
1:0483	Y_ALARMS.ALM.SEL_483	Alarm—Relay #10 A1 Driver Fault
1:0484	Y_ALARMS.ALM.SEL_484	Alarm—Relay #10 A1 Fault
1:0485	Y_ALARMS.ALM.SEL_485	Alarm—Relay #10 A2 Fault
1:0486	Y_ALARMS.ALM.SEL_486	Alarm—Relay #10 B1 Driver Fault
1:0487	Y_ALARMS.ALM.SEL_487	Alarm—Relay #10 B2 Driver Fault
1:0488	Y_ALARMS.ALM.SEL_488	Alarm—Relay #1Fault
1:0489	Y_ALARMS.ALM.SEL_489	Alarm—Relay #1Fault
1:0490	Y_ALARMS.ALM.SEL_490	Alarm—Relay #10 C1 Driver Fault
1:0491	Y_ALARMS.ALM.SEL_491	Alarm—Relay #10 C2 Driver Fault
1:0492	Y_ALARMS.ALM.SEL_492	Alarm—Relay #1Fault
1:0493	Y_ALARMS.ALM.SEL_493	Alarm—Relay #1Fault
1:0494	Y_ALARMS.ALM.SEL_494	Alarm—Relay #10 A1 or B1 Fault
1:0495	Y_ALARMS.ALM.SEL_495	Alarm—Relay #10 C2 or A2 Fault
1:0496	Y_ALARMS.ALM.SEL_496	Alarm—Relay #10 B2 or C1 Fault
1:0497	Y_ALARMS.ALM.SEL_497	Alarm—Relay #11 A1 Driver Fault
1:0498	Y_ALARMS.ALM.SEL_498	Alarm—Relay #11 A2 Driver Fault
1:0499	Y_ALARMS.ALM.SEL_499	Alarm—Relay #11 A1 Fault
1:0500	Y_ALARMS.ALM.SEL_500	Alarm—Relay #11 A2 Fault
1:0501	Y_ALARMS.ALM.SEL_501	Alarm—Relay #11 B1 Driver Fault
1:0502	Y_ALARMS.ALM.SEL_502	Alarm—Relay #11 B2 Driver Fault
1:0503	Y_ALARMS.ALM.SEL_503	Alarm—Relay #11 B1 Fault
1:0504	Y_ALARMS.ALM.SEL_504	Alarm—Relay #11 B2 Fault
1:0505	Y_ALARMS.ALM.SEL_505	Alarm—Relay #11 C1 Driver Fault
1:0506	Y_ALARMS.ALM.SEL_506	Alarm—Relay #11 C2 Driver Fault
1:0507	Y_ALARMS.ALM.SEL_507	Alarm—Relay #11 C1 Fault
1:0508	Y_ALARMS.ALM.SEL_508	Alarm—Relay #11 C2 Fault
1:0509	Y_ALARMS.ALM.SEL_509	Alarm—Relay #11 A1 or B1 Fault
1:0510	Y_ALARMS.ALM.SEL_510	Alarm—Relay #11 C2 or A2 Fault
1:0511	Y_ALARMS.ALM.SEL_511	Alarm—Relay #11 B2 or C1 Fault
1:0512	Y_ALARMS.ALM.SEL_512	Alarm—Relay #12 A1 Driver Fault
1:0513	Y_ALARMS.ALM.SEL_513	Alarm—Relay #12 A2 Driver Fault
1:0514	Y_ALARMS.ALM.SEL_514	Alarm—Relay #12 A1 Fault
1:0515	Y_ALARMS.ALM.SEL_515	Alarm—Relay #12 A2 Fault
1:0516	Y_ALARMS.ALM.SEL_516	Alarm—Relay #12 B1 Driver Fault
1:0517	Y_ALARMS.ALM.SEL_517	Alarm—Relay #12 B2 Driver Fault
1:0518	Y_ALARMS.ALM.SEL_518	Alarm—Relay #12 B1 Fault
1:0519	Y_ALARMS.ALM.SEL_519	Alarm—Relay #12 B2 Fault
1:0520	Y_ALARMS.ALM.SEL_520	Alarm—Relay #12 C1 Driver Fault
1:0521	Y_ALARMS.ALM.SEL_521	Alarm—Relay #12 C2 Driver Fault

1:0522	Y_ALARMS.ALM.SEL_522	Alarm—Relay #12 C1 Fault
1:0523	Y_ALARMS.ALM.SEL_523	Alarm—Relay #12 C2 Fault
1:0524	Y_ALARMS.ALM.SEL_524	Alarm—Relay #12 A1 or B1 Fault
1:0525	Y_ALARMS.ALM.SEL_525	Alarm—Relay #12 C2 or A2 Fault
1:0526	Y_ALARMS.ALM.SEL_526	Alarm—Relay #12 B2 or C1 Fault
1:0527	Y_ALARMS.ALM.SEL_527	Alarm—Relay #1 Power Fault
1:0528	Y_ALARMS.ALM.SEL_528	Alarm—Relay #2 Power Fault
1:0529	Y_ALARMS.ALM.SEL_529	Alarm—Relay #3 Power Fault
1:0530	Y_ALARMS.ALM.SEL_530	Alarm—Relay #4 Power Fault
1:0531	Y_ALARMS.ALM.SEL_531	Alarm—Relay #5 Power Fault
1:0532	Y_ALARMS.ALM.SEL_532	Alarm—Relay #6 Power Fault
1:0533	Y_ALARMS.ALM.SEL_533	Alarm—Relay #7 Power Fault
1:0534	Y_ALARMS.ALM.SEL_534	Alarm—Relay #8 Power Fault
1:0535	Y_ALARMS.ALM.SEL_535	Alarm—Relay #9 Power Fault
1:0536	Y_ALARMS.ALM.SEL_536	Alarm—Relay #10 Power Fault
1:0537	Y_ALARMS.ALM.SEL_537	Alarm—Relay #11 Power Fault
1:0538	Y_ALARMS.ALM.SEL_538	Alarm—Relay #12 Power Fault
1:0539	Y_ALARMS.ALM.SEL_539	Alarm—Analog Out #1 Failed
1:0540	Y_ALARMS.ALM.SEL_540	Alarm—Anlg Out #1 Drvr A Fault
1:0541	Y_ALARMS.ALM.SEL_541	Alarm—Anlg Out #1 Drvr B Fault
1:0542	Y_ALARMS.ALM.SEL_542	Alarm—Anlg Out #1 Drvr C Fault
1:0543	Y_ALARMS.ALM.SEL_543	Alarm—Anlg Out #1 Load Fault
1:0544	Y_ALARMS.ALM.SEL_544	Alarm—Analog Out #2 Failed
1:0545	Y_ALARMS.ALM.SEL_545	Alarm—Anlg Out #2 Drvr A Fault
1:0546	Y_ALARMS.ALM.SEL_546	Alarm—Anlg Out #2 Drvr B Fault
1:0547	Y_ALARMS.ALM.SEL_547	Alarm—Anlg Out #2 Drvr C Fault
1:0548	Y_ALARMS.ALM.SEL_548	Alarm—Anlg Out #2 Load Fault
1:0549	Y_ALARMS.ALM.SEL_549	Alarm—Analog Out #3 Failed
1:0550	Y_ALARMS.ALM.SEL_550	Alarm—Anlg Out #3 Drvr A Fault
1:0551	Y_ALARMS.ALM.SEL_551	Alarm—Anlg Out #3 Drvr B Fault
1:0552	Y_ALARMS.ALM.SEL_552	Alarm—Anlg Out #3 Drvr C Fault
1:0553	Y_ALARMS.ALM.SEL_553	Alarm—Anlg Out #3 Load Fault
1:0554	Y_ALARMS.ALM.SEL_554	Alarm—Analog Out #4 Failed
1:0555	Y_ALARMS.ALM.SEL_555	Alarm—Anlg Out #4 Drvr A Fault
1:0556	Y_ALARMS.ALM.SEL_556	Alarm—Anlg Out #4 Drvr B Fault
1:0557	Y_ALARMS.ALM.SEL_557	Alarm—Anlg Out #4 Drvr C Fault
1:0558	Y_ALARMS.ALM.SEL_558	Alarm—Anlg Out #4 Load Fault
1:0559	Y_ALARMS.ALM.SEL_559	Alarm—AO#1 in Calib or Out Removed
1:0560	Y_ALARMS.ALM.SEL_560	Alarm—AO#2 in Calib or Out Removed
1:0561	Y_ALARMS.ALM.SEL_561	Alarm—AO#3 in Calib or Out Removed
1:0562	Y_ALARMS.ALM.SEL_562	Alarm—AO#4 in Calib or Out Removed
1:0563	Y_ALARMS.ALM.SEL_563	Alarm—Act1 in Calib or Out Removed
1:0564	Y_ALARMS.ALM.SEL_564	Alarm—Act2 in Calib or Out Removed
1:0565		
1:0566	through 1:0799	
1:0800		
1:0801	CONF_CHK_1.C_ERR.SEL_1	Prgm Error—Duplicate Contact In
1:0802	CONF_CHK_1.C_ERR.SEL_2	Prgm Error—Contact In #5
1:0803	CONF_CHK_1.C_ERR.SEL_3	Prgm Error—Contact In #6
1:0804	CONF_CHK_1.C_ERR.SEL_4	Prgm Error—Contact In #7
1:0805	CONF_CHK_1.C_ERR.SEL_5	Prgm Error—Contact In #8
1:0806	CONF_CHK_1.C_ERR.SEL_6	Prgm Error—Contact In #9
1:0807	CONF_CHK_1.C_ERR.SEL_7	Prgm Error—Contact In #10
1:0808	CONF_CHK_1.C_ERR.SEL_8	Prgm Error—Contact In #11
1:0809	CONF_CHK_1.C_ERR.SEL_9	Prgm Error—Contact In #12
1:0810	CONF_CHK_1.C_ERR.SEL_10	Prgm Error—Contact In #13
1:0811	CONF_CHK_1.C_ERR.SEL_11	Prgm Error—Contact In #14
1:0812	CONF_CHK_1.C_ERR.SEL_12	Prgm Error—Contact In #15
1:0813	CONF_CHK_1.C_ERR.SEL_13	Prgm Error—Contact In #16
1:0814	CONF_CHK_1.C_ERR.SEL_14	Prgm Error—Contact In #17
1:0815	CONF_CHK_1.C_ERR.SEL_15	Prgm Error—Contact In #18

1:0816	CONF_CHK_1.C_ERR.SEL_16	Prgm Error—Contact In #19
1:0817	CONF_CHK_1.C_ERR.SEL_17	Prgm Error—Contact In #20
1:0818	CONF_CHK_1.C_ERR.SEL_18	Prgm Error—Contact In #21
1:0819	CONF_CHK_1.C_ERR.SEL_19	Prgm Error—Contact In #22
1:0820	CONF_CHK_1.C_ERR.SEL_20	Prgm Error—Contact In #23
1:0821	CONF_CHK_1.C_ERR.SEL_21	Prgm Error—Contact In #24
1:0822	CONF_CHK_1.C_ERR.SEL_22	Prgm Error—Duplicate Anlg INs
1:0823	CONF_CHK_1.C_ERR.SEL_23	Prgm Error—Analog In #1
1:0824	CONF_CHK_1.C_ERR.SEL_24	Prgm Error—Analog In #2
1:0825	CONF_CHK_1.C_ERR.SEL_25	Prgm Error—Analog In #3
1:0826	CONF_CHK_1.C_ERR.SEL_26	Prgm Error—Analog In #4
1:0827	CONF_CHK_1.C_ERR.SEL_27	Prgm Error—Analog In #5
1:0828	CONF_CHK_1.C_ERR.SEL_28	Prgm Error—Analog In #6
1:0829	CONF_CHK_1.C_ERR.SEL_29	Prgm Error—Analog In #7
1:0830	CONF_CHK_1.C_ERR.SEL_30	Prgm Error—Analog In #8
1:0831	CONF_CHK_1.C_ERR.SEL_31	Prgm Error—Relay #3
1:0832	CONF_CHK_1.C_ERR.SEL_32	Prgm Error—Relay #4
1:0833	CONF_CHK_1.C_ERR.SEL_33	Prgm Error—Relay #5
1:0834	CONF_CHK_1.C_ERR.SEL_34	Prgm Error—Relay #6
1:0835	CONF_CHK_1.C_ERR.SEL_35	Prgm Error—Relay #7
1:0836	CONF_CHK_1.C_ERR.SEL_36	Prgm Error—Relay #8
1:0837	CONF_CHK_1.C_ERR.SEL_37	Prgm Error—Relay #9
1:0838	CONF_CHK_1.C_ERR.SEL_38	Prgm Error—Relay #10
1:0839	CONF_CHK_1.C_ERR.SEL_39	Prgm Error—Relay #11
1:0840	CONF_CHK_1.C_ERR.SEL_40	Prgm Error—Relay #12
1:0841	CONF_CHK_1.C_ERR.SEL_41	Prgm Error—Readout #1
1:0842	CONF_CHK_1.C_ERR.SEL_42	Prgm Error—Readout #2
1:0843	CONF_CHK_1.C_ERR.SEL_43	Prgm Error—Readout #3
1:0844	CONF_CHK_1.C_ERR.SEL_44	Prgm Error—Readout #4
1:0845	CONF_CHK_1.C_ERR.SEL_45	Prgm Error—Act #2 Readout
1:0846	CONF_CHK_1.C_ERR.SEL_46	Prgm Error—No Start Mode
1:0847	CONF_CHK_1.C_ERR.SEL_47	Prgm Error—Max Speed > 25000
1:0848	CONF_CHK_1.C_ERR.SEL_48	Prgm Error—Failed Speed Level
1:0849	CONF_CHK_1.C_ERR.SEL_49	Prgm Error—Speed Input #4
1:0850	CONF_CHK_1.C_ERR.SEL_50	Prgm Error—Spd Setpt Settings
1:0851	CONF_CHK_1.C_ERR.SEL_51	Prgm Error—Crit Rate < Slow Rate
1:0852	CONF_CHK_1.C_ERR.SEL_52	Prgm Error—Crit #2 / No Crit #1
1:0853	CONF_CHK_1.C_ERR.SEL_53	Prgm Error—Critical Band < Idle
1:0854	CONF_CHK_1.C_ERR.SEL_54	Prgm Error—Crit Bnd Err / No Idle
1:0855	CONF_CHK_1.C_ERR.SEL_55	Prgm Error—Crit Band #1 Settings
1:0856	CONF_CHK_1.C_ERR.SEL_56	Prgm Error—Crit Band #2 Settings
1:0857	CONF_CHK_1.C_ERR.SEL_57	Prgm Error—Idle/Rated Settings
1:0858	CONF_CHK_1.C_ERR.SEL_58	Prgm Error—Idle > Min Gov Setpt
1:0859	CONF_CHK_1.C_ERR.SEL_59	Prgm Error—Rated > Max Gov Setpt
1:0860	CONF_CHK_1.C_ERR.SEL_60	Prgm Error—Auto Start Seq Settings
1:0861	CONF_CHK_1.C_ERR.SEL_61	Prgm Error—Hi Idle Set in Crit Band
1:0862	CONF_CHK_1.C_ERR.SEL_62	Prgm Error—Lo Idle Set in Crit Band
1:0863	CONF_CHK_1.C_ERR.SEL_63	Prgm Error—Hi Idle > Min Gov
1:0864	CONF_CHK_1.C_ERR.SEL_64	Prgm Error—Steam Map Settings
1:0865	CONF_CHK_1.C_ERR.SEL_65	Prgm Error—No Extr Analog Input
1:0866	CONF_CHK_1.C_ERR.SEL_66	Prgm Error—No Rmt Extr Anlg Input
1:0867	CONF_CHK_1.C_ERR.SEL_67	Prgm Error—No Cascade Anlg Input
1:0868	CONF_CHK_1.C_ERR.SEL_68	Prgm Error—No Rmt Casc Anlg Input
1:0869	CONF_CHK_1.C_ERR.SEL_69	Prgm Error—No Aux Analog Input
1:0870	CONF_CHK_1.C_ERR.SEL_70	Prgm Error—No Rmt Aux Anlg Input
1:0871	CONF_CHK_1.C_ERR.SEL_71	Prgm Error—No Rmt Spd Anlg Input
1:0872	CONF_CHK_1.C_ERR.SEL_72	Prgm Error—Extr Setpt Settings
1:0873	CONF_CHK_1.C_ERR.SEL_73	Prgm Error—Casc Setpt Settings
1:0874	CONF_CHK_1.C_ERR.SEL_74	Prgm Error—Aux Setpt Settings
1:0875	CONF_CHK_1.C_ERR.SEL_75	Prgm Error—KW/Load Setpt Settings
1:0876	CONF_CHK_1.C_ERR.SEL_76	Prgm Error—No Tie Brkr Input

1:0877	CONF_CHK_1.C_ERR.SEL_77	Prgm Error—No Gen Brkr Input
1:0878	CONF_CHK_1.C_ERR.SEL_78	Prgm Error—No Ld Shr Anlg Input
1:0879	CONF_CHK_1.C_ERR.SEL_79	Prgm Error—No Sync Anlg Input
1:0880	CONF_CHK_1.C_ERR.SEL_80	Prgm Error—No KW/MW Anlg Input
1:0881	CONF_CHK_1.C_ERR.SEL_81	Prgm Error—Sync & Ld Shr Anlgs Prgmd
1:0882	CONF_CHK_1.C_ERR.SEL_82	Prgm Error—Freq E/D & Ld Shr Prgmd
1:0883	CONF_CHK_1.C_ERR.SEL_83	Prgm Error—KW Max Ld > KW Input
1:0884	CONF_CHK_1.C_ERR.SEL_84	Prgm Error—KW & Aux Anlgs Prgmd
1:0885	CONF_CHK_1.C_ERR.SEL_85	Prgm Error—KW & Casc Anlgs Prgmd
1:0886		
1:0887	through 1:0902	Spare
1:0903		
1:0904	Z_MOD.CTC_LATCH.LATCH	Alarm Not Acknowledged
1:0905	Z_MOD.ALM_ACKN1.B_SW	Alarm Acknowledge
1:0906	Y_ALARMS.ALM.ALM	Alarm Exists (Common Alarm Indication)
1:0907	Y_ALARMS.MAJOR_ALM.OR	Major Alarm Exists
1:0908		
1:0950		
1:0951	X_TRIPS.ANY.SEL_2	Trip—External Trip
1:0952	X_TRIPS.ANY.SEL_3	Trip—External Trip 2
1:0953	X_TRIPS.ANY.SEL_4	Trip—External Trip 3
1:0954	X_TRIPS.ANY.SEL_5	Trip—External Trip 4
1:0955	X_TRIPS.ANY.SEL_6	Trip—External Trip 5
1:0956	X_TRIPS.ANY.SEL_7	Trip—External Trip 6
1:0957	X_TRIPS.ANY.SEL_8	Trip—External Trip 7
1:0958	X_TRIPS.ANY.SEL_9	Trip—External Trip 8
1:0959	X_TRIPS.ANY.SEL_10	Trip—External Trip 9
1:0960	X_TRIPS.ANY.SEL_11	Trip—External Trip 10
1:0961	X_TRIPS.ANY.SEL_12	Trip—PC Programmer Trip
1:0962	X_TRIPS.ANY.SEL_13	Trip—Modbus Link #1 Trip
1:0963	X_TRIPS.ANY.SEL_14	Trip—Modbus Link #2 Trip
1:0964	X_TRIPS.ANY.SEL_15	Trip—Overspeed Trip
1:0965	X_TRIPS.ANY.SEL_16	Trip—Loss of all Speed Probes
1:0966	X_TRIPS.ANY.SEL_17	Trip—All Anlg I/O Modules Failed
1:0967	X_TRIPS.ANY.SEL_18	Trip—All Discrete I/O Mods Failed
1:0968	X_TRIPS.ANY.SEL_19	Trip—Act #1 (HP) Fault
1:0969	X_TRIPS.ANY.SEL_20	Trip—Act #2 (LP) Fault
1:0970	X_TRIPS.ANY.SEL_21	Trip—Aux Input Failed
1:0971	X_TRIPS.ANY.SEL_22	Trip—Extraction Input Failed
1:0972	X_TRIPS.ANY.SEL_23	Trip—Tie Breaker Opened
1:0973	X_TRIPS.ANY.SEL_24	Trip—Gen Breaker Opened
1:0974	X_TRIPS.ANY.SEL_1	Trip—Power Up Trip
1:0975	X_TRIPS.ANY.SEL_25	Trip—Controlled Shutdown
1:0976	X_TRIPS.ANY.SEL_26	Trip—Configuration Error
1:0977		
1:0978	through 1:0999	Spare
1:1000		
1:1001	Y_ALARMS.MAJOR_ALM.OR	Major Alarm Condition
1:1002	Y_ALARMS.MINOR_ALM.AND	Minor Alarm Condition
1:1003	Y_ALARMS.ALM.HORN	Any Alarm Condition
1:1004	X_TRIPS.TRIPPED.B_NAME	Shutdown Condition
1:1005	Z_MOD_VALS.MOD_OS1.ONE_ SHOT	ESD Acknowledge Enable
1:1006	I_V1_STRT.START2_EN.AND	Ready for 2nd Start (open hp)
1:1007	I_START.OK_TO_STRT.AND	Start Permissives Met
1:1008	I_START.LTCH_START.LATCH	Unit Started / Run Initiated
1:1009	D_IFACE_O.MVG_TO_IDL.B_NA ME	Startup—Moving to Min Setpoint
1:1010	D_IFACE_O.IDLE.B_NAME	Idle/Rated—Ramping to Idle
1:1011	C_IDLE_RTD.AT_IDLE.A_EQUA L	Idle/Rated—At Idle Setpt
1:1012	D_IFACE_O.RATED.B_NAME	Idle/Rated—Ramping to Rated
1:1013	D_IFACE_O.AT_RATED.B_NAM E	Idle/Rated—At Rated Setpt
1:1014	D_IDLE_RTD.ENBL_IDLE.AND	Idle/Rated—Idle Permissive

1:1015	D_IDLE_RTD.ENBL_RATED.AN D	Idle/Rated—Rated Permissive
1:1016	D_IFACE_O.AT_LO_IDL.B_NAM E	Auto Seq—Setpt at Lo Idle
1:1017	D_IFACE_O.SEL_HI_IDL.B_NAM E	Auto Seq—Ramping to High Idle
1:1018	D_IFACE_O.AT_HI_IDL.B_NAM E	Auto Seq—Setpt at High Idle
1:1019	D_IDLE_RTD.SEL_RATED.B_S W	Auto Seq—Ramping to Rated
1:1020	D_IFACE_O.AT_ASS_RTD.B_N AME	Auto Seq—At Rated
1:1021	D_AUTOENBL.HAULT.NOT	Auto Seq—Sequence Halted
1:1022	D_AUTOENBL.ASS_PERM.NOT	Auto Seq—Permissive
1:1023		
1:1024		
1:1025	D_IFACE_O.SPD_LSSCTL.B_NA ME	Speed PID In Control of LSS (not aux)
1:1026	D_MPU_OVRD.OVRD_ON.OR	Speed Sensor 1 Failed Override ON
1:1027	A_SPEED2.OVRD_INPUT.OR	Speed Sensor 2 Failed Override ON
1:1028	A_SPEED3.OVRD_INPUT.OR	Speed Sensor 3 Failed Override ON
1:1029	A_SPEED4.OVRD_INPUT.OR	Speed Sensor 4 Failed Override ON
1:1030	D_IFACE_O.OSPD_PERM.B_NA ME	Overspeed Test Permissive
1:1031	D_IFACE_O.IN_OSPDTST.B_NA ME	Overspeed Test In Progress
1:1032	D_OSPD_EN.INTRNL_TST.LAT CH_R	Electrical (5009) Ospd Test Enabled
1:1033	D_OSPD_EN.EXTRNL_TST.LAT CH_R	External Overspeed Test Enabled
1:1034	D_MPU.SPD>MINGOV.A_COMP ARE	Speed At or above Min Gov
1:1035	D_IFACE_O.IN_CRIT.B_NAME	Turbine In Critical Speed Band
1:1036	D_SPD_R_L.EN_R_L.NOR	Speed Setpt Raise/Lower Permissive
1:1037		
1:1038	D_REMOTE.RMT_PERM.AND	Remote Speed Control Permissible
1:1039	D_RMT_ENBL.RMT_ENBL.LATC H_R	Remote Speed Setpt Is Enabled
1:1040	D_REMOTE.RMT_ACTV.AND	Remote Speed Setpt Is Active
1:1041	J_MESSAGE.RMT_IN_CTL.AND	Remote Speed Setpt Is In Control
1:1042	D_RMT_ENBL.INHIBITED.OR	Remote Speed Setpt Is Inhibited
1:1043	J_CONTROL.SPD_CTRL.AND	Speed PID In Control (not being lmted)
1:1044		
1:1045	D_SPD_CTRL.SW_DYN.B_SW	On-Line Dynamics Mode
1:1046	D_BRKR.GEN_BRKR.B_NAME	Generator Breaker Closed
1:1047	D_BRKR.UTIL_TIE.B_NAME	Utility Tie Breaker Closed
1:1048		
1:1049		
1:1050	D_SYNC_SEL.SYNC_PERM.AN D	Sync/Ld Share is Permissible
1:1051	D_SYNC_SEL.SYNC_ENBLD.LA TCH_R	Synchronizing Is Enabled
1:1052	D_LD_SHARE.LS_CTRL.AND	Sync or Load Share Is In Control
1:1053	D_SYNC_SEL.INHIBITED.OR	Sync / Load Share Is Inhibited
1:1054		
1:1055	D_FREQ.FREQ_ARMD.B_SW	Frequency Control Armed
1:1056	D_FREQ.ISOCH.AND	Frequency Control Active
1:1057		
1:1058	F_RMT_CASC.RL_PERM.NOR	Cascade Raise/Lower Perm
1:1059	F_CASC_EN.CASC_PERM.AND	Cascade Ctrl Is Permissible
1:1060	F_CASC_EN.CASC_EN.LATCH_ R	Cascade Is Enabled
1:1061	F_CASC_EN.CASC_CTRL.AND	Cascade Is Active
1:1062	J_MESSAGE.CASC_CTL.AND	Cascade Is In Control
1:1063	F_CASC_EN.INHIBITED.OR	Cascade Is Inhibited
1:1064	F_RMT_CASC.RMT_CAS_EN.L ATCH_R	Rmt Cascade Is Enabled
1:1065	F_RMT_CASC.REM_SEL.AND	Rmt Cascade Is Active
1:1066	J_MESSAGE.CASC_RMT.AND	Rmt Cascade Is In Control
1:1067	F_RMT_CASC.INHIBITED.OR	Rmt Cascade Is Inhibited
1:1068		
1:1069	G_RMT_AUX.RL_PERM.B_SW	Auxiliary Raise/Lower Perm
1:1070	G_AUX_ENBL.AUX_PERM.AND	Auxiliary Ctrl Is Permissible
1:1071	G_AUX_ENBL.AUX_EN.B_SW	Auxiliary Is Enabled
1:1072	G_AUX_ACTV.AUX_ACTV.AND	Auxiliary Is Active
1:1073	J_MESSAGE.AUX_INCTRL.AND	Auxiliary Is In Control
1:1074	J_MESSAGE.IN_CTL_LMT.NC	Aux Active / Not Limiting

1:1075	J_MESSAGE.IN_CTL_LMT.NO	Aux Active / Not In Control
1:1076	G_AUX_ENBL.INHIB.B_SW	Auxiliary is Inhibited
1:1077	G_RMT_AUX.RMT_AUX_EN.LA TCH_R	Remote Aux Is Enabled
1:1078	G_RMT_AUX.RMT_ACTV.AND	Remote Aux Is Active
1:1079	J_MESSAGE.RMT_AUXCTL.AN D	Rmt Aux Is In Control
1:1080	G_RMT_AUX.INHIBITED.OR	Rmt Aux Is Inhibited
1:1081		
1:1082	E_RMT_EXTR.RL_PERM.AND	Extraction Raise/Lower Perm
1:1083	EXT_ACTIVE.EXTR_PERMS.AN D	Extraction Ctrl Is Permissible
1:1084	EXTR_ENBL.EXTR.LATCH	Extraction Is Enabled
1:1085	EXT_ACTIVE.EXTR_ACTV.AND	Extraction Is Active
1:1086	J_CONTROL.PRS_CTRL.AND	Extraction Is In Control (not lmted)
1:1087	EXTR_ENBL.INHIBITED.OR	Extraction is Inhibited
1:1088	E_RMT_EXTR.RMT_XTR_EN.LA TCH_R	Remote Extr Is Enabled
1:1089	E_RMT_EXTR.RMT_ACTV.AND	Remote Extr Is Active
1:1090	J_MESSAGE.EXTR_RMT.AND	Rmt Extr Is In Control
1:1091	E_RMT_EXTR.INHIBITED.OR	Rmt Extr Is Inhibited
1:1092		
1:1093	through 1:1094	Spare
1:1095		
1:1096	E_MAPPRIOR.PRSPRIORTY.B_ SW	Pressure Priority Enabled
1:1097	J_PRI_ACTV.PRS_ACTV.AND	Pressure Priority Active
1:1098	J_CONTROL.S_PRI_ACTV.OR	Speed Priority Active
1:1099	E_MAPPRIOR.XFER_PERM.AN D	Priority Transfer Permissible
1:1100		
1:1101	J_CTRLSTOP.ACK_STP_L.LAT CH	Controlled Stop In Progress
1:1102		
1:1103		
1:1104	I_V1_LMTR.VLV_RAMP.P_LIM_ 2	HP Valve Lmtr Is Open (at max)
1:1105	I_V1_LMTR.VLV_RAMP.P_LIM_ 1	HP Valve Lmtr Is Closed (at min)
1:1106	I_IFACE_O.RMP_LSSCTL.B_NA ME	HP Valve Limiter In Control
1:1107		
1:1108	I_V2_LMTR.VLV_RAMP.P_LIM_ 3	LP Valve Lmtr Is Open (at max)
1:1109	I_V2_LMTR.VLV_RAMP.P_LIM_ 2	LP Valve Lmtr Is Closed (at min)
1:1110	I_IFACE_O.N_EXTR_CTL.NOT	LP Valve Limiter In Control
1:1111		
1:1112	J_RMT_LCL.RMT_SEL.LATCH	Remote/Local Remote Selected
1:1113	J_RMT_LCL.USE_MOD1.AND	MODBUS 1 Active
1:1114		
1:1115	J_MAP_LMTS.AT_LIMIT.OR	At Steam Map Limit
1:1116	J_LMT_P.PMIN_LOGIC.AND	At Min Press Limit
1:1117	J_LMT_HP.HP_MAX_LIM.OR	At HP MAX Limit
1:1118	J_LMT_HP.HPMIN.AND	At HP MIN Limit
1:1119	J_LMT_LP.LP_MAX_LIM.OR	At LP MAX Limit
1:1120	J_LMT_LP.LP_MIN_LIM.OR	At LP MIN Limit
1:1121	J_LMT_S.MAX_PWR.B_SW	At Max Power Limit
1:1122	J_LMT_P.PMX_LMT.OR	At Max Press Limit
1:1123		
1:1124	through 1:1126	Spare
1:1127		
1:1128	J_RELAYS.OUT1.B_SW	Shutdown Relay Energized
1:1129	J_RELAYS.OUT2.B_SW	Alarm Relay Energized
1:1130	J_RELAYS.OUT3.B_SW	Relay 3 Energized
1:1131	J_RELAYS.OUT4.B_SW	Relay 4 Energized
1:1132	J_RELAYS.OUT5.B_SW	Relay 5 Energized
1:1133	J_RELAYS.OUT6.B_SW	Relay 6 Energized
1:1134	J_RELAYS.OUT7.B_SW	Relay 7 Energized
1:1135	J_RELAYS.OUT8.B_SW	Relay 8 Energized
1:1136	J_RELAYS.OUT9.B_SW	Relay 9 Energized
1:1137	J_RELAYS.OUT10.B_SW	Relay 10 Energized

1:1138	J_RELAYS.OUT11.B_SW	Relay 11 Energized
1:1139	J_RELAYS.OUT12.B_SW	Relay 12 Energized
1:1140	A_DI_01.CONTACT_IN.NOT	ESD Contact Input Closed
1:1141	A_DI_02.CONTACT_IN.B_NAME	Reset Contact Input Closed
1:1142	A_DI_03.CONTACT_IN.B_NAME	Raise Speed Contact Input Closed
1:1143	A_DI_04.CONTACT_IN.B_NAME	Lower Speed Contact Input Closed
1:1144	A_DI_05.CONTACT_IN.B_NAME	Contact In 5 Closed
1:1145	A_DI_06.CONTACT_IN.B_NAME	Contact In 6 Closed
1:1146	A_DI_07.CONTACT_IN.B_NAME	Contact In 7 Closed
1:1147	A_DI_08.CONTACT_IN.B_NAME	Contact In 8 Closed
1:1148	A_DI_09.CONTACT_IN.B_NAME	Contact In 9 Closed
1:1149	A_DI_10.CONTACT_IN.B_NAME	Contact In 10 Closed
1:1150	A_DI_11.CONTACT_IN.B_NAME	Contact In 11 Closed
1:1151	A_DI_12.CONTACT_IN.B_NAME	Contact In 12 Closed
1:1152	A_DI_13.CONTACT_IN.B_NAME	Contact In 13 Closed
1:1153	A_DI_14.CONTACT_IN.B_NAME	Contact In 14 Closed
1:1154	A_DI_15.CONTACT_IN.B_NAME	Contact In 15 Closed
1:1155	A_DI_16.CONTACT_IN.B_NAME	Contact In 16 Closed
1:1156	A_DI_17.CONTACT_IN.B_NAME	Contact In 17 Closed
1:1157	A_DI_18.CONTACT_IN.B_NAME	Contact In 18 Closed
1:1158	A_DI_19.CONTACT_IN.B_NAME	Contact In 19 Closed
1:1159	A_DI_20.CONTACT_IN.B_NAME	Contact In 20 Closed
1:1160	A_DI_21.CONTACT_IN.B_NAME	Contact In 21 Closed
1:1161	A_DI_22.CONTACT_IN.B_NAME	Contact In 22 Closed
1:1162	A_DI_23.CONTACT_IN.B_NAME	Contact In 23 Closed
1:1163	A_DI_24.CONTACT_IN.B_NAME	Contact In 24 Closed
1:1164		
1:1165	C_COMM.M1_VLV_CAL.AND	Mod #1 Valve Calibration Enabled
1:1166	I_STRK_V1.MOD_STROKE.LAT CH	V1 Valve Calibration Enabled
1:1167	I_STRK_V2.MOD_STROKE.LAT CH	V2 Valve Calibration Enabled
1:1168	I_STRK_V1.STROKEPERM.NOT	Valve Calib/Stroking Permissible
1:1169	D_OSPD_EN.M1OSPDENBL.AN D	Modbus #1 Ospd Testing Enabled
1:1170	D_SPD_DYN.M1_DYN_ENB.AN D	Modbus #1 Dyn Adjust Enabled
1:1171	J_SAVETUNE.SAVING.ONE_SH OT	Saving Changes to EEPROMs
1:1172		
1:1173	through 1:1181	Spare
1:1182		
1:1183	Z_MOD_VALS.ANY_MODRLY.O R	Modbus Relay Configured
1:1184	G_AUX_ENBL.USE_AUX_EN.B_ NAME	Aux Enable/Disable Configured
1:1185	CONF_VAL_1.USE_SYNC.B_NA ME	Sync Function Configured
1:1186	Z_MOD_VALS.USE_SD1.NOT	ESD Control Configured
1:1187	C_SPD_CTRL.MAN_START.B_N AME	Manual Start Configured
1:1188	C_START.AUTO_START.B_NA ME	Auto Start Configured
1:1189	C_START.SEMI_AUTO.B_NAME	Semi-Auto Start Configured
1:1190	C_START.USE_IDLRTD.B_NAM E	Idle/Rated Start Configured
1:1191	C_START.USE_ASS.B_NAME	Auto Start Sequence Configured
1:1192	CONF_VAL_1.USE_FSP.B_NAM E	First Stage Pressure Configured
1:1193	CONF_VAL_1.USE_REMOTE.B_ NAME	Remote Speed Control Configured
1:1194	CONF_VAL_1.USE_LD_SHR.B_ NAME	Loadsharing Configured
1:1195	WGSPL.MONTOR_AI1.B_NAME	Monitor Analog Configured
1:1196	CONF_VAL_1.GEN_SET.B_NAM E	Gen Set Configured
1:1197	CONF_VAL_1.USE_CASC.B_NA ME	Cascade Control Configured
1:1198	CONF_VAL_2.CAS_RMT_SW.B_ SW	Remote Cascade Configured
1:1199	CONF_VAL_1.USE_AUX.B_NAM E	Aux Configured
1:1200	CONF_VAL_2.AUX_RMT_SW.B_ SW	Remote Aux Configured
1:1201	J_RMT_LCL.MOD1_LCL.B_NAM E	Mod 1 Local/Remote Active Configured
1:1202	WGSPL.STRT_PERM.B_NAME	Start Permissive Configured
1:1203	CONF_VAL_1.ARM_DISARM.AN D	Frequency Arm/Disarm Configured
1:1204	CONF_VAL_1.ARM_DISARM.AN D	Frequency Control Configured
1:1205	D_SPD_CTRL.DSPLY_ONLN.LA TCH	Display On-Line Dynamics

1:1206	C_APPL.USE_LCLRMT.B_NAME	Local/Remote Configured
1:1207	Z_MOD_VALS.LOCALTRIP1.B_ NAME	Local/Remote ESD Always Active
1:1208	CONF_VAL_1.CAS_SP_TRK.AN D	Casc Setpt Tracking Config'd
1:1209	CONF_VAL_2.KW_OK.AND	KW Input Configured and Not Fld
1:1210	CONF_VAL_2.EXTRANDADM.B _NAME	Extr/Adm Configured
1:1211	CONF_VAL_2.ADMONLY.B_NA ME	Admission-only Configured
1:1212	CONF_VAL_2.USE_XTR_ED.OR	Extr Enable/Disable Configured
1:1213	WGSPL.PRIOR_ENBL.AND	Priority Selection Configured
1:1214	CONF_VAL_2.EXTR_RMT.B_NA ME	Remote Extr/Adm Setpt Configured
1:1215	CONF_VAL_2.XTR_SP_TRK.AN D	E/A Setpt Tracking Config'd
1:1216	CONF_VAL_2.EXTR_TURB.B_N AME	Extraction Turbine (not dual)
1:1217	J_CTRLSTOP.ENBL_CSTOP.B_ SW	Controlled Stop Configured
1:1218		
1:1219		
1:1220	C_SPD_CTRL.IN2_USED.B_NA ME	Speed Sensor #2 Configured
1:1221	C_SPD_CTRL.IN3_USED.B_NA ME	Speed Sensor #3 Configured
1:1222	C_SPD_CTRL.IN4_USED.B_NA ME	Speed Sensor #4 Configured
1:1223	J_AO_MUX.GT32000_1.A_COM PARE	AO#1 scaling = x10 (value > 32000)
1:1224	J_AO_MUX.GT32000_2.A_COM PARE	AO#2 scaling = x10 (value > 32000)
1:1225	J_AO_MUX.GT32000_3.A_COM PARE	AO#3 scaling = x10 (value > 32000)
1:1226	J_AO_MUX.GT32000_4.A_COM PARE	AO#4 scaling = x10 (value > 32000)
1:1227	J_AO_MUX.GT32000_A2.A_CO MPARE	Act#2 RO scaling = x10 (value>32000)
1:1228	ANIN1.VALGT32000.A_COMPA RE	AI#1 scaling = x10 (value > 32000)
1:1229	ANIN2.VALGT32000.A_COMPA RE	AI#2 scaling = x10 (value > 32000)
1:1230	ANIN3.VALGT32000.A_COMPA RE	AI#3 scaling = x10 (value > 32000)
1:1231	ANIN4.VALGT32000.A_COMPA RE	AI#4 scaling = x10 (value > 32000)
1:1232	ANIN5.VALGT32000.A_COMPA RE	AI#5 scaling = x10 (value > 32000)
1:1233	ANIN6.VALGT32000.A_COMPA RE	AI#6 scaling = x10 (value > 32000)
1:1234	ANIN7.VALGT32000.A_COMPA RE	AI#7 scaling = x10 (value > 32000)
1:1235	ANIN8.VALGT32000.A_COMPA RE	AI#8 scaling = x10 (value > 32000)

Table 7-6. Boolean Reads

Addr	Servlink Tag Name	Description	Units	Mult
3:0001	X_TRIPS.LAST_TRIP.OUT_1	Cause of last turbine trip	none	none
3:0002	A_SPEED1.MON_SPEED.A_NAME	Speed Sensor #1 Input	rpm	none
3:0003	A_SPEED2.MON_SPEED.A_NAME	Speed Sensor #2 Input	rpm	none
3:0004	A_SPEED3.MON_SPEED.A_NAME	Speed Sensor #3 Input	rpm	none
3:0005	A_SPEED4.MON_SPEED.A_NAME	Speed Sensor #4 Input	rpm	none
3:0006	A_SPEED.MON_SPEED.A_NAME	Actual Turbine Speed	rpm	none
3:0007	Z_MOD_VALS.SPD_PV_PCT.MULTIPLY	Actual Speed	%	100
3:0008				
3:0009	Z_MOD_VALS.SPD_SP_PCT.MULTIPLY	Speed Setpoint	%	100
3:0010	D_IFACE_O.SPD_SETPT.A_NAME	Speed Setpoint	rpm	none
3:0011	AA_MONITOR.SPD_SETPT.A_NAME	Speed Droop Setpoint	rpm	none
3:0012	AA_MONITOR.LOAD.A_NAME	Calculated Load	%	100
3:0013				
3:0014	AA_MONITOR.SPD_PID.A_NAME	Speed PID Output	%	100
3:0015	D_SPD_DYN.P_GAIN_OFF.RAMP	Speed PID—Off-Line P-term	%	100
3:0016	D_SPD_DYN.I_GAIN_OF.RAMP	Speed PID—Off-Line I-term	rps	100
3:0017	D_SPD_DYN.D_GAIN_OF.RAMP	Speed PID—Off-Line SDR	%	100
3:0018	D_SPD_DYN.P_GAIN_ON.RAMP	Speed PID—On-Line P-term	%	100
3:0019	D_SPD_DYN.I_GAIN_ON.RAMP	Speed PID—On-Line I-term	rps	100
3:0020	D_SPD_DYN.D_GAIN_ON.RAMP	Speed PID—On-Line SDR	%	100
3:0021	Z_MOD_VALS.STATUS_MSG.OUT_3	Speed Control Status	none	none
3:0022	D_MPU.MIN_GOV.A_NAME	Min Governor Speed Setpoint	rpm	none
3:0023				
3:0024				

3:0025				
3:0026	C_IDLE_RTD.IDLE_SETPT.SAMP_TUNE	Idle / Rated—Idle Speed	rpm	none
3:0027	D_INTRFACE.RATED_SPD.A_NAME	Idle / Rated—Rated Speed	rpm	none
3:0028	Z_MOD_VALS.STATUS_MSG.OUT_4	Idle / Rated Status	none	none
3:0029				
3:0030	C_AUTOSEQ.LO_IDLE_SP.SAMP_TUNE	Auto Seq—Low Idle Speed Setpt	rpm	none
3:0031	D_IFACE_O.DLY_LO.A_NAME	Auto Seq—Low Idle Delay	min	100
3:0032	D_IFACE_O.R_TIME_LO.A_NAME	Auto Seq—Time Left At Lo Idle	min	100
3:0033	D_IFACE_O.RATE_LO.A_NAME	Auto Seq—Low to Hi Idle Rate	rpm/ sec	none
3:0034	C_AUTOSEQ.HI_IDLE_SP.SAMP_TUNE	Auto Seq—High Idle Speed Setpt	rpm	none
3:0035	D_IFACE_O.DLY_HI.A_NAME	Auto Seq—High Idle Delay	min	100
3:0036	D_IFACE_O.R_TIME_HI.A_NAME	Auto Seq—Time Left At High Idle	min	100
3:0037	D_IFACE_O.RATE_HI.A_NAME	Auto Seq—Hi Idle to Rated Rate	rpm/ sec	none
3:0038	C_AUTOSEQ.RTD_SETPT.SAMP_TUNE	Auto Seq—Rated Speed Setpt	rpm	none
3:0039	I_START.RUN_HRS.DIVIDE	Auto Seq—Run Time Hours	hours	none
3:0040	D_IFACE_O.HRS_TRIPPD.A_NAME	Auto Seq—Hours Since Trip	hours	none
3:0041	Z_MOD_VALS.STATUS_MSG.OUT_5	Auto Sequence Status	none	none
3:0042				
3:0043	through 3:0045	Spare		
3:0046				
3:0047	D_REMOTE.RMT_INPUT.A_LIMITER	Remote Speed Setpoint Input	rpm	none
3:0048	Z_MOD_VALS.STATUS_MSG.OUT_6	Remote Speed Status	none	none
3:0049				
3:0050				
3:0051	ANIN_LOGIC.SEL_AI.OUT_14	Cascade Input #1 (Scaled)	Casc Units	C.S.F .
3:0052	ANIN_LOGIC.SEL_AI.OUT_15	Cascade Input #2 (Scaled)	Casc Units	C.S.F .
3:0053	ANIN_LOGIC.SEL_AI.OUT_16	Cascade Input #3 (Scaled)	Casc Units	C.S.F .
3:0054	F_CASC_AI.CASC_INPUT.A_NAME	Cascade Input (Scaled)	Casc Units	C.S.F .
3:0055	Z_MOD_VALS.CAS_PV_PCT.MULTIPLY	Cascade Input	%	100
3:0056	F_IFACE_O.CAS_SETPT.A_NAME	Cascade Setpoint (Scaled)	Casc Units	C.S.F .
3:0057	Z_MOD_VALS.CAS_SP_PCT.MULTIPLY	Cascade Setpoint	%	100
3:0058	Z_MOD_VALS.CASC_SCALE.A_NAME	Cascade Scale Factor	none	none
3:0059	AA_MONITOR.CASC_PID.A_NAME	Cascade PID Output	%	100
3:0060	F_CAS_DYN.P_GAIN.RAMP	Cascade PID—P-term	%	100
3:0061	F_CAS_DYN.I_GAIN.RAMP	Cascade PID—I-term	rps	100
3:0062	F_CAS_DYN.D_GAIN.RAMP	Cascade PID—SDR	%	100
3:0063	Z_MOD_VALS.STATUS_MSG.OUT_7	Cascade Control Status	none	none
3:0064	F_RMT_CASC.RMT_CAS_IN.A_LIMITER	Remote Cascade Input (Scaled)	Casc Units	C.S.F .
3:0065	Z_MOD_VALS.STATUS_MSG.OUT_8	Remote Cascade Control Status	none	none
3:0066				
3:0067	through 3:0070	Spare		
3:0071				
3:0072	ANIN_LOGIC.SEL_AI.OUT_18	Aux Input #1 (Scaled)	Aux Units	A.S.F.
3:0073	ANIN_LOGIC.SEL_AI.OUT_19	Aux Input #2 (Scaled)	Aux Units	A.S.F.
3:0074	ANIN_LOGIC.SEL_AI.OUT_20	Aux Input #3 (Scaled)	Aux Units	A.S.F.
3:0075	G_AUX_AI.AUX.A_NAME	Aux Input (Scaled)	Aux Units	A.S.F.
3:0076	Z_MOD_VALS.AUX_PV_PCT.MULTIPLY	Aux Input	%	
3:0077	AA_MONITOR.AUX_SETPT.A_NAME	Aux Setpoint (Scaled)	Aux Units	A.S.F.
3:0078	Z_MOD_VALS.AUX_SP_PCT.MULTIPLY	Aux Setpoint	%	100
3:0079	Z_MOD_VALS.AUX_SCALE.A_NAME	Aux Scale Factor	none	none
3:0080	AA_MONITOR.AUX_PID.A_NAME	Aux PID Output	%	100
3:0081	G_AUX_DYN.P_GAIN.RAMP	Aux PID—P-term	%	100
3:0082	G_AUX_DYN.I_GAIN.RAMP	Aux PID—I-term	%	100
3:0083	G_AUX_DYN.D_GAIN.RAMP	Aux PID—SDR	%	100
3:0084	Z_MOD_VALS.STATUS_MSG.OUT_9	Aux Control Status	none	none
3:0085	G_RMT_AUX.INPUT.A_NAME	Remote Aux Input	Aux Units	A.S.F.

3:0086	Z_MOD_VALS.STATUS_MSG.OUT_10	Remote Aux Control Status	none	none
3:0087				
3:0088	through 3:0090	Spare		
3:0091				
3:0092	D_MPU.SPEED_HOLD.A_MAX	Highest Speed Reached	rpm	none
3:0093	C_OSPD.RST_TIME.A_SW	Ospd Test—Auto Disabl Time Remaining	sec	none
3:0094	Z_MOD_VALS.STATUS_MSG.OUT_1	Overspeed Test Status	none	none
3:0095				
3:0096				
3:0097	J_MISC.MONITOR.A_NAME	Monitor Input (Scaled)	Mon Units	M.S.F
3:0098	Z_MOD_VALS.MON_SCALE.A_NAME	Monitor Input Scale Factor	none	none
3:0099	J_MISC.FSP.A_NAME	FSP Input (Scaled)	FSP Units	F.S.F
3:0100	Z_MOD_VALS.FSP_SCALE.A_NAME	FSP Scale Factor	none	none
3:0101	ANIN_LOGIC.SEL_AI.OUT_4	Sync / Ldshr Input #1	rpm	10
3:0102	ANIN_LOGIC.SEL_AI.OUT_5	Sync / Ldshr Input #2	rpm	10
3:0103	ANIN_LOGIC.SEL_AI.OUT_6	Sync / Ldshr Input #3	rpm	10
3:0104	D_LD_SHARE.LD_SHR.A_LIMITER	Sync / Ldshr Input	rpm	10
3:0105	Z_MOD_VALS.STATUS_MSG.OUT_11	Loadshare Status	none	none
3:0106	Z_MOD_VALS.STATUS_MSG.OUT_11			
3:0107				
3:0108				
3:0109	ANIN_LOGIC.SEL_AI.OUT_7	KW Input #1 (Scaled)	kW Units	kW.S. F.
3:0110	ANIN_LOGIC.SEL_AI.OUT_8	KW Input #2 (Scaled)	KW Units	KW.S. F.
3:0111	ANIN_LOGIC.SEL_AI.OUT_9	KW Input #3 (Scaled)	KW Units	KW.S. F.
3:0112	D_KW_AI.KW_INPUT.A_NAME	KW Input (Scaled)	KW Units	KW.S. F.
3:0113	Z_MOD_VALS.KW_SCALE.A_NAME	KW Scale Factor	none	none
3:0114	AA_MONITOR.HP_LIMITER.A_NAME	HP Valve Limiter Output	%	100 100
3:0115	AA_MONITOR.LP_LIMITER.A_NAME	LP Valve Limiter Output	%	100
3:0116	AA_MONITOR.HP_DEMAND.A_NAME	Actuator 1 Demand	%	100
3:0117	AA_MONITOR.LP_DEMAND.A_NAME	Actuator 2 Demand	%	100
3:0118				
3:0119				
3:0120	Z_MOD_VALS.STATUS_MSG.OUT_15	Frequency Control Status	none	none
3:0121	Z_MOD_VALS.STATUS_MSG.OUT_18	Controlled Stop Status	none	none
3:0122				
3:0123				
3:0124	E_MAN_DMND.MOD_MULT.MULTIPLY	Extr/Adm Manual Demand	%	100
3:0125	ANIN_LOGIC.SEL_AI.OUT_10	Ext/Adm Input #1 (Scaled)	prgd units	E.S.F.
3:0126	ANIN_LOGIC.SEL_AI.OUT_11	Ext/Adm Input #2 (Scaled)	prgd units	E.S.F.
3:0127	ANIN_LOGIC.SEL_AI.OUT_12	Ext/Adm Input #3 (Scaled)	prgd units	E.S.F.
3:0128	AA_MONITOR.EXTR_INPUT.A_NAME	Ext/Adm Input (Scaled)	prgd units	E.S.F.
3:0129	Z_MOD_VALS.XTR_VL_PRC.MULTIPLY	Ext/Adm Input	%	100
3:0130	Z_MOD_VALS.XTR_PRCT.MULTIPLY	Ext/Adm Setpoint	%	100
3:0131	AA_MONITOR.EXTR_SETPT.A_NAME	Ext/Adm Setpoint (Scaled)	prgd units	E.S.F.
3:0132	Z_MOD_VALS.XTR_SCALE.A_NAME	Ext/Adm Scale Factor	none	none
3:0133	AA_MONITOR.EXTR_PID.A_NAME	Ext/Adm PID Output	%	100
3:0134	EXTR_DYN.P_GAIN.RAMP	Ext/Adm PID—P-term	%	100
3:0135	EXTR_DYN.I_GAIN.RAMP	Extr/Adm PID—I-term	%	100
3:0136	EXTR_DYN.D_GAIN.RAMP	Extr/Adm PID—SDR	%	100
3:0137	Z_MOD_VALS.STATUS_MSG.OUT_12	Ext/Adm Control Status	none	none
3:0138	E_RMT_EXTR.INPUT.A_NAME	Remote Ext/Adm Input (Scaled)	prgd units	E.S.F.
3:0139	Z_MOD_VALS.STATUS_MSG.OUT_13	Remote Ext/Adm Control Status	none	none
3:0140	Z_MOD_VALS.STATUS_MSG.OUT_14	Map Priority Status	none	none
3:0141				
3:0142	through 3:0143	Spare		
3:0144				
3:0145	D_MOD_SPD.M1_SMP_TUN.SAMP_TUN E	Modbus Entered Speed Setpoint (fdbk)	rpm	none

3:0146	F_CAS_ENTR.M1_SMP_TUN.SAMP_TU NE	Modbus Entered Cascade Setpoint (fdbk)	prgd units	C.S.F .
3:0147	G_AUX_ENTR.M1_SMP_TUN.SAMP_TU NE	Modbus Entered Aux Setpoint (fdbk)	prgd units	A.S.F.
3:0148	EXTR_ENTRD.M1_SMP_TUN.SAMP_TU NE	Modbus Entered Extr Setpoint (fdbk)	prgd units	E.S.F.
3:0149	AA_MONITOR.S_LMTD.A_NAME	S-demand Limited (from ratio/lmtr)	%	100
3:0150	AA_MONITOR.P_LMTD.A_NAME	P-demand Limited (from ratio/lmtr)	%	100
3:0151	AA_MONITOR.HPOUT.A_NAME	HP Map Demand (from ratio/ lmtr)	%	100
3:0152	AA_MONITOR.LPOUT.A_NAME	LP Map Demand (from ratio/ lmtr)	%	100
3:0153	AA_MONITOR.S_TERM.A_NAME	S-term (from LSS to ratio/ lmtr)	%	100
3:0154	AA_MONITOR.P_TERM.A_NAME	P-term (from E/A dmd to ratio/lmtr)	%	100
3:0155	J_CONTROL.CP.OUT_1	Controlling Parameter (Line 1)	none	none
3:0156	J_CONTROL.CP.OUT_2	Controlling Parameter (Line 2)	none	none
3:0157				
3:0158	I_IFACE_O.HP_OUT.A_NAME	Split-Range Actuator Demand	%	100
3:0159	J_AO_MUX.OUT_ACT2.A_SW	Actuator 2 Readout	mA	100
3:0160	ANIN1.IN_MA_100.CALCULATE	Analog Input 1	mA	100
3:0161	ANIN2.IN_MA_100.CALCULATE	Analog Input 2	mA	100
3:0162	ANIN3.IN_MA_100.CALCULATE	Analog Input 3	mA	100
3:0163	ANIN4.IN_MA_100.CALCULATE	Analog Input 4	mA	100
3:0164	ANIN5.IN_MA_100.CALCULATE	Analog Input 5	mA	100
3:0165	ANIN6.IN_MA_100.CALCULATE	Analog Input 6	mA	100
3:0166	ANIN7.IN_MA_100.CALCULATE	Analog Input 7	mA	100
3:0167	ANIN8.IN_MA_100.CALCULATE	Analog Input 8	mA	100
3:0168	ANIN1.IN.A_SW	Analog Input 1	prgd units units	none
3:0169	ANIN2.IN.A_SW	Analog Input 2	prgd units	none
3:0170	ANIN3.IN.A_SW	Analog Input 3	prgd units	none
3:0171	ANIN4.IN.A_SW	Analog Input 4	prgd units	none
3:0172	ANIN5.IN.A_SW	Analog Input 5	prgd units	none
3:0173	ANIN6.IN.A_SW	Analog Input 6	prgd units	none
3:0174	ANIN7.IN.A_SW	Analog Input 7	prgd units	none
3:0175	ANIN8.IN.A_SW	Analog Input 8	prgd units	none
3:0176	A_AN_OUT1.AO_RM.RDBK_MA	Analog Output 1	mA	100
3:0177	A_AN_OUT2.AO_RM.RDBK_MA	Analog Output 2	mA	100
3:0178	A_AN_OUT3.AO_RM.RDBK_MA	Analog Output 3	mA	100
3:0179	A_AN_OUT4.AO_RM.RDBK_MA	Analog Output 4	mA	100
3:0180	J_AO_MUX.OUT_1.A_SW	Analog Output 1	prgd units	none
3:0181	J_AO_MUX.OUT_2.A_SW	Analog Output 2	prgd units	none
3:0182	J_AO_MUX.OUT_3.A_SW	Analog Output 3	prgd units	none
3:0183	J_AO_MUX.OUT_4.A_SW	Analog Output 4	prgd units	none
3:0184	A_HP_ACT.ACT_RM.RDBK_MA	Actuator #1 Output	mA	100
3:0185	Z_MOD_VALS.ACT2MAOUT.A_SW	Actuator #2 Output	mA	100
3:0186	AA_MONITOR.HP_LINEAR.A_NAME	Actuator #1 Output	mA	100
3:0187	AA_MONITOR.LP_LINEAR.A_NAME	Actuator #2 Output	mA	100
3:0188	Z_MOD_VALS.AIO_CONFIG.OUT_1	Analog Input 1 Configuration	none	none
3:0189	Z_MOD_VALS.AIO_CONFIG.OUT_2	Analog Input 2 Configuration	none	none
3:0190	Z_MOD_VALS.AIO_CONFIG.OUT_3	Analog Input 3 Configuration	none	none
3:0191	Z_MOD_VALS.AIO_CONFIG.OUT_4	Analog Input 4 Configuration	none	none
3:0192	Z_MOD_VALS.AIO_CONFIG.OUT_5	Analog Input 5 Configuration	none	none
3:0193	Z_MOD_VALS.AIO_CONFIG.OUT_6	Analog Input 6 Configuration	none	none
3:0194	Z_MOD_VALS.AIO_CONFIG.OUT_7	Analog Input 7 Configuration	none	none
3:0195	Z_MOD_VALS.AIO_CONFIG.OUT_8	Analog Input 8 Configuration	none	none
3:0196	Z_MOD_VALS.AIO_CONFIG.OUT_9	Analog Output 1 Configuration	none	none
3:0197	Z_MOD_VALS.AIO_CONFIG.OUT_10	Analog Output 2 Configuration	none	none
3:0198	Z_MOD_VALS.AIO_CONFIG.OUT_11	Analog Output 3 Configuration	none	none
3:0199	Z_MOD_VALS.AIO_CONFIG.OUT_12	Analog Output 4 Configuration	none	none
3:0200	Z_MOD_VALS.RLY1.A_MUX_N_1	Relay 3 Configuration	none	none
3:0201	Z_MOD_VALS.RLY2.A_MUX_N_1	Relay 4 Configuration	none	none
3:0202	Z_MOD_VALS.RLY3.A_MUX_N_1	Relay 5 Configuration	none	none
3:0203	Z_MOD_VALS.RLY4.A_MUX_N_1	Relay 6 Configuration	none	none

3:0204	Z_MOD_VALS.RLY5.A_MUX_N_1	Relay 7 Configuration	none	none
3:0205	Z_MOD_VALS.RLY6.A_MUX_N_1	Relay 8 Configuration	none	none
3:0206	Z_MOD_VALS.RLY7.A_MUX_N_1	Relay 9 Configuration	none	none
3:0207	Z_MOD_VALS.RLY8.A_MUX_N_1	Relay 10 Configuration	none	none
3:0208	Z_MOD_VALS.RLY9.A_MUX_N_1	Relay 11 Configuration	none	none
3:0209	Z_MOD_VALS.RLY10.A_MUX_N_1	Relay 12 Configuration	none	none
3:0210	Z_MOD_VALS.CONT.OUT_1	Contact Configuration Select 5	none	none
3:0211	Z_MOD_VALS.CONT.OUT_2	Contact Configuration Select 6	none	none
3:0212	Z_MOD_VALS.CONT.OUT_3	Contact Configuration Select 7	none	none
3:0213	Z_MOD_VALS.CONT.OUT_4	Contact Configuration Select 8	none	none
3:0214	Z_MOD_VALS.CONT.OUT_5	Contact Configuration Select 9	none	none
3:0215	Z_MOD_VALS.CONT.OUT_6	Contact Configuration Select 10	none	none
3:0216	Z_MOD_VALS.CONT.OUT_7	Contact Configuration Select 11	none	none
3:0217	Z_MOD_VALS.CONT.OUT_8	Contact Configuration Select 12	none	none
3:0218	Z_MOD_VALS.CONT.OUT_9	Contact Configuration Select 13	none	none
3:0219	Z_MOD_VALS.CONT.OUT_10	Contact Configuration Select 14	none	none
3:0220	Z_MOD_VALS.CONT.OUT_11	Contact Configuration Select 15	none	none
3:0221	Z_MOD_VALS.CONT.OUT_12	Contact Configuration Select 16	none	none
3:0222	Z_MOD_VALS.CONT.OUT_13	Contact Configuration Select 17	none	none
3:0223	Z_MOD_VALS.CONT.OUT_14	Contact Configuration Select 18	none	none
3:0224	Z_MOD_VALS.CONT.OUT_15	Contact Configuration Select 19	none	none
3:0225	Z_MOD_VALS.CONT.OUT_16	Contact Configuration Select 20	none	none
3:0226	Z_MOD_VALS.CONT.OUT_17	Contact Configuration Select 21	none	none
3:0227	Z_MOD_VALS.CONT.OUT_18	Contact Configuration Select 22	none	none
3:0228	Z_MOD_VALS.CONT.OUT_19	Contact Configuration Select 23	none	none
3:0229	Z_MOD_VALS.CONT.OUT_20	Contact Configuration Select 24	none	none
3:0230	Z_MOD_VALS.UNITS.OUT_1	Aux Units Configured	none	none
3:0231	Z_MOD_VALS.UNITS.OUT_2	Cascade Units Configured	none	none
3:0232	Z_MOD_VALS.UNITS.OUT_3	Extraction Units Configured	none	none
3:0233	Z_MOD_VALS.UNITS.OUT_4	KW/Load Units Active	none	none
3:0234	Z_MOD_VALS.UNITS.OUT_5	KW/Load Setpt Units Active	none	none
3:0235	Z_MOD_VALS.CTRL_CONF.OUT_1	Turbine Type Configured	none	none
3:0236	Z_MOD_VALS.CTRL_CONF.OUT_2	Aux Control Configured	none	none
3:0237	Z_MOD_VALS.CTRL_CONF.OUT_3	Casc Control Configured	none	none
3:0238	Z_MOD_VALS.CTRL_CONF.OUT_4	Start Mode Configured	none	none
3:0239	Z_MOD_VALS.CTRL_CONF.OUT_5	Idle-to-Rated Mode Configured	none	none
3:0240	C_DRIVER.ACT2RO_NUM.OUT_1	Actuator2 Readout Configuration	none	none
3:0241				
3:0242	through 3:0250	Spare		
3:0251				
3:0252	Z_MOD_VALS.STATUS_MSG.OUT_16	V1 Calibration Status	none	none
3:0253	I_STRK_V1.STROKE_RMP.RAMP	V1 Calibration Demand	%	100
3:0254	I_V1_SCALE.SEL_MIN.A_SW	V1 Min Current Calib	mA	100
3:0255	I_V1_SCALE.SEL_MAX.A_SW	V1 Max Current Calib	mA	100
3:0256	Z_MOD_VALS.STATUS_MSG.OUT_17	V2 Calibration Status	none	none
3:0257	I_STRK_V2.STROKE_RMP.RAMP	V1 Calibration Demand	%	100
3:0258	I_V2_SCALE.SEL_MIN.A_SW	V2 Min Current Calib	mA	100
3:0259	I_V2_SCALE.SEL_MAX.A_SW	V2 Max Current Calib	mA	100
3:0260				

Table 7-7. Analog Reads

ADDR	DESCRIPTION	UNITS	MULTIPLIER
4:0001	Modbus Entered Speed Setpoint	rpm	none
4:0002	Modbus Entered Casc Setpoint	casc units	casc scale factor
4:0003	Modbus Entered Aux Setpoint	aux units	aux scale factor
4:0004	Modbus Entered Extr Setpoint	extr units	extr scale factor
4:0005	Spare		

Table 7-8. Analog Writes

Analog Reads Lookup Tables

Last Turbine Trip Cause

The cause of the last turbine trip (address 3:0001) is an integer that represents the following cause:

1. Power Up Shutdown
2. External Trip Input
3. External Trip 2
4. External Trip 3
5. External Trip 4
6. External Trip 5
7. External Trip 6
8. External Trip 7
9. External Trip 8
10. External Trip 9
11. External Trip 10
12. PC Programmer Trip
13. Comm Link #1 Trip
14. Comm Link #2 Trip
15. Overspeed Trip
16. All Speed Probes Failed
17. All Analog I/O Modules Failed
18. All Discrete I/O Modules Failed
19. Act #1 (HP) Fault
20. Act #2 (LP) Fault
21. Aux Input Failed
22. Extr/Adm Input Failed
23. Utility Tie Breaker Opened
24. Generator Breaker Opened
25. Controlled Shutdown
26. Configuration Error

Idle/Rated Status

The idle/rated status (address 3:0028) is an integer that represents the following cause.

0. Idle/Rated is Stopped
1. Idle/Rated is In Critical Avoidance Band
2. Idle/Rated is Moving to Rated
3. Idle/Rated is At Idle Speed
4. Idle/Rated is Moving to Idle
5. Rated Speed Selection is Inhibited
6. Idle Speed Selection is Inhibited
7. Idle/Rated is At Rated Speed

Auto Start Sequence Status

The auto start sequence status (address 3:0041) is an integer that represents the following cause.

0. Auto Start Sequence is Disabled
1. Auto Start Sequence is In Critical Avoidance Band
2. Auto Start Sequence is Completed
3. Auto Start Sequence is Halted
4. Auto Start Sequence is Moving to Low Idle
5. Auto Start Sequence is Moving to Hi Idle
6. Auto Start Sequence is Moving to Rated
7. Auto Start Sequence is At Low Idle
8. Auto Start Sequence is At High Idle
9. Auto Start Sequence is in a Hi Idle Timed Wait
10. Auto Start Sequence is in a Low Idle Timed Wait

Remote Speed Setpoint Status

The remote speed control status (address 3:0048) is an integer that represents the following:

0. Remote Speed Control is Disabled
1. Remote Speed Control is In Control
2. Remote Speed Control is Active
3. Remote Speed Control is Enabled
4. Remote Speed Control is Inhibited

Cascade Control Status

The cascade control status (address 3:0063) is an integer that represents the following cause.

0. Cascade is Disabled
1. Casc Control w/Rmt Setpt
2. Casc Active w/Rmt Setpt
3. Cascade is In Control
4. Casc Active/Not Spd Ctl
5. Cascade is Enabled
6. Cascade is Inhibited

Remote Cascade Setpoint Status

The remote cascade control status (address 3:0065) is an integer that represents the following:

0. Remote Cascade Control is Disabled
1. Remote Cascade Control is In Control
2. Remote Cascade Control is Active
3. Remote Cascade Control is Enabled
4. Remote Cascade Control is Inhibited

Auxiliary Control Status

The auxiliary control status (address 3:0084) is an integer that represents the following cause.

0. Auxiliary is Disabled
1. Controlling w/ Rmt Setpt
2. Aux Active w/ Rmt Setpt
3. Aux Enabled w/Rmt Setpt
4. Auxiliary is In Control
5. Aux is Active / Not Limiting
6. Aux Active/ Not In Control
7. Auxiliary is Inhibited
8. Auxiliary is Enabled

Remote Auxiliary Setpoint Status

The remote auxiliary control status (address 3:0086) is an integer that represents the following:

0. Remote Auxiliary Control is Disabled
1. Remote Auxiliary Control is In Control
2. Remote Auxiliary Control is Active
3. Remote Auxiliary Control is Enabled
4. Remote Auxiliary Control is Inhibited

Overspeed Test Status

The overspeed test status (address 3:0094) is an integer that represents the following:

0. Overspeed Test Mode is Disabled
1. Unit is Tripped
2. At Overspeed Test Limit
3. Speed > 5009 Trip Level
4. External Ospd Trip Test Enabled
5. 5009 Ospd Trip Test Enabled
6. Overspeed Test Permissible
7. Ospd Test NOT Permissible

Load Share Status

The load share control status (address 3:0105) is an integer that represents the following:
0. Load Share is Disabled
1. Load Share is Active
2. Load Share is Enabled
3. Load Share is Inhibited

Frequency Control Status

The frequency control status (address 3:0120) is an integer that represents the following:
0. Frequency Control is Disarmed
1. Frequency Control is In Control
2. Frequency Control is Armed
3. Frequency Control is Inhibited

Control Stop Status

The frequency control status (address 3:0121) is an integer that represents the following:
0. Not Selected
1. Inhibited
2. Closing Hp Limiter
3. Lowering Speed Setpoint
4. Transferring to Coupled Map
5. Disabling Extraction

Extraction/ Admission Control Status

The extraction/admission control status (address 3:0137) is an integer that represents the following:
0. Ext/Adm is Disabled

Ext/Adm Contrl w/Rmt Setpt

0. Ext/Adm Active w/Rmt Setpt
1. Ext/Adm In Control
2. Ext/Adm Active/Not in Ctrl
3. Ext/Adm is Enabled
4. Ext/Adm is Inhibited

Remote Ext/Adm Status

The remote extraction/admission control status (address 3:0139) is an integer that represents the following:

0. Rmt Control Disabled
1. Remote Extr In Control
2. Rmt Extr/Adm In Control
3. Remote Adm In Control
4. Remote Extract Active
5. Remote Extr/Adm Active
6. Remote Admission Active
7. Rmt Extraction Enabled
8. Remote Extr/Adm Enabled
9. Rmt Admission Enabled
10. Rmt Extraction Inhibited
11. Rmt Extr/Adm Inhibited
12. Rmt Admission Inhibited
13. Rmt Extraction Disabled
14. Remote Ext/Adm Disabled
15. Rmt Admission Disabled

Steam Map Priority

The steam map priority status (address 3:0143) is an integer that represents the following:

0. Speed Priority Active
1. Priority Xfer Inhibited
2. Ext Active/Spd Selected
3. Prs Active/Spd Selected
4. Adm Active/Spd Selected
5. Auto Switching Config'd
6. Priority Swtch Not Used
7. Spd Active/Ext Selected
8. Spd Active/Prs Selected
9. Spd Active/Adm Selected
10. Extr Priority Active
11. E/A Priority Active
12. Adm Priority Active
13. Speed Priority Active

5009 Control System Controlling Parameters

The controlling parameter status of the 5009 Control System uses two Analog Read registers (3:0155 & 3:0156) to identify the parameters that are in control of the control. If the control is programmed as a single-valve or split-range actuator only address 3:0156 is used. Analog register 3:0156 corresponds to the parameter in control for non-extraction units or the second controlling parameter for extraction units. There are two status lists provided, depending on the unit's configuration. The variables give the current status of the control and are defined in the following tables.

Control Status (Extraction Unit Controlling Parameter #1)—The controlling parameter status (address 3:0155) is an integer that represents the following:

1. Controlling Parameter
2. Shutdown
3. Control at Two Limits
4. HP Max Actuator
5. HP Valve Limiter
6. Max Power Limit
7. HP Max Limit
8. LP Max Limit
9. HP Min Limit
10. LP Min Limit
11. Remote Auxiliary
12. Auxiliary
13. Manual Start
14. Auto Start
15. Semi Auto Start
16. Idle / Rated Start
17. Auto Start Sequence
18. Synchronizing
19. Load Share / Speed
20. Frequency / Speed
21. Remote Cascade / Speed
22. Cascade / Speed
23. Remote / Speed
24. Speed / On—Line
25. Speed / Off—Line

Control Status (Extraction Unit Controlling Parameter #2)—The controlling parameter status (address 3:0156) is an integer that represents the following:

1. Shutdown—External Trip Input
2. Shutdown—External Trip 2
3. Shutdown—External Trip 3
4. Shutdown—External Trip 4
5. Shutdown—External Trip 5
6. Shutdown—External Trip 6
7. Shutdown—External Trip 7
8. Shutdown—External Trip 8
9. Shutdown—External Trip 9
10. Shutdown—External Trip 10
11. Shutdown—PC Programmer Trip
12. Shutdown—Comm Link #1 Trip
13. Shutdown—Comm Link #2 Trip
14. Shutdown—Overspeed Trip
15. Shutdown—All Speed Probes Failed
16. Shutdown—All Analog I/O Modules Failed
17. Shutdown—All Discrete I/O Modules Failed
18. Shutdown—Act #1 (HP) Fault
19. Shutdown—Act #2 (LP) Fault
20. Shutdown—Aux Input Failed
21. Shutdown—Extr/Adm Input Failed
22. Shutdown—Utility Tie Breaker Opened
23. Shutdown—Generator Breaker Opened
24. Shutdown—Power up Trip
25. Shutdown—Manual (controlled) Stop
26. Shutdown—Configuration Error
27. Controlled Shutdown in Progress
28. Unit Initializing (Power up)
29. Checking Configuration (Program)

30. Start Perm Not Met
31. Ready to Start
32. Max HP & Max LP Limits (at two limits)
33. Max HP & Max Pwr Limits (at two limits)
34. Max HP & Min LP Limits (at two limits)
35. Max Pwr & Max LP Limits (at two limits)
36. Min LP & Max Prs Limits (at two limits)
37. Max HP & Max Prs Limits (at two limits)
38. Max Pwr & Min Prs Limits (at two limits)
39. Min HP & Min LP Limits (at two limits)
40. Max LP & Min Prs Limits (at two limits)
41. Min LP & Min Prs Limits (at two limits)
42. Min HP & Min Prs Limits (at two limits)
43. LP Max Actuator Control
44. LP Valve Limiter Control
45. Max Power Limit Control
46. HP Max Limit Control
47. LP Max Limit Control
48. HP Min Limit Control
49. LP Min Limit Control
50. Max Extr Limit Control
51. Min Adm Limit Control
52. Max Extr Limit Control
53. Min Extr Limit Control
54. Max Adm Limit Control
55. Max Adm Limit Control
56. Extr Ctrl w/ Rmt Setpt
57. Adm Ctrl w/ Rmt Setpt
58. E/A Ctrl w/ Rmt Setpt
59. Extraction Control
60. Admission Control
61. Extr/Adm Control
62. Manual Extr/Extr Demand
63. Manual Admission Demand

Control Status (Non-Extraction Unit Controlling Parameter)—The controlling parameter status (address 3:0156) is an integer that represents the following:

1. Shutdown—External Trip Input
2. Shutdown—External Trip 2
3. Shutdown—External Trip 3
4. Shutdown—External Trip 4
5. Shutdown—External Trip 5
6. Shutdown—External Trip 6
7. Shutdown—External Trip 7
8. Shutdown—External Trip 8
9. Shutdown—External Trip 9
10. Shutdown—External Trip 10
11. Shutdown—PC Programmer Trip
12. Shutdown—Comm Link #1 Trip
13. Shutdown—Comm Link #2 Trip
14. Shutdown—Overspeed Trip
15. Shutdown—All Speed Probes Failed
16. Shutdown—All Analog I/O Modules Failed
17. Shutdown—All Discrete I/O Modules Failed
18. Shutdown—Act #1 Fault
19. Shutdown—Act #2 Fault
20. Shutdown—Aux Input Failed
21. Shutdown—KW Input Failed
22. Shutdown—Utility Tie Breaker Opened

23. Shutdown—Generator Breaker Opened
24. Shutdown—Power up Trip
25. Shutdown—Manual (controlled) Stop
26. Shutdown—Configuration Error
27. Controlled Shutdown in Progress
28. Unit Initializing (Power up)
29. Checking Configuration (Program)
30. Max Actuator Control
31. Valve Limiter Control
32. Remote Auxiliary Control
33. Auxiliary Control
34. Configuration Error
35. Start Perm Not Met
36. Ready to Start
37. Manual Start Control
38. Auto Start Control
39. Semi Auto Start Control
40. Idle / Rated Start
41. Auto Start Sequence
42. Synchronizing
43. Load Share / Speed Control
44. Frequency / Speed Control
45. Remote Cascade / Speed Control
46. Cascade / Speed Control
47. Remote / Speed Control
48. Speed / On—Line Control
49. Speed / Off—Line Control

Analog Input Configuration—The Analog Input Configuration (addresses 3:0188—0195) is an integer that represents the programmed function of each analog input and is defined as follows:

1. Analog Input is Not Used
2. Remote Speed Setpt
3. Synchronizing Input
4. Sync/Load Share Input #1
5. Sync/Load Share Input #2
6. Sync/Load Share Input #3
7. KW / Unit Load Input #1
8. KW / Unit Load Input #2
9. KW / Unit Load Input #3
10. Extraction/Admission Input #1
11. Extraction/Admission Input #2
12. Extraction/Admission Input #3
13. Remote Extr / Adm Setpt
14. Cascade Input #1
15. Cascade Input #2
16. Cascade Input #3
17. Remote Cascade Setpt
18. Auxiliary Input #1
19. Auxiliary Input #2
20. Auxiliary Input #3
21. Remote Aux Setpt
22. First Stage Press Input
23. Monitor Analog Input

Analog Output Configuration—The Analog Output Configuration (addresses 3:0196—0199) is an integer that represents the programmed function of each analog output and is defined as follows:

1. Analog Output is Not Used
2. Actual Speed
3. Speed Setpoint
4. Remote Speed Setpt
5. Load Share Input
6. Sync Input
7. KW Input
8. Extr/Adm Input
9. Extr/Adm Setpt
10. Rmt Extr/Adm Setpt
11. Cascade Input
12. Cascade Setpoint
13. Rmt Cascade Setpt
14. Auxiliary Input
15. Auxiliary Setpoint
16. Rmt Auxiliary Setpt
17. Speed/Load Demand
18. Extr/Adm Demand
19. Act 1 (or HP) Valve Limiter Setpt
20. Act 2 (or LP) Valve Limiter Setpt
21. Act 1 (or HP) Valve Demand
22. Act 2 (or LP) Valve Demand
23. Actuator Demand (Split Range)
24. First Stage Press Input
25. Monitor Analog Input

Relay Configuration—The Relay Configuration (addresses 3:0200—0209) is an integer that represents the programmed function for each relay output and is defined as follows:

VALUE DESCRIPTION (level switch options)

1. Actual Speed
2. Speed Setpoint
3. KW Input
4. Sync/Ld Share Input
5. Extr/Adm Input
6. Extr/Adm Setpoint
7. Cascade Input
8. Cascade Setpoint
9. Auxiliary Input
10. Auxiliary Setpoint
11. Speed/Load Demand
12. Extr/Adm Demand
13. HP Valve Limiter
14. LP Valve Limiter
15. Act 1 Valve Demand Output
16. Act 2 Valve Demand Output
17. Actuator Demand (Split Range)
18. First Stage Pressure
19. Monitor Analog Input
20. NOT USED
21. Shutdown Condition
22. Trip Relay (additional trip relay output)
23. Alarm Condition
24. Major Alarm Condition
25. Overspeed Trip
26. Overspeed Test Enabled

27. Speed PID in Control
28. Remote Speed Setpt Enabled
29. Remote Speed Setpt Active
30. Underspeed Switch
31. Auto Start Sequence Halted
32. On-Line Speed PID Dynamics Mode Selected
33. Local Interface Mode Selected
34. Frequency Control Armed
35. Frequency Control
36. Sync Enabled
37. Sync / Load Shr Enabled
38. Load Share Mode
39. Extr/Adm Control Enabled
40. Extr/Adm Control Active
41. Extr/Adm PID in Control
42. Remote Extr/Adm Setpt Enabled
43. Remote Extr/Adm Setpt Active
44. Casc Control Enabled
45. Cascade Control Active
46. Remote Casc Setpt Enabled
47. Remote Casc Setpt Active
48. Aux Control Enabled
49. Aux Control Active
50. Auxiliary PID in Control
51. Remote Aux Setpt Enabled
52. Remote Aux Setpt Active
53. HP Valve Limiter in Control
54. LP Valve Limiter in Control
55. Extr/Adm Priority Enabled
56. Extr/Adm Priority Active
57. All Extr/Adm Inputs Failed
58. Controlling on a Steam Map Limit
59. Modbus Commanded Relay
60. PCI Port C Failed (xfer to B)
61. Reset Pulse: 2 Seconds
62. Relay is Not Used

Contact Input Configuration—The Contact Input Configuration (addresses 3:0210—0229) is an integer that represents the programmed function of each contact input and is defined as follows:

1. Contact Input is Not Used
2. Generator Breaker Position
3. Utility Tie Breaker Position
4. Select Overspeed Test
5. Start Command
6. Start Permissible
7. Select Idle / Rated Speed Setpt
8. Halt / Continue Auto Start Sequence
9. Override Speed Sensor Fault
10. Select On-Line Speed PID Dynamics
11. Select Local / Remote Interface Mode
12. Remote Speed Setpt Enable
13. Sync Enable
14. Select Speed Setpoint Fast Rate
15. Freq Control Arm/Disarm
16. Extr/Adm Setpt Raise
17. Extr/Adm Setpt Lower
18. Extr/Adm Control Enable
19. Remote Extr/Adm Setpt Enable

20. Select Extr/Adm Priority
21. Cascade Setpt Raise
22. Cascade Setpt Lower
23. Cascade Control Enable
24. Remote Casc Setpt Enable
25. Aux Setpt Raise
26. Aux Setpt Lower
27. Aux Control Enable
28. Remote Aux Setpt Enable
29. HP Valve Limiter Raise
30. HP Valve Limiter Lower
31. LP Valve Limiter Raise
32. LP Valve Limiter Lower
33. Extr/Adm Demand Raise
34. Extr/Adm Demand Lower
35. External Trip 2
36. External Trip 3
37. External Trip 4
38. External Trip 5
39. External Trip 6
40. External Trip 7
41. External Trip 8
42. External Trip 9
43. External Trip 10
44. External Alarm 1
45. External Alarm 2
46. External Alarm 3
47. External Alarm 4
48. External Alarm 5
49. External Alarm 6
50. External Alarm 7
51. External Alarm 8
52. External Alarm 9
53. External Alarm 10
54. Select Controlled Shutdown
55. Synchronize Time-of-Day

Cascade and Auxiliary Units Configured—The cascade & auxiliary control units (addresses 3:0230 & 231) are integers that represents the following:

0. (none)
1. psi
2. kPa
3. MW
4. KW
5. bar
6. atm
7. t/h
8. kg/hr
9. kg/cm2
10. #/hr
11. k#/hr
12. deg F
13. deg C

Ext/Adm Units Configured—The extraction/admission control units (address 3:0232) is an integer that represents the following:
0. (none)
1. psi
2. kPa
3. bar
4. atm
5. t/h
6. kg/hr
7. kg/cm2
8. #/hr
9. k#/hr

KW/Load Units Active—The KW/Load units active (address 3:0233) is an integer that represents the following:
0. %
1. MW
2. KW

KW/Load Setpt Units Active—The KW/Load setpt units active (address 3:0234) is an integer that represents the following:
0. rpm
1. MW
2. KW

Turbine Type Configured—The turbine type (address 3:0235) is an integer that represents the following:
1. Single Valve
3. Split Range Valves
4. Extraction Only
5. Admission Only
6. Extraction and Admission

Aux Control Configured—The auxiliary control configured (address 3:0236) is an integer that represents the following:
1. Not Used
2. Controller
3. Limiter

Cascade Control Configured—The cascade control configured (address 3:0237) is an integer that represents the following:
1. Not Used
2. Controller

Start Mode Configured—The start mode configured (address 3:0238) is an integer that represents the following:
Manual
Semiautomatic
Automatic

Method from Idle to Rated Configured—The method from idle to rated configured (address 3:0239) is an integer that represents the following:
1. No Idle Used
2. Manual Raise/Lower
3. Idle/Rated Ramp
4. Auto Startup Sequence

Actuator #2 Readout—The Act 2 Readout Configured (address 3:0240) is an integer that represents the following:

1. Actual Speed
2. Speed Setpoint
3. Remote Speed Setpoint
4. Load Share Input
5. Sync Input
6. KW Input
7. Cascade Input
8. Cascade Setpoint
9. Remote Cascade Setpoint
10. Auxiliary Input
11. Auxiliary Setpoint
12. Remote Auxiliary Setpoint
13. HP Valve Limiter Setpoint
14. Act 1 Valve Demand
15. First Stage Pressure
16. Monitor Analog Input

V1 Calibration Status—The V1 calibration status (address 3:0252) is an integer that represents the following:

0. Calibration is Disabled
1. Calibration is At Min output
2. Calibration is At Max output
3. Calibration is in Manual Entry Mode
4. Calibration is Enabled
5. Speed > 1000 rpm
6. Unit Not Shutdown

V2 Calibration Status—The V2 calibration status (address 3:0256) is an integer that represents the following:

0. Calibration is Disabled
1. Calibration is At Min output
2. Calibration is At Max output
3. Calibration is in Manual Entry Mode
4. Calibration is Enabled
5. Speed > 1000 rpm
6. Shutdown

Specific Address Information

Entering Setpoint from the Modbus

The setpoints for the Speed, Extraction, Cascade and Auxiliary can be directly entered through the Modbus link. When the setpoint is entered for any of these functions the setpoint will not move instantly, rather the setpoint will move towards the entered setpoint at the ‘entered rate’ defined for the function in the program.

There is feedback provided to let the operator know what value was entered. This value will not change until a new value is entered from the Modbus. Addresses 3:0145-:0148 provide this feedback for speed, cascade, auxiliary, and extraction/ admission respectively. When a new value is entered from the Modbus, the setpoint will move to the new value. If the desired setpoint is already the same as the feedback, the operator can use a 'Go To Modbus Entered' setpoint command (0:0019, 0:0035, 0:0043, & 0:0079) instead of entering the setpoint again. Since the control determines if a new Modbus setpoint has been entered by looking to see if it has changed, either a new setpoint value must be entered or the 'Go To Modbus Entered' command needs to be used whenever the setpoint to be entered is the same as the feedback.

Modbus Scale Factors

Modbus has two limitations:

- only integers can be sent across
- the value is limited between -32767 and 32767

These limitations can be overcome by scaling the value before it is sent across the Modbus. The default scale factor for the analog values is automatically set by the control based on the scaling of the analog input. If the maximum value of the analog input (Value @ 20 mA) is less than 3200, the scale factor is automatically set to 10. If the maximum value of the analog input (Value @ 20 mA) is less than 320, the scale factor is automatically set to 100. If the maximum value of the analog input (Value @ 20 mA) is greater than 32000, the scale factor is automatically set to 0.1. The scale factor can be changed in the service mode between 0.1, 1.0, 10, and 100, if desired.

The following input and setpoint values that are sent across the Modbus have independent scale factors: Extraction/Admission, Auxiliary, Cascade, FSP, KW, and Sync/Load Share. These scaled parameters and their scale factor are available through the Modbus.

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 5009 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. An “ESD ACKN ENABLE” feedback (1:1005) is given 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

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

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

Service Mode

Default Password : **1111**

If changed, write down the new password here and remove this page and store in a safe place.

_____
NEW PASSWORD

IMPORTANT **Remove this page to prevent unauthorized access to access to the Program, Run, and Service Modes.**

Appendix B.
5009 Program Mode Worksheet

GOVERNOR SERIAL NUMBER: _____

DATE: _____

APPLICATION: _____

APPLICATION FOLDER

Site	
Turbine	
ID Tag	
Turbine Type	
Application	
Ratio/Limiter Mode	
Use Auxiliary PID	
Use Cascade PID	

START SETINGS FOLDER

Start Routine	
Use Initial V1 Position?	
V1 Initial Position	%
Idle to Rated Routine	
Speed Setpoint Rate to Min Speed	rpm/sec
HP Valve Limiter Rate	%/sec
Use Critical Speed Avoidance?	
Critical Rate	rpm/sec
Critical Speed Band 1 Minimum	rpm
Critical Speed Band 1 Maximum	rpm
Use Critical Speed Avoidance Band 2?	
Critical Speed Band 2 Minimum	rpm
Critical Speed Band 2 Maximum	rpm
IDLE/RATED RAMP (if configured)	
Idle Setpoint	rpm
Rated Setpoint	rpm
Setpoint Rate	rpm/sec

AUTO SEQUENCE SETTINGS (if configured)

Cold Star (> xx hrs)	hrs
Hot Start (< xx hrs)	hrs
Low Idle Setpoint	rpm
Low Idle Delay (Cold)	min
Low Idle Delay (Hot)	min
Low Idle to High Idle Rate (Cold)	rpm/sec
Low Idle to High Idle Rate (Hot)	rpm/sec
High Idle Setpoint	rpm
High Idle Delay Time (Cold)	min
High Idle Delay Time (Hot)	min
High Idle to Rated Rate (Cold)	rpm/sec
High Idle to Rated Rate (Hot)	rpm/sec
Rated Setpoint	rpm

SPEED CONTROL FOLDER

Overspeed Test Limit	rpm
Overspeed Trip Level	rpm
Max Control Setpoint	rpm
Min Control Setpoint	rpm
Setpoint Slow Rate	rpm/sec
Use 4-20mA Remote Speed Setpoint?	
Remote Setpt Mas Rate	rpm/sec
Off-Line Proportional Gain	%
Off-Line Integral Gain	rps
Off-Line Derivative Ratio	%
On-Line Proportional Gain	%
On-Line Integral Gain	rps
On-Line Derivative Ratio	%
Type of Droop	
Droop	%
Maximum Load	units
Load Units (KW,MW)	
Rated Setpoint	rpm
Teeth Seen by Speed Probe	
Gear Ratio 1:	
Speed Input #1	
Input 1—FTM Channels Used?	
Speed Input #2	
Input 2—FTM Channels Used?	
Speed Input #3	
Input 3—FTM Channels Used?	
Speed Input #4	
Input 4—FTM Channels Used?	

EXTR / ADM CONTROL FOLDER (if configured)

Extr/Adm Units	
Max Setpoint	units
Min Setpoint	units
Use Setpoint Tracking?	
Setpoint Initial Value	
Setpoint Rate	units/sec
Use 4-20mA Remote Extr/Adm Setpoint?	
Rmt Setpoint Max Rate	units/sec
Proportional Gain	%
Integral Gain	rps
Derivative Ratio	%
Droop	%
Use Automatic Enable?	(Extr only)
Invert Extr/Adm Input?	
Lost Extr/Adm Input	
Extr/Adm Permissive Speed	rpm
Adm Demand Rate	(not Extr)
LP Valve Limiter Rate	%/Sec
Disable Extr/Adm On Open Tie Breaker	
Disable Extr/Adm On Open Gen Breaker	
Min HP Valve Lift	% (not Extr)
Min LP Valve Lift	%

EXTRACTION STEAM MAP FOLDER

Maximum Power	units
Maximum HP Flow	units
Max Power @ Min Extr	units
Max HP Flow @ Min Extr	units
Min Power @ Max Extr	units
Min HP Flow @ Max Extr	units
Min Power @ Min Extr	units
Min HP Flow @ Min Extr	units
Priority On Steam Map Limits	
Pres Priority Ovd on LP Max Lift Limit?	

ADMISSION STEAM MAP FOLDER

Maximum Power	units
Maximum HP Flow	units
Maximum Adm Flow	units
Max Power @ Max Adm	units
Max HP Flow @ Max Adm	units
Min Power @ Min Adm	units
Min HP Flow @ Min Adm	units
Max Power @ Min Adm	units
Max HP Flow @ Min Adm	units
Priority On Steam Map Limits	
Pres Priority Ovd on LP Max Lift Limit?	

EXT/ADM STEAM MAP FOLDER

Maximum Power	units
Maximum HP Flow	units
Maximum Adm Flow	units
Max Power @ 0 E/A	units
Max HP Flow @ 0 E/A	units
Min Power @ Max Extr	units
Min HP Flow @ Max Extr	units
Min Power @ 0 E/A	units
Min HP Flow @ 0 E/A	units
Priority On Steam Map Limits	
Pres Priority Ovd on LP Max Lift Limit?	

DRIVER CONFIG FOLDER

Act #1 (HP) Settings	
Range	mA
Dither	mA
Calibration Value at 0%	mA
Calibration Value at 100%	mA
Dual Coil?	
Invert Driver Output?	
Trip on all failed?	
Act #2 (LP) Settings:	
Range	
Offset Value	%
Dither	mA
Calibration Value at 0%	mA
Calibration Value at 100%	mA
Dual Coil?	
Invert Driver Output?	
Trip on all failed?	

Act #2 as a Readout Settings:	
Use Act #2 As a Readout?	
Readout Options	
4mA Value	units
20mA Value	units

ANALOG INPUTS FOLDER

Analog Input #1 Function	
4mA Value	units
20mA Value	units
Device Power	
Analog Input #2 Function	
4mA Value	units
20mA Value	units
Device Power	
Analog Input #3 Function	
4mA Value	units
20mA Value	units
Device Power	
Analog Input #4 Function	
4mA Value	units
20mA Value	units
Device Power	
Analog Input #5 Function	
4mA Value	units
20mA Value	units
Device Power	
Analog Input #6 Function	
4mA Value	units
20mA Value	units
Device Power	
Analog Input #7 Function	
4mA Value	units
20mA Value	units
Device Power	
Analog Input #8 Function	
4mA Value	units
20mA Value	units
Device Power	

CONTACT INPUTS FOLDER

Contact Input 5 Function	
Contact Input 6 Function	
Contact Input 7 Function	
Contact Input 8 Function	
Contact Input 9 Function	
Contact Input 10 Function	
Contact Input 11 Function	
Contact Input 12 Function	
Contact Input 13 Function	
Contact Input 14 Function	
Contact Input 15 Function	
Contact Input 16 Function	
Contact Input 17 Function	
Contact Input 18 Function	
Contact Input 19 Function	
Contact Input 20 Function	
Contact Input 21 Function	
Contact Input 22 Function	
Contact Input 23 Function	
Contact Input 24 Function	

Contact Input Power Configuration	
Inputs 1-3 Config	
Inputs 4-6 Config	
Inputs 7-9 Config	
Inputs 10-12 Config	
Inputs 13-15 Config	
Inputs16-18 Config	
Inputs 19-21 Config	
Inputs 22-24 Config	

AUXILIARY CONTROL/LIMITER FOLDER

Auxiliary Units	
Max Setpoint	units
Min Setpoint	units
Setpoint Initial Value	units
Setpoint Rate	units/sec
Use 4-20mA Remote Auxiliary Setpoint?	
Rmt Setpoint Max Rate	units/sec
Proportional Gain	%
Integral Gain	rps
Derivative Ratio	%
Droop	%
Invert Auxiliary Input?	
Lost Auxiliary Input Shutdown?	
Use KW Input?	
Disable Auxiliary On Open Tie Breaker?	
Disable Auxiliary On Open Gen Breaker?	

CASCADE CONTROL FOLDER

Cascade Units	
Max Casc Setpoint	units
Min Casc Setpoint	units
Use Setpoint Tracking?	
Setpoint Initial Value	units
Setpoint Rate	units/sec
Use 4-20mA Remote Cascade Setpoint?	
Rmt Setpoint Max Rate	units/sec
Proportional Gain	%
Integral Gain	rps
Derivative Ratio	%
Droop	%
Invert Cascade Input?	
Max Speed Setpoint	
Min Speed Setpoint	
Speed Setpoint Rate (max)	
Use KW Input?	
Disable Cascade On Open Tie Breaker?	
Disable Cascade On Open Gen Breaker?	

ANALOG READOUTS FOLDER

Analog Readout 1	
4mA Value	units
20mA Value	units
Analog Readout 2	
4mA Value	units
20mA Value	units
Analog Readout 3	
4mA Value	units
20mA Value	units
Analog Readout 4	
4mA Value	units
20mA Value	units

RELAY FOLDER

Test Relays(s) Every	hrs
Trip (Relay #1)	
Configuration	
Test Relay	
Reset Clears Trip Relay output?	
Use external trips in trip relay output?	
Trip Relay Energizes For Trip?	
Alarm (Relay #2)	
Configuration	
Test Relay	
Use Non-Latching Alarm Indication?	
Relay #3	
Function	
Indication of	
Level Switch for	
Relay On Level	
Relay Off Level	
Configuration	
Test Relay	
Relay #4	
Function	
Indication of	
Level Switch for	

Relay On Level
Relay Off Level
Configuration
Test Relay
Relay #5
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration
Test Relay
Relay #6
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration
Test Relay
Relay #7
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration
Test Relay
Relay #8
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration
Test Relay
Relay #9
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration
Test Relay
Relay #10
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration
Test Relay
Relay #11
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration

Test Relay
Relay #12
Function
Indication of
Level Switch for
Relay On Level
Relay Off Level
Configuration
Test Relay

CPU COMMUNICATIONS FOLDER
Port 1 (CPU-A) Modbus Settings
Port Configuration
Driver Protocol
Device Number
Baud Rate
Stop Bits
Parity
Port 2 (CPU-B) Modbus Settings
Port Configuration
PCI To Revert To Port C Fault?
Driver Protocol
Device Number
Baud Rate
Stop Bits
Parity
Port 3 (CPU-C)
Use Local/Remote Function?
Allow Emrg Shutdown from Run Mode?

Appendix C.
5009 Service Mode Worksheet

GOVERNOR SERIAL NUMBER: _____

DATE: _____

APPLICATION: _____

APPLICATION FOLDER
Same as Program Mode

START SETTINGS Folder
Idle/Rated Ramp (if configured)
Use Idle?
Idle has priority over Rmt Speed, Casc, Aux?

AUTO SEQUENCE SETTINGS (if configured)
Automatically Halt at Idle Setpoints?

SPEED CONTROL FOLDER
Remove KW/MW Droop (force LSS droop)?
Zero Load LSS Value
Use Frequency Control Arm/Disarm?
Min Load Bias
Use Utility Tie Breaker Opening Trip?
Use Generator Breaker Opening Trip?
Gen Open Setback
Rate to Rated
Use Sync Window and Synchronizing Rate?
Synchronizing Rate rpm/sec
Fast Rate Delay sec
Setpoint Fast Rate rpm/sec
Setpoint Entered Rate rpm/sec
Ospd Test Auto Dsbl Time sec
Trip at Overspeed Limit?
Underspeed Setting
Remote Speed Setpoint Settings
Max Speed Setting rpm
Min Speed Setting rpm
Not-Matched Rate rpm/sec
Input Deadband rpm
Input Lag-Tau sec
Use Utility Tie Breaker Closed Permissive?
Use Generator Breaker Closed Permissive?
Speed Sensor Settings
Maximum Deviation _____%, rpm
Speed Failure Level rpm
Use Override Timer?
Max Override Time min
Alarm Setpoint rpm

KW Inputs

Max Input Deviation	units
Two Good Inputs Eqn	

Load Share Inputs

Max Input Deviation	units
Two Good Inputs Eqn	

EXTR / ADM CONTROL FOLDER (if configured)

LP Valve Lmtr Entered Rate	%/Sec
Max HP Valve Lift (not Ext)	%
Max LP Valve Lift	%
Manual E/A Demand (Adm)	%
Manual E/A Demand Rate (Adm)	%/sec
Extr/Adm Demand Rate (Ext/Adm)	%/sec
Initial Ctrl Demand (Ext/Adm)	%
Setpoint Rated Value	units
Min Setpoint	units
Fast Rate Delay	sec
Setpoint Fast Rate	units/sec
Setpoint Entered Rate	units/sec

Remote Extr/Adm Setpoint Settings

Max Ext/Adm Setting	units
Min Extr/Adm Setting	units
Not-Matched Rate	units/sec
Input Deadband	units

Ext/Adm Inputs

Max Input Deviation	units
Two Good Inputs Eqn	

EXT /ADM STEAM MAP FOLDER

K1 Value (dHP/dS)	
K2 Value (dHP/dP	
K3 Value (HP offset)	
K4 Value (dLP/dS)	
K5 Value (dLP/dP)	
K6 Value (LP offset)	
D1 Value (dHP/dS)	
D2 Value (dHP/dP	
D3 Value (HP offset)	
D4 Value (dLP/dS)	
D5 Value (dLP/dP)	
D6 Value (LP offset)	

DRIVER CONFIG FOLDER

Act #1 (HP) Settings:

X-1 Value____%	Y-1 Value_____%
X-2 Value____%	Y-2 Value_____%
X-3 Value____%	Y-3 Value_____%
X-4 Value____%	Y-4 Value_____%
X-5 Value____%	Y-5 Value_____%
X-6 Value____%	Y-6 Value_____%
X-7 Value____%	Y-7 Value_____%
X-8 Value____%	Y-8 Value_____%
X-9 Value____%	Y-9 Value_____%
X-10 Value____%	Y-10 Value_____%
X-11 Value____%	Y-11 Value_____%

Act #2 (LP) Settings:

X-1 Value ____ %,	Y-1 Value ____ %
X-2 Value ____ %,	Y-2 Value ____ %
X-3 Value ____ %,	Y-3 Value ____ %
X-4 Value ____ %,	Y-4 Value ____ %
X-5 Value ____ %,	Y-5 Value ____ %
X-6 Value ____ %,	Y-6 Value ____ %
X-7 Value ____ %,	Y-7 Value ____ %
X-8 Value ____ %,	Y-8 Value ____ %
X-9 Value ____ %,	Y-9 Value ____ %
X-10 Value ____ %,	Y-10 Value ____ %
X-11 Value ____ %,	Y-11 Value ____ %

ANALOG INPUTS FOLDER

Analog Input #1 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units
High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	
Analog Input #2 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units
High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	
Analog Input #3 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units
High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	
Analog Input #4 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units
High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	
Analog Input #5 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units

High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	
Analog Input #6 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units
High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	
Analog Input #7 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units
High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	
Analog Input #8 Function	
Fail Low Value	units
Fail High Value	units
Use Time stamped Alarm?	
Low Alarm Value	units
High Alarm Value	units
Input Offset	%
Input Gain	
Max Input Deviation	%
Two Good Inputs Eqn	

CONTACT INPUTS FOLDER

Keep Contacts Enabled for Local Select?	

AUXILIARY CONTROL/LIMITER FOLDER

PID Deadband	units
PID Minimum	%
Setpoint Rated Value	units
Fast Rate Delay	sec
Setpoint Fast Rate	units/sec
Setpoint Entered Rate	units/sec
Remote Auxiliary Setpoint Settings	
Max Aux Setting	units
Min Aux Setting	units
Not-Matched Rate	units/sec
Input Deadband	units
Auxiliary Inputs	
Max Input Deviation	units
Two Good Inputs Eqn	

CASCADE CONTROL FOLDER

PID Deadband	units
PID Minimum	%
Setpoint Rated Value	units
Fast Rate Delay	sec
Setpoint Fast Rate	units/sec
Setpoint Entered Rate	units/sec
Speed Not-Matched Sept Rate	rpm/sec
Remote Cascade Setpoint Settings	
Max Casc Setting	units
Min Casc Setting	units
Not-Matched Setpt Rate	units/sec
Input Deadband	units
Cascade Inputs	
Max Input Deviation	units
Two Good Inputs Eqn	

ANALOG READOUTS FOLDER

Analog Readout 1	
Min Offset	mA
Max Offset	mA
Analog Readout 2	
Min Offset	mA
Max Offset	mA
Analog Readout 3	
Min Offset	mA
Max Offset	mA
Analog Readout 4	
Min Offset	mA
Max Offset	mA

RELAY POSITIONS FOLDER

Major Alarm Relay Settings

Use Tie Breaker Open?
Use Gen Breaker Open?
Use 5009 Over Temperature?
Use Operating System Fail?
Use Kernel A Com Link Fail?
Use Kernel B Com Link Fail?
Use Turbine (5009) Trip?
Use Stuck in Critical Band?
Use External Alarm #1?
Use External Alarm #2?
Use External Alarm #3?
Use External Alarm #4?
Use External Alarm #5?
Use External Alarm #6?
Use External Alarm #7?
Use External Alarm #8?
Use External Alarm #9?
Use External Alarm #10?
Use Remote Speed Input Failed?
Use All Cascade Inputs Failed?
Use Remote Cascade Input Failed?
Use All KW/Unit Load Inputs Failed?
Use All Extraction Inputs Failed?
Use Remote Extraction Input Failed?
Use All Auxiliary Inputs Failed?
Use Remote Auxiliary Input Failed?

Use All FSP Input Failed?
Use All Sync/Load Share Input Failed?
Use All Monitor Inputs Failed?
Use Relay #1 (Trip Rly) Fault?
Use Relay #2 (Alarm Rly) Fault?
Use Relay #3 Fault Alarm?
Use Relay #4 Fault Alarm?
Use Relay #5 Fault Alarm?
Use Relay #6 Fault Alarm?
Use Relay #7 Fault Alarm?
Use Relay #8 Fault Alarm?
Use Relay #9 Fault Alarm?
Use Relay #10 Fault Alarm?
Use Relay #11 Fault Alarm?
Use Relay #12 Fault Alarm?
Use Act #1 (HP) Fault?
Use Act #2 (LP) Fault?
Use Analog Out #1 Failure?
Use Analog Out #2 Failure?
Use Analog Out #3 Failure?
Use Analog Out #4 Failure?

RELAY SETTINGS FOLDER
Indicate Trip as an Alarm?
Blink for Alarms?

CPU COMMUNICATIONS FOLDER
Modbus #1
Trip Command
Allow Modbus Dynamics Adjustments?
Allow Modbus Valve Calibration?
Allow Modbus Overspeed Test?
Driver Protocol
Modbus #2
Trip Command
Allow Modbus Dynamics Adjustments?
Allow Modbus Valve Calibration?
Allow Modbus Overspeed Test?
Driver Protocol
Device Number
Modbus Scale Factors
Cascade Scale Factor
Auxiliary Scale Factor
KW Scale Factor
Ext/Adm Scale Factor
Monitor In Scale Factor
FSP Scale Factor

SIO COMMUNICATIONS FOLDER
SIO-A Port 1 Settings (Printer)
Baud Rate
Data Bits
Stop Bits
Parity
Endline Character
Echo
Flow
Ignore CR

SIO-A Port 2 Settings (ServPanel)
Baud Rate
Data Bits
Stop Bits
Parity
Endline Character
Echo
Flow
Ignore CR
SIO-A Port 3 Setting (Modbus #1 port 1)
Driver Type
SIO-A Port 4 Settings
Port Configuration Not Used / PCI / Modbus #2 port 1
RS Protocol
Baud Rate
Stop Bits
Parity
SIO-B Port 1 Settings (Printer)
Baud Rate
Data Bits
Stop Bits
Parity
Endline Character
Echo
Flow
Ignore CR
SIO-B Port 2 Settings (ServPanel)
Baud Rate
Data Bits
Stop Bits
Parity
Endline Character
Echo
Flow
Ignore CR
SIO-B Port 3 Settings
Port Configuration Not Used / PCI / Modbus #1 port 2
RS Protocol
Baud Rate
Stop Bits
Parity
SIO-B Port 4 Setting (Modbus #2 port 2)
Driver Type

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