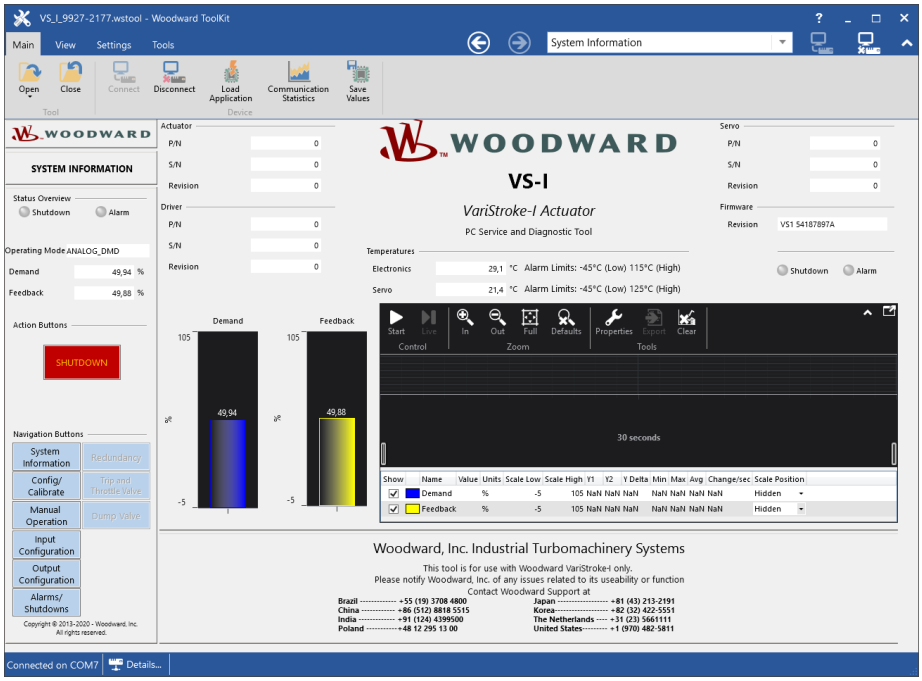
Released

WOODWARD

Product Manual 35148
(Revision C, 04/2024)
Original Instructions



Customer Service Tool for VariStroke-I (VS-I, VS-GI, and VS-DX) Electrohydraulic Actuator

User Manual

General Precautions

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

Practice all plant and safety instructions and precautions.

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

Revisions

This publication may have been revised or updated since this copy was produced. The latest version of most publications is available on the Woodward website.

http://www.woodward.com

If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

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

Translated Publications

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

The original source of this publication may have been updated since this translation was made. The latest version of most publications is available on the Woodward website.

www.woodward.com/publications

Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

If your publication is not on the Woodward website, please contact your customer service representative to get the latest copy.

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

Manual 35148

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

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

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

⚠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 completely independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

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

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

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible as 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.

Regulatory Compliance

IMPORTANT

Regulatory Compliance and Declarations information are not contained in this manual and may be found in the product manuals. For VariStroke-I double acting actuators and servos, refer to manual 26727. For VariStroke-I GI single acting actuators and servos refer to manual 35119. For VariStroke-DX duplex hydraulic servo skid servos refer to manual 35132.

Chapter 1.
General Information

Introduction

This manual contains user instructions for the Service and Configuration Tool for use with the Woodward VariStroke-I, VariStroke-GI, and VariStroke-DX linear electrohydraulic actuator family. This manual complements the VariStroke-I, VariStroke-GI, and VariStroke-DX hardware manuals.

This manual provides initial setup instructions, in addition to detailed descriptions of how to enable and/or configure various features and functions of the VariStroke-I actuator family using the Customer Service Tool.

This manual also describes the on-board monitoring and diagnostics features enabled by the VariStroke product when connected to the Customer Service Tool.

For additional information on the VariStroke product family, see Table 1-2 for a list of other relevant Woodward literature. The hardware manuals cover various aspects of the product family including certifications, important application and installation instructions, specifications, as well as other information on the physical aspects of the product.

⚠WARNING

Personal Injury

Improper use of software tools may lead to unsafe conditions. Only qualified personnel should use these tools to modify or monitor the VariStroke-I functions.

NOTICE

Always use the Customer Service Tool at the latest available revision provided within Woodward's software download website. For more information, refer to Chapter 2 Customer Service Tool Installation.

Table 1-1. Abbreviations and Definitions

VS-DX	VariStroke-DX duplex hydraulic servo skid
VS-I	VariStroke-I servo product family
VS-GI	VariStroke-GI single acting servo model
DCS	Distributed Control System
Demand	This term describes the reference value for the position, as well as cases in which the term “position demand” is used. This is synonymous to the industry term “position setpoint”.
In Control	The unit controlling the position of the actuation system
Not In Control	The unit acting as the backup to the In Control unit
Customer Service Tool	The PC software providing capabilities to configure, monitor, and diagnose the VariStroke-I servo
Master	The unit designated as the master is in charge of hydraulic cylinder positioning control, unless it has a failure (only in VS-DX)
Slave	The unit designated as the slave is in standby and takes control over the hydraulic cylinder position immediately once the master became inoperable (only in VS-DX)
PCBA	Printed Circuit Board Assembly
PST	Partial Stroke Test
T&TV	Trip and Throttle Valve
PI Controller	Proportional + Integral Controller
DI	Discrete Input
DO	Discrete Output
DV	Dump Valve

Table 1-2. Woodward Reference Literature

Manual 26727	*VariStroke-I (VS-I) Electrohydraulic Actuator*
Manual 35119	*VS-I GI VariStroke-I (VS-I) Electrohydraulic Actuator*
Manual 35132	*VariStroke-DX Duplex Hydraulic Servo Skid*
Manual 35163	*VariStroke Power Cylinder*
Customer Service Tool Training Videos	YouTube - Woodward Inc, Training and Products channel: https://www.youtube.com/channel/UC0Ogv5ntWU2OXxshcYYt6Mg
Manual 25071	*Oils for Hydraulic Controls*
CMM-03002	*VariStroke-I (VS-I) Family Bronze Level Component Maintenance Manual*
CMM-03013	*Component Maintenance, Manual Bronze Level, VariStroke-DX (VS-DX)*
Manual 82715	*Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, & Modules*
Manual 25075	*Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls*

Chapter 2.
Customer Service Tool Installation

System Requirements

The minimum system requirements for the Customer Service Tool software are:

- Microsoft Windows® 10, 8.1, 7.
- Microsoft.NET™ Framework ver. 4.6.2
- 1 GHz or faster x86 or x64 processor
- 1 GB of RAM
- Minimum of 1024 by 768 pixel screen resolution
- Serial port or USB-to-RS232 adapter and driver
- Serial extension cable - straight through type
- Woodward ToolKit Software version 6.4.0 (installed as a package together with Customer Service Tool Installer) or newer

Setup

The VS-I product family utilizes a software-based Customer Service Tool that can be loaded onto a computer and used to:

- Calibrate the minimum and maximum stop positions of the cylinder
- Modify the device performance based on cylinder size and supply pressure conditions
- Configure the scaling and redundancy options for the inputs and outputs
- Monitor the status of various available diagnostics
- Configure the behavior of various available diagnostics
- Configure or enable various features to suit the application requirements

⚠WARNING **Improper use of software tools may lead to an unsafe condition. Only trained personnel should have access to these tools.**

The VariStroke Customer Service Tool program is a software application which runs on a Windows-based PC or laptop. It requires a physical RS-232 connection between the computer and the VS-I. Make the physical connection by connecting to the VS-I at the Service Port (RS-232).

Use a straight-through serial cable (not a null modem cable). For newer PCs or laptops with USB ports, a USB-to-serial converter is required.

Obtain an approved converter from Woodward by ordering dedicated components:

- 8928-1151 Converter Kit contains:
  - (1) USB-to-Serial Converter
  - (1) 10-ft DB9F to DB9M extension

- 8928-7323 Cable:
  - (1) 10-ft DB9F to DB9M extension

  Note: Remove the two nuts on the female end prior to installing the cable.

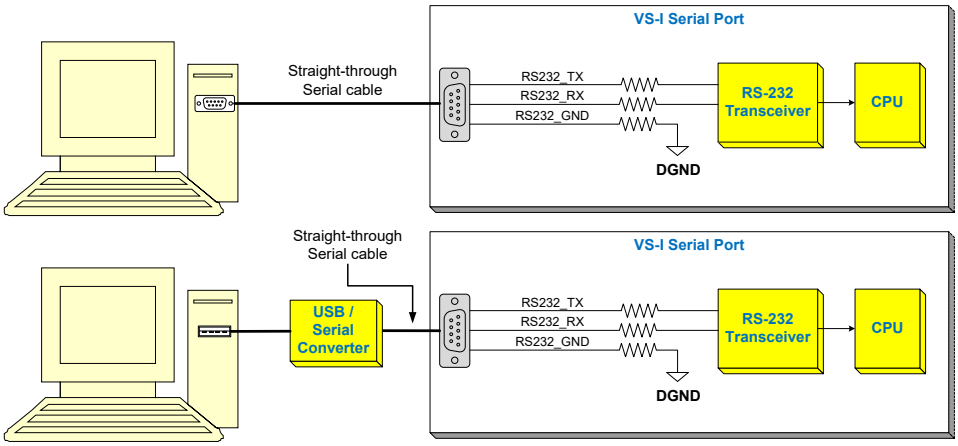


Figure 2-1. Service Port Connections

WARNING

Do not damage the cover seal, cover surface, threads, or the VS-I surface while removing or replacing the cover. Damage to sealing surfaces may result in moisture ingress, fire, or explosion. Clean the surface with rubbing alcohol if necessary. Inspect the cover joint surfaces to ensure that they are not damaged or contaminated.

Installation of VariStroke Customer Service Tool

Use the following procedure to install the VariStroke Customer Service Tool software program on a computer:

1. On a computer connected to the internet, navigate to www.woodward.com/software.
2. Search for installation program "9927-2177".
3. Follow instructions on the website to download the 9927-2177_xxx.exe file onto the computer.
4. Once downloaded, locate and double click the 9927-2177_xxx.exe file to initiate extraction and installation of the VariStroke Service Tool program onto the computer.

   Note: xxx is a placeholder for the revision of the Customer Service Tool install package. i.e., 9927-2177_A.exe or 9927-2177_J are examples of Revision A and Revision J.

5. The End-User License Agreement (EULA) screen appears. “Add Desktop Shortcut” is set as the default. Uncheck this box if you do not want a Customer Service Tool icon on your desktop. Read and accept the terms of the License Agreement then click “Install” to continue.

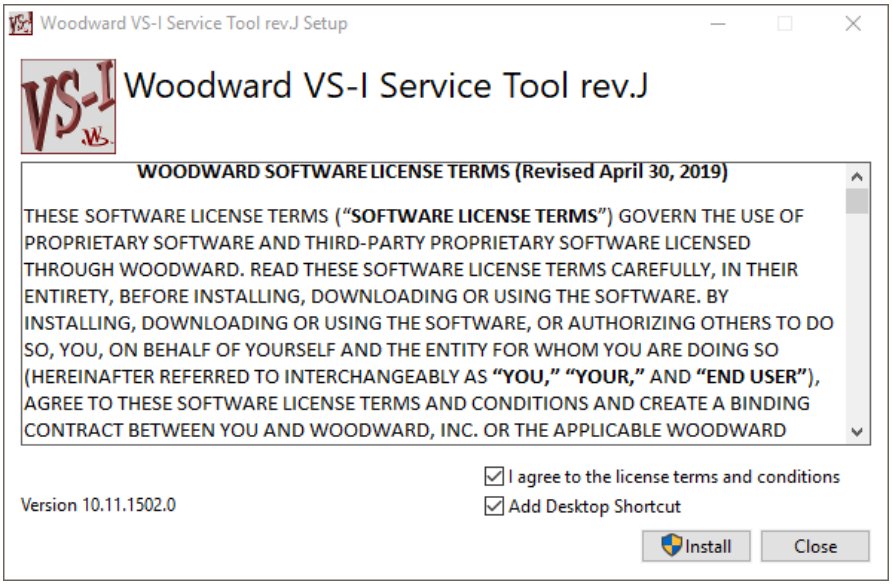


Figure 2-2. End-User License Agreement Screen

6. The Customer Service Tool installation will proceed.

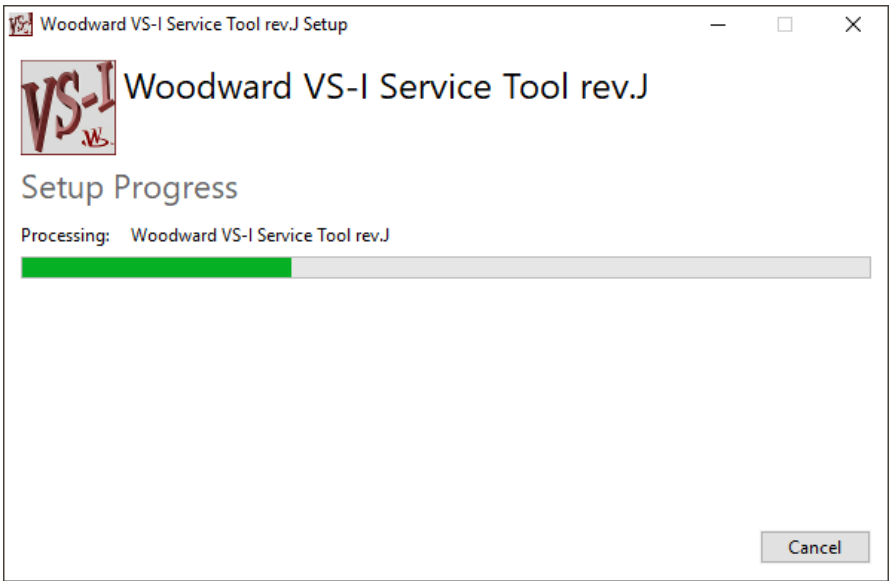


Figure 2-3. Customer Service Tool Installation Screen

7. Pressing the “Launch” button starts the Customer Service Tool and exits the installation wizard. Pressing the “Close” button completes the installation wizard without starting the Customer Service Tool.

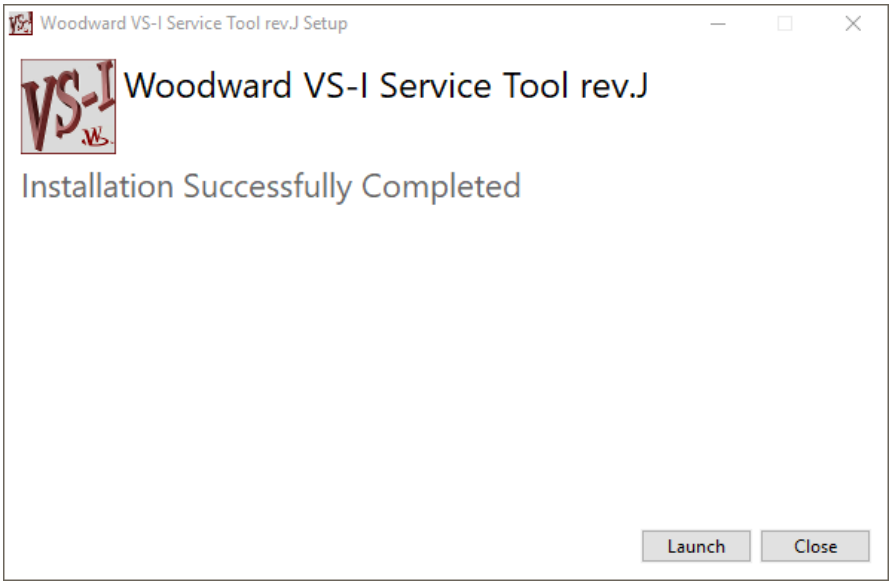


Figure 2-4. Installation Complete and Finish Screen

Chapter 3.
Connecting to VariStroke

Introduction

The VS-I Customer Service Tool is organized in a series of pages that allow the VS-I to be set up for proper operation. The following section will outline the various pages and their functions.

⚠WARNING

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

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

⚠WARNING

Improper use of these software tools may lead to an unsafe condition. Only trained personnel should have access to these tools.

Connection Procedure

1. With Customer Service Tool program installed, connect the computer to the VariStroke-I (VS-I) actuator using a straight through RS232 serial cable (a USB converter may also be required). Once connected, double-click on the VS I Customer Service Tool icon on the desktop, or from the computer's command prompt, type "VS I Customer Service Tool" and select open. The Customer Service Tool will launch and the next screen you will see will be the Home Screen.

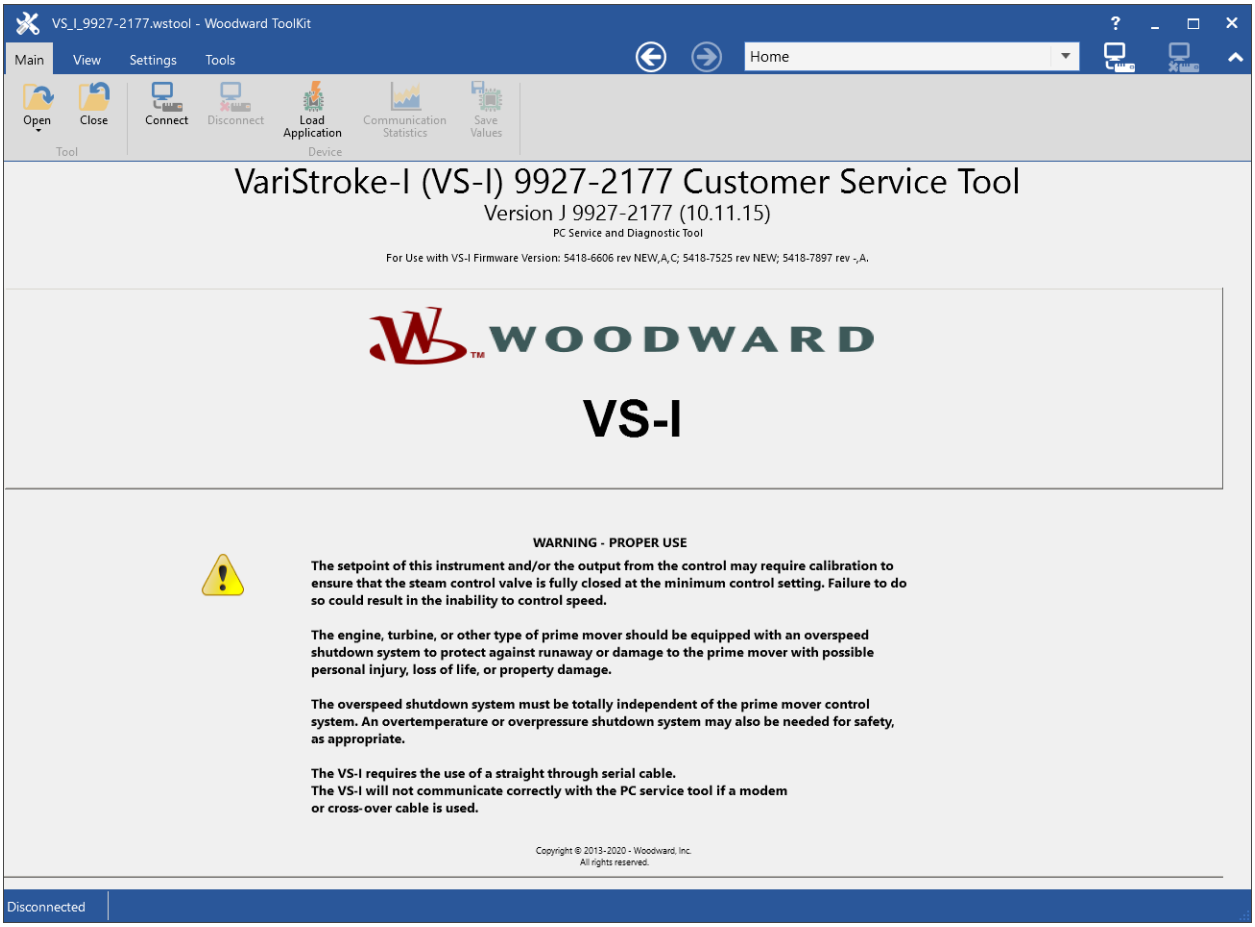


Figure 3-1. VS-I Customer Service Tool Home Screen

2. Press the “Connect” icon in the ribbon at the top of the Customer Service Tool screen.

3. Select the network connection to which the serial cable is connected. Select your available network and then set “Baud Rate” to “AutoDetection”. Press the “Connect” icon.

4. The Customer Service Tool will connect to the VS-I within a few seconds. Once connected, the “Connect” icon in the ribbon is grayed-out and the “Disconnect” icon is activated. The Customer Service Tool is now connected and communicating with the VS-I and you can calibrate, configure, and control the VS-I through the Customer Service Tool.

5. When the user wishes to end the session and disconnect the Customer Service Tool, press the “Disconnect” icon.

6. When disconnected, the Customer Service Tool will cease communication with the VS-I and the “Disconnect” icon will be grayed-out and the “Connect” icon will be activated.

7. The Customer Service Tool is now ready to communicate with the VS-I the next time the “Connect” icon is pressed.

Chapter 4.
Main Page and Navigation

Navigation Sidebar

The navigation sidebar is displayed along the left panel of the Customer Service Tool screens. The sidebar provides general information about the product status and allows for navigation between pages.

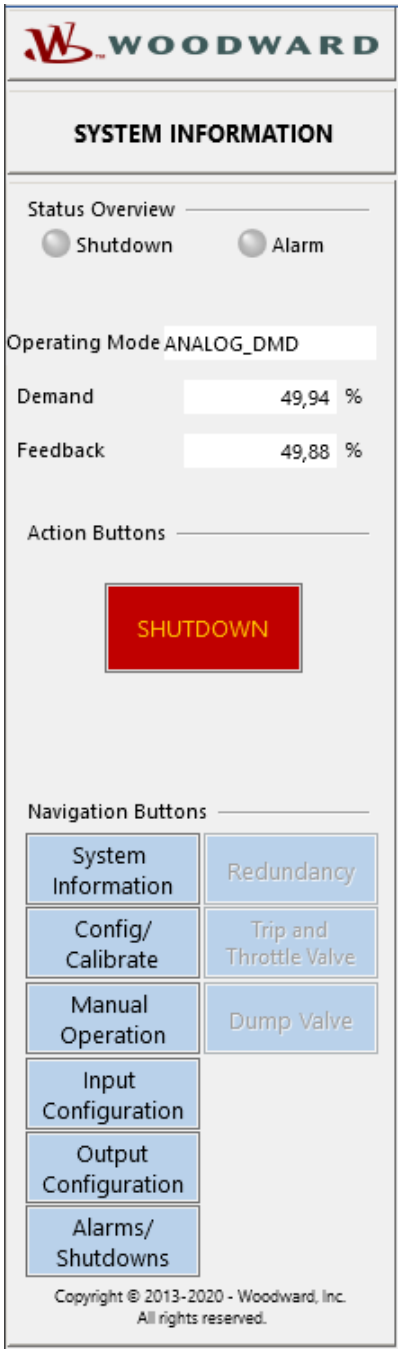


Figure 4-1. Navigation Sidebar

Shutdown Status Indicator: The shutdown status indicator is illuminated when the VariStroke driver is in a shutdown state. Refer to Chapter 8 for a list of all shutdown conditions.

Alarm Status Indicator: The alarm status indicator is illuminated when the VariStroke driver senses an alarm condition. Refer to Chapter 8 for a full list of all alarm conditions.

Operating Mode: The operating mode gauge indicates the current state/mode that the VariStroke driver is in. Possible states are:

STARTUP - Initialization is in progress. If the state is displayed for an excessive amount of time, check the Internal Status screen. See also the “Internal Status” section of this manual.

SPRING_CHK - Initialization of the system is currently testing the spring.

ANALOG_DMD - Normal operating mode when the cylinder position is selected by the analog input demand signals(s). There is an option of one or two demand signals on the Input Configuration screen.

SHUTDOWN - Servo is not operable. This state may have occurred because the analog inputs are not in the 4–20 mA range, or the Run Enable discrete input is selected and not on, or the “Shutdown” button has been pressed. After checking that the analog demands and the Run Enable are OK, refer to Chapter 8 for a list of shutdown conditions if the problem persists.

CONFIGURATION - The system is ready to receive the configuration or calibration information. When this process is completed and saved, turn on the input signals to re-enable normal operation.

CSD_FETS - This means the system is shut down due to a critical error. Please check your input power and connections and then reset the system. If the problem persists, service may be required.

CSD_CURR - The system is shut down due to a critical error. Please reset the system. If the problem persists, service may be required.

CSD_SERVO - The system is shut down due to a critical error. Please check the connections to the final cylinder feedback and then reset the system. If the problem persists, service may be required.

Demand and Feedback Gages:
The demand and feedback gages show the current demanded position and measured feedback position of the final cylinder.

Shutdown Button:
This “smart” button only appears when the VS-I is running and can be shut down. Pressing this button will call for additional confirmation and then invoke a shutdown condition.

Navigation Buttons:
Pressing these buttons will direct you to the respective page/function. Alternatively, you may access these and other pages by using the dropdown menu at the top of the Customer Service Tool Window. Depending on the type of actuator being used, some buttons may not be active and will be grayed out.

System Information

The first page displayed after establishing communication with the VS-I driver is the System Information page. This page shows system information about the VS-I servo currently connected to the Customer Service Tool.

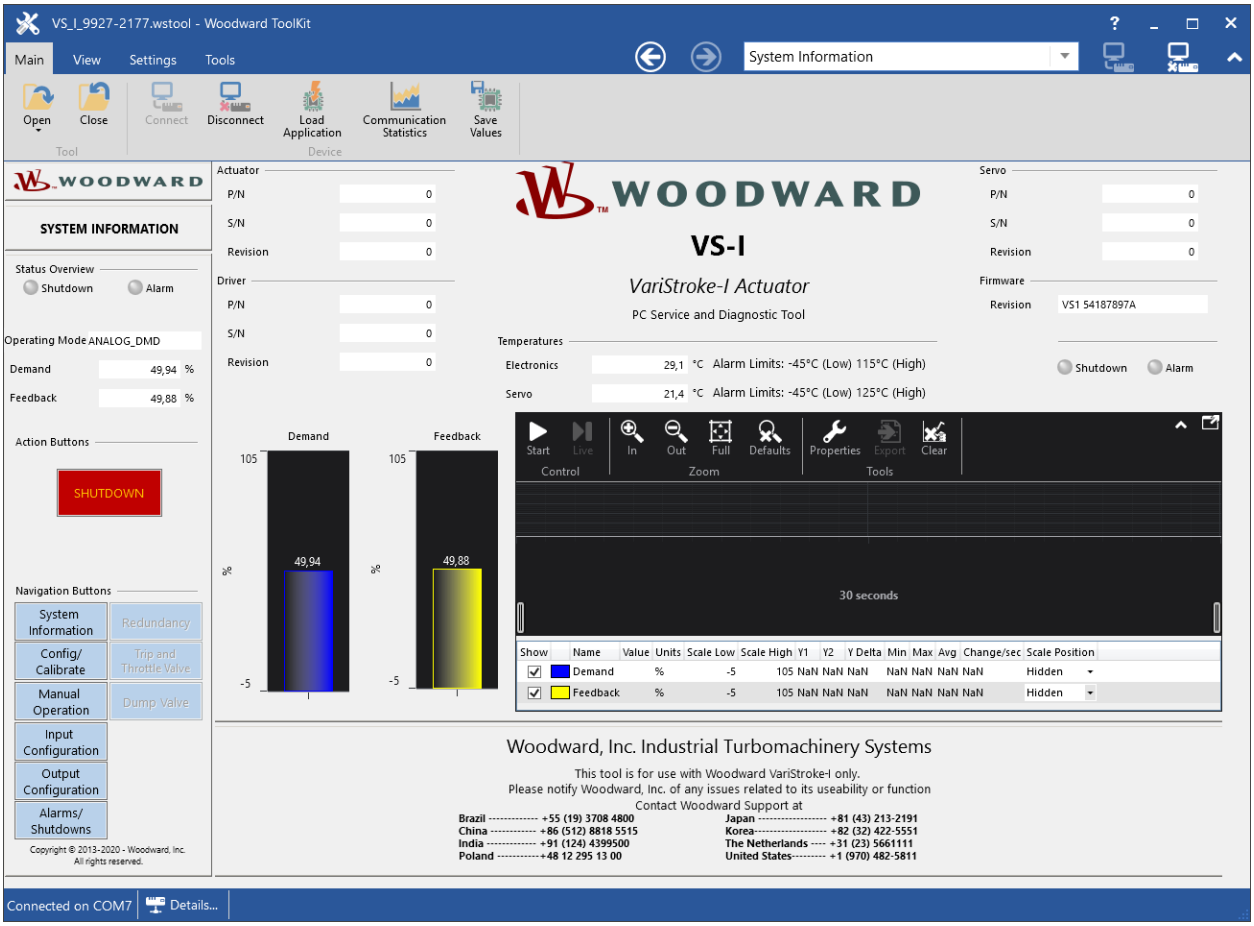


Figure 4-2. The System Information Screen

Actuator P/N, S/N, Revision: These fields display the Actuator Assembly Part Number (P/N), Serial Number (S/N), and Revision Number. This information is automatically uploaded from the VariStroke actuator it is connected to.

Driver P/N, S/N, Revision: These fields display the Electronic Driver Part Number (B_P/N), Serial Number (B_S/N), and Revision Number. This information is automatically uploaded from the VariStroke driver module it is connected to.

Servo P/N, S/N, Revision: These fields display the Servo Valve Part Number (S_P/N), Serial Number (S_S/N), and Revision Number. This information is automatically uploaded from the VariStroke actuator it is connected to.

Firmware Revision: This field displays the firmware part number and revision to the software programmed into the VS-I driver. This information is automatically uploaded from the VariStroke driver module it is connected to.

Temperature Electronics/Servo: These fields display the actual temperatures of the driver module and servo motor in the VS-I servo.

Demand & Feedback Bar Charts: These bar charts display the current demanded position and measured feedback position of the final cylinder.

Trending Plot / Graph: This graph will display the current demanded position and the measured feedback position of the final cylinder with respect to time. Press the “Start” arrow in the upper left-hand corner of the graph to start the trending function.

Chapter 5.
Configuration

WARNING

Any change of parameters requires a command to save the values. This is done by pressing the "Save Values" icon (floppy disc overlayed by the microchip icon). This is to ensure that the parameters are stored in non-volatile memory and will be recovered during the next power up cycle.

Any unsaved changes will disappear if the unit is powered down. This can lead to significant performance changes and can affect safe operation of the system.

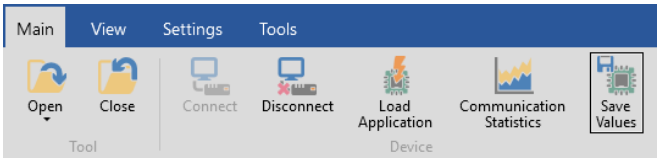


Figure 5-1. Save Values Icon Location

Input Configuration

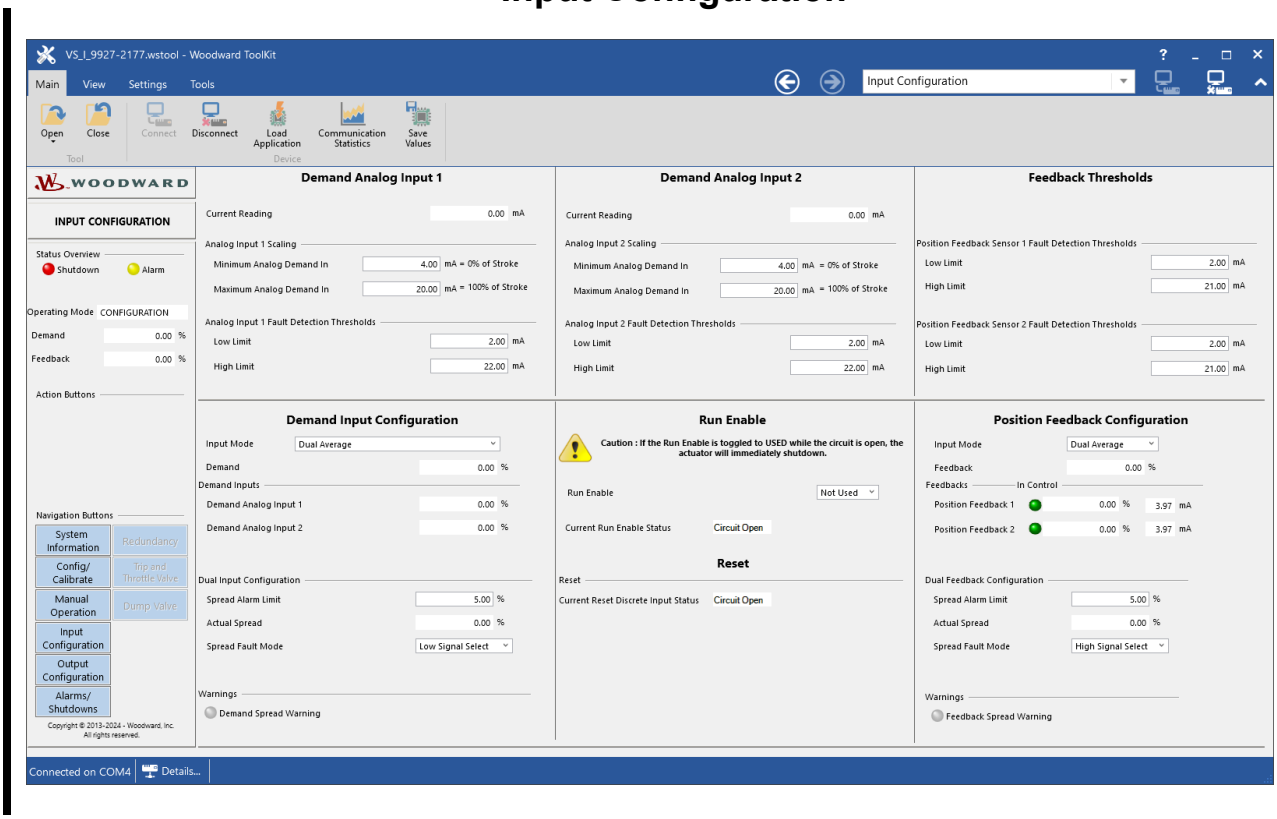


Figure 5-2. Input Configuration Screen

The analog input configuration, including scaling and diagnostics levels, are displayed on this screen. The values of the current operational and diagnostic configuration are also displayed.

Demand Analog Input

Current Reading: Displays the current value of the analog input signal in mA.

Analog Input Scaling

Minimum Analog Demand In: Indicates the input demand current (4 mA default) that is used to position the actuator to 0%.

Maximum Analog Demand In: Indicates the input demand current (20 mA default) that is used to position the actuator to 100%.

Analog Input Fault Detection Thresholds, Low/High Limit: Displays the fault detection limits of the analog demand signals. Any demand signal below the low limit or above the high limit will trigger an alarm.

⚠WARNING

Reaching the low limit threshold of the analog demand results in a Shutdown command. When all configured analog demands fall below the low limit threshold, the VS-I will revert to its shutdown state.

IMPORTANT

Demand lowered below the low limit threshold, followed by elevation back within the normal range will reset alarm or shutdown conditions which are no longer active. This is an alternative way to initiate a reset command rather than using a separately wired discrete input for reset or the use of the Customer Service Tool reset button.

Demand Input Configuration

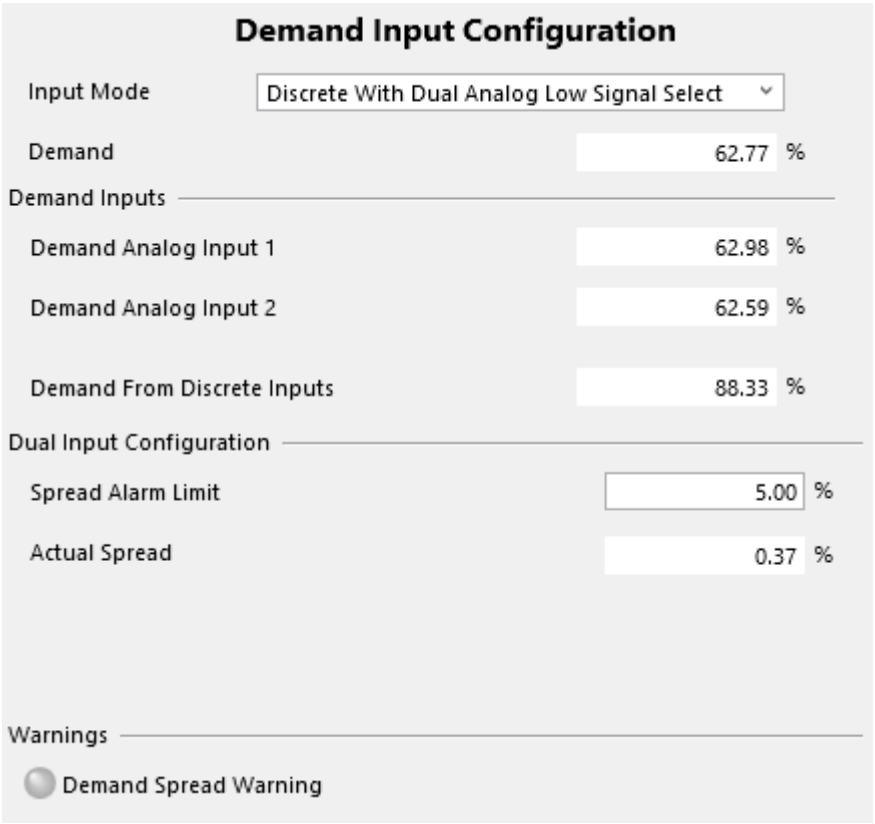


Figure 5-3. Demand Input Configuration for Trip and Throttle Valve Example

Input Mode: This setting is used to configure the type of analog demand input voting logic required. The following input voting options are available: Single Channel 1 (non-voted), Single Channel 2 (non-voted), Dual Averaging, Dual Low Signal Select, and Dual High Signal Select.

When the VariStroke is configured to function as a Trip & Throttle Valve actuator, the following three additional input demand options are also available:

- **Discrete Only:** Use discrete open/close demand only
- **Discrete With Analog 1 Low Signal Select:** Use discrete open/close demand & Single 4-20 mA Input Channel 1 - Lowest Signal Voting
  Note: If the Analog Channel 1 fails, the VariStroke will shut down.
- **Discrete With Dual Analog Low Signal Select:** Use discrete open/close demand & Dual 4-20 mA Input Channels 1 & 2 - Lowest Signal Voting
  Note: If both analog channels fail, the VariStroke will shut down.

  Note: When any of the dual input configurations are selected and only one analog input is supplied, the driver will continue to operate normally but a failed analog input alarm will be initiated.

⚠WARNING

For the trip and throttle valve actuator, when changing the demand mode from modes not using the discrete demand into ones that do, the effective demand will become 0%, causing the actuator to go to the fail-safe position immediately due to the discrete initial value being zero and low signal selection voting.

⚠WARNING

For the trip and throttle valve actuator, when changing the demand mode from modes using the discrete demand into ones that do not, the effective demand will no longer be limited by the discrete demand. Due to this, the actuator may step the demand up to the proper value as directed by the new mode sources.

Demand: Displays the value (in percent position) of the voted/selected demand signal used to control the actuator position.

Demand Inputs

Demand Analog Input 1 and 2: Displays the value (in percent position) of the individual demand signals that are received via analog 4-20mA inputs.

Demand From Discrete Inputs: Displays the value of demand that is controlled by using two discrete inputs "open valve" / "close valve". Available only for the VariStroke-GI Trip and Throttle Valve variant.

Dual Input Configuration: These fields will only be displayed when the Input Mode is set to one of the dual options.

Spread Alarm Limit: Indicates the difference allowed between Demand Analog Input 1 and Demand Analog Input 2 before the Demand Spread Warning flag is set. The action of this flag can be configured on the Alarms/Shutdowns screen (by pressing the “Configure Alarms and Shutdowns” button).

Actual Spread: The difference in percent between the dual inputs.

Spread Fault Mode: This field determines which of the two demand inputs is used after the actual spread exceeds the spread alarm limit. It can be set to Low Signal Select, High Signal Select, or Average.

Demand Spread Warning: When illuminated, this light indicates that the input spread alarm limit (the difference between demand signals) has exceeded the configured threshold limit.

Position Feedback Configuration

NOTICE

The VariStroke will always interpret the cylinder position feedback signal the same, regardless of the fail direction. Small current (~4mA) position signals always designate a retracted position. Larger current (~20mA) position signals always designate an extended position.

Input Mode: This setting is used to configure the type of position feedback voting logic required. The following input voting options are available: Single Channel 1 (non-voted), Single Channel 2 (non-voted), and Dual Averaging. If Dual Averaging is selected, but only one signal is supplied, the actuator will operate while outputting an alarm due to the missing other signal.

Feedback: Displays the value (in percent position) of the voted/selected feedback signal used to control actuator position.

Feedbacks

Position Feedback 1 and 2: Shows the current position of the cylinder in percent and in mA.

Dual Feedback Configuration: These fields will only be displayed when the Input Mode is set to one of the dual options.

Spread Alarm Limit: Indicates the difference allowed between Position Feedback 1 and Position Feedback 2 before the feedback spread warning flag is set. The action of this flag can be configured on the Alarms/Shutdowns screen (by pressing the “Configure Alarms and Shutdowns” button).

Actual Spread: The difference in percent between the dual feedback inputs.

Spread Fault Mode: This field determines which of the two feedback inputs is used after the actual spread exceeds the spread alarm limit. It can be set to Low Signal Select, High Signal Select, or Average.

Feedback Spread Warning: When illuminated, this light indicates that the feedback spread alarm limit (the difference between the cylinder feedback signals) has exceeded the configured value.

Feedback Thresholds

Position Feedback Sensor Fault Detection Thresholds, Low/High Limit:
Displays the fault detection limits of the analog feedback signals. Any feedback signal below the low limit or above the high limit will trigger an alarm.

⚠WARNING

It is highly recommended to set the feedback sensor fault detection thresholds low limit at 2 mA and the high limit at 21 mA when using a Woodward-supplied position sensor. This is crucial for the VariStroke operation to properly detect the sensor's failure modes and to act accordingly. Failure to detect the sensor failure may cause the VariStroke actuator to operate in the wrong position or ramp its output shaft and connected steam valve to the full-open or full-closed positions.

All VariStroke-I actuators utilizing a 3rd party position sensor, other than the Woodward-supplied position sensor, should evaluate the potential impact to their system. Verify the current value of the position sensor failure modes against the VariStroke-I settings for position feedback sensor fault detection thresholds, low/high limits.

Run Enable (Emergency Trip Command) Configuration

WARNING

If the Run Enable configuration setting is configured as "Used", then the driver module's "Run Enable" discrete input will function as a fail-safe Emergency Shutdown Command.

Run Enable (Discrete Input Function): Optionally, users can configure the servo to utilize the Run Enable discrete input as a fail-safe emergency shutdown. When the Run Enable function is configured as "Used" the servo will immediately revert to its shutdown state if the Run Enable discrete input is opened.

> **Note:** Once the Run Enable discrete input has been opened (with the Emergency Shutdown command given), when the discrete input is closed again a reset action will automatically occur, setting the VariStroke to the run/operational state.

When the Run Enable function is configured as "Not Used" then the servo will ignore the state of the Run Enable discrete input.

Current Run Enable Status: This display box shows the electrical state of the Run Enable discrete input. "Circuit Closed" indicates continuity, "Circuit Open" indicates lack of continuity. When used, a Circuit Closed status is needed to run, Circuit Open results in a shutdown.

Reset

The VariStroke actuator has a dedicated, discrete input which can optionally be used to remotely issue a Reset command to reset all latched alarms or shutdowns and return the actuator to its run/operate state.

Reset Discrete Input Status

The Current Reset Discrete Input Status gauge indicates the electrical circuit status of the driver module's discrete input (for example: Circuit Open or Circuit Closed).

> **Note:** The reset discrete input can be used to reset latched alarms or shutdown conditions.

IMPORTANT

The actuator driver can also be reset by power cycling, pressing the "reset" button on the Alarms/Shutdowns screen of the Customer Service Tool, or by increasing the analog demand inputs from below the low limit threshold up to value within normal range.

The remaining two discrete inputs are used only in specific variations of VariStroke-I (e.g., redundant VariStroke-DX or VariStroke-GI trip and throttle). The function and settings for these variations are pre-configured, thus not visible or changeable in the Customer Service Tool.

Output Configuration

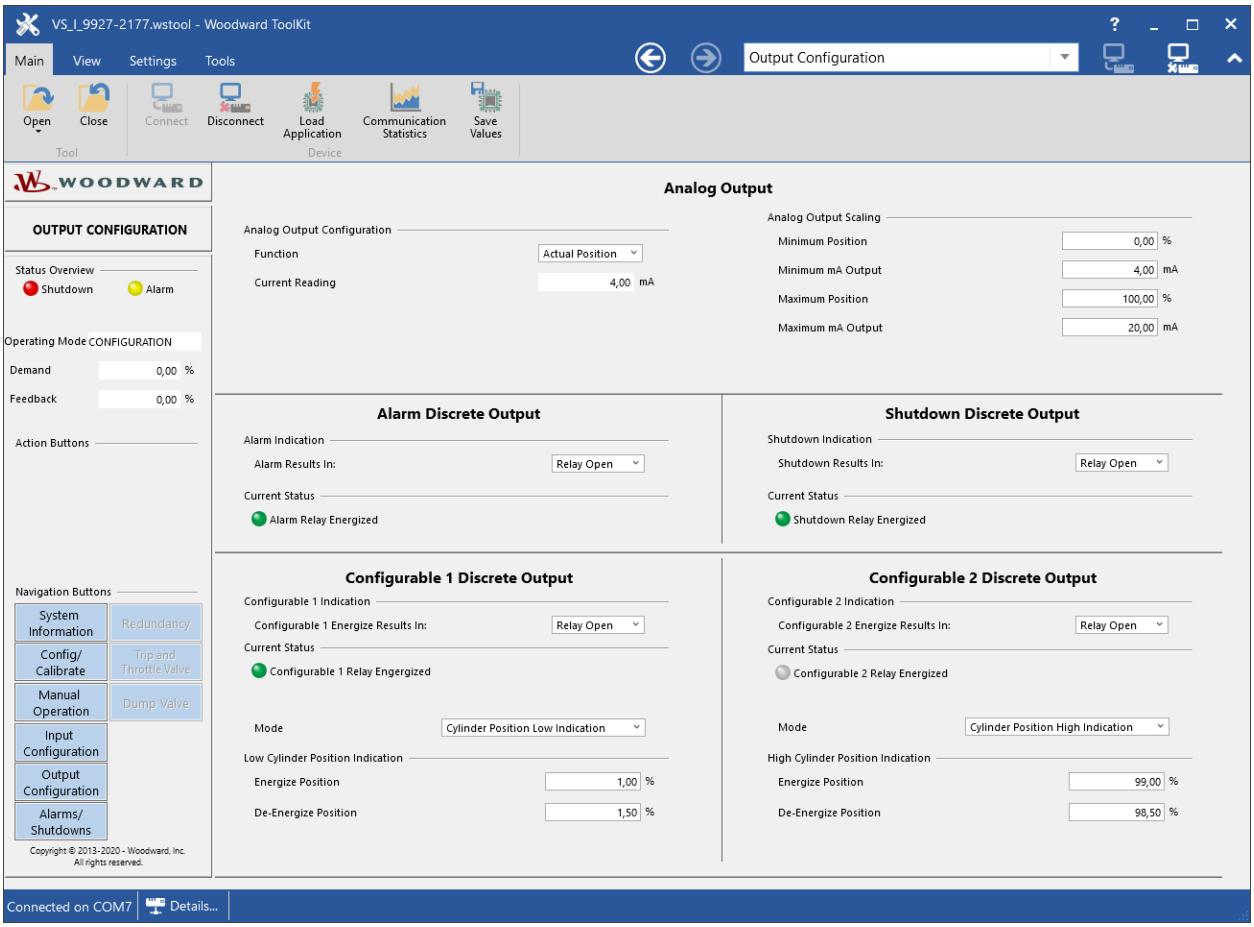


Figure 5-4. Output Configuration Screen

Analog Output Configuration

Function: This configuration setting is used to select what operational value the analog output represents. The analog output can be configured to output a 4-20 mA current signal corresponding to any of the following signals:

- **No Output:** No output will be sourced.
- **Input Demand:** The analog output will equal the demand input.
- **Actual Position:** The analog output will equal the feedback position based on the configurable analog output scaling.

Current Reading: Analog output reading in mA.
Analog Output Scaling: These settings are only visible when the Analog Output Function is set to “Actual Position”.

Minimum Position: Used to set the minimum signal value (Input Demand or Actual Position), which corresponds with the **Minimum mA Output** setting.

Maximum Position: Used to set the maximum signal value (Input Demand or Actual Position) which corresponds with the **Maximum mA Output** setting.

Alarm/Shutdown Discrete Outputs

Alarm/Shutdown Results In: These configuration settings are used to configure which state the alarm/shutdown relay outputs will be when a driver alarm/shutdown relay is energized.

Alarm/Shutdown Relay Energized: Indicates the current state of the discrete output.

Configurable 1 and 2 Discrete Outputs

IMPORTANT

The configurable discrete output relays are not available when used with the VariStroke-DX models. In VariStroke-DX models these outputs are used to communicate the health status between the two VariStroke-DX Skid servos. See the VariStroke-DX manual for more details.

Energize Results In: Sets the state at which the discrete output relay will be when energized.

Current Status: Indicates the current state of the discrete output relay.

Mode: This setting is used to select the function of the output relay. This relay can be configured to energize upon the following conditions:

- **Unused/Manual:** Sets the discrete output to unused. This mode can also be used to manually toggle the output by switching the “Energize Results In” configuration.
- **Alarm Indication:** Sets the discrete output to energize when any alarm is active.
- **Shutdown Indication:** Sets the discrete output to energize when any shutdown is active.
- **Alarm and/or Shutdown Indication:** Sets the discrete output to energize when any alarm and/or shutdown is active.
- **Internal Fault Indication:** Sets the discrete output to energize when the Internal Fault alarm/shutdown is active.
- **Cylinder Position Low Indication:** Sets the discrete output to energize whenever the cylinder is below the configured “Energize Position”. The output will de-energize once the cylinder is above the configured “De-Energize” position. Note: These configurable fields will only be displayed when the Mode is set to “Cylinder Position Low Indication”.
- **Cylinder Position High Indication:** Sets the discrete output to energize whenever the cylinder is above the configured “Energize Position”. The output will de-energize once the cylinder is below the configured “De-Energize” position. Note: These configurable fields will only be displayed when the mode is set to “Cylinder Position High Indication”.
- **Dump Valve Control:** Sets the discrete output to function as a dump valve relay control signal. See the “Dump Valve Configuration” section for more information.

Advanced Settings

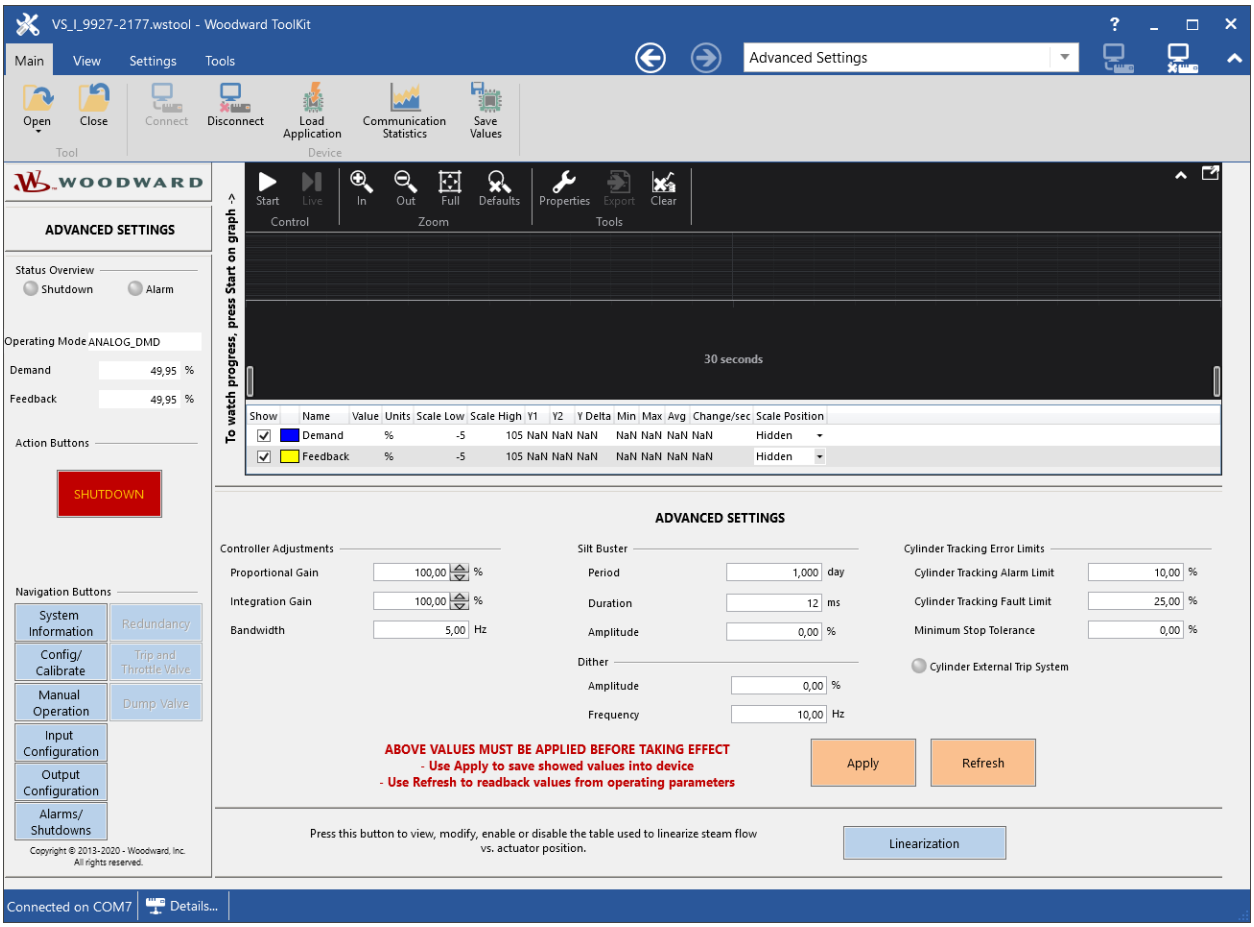


Figure 5-5. Advanced Settings Screen

Controller Adjustments

⚠CAUTION

All tuning of the controller adjustment values shall be performed by qualified person. Improper tuning may result in instability of the system or could significantly worsen the dynamic response of cylinder position control.

Note the basic formula of the VS-I PI controller:

$$u(t) = K_P \times \frac{UserP\%}{100} \times \left(e(t) + K_I \times \frac{UserI\%}{100} \times \int e(t)dt \right)$$

$\boldsymbol{u(t)}$ Controlled variable in time, output of the controller
$\boldsymbol{e(t)}$ Error value in time, represents how far the real position is from demanded position

$$e(t) = PositionDemand - PositionFeedback$$

$\boldsymbol{K_P}$ The gain of proportional term of the controller. Value of K_P in VariStroke is self-tuned and optimized based on supply oil pressure and cylinder dimensions. The self-tuned value is not visible for the user.

$\boldsymbol{K_I}$ The gain of integral term of the controller. Value of K_I in VariStroke is self-tuned and optimized based on supply oil pressure and cylinder dimensions. The self-tuned value is not visible for the user.

Proportional Gain (UserP%): This setting is used to adjust the proportional gain term of the VS-I control algorithm. The 100% value represents the optimum calculated proportional gain value calculated by the VariStroke based on the size of the power cylinder and the entered value of the hydraulic supply pressure.

Integration Gain (UserI%): This setting is used to adjust the integral gain term of the VS-I control algorithm. The 100% value represents the optimum calculated integral gain value in repeats/second calculated by the VariStroke based on the size of the power cylinder and entered value of the hydraulic supply pressure.

Bandwidth: This setting is used to adjust how fast the actuator will respond to a demand input change. The higher the setting value the faster the actuator will respond to an input change, but the more sensitive it will be to electrical noise on the demand signal. This setting basically adjusts the input filter of the analog input demand signal. A 5 Hz setting has been determined to be optimal for most applications.

Silt Buster

Description of Operation: The silt buster routine can be used to flush out any trapped silt/dirt on a daily, weekly, or monthly basis. This setting is typically used in applications where the actuator may be held in one position for a long period, allowing silt/dirt to become trapped within the servo valve.

Silt Buster Parameter Settings

Period: Time between silt buster events.

Duration: Duration of the silt buster event.

Amplitude: Amplitude of de-silting function. This is not a value related to the cylinder position but instead the displacement of the internal servo valve.

⚠CAUTION

It is recommended that you verify the silt buster configuration settings during commissioning to confirm that the silt flushing function does not disturb normal cylinder positioning.
First: Set the period to a short interval (for example a value of .001 day is one silt buster event every 90 seconds).
Second: Observe several silt buster events while monitoring the actuator position. If the silt buster causes the VariStroke cylinder to visibly move, decrease the amplitude or reduce the duration. The recommended values should generally not cause observable movement of the VariStroke cylinder.
Last: Set the period value according to the specific plant oil quality level.

IMPORTANT

The recommended values for the silt buster parameters are generally near the following ranges for most applications:
Duration: 12-24 ms
Amplitude: 3% maximum is sufficient in most cases
Exceeding a duration above 40 ms or 5% amplitude may cause movement of the VariStroke cylinder, particularly in single acting servo applications.

IMPORTANT

For the VariStroke-DX – redundant configuration:
Using the silt buster feature is highly recommended due to fact that the slave servo could remain in an unchanged position for a long time, which increases the risk of silt deposits. The silt buster parameter settings should be determined based on the hydraulic oil condition and level of filtration, aftertreatment, etc.

Dither

Dither: Typically used if the actuator or servo is connected to a pilot valve to overcome sticky pilot valve action.

Amplitude: Amplitude of the dither function. This is not a value related to the cylinder position, but rather the displacement of the internal servo valve.

Frequency: Frequency of the dither function signal.

IMPORTANT

It is recommended that the dither function NOT be used unless it is deemed absolutely necessary. Excessive dither will result in accelerated wear.

Cylinder Tracking Error Limits

Cylinder Tracking Alarm Limit: This value sets the threshold which triggers a diagnostic alarm. The diagnostic is triggered if the absolute value of the difference between the position demand and the actual position exceeds the alarm threshold setting. See also “Configuration of Alarms/Shutdown”.

Cylinder Tracking Fault Limit: This value sets the threshold which triggers a diagnostic fault. The diagnostic is triggered if the absolute value of the difference between the position demand and the actual position exceeds the fault threshold setting. See also “Configuration of Alarms/Shutdown”.

IMPORTANT

The cylinder position tracking limits are defined by the parameters as described above and applied for alarm/fault detection when the demand signal is stable.
During large position changes (control transients), the alarm and shutdown limits are automatically expanded based on the observed system dynamics. The assigned alarm and shutdown thresholds will become active a few seconds after sudden demand changes.
For normal operation with small demand changes, the extension of limits is not generally observable.

IMPORTANT

For the VariStroke-DX, cylinder tracking error limits are important for fast control switchover in case of Unit in Control failure. Default setting of thresholds are 5% for alarm and 10% for fault. It is not advisable to set limits beyond the recommended values.

Minimum Stop Tolerance: This parameter sets a range near the low end of travel, which disables the cylinder tracking alarm and fault. This prevents unwanted cylinder tracking alarms or shutdowns in cases where a physical hard stop may be set above the minimum control position of the VariStroke actuator. This can also be used if thermal expansion of the actuated system can cause variation in the lower hard stop location.

Cylinder External Trip System: When the Cylinder External Trip System is activated, the cylinder tracking alarms/faults will be disabled if the cylinder feedback position is closer to the fail-safe position than the demand position. This setting cannot be changed during normal operation; it can only be changed when the VS-I is in the configuration mode (the firmware enforces a shutdown condition when in the configuration mode).

IMPORTANT

The cylinder external trip system is recommended for use in applications where the hydraulic oil system is equipped with an external emergency protection system, which could interrupt the hydraulic supply to the system before the cylinder position demand is set to the fail-safe position.

Performing On-Line Parameter Changes

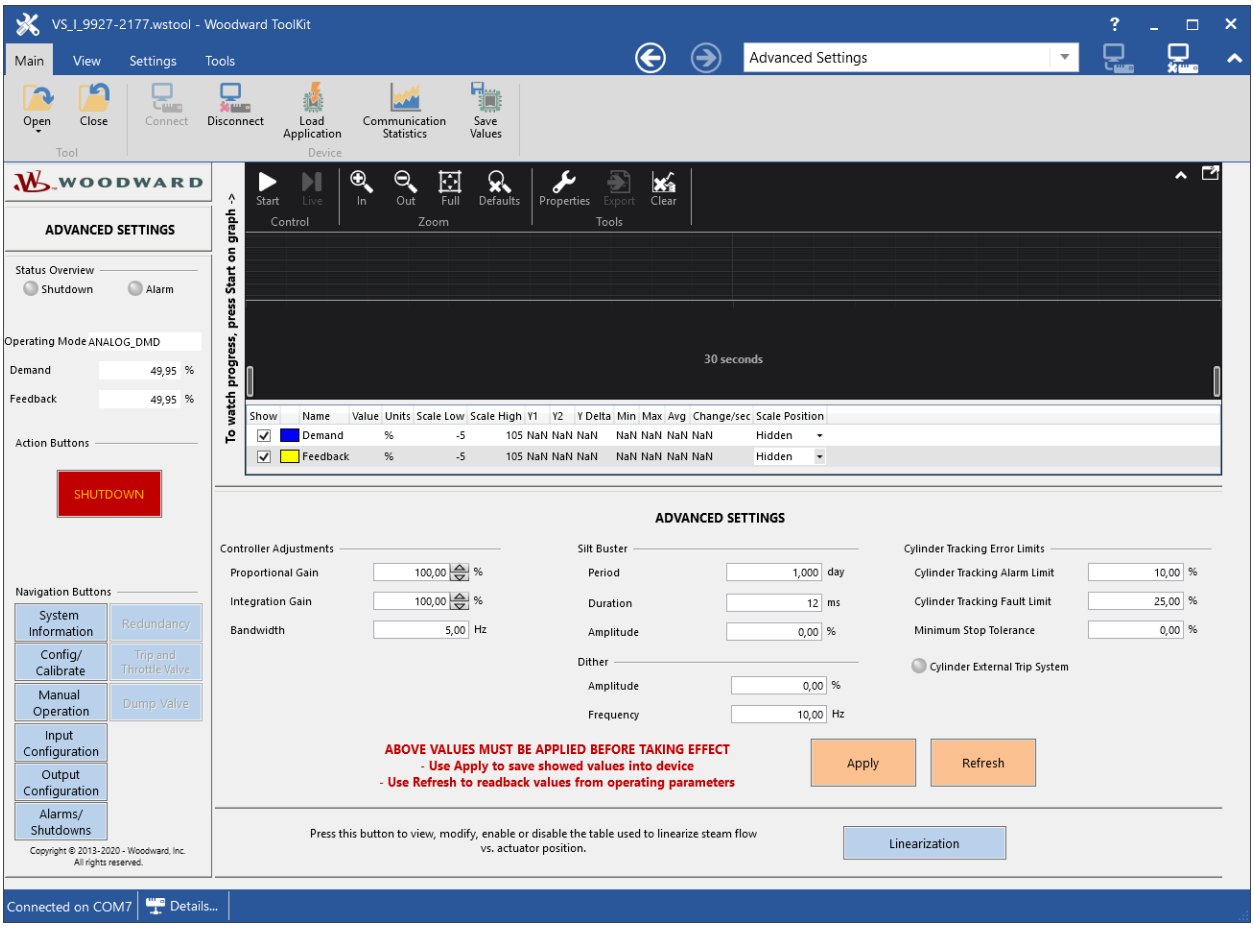


Figure 5-6. Advanced Settings Screen - On-Line Parameter Changes

The parameters shown on the Advanced Settings screen impact dynamic performance of the system. These changes can be made when the turbine or controlled process is running. It is important to note that inappropriate changes could have an adverse impact on the operation of the machine. Each setting change should be considered carefully as to the impact of the operation and safety of the machine.

1. Changes do not take effect until they are applied, allowing time to review before committing them.
2. After new values are input, press the “Apply” button to activate them as the operating values.
3. If is deemed necessary to revert them back to the previous values, this can be done by pressing the “Refresh” button. The previous values will be displayed in the input screens.
4. Once the “Apply” button is pressed, the values cannot be reverted to the previous operating values.

IMPORTANT

Whenever the displayed parameters differ from the current operating values, a warning of "ABOVE VALUES MUST BE APPLIED BEFORE TAKING EFFECT" will be displayed on the screen.

Linearization

This table is used to linearize steam flow to actuator position. It can only be modified when the actuator is shut down.

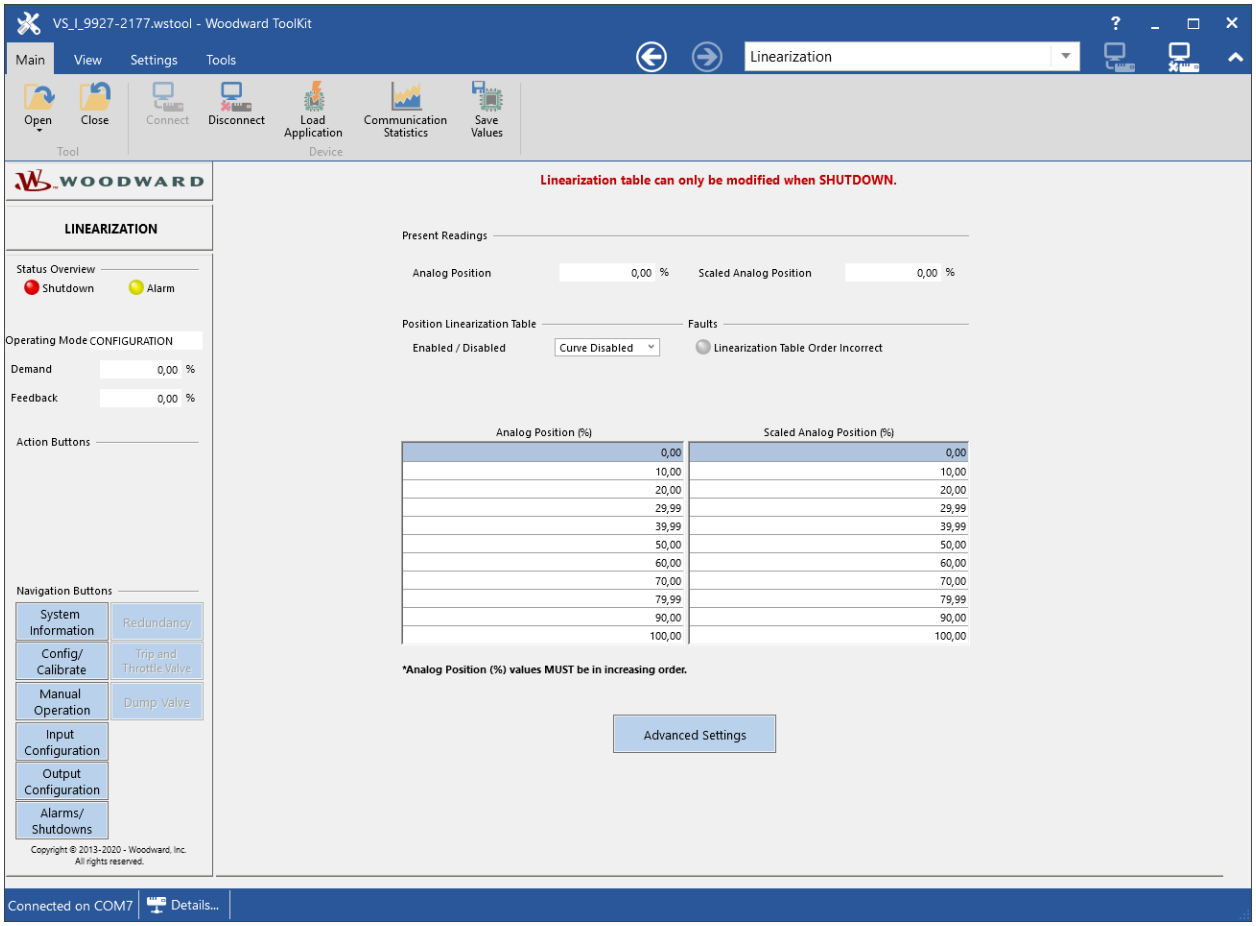


Figure 5-7. Linearization Screen

Enabled / Disabled: Enables or disables the demand curve (linearization) functionality.

Linearization Table Order Incorrect: This alarm will activate if the analog position values are not set in numerically increasing order (from top to bottom).

Analog Position (%): These are analog demand positions that will be converted to the scaled analog position when the linearization curve is enabled.

Scaled Analog Position (%): These are the cylinder output positions (steam valve position) that will result when the demand is equal to the values in the analog position column.

Trip and Throttle Valve Configuration

Trip and Throttle Valve Functions - Description of Operation

Using Trip and Throttle Valve functions for Turbine Warm-Up

One function of the VariStroke electronics and firmware is it enables automated, controlled opening of the trip and throttle valve to purge steam condensate from the steam lines and to slow roll and warm up the turbine, casing, and steam lines. The desired warm up position can be set precisely using the analog demand, or it can be adjusted by using the discrete inputs as a raise/lower command to the actuator.

Using Trip and Throttle Valve functions for Partial Stroke Testing

An additional function of the VariStroke electronics with trip and throttle firmware enables automated, partial stroke testing of the trip and throttle valve. This partial stroke test can be performed while the machine is on-line by reducing the valve position slightly from the normal control point. Once it is confirmed that the valve/actuator can move, the partial stroke test can be disabled, returning the system to normal operation.

The ramp rate and target position for the partial stroke test can be set as parameters within the VariStroke firmware by using Customer Service Tool.

Using Trip and Throttle Valve functions for Slow Valve Closure

The last function of the VariStroke electronics with trip and throttle valve firmware enables automated, controlled shutdown of the turbine at a controlled ramp rate. The time to close can be set by the close rate parameter shown in the Customer Service Tool but can also be increased by keeping the discrete input active for a period longer than the set ramp acceleration delay.

Trip and Throttle Screen: This screen is only visible and configurable with VariStroke-TTV model actuators. VariStroke-TTV model actuators include special logic designed to operate steam turbine trip and throttle valves.

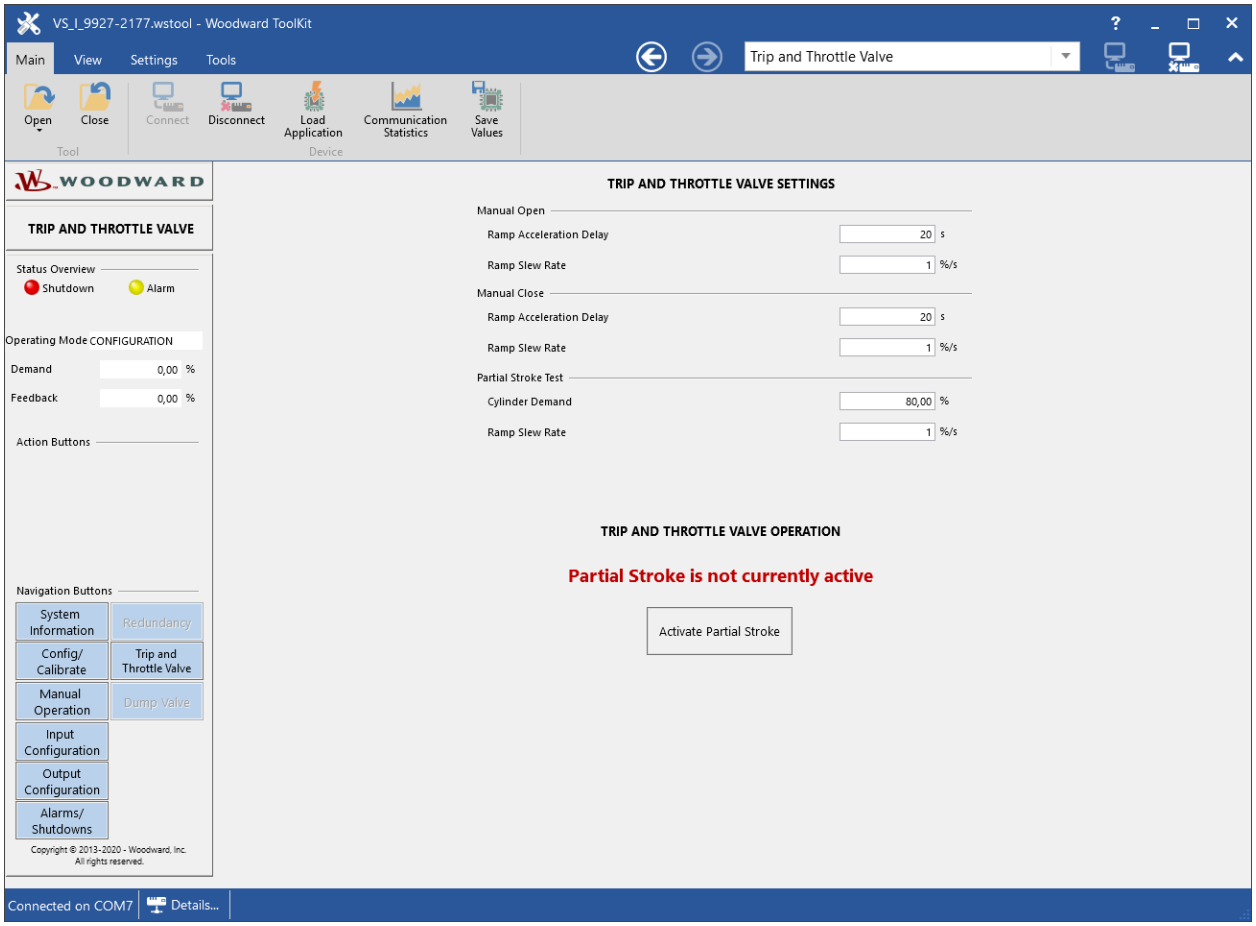


Figure 5-8. Trip and Throttle Screen

Trip and Throttle mode is designed for application on T&T valves. Position control is based on low signal selection logic that uses any of the following selected inputs:

- Analog Input 1
- Analog Input 2
- Manual demand via discrete inputs (discrete demand)
- Partial Stroke Test position demand

As a representation of the T&TV logic used to generate the demand, see Figures 5-8a through 5-8h shown below.

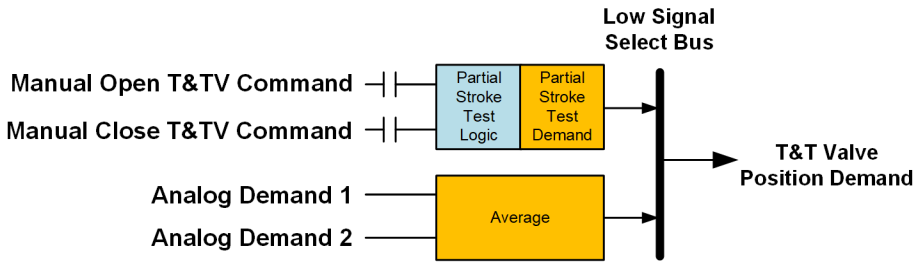


Figure 5-9a. VS T&T Valve Demand - Dual Average

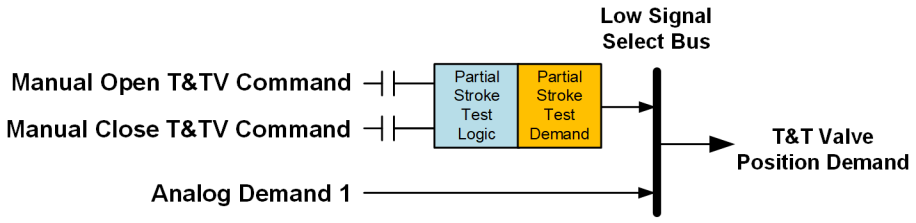


Figure 5-9b. VS T&T Valve Demand - Single Channel 1

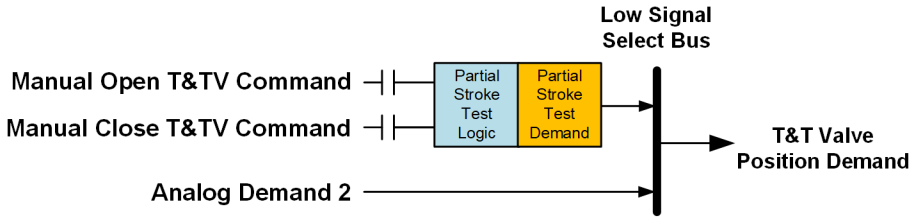


Figure 5-9c. VS T&T Valve Demand - Single Channel 2

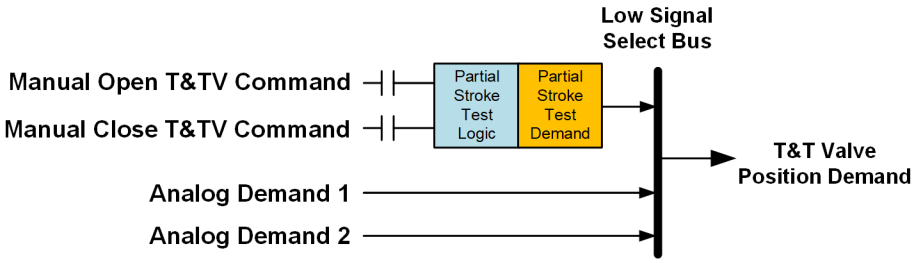


Figure 5-9d. VS T&T Valve Demand - Dual Analog Low Signal Select

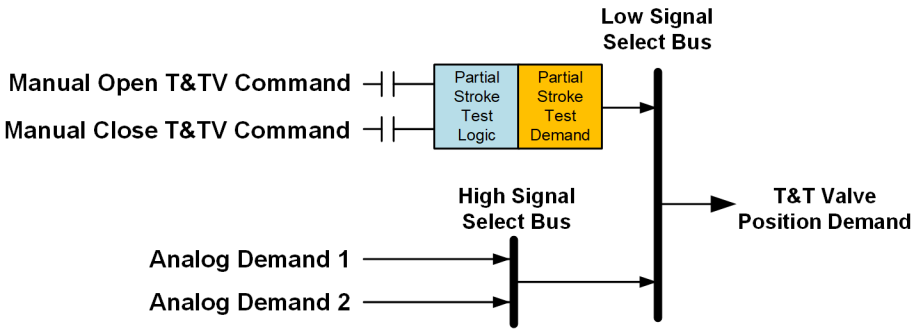


Figure 5-9e. VS T&T Valve Demand - Dual Analog High Signal Select

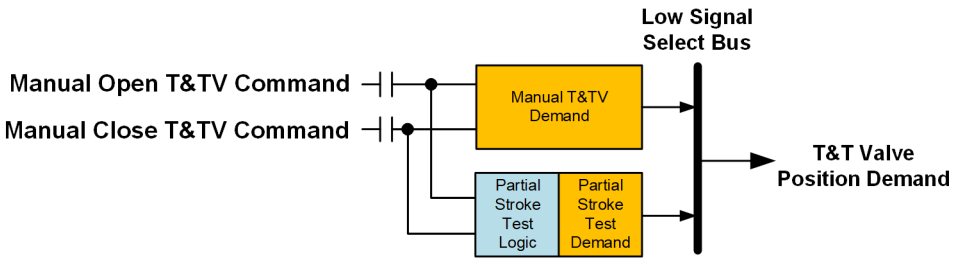


Figure 5-9f. VS T&T Valve Demand - Discrete Only

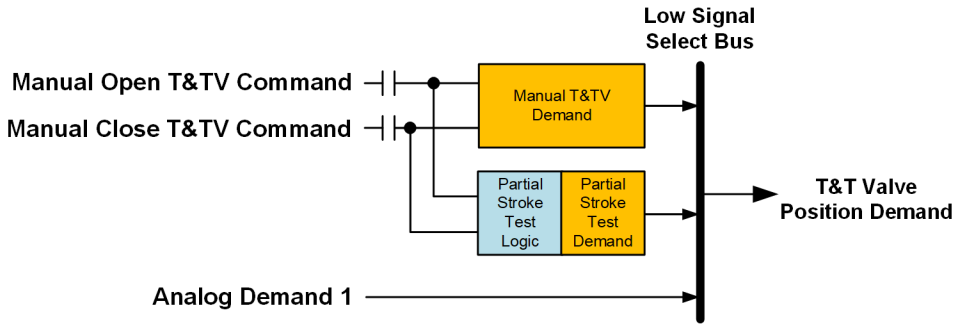


Figure 5-9g. VS T&T Valve Demand - Discrete with Analog 1 Low Signal Select

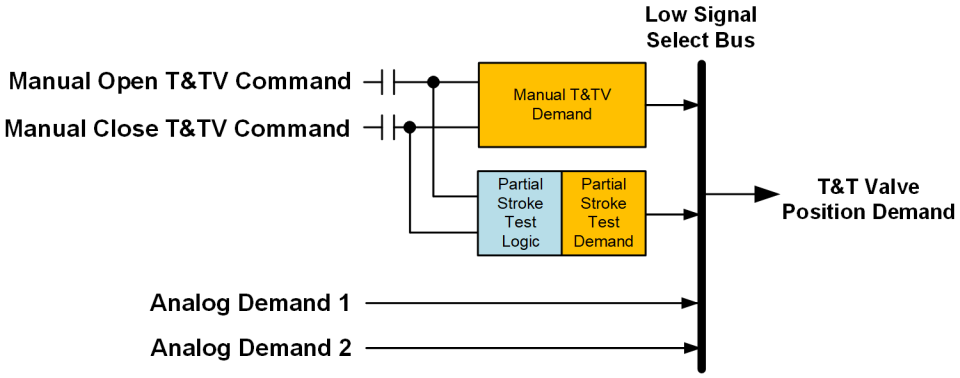


Figure 5-9h. VS T&T Valve Demand - Discrete with Dual Analog Low Signal Select

For additional information on configuring the demand input, see also the “Input Configuration” section.

IMPORTANT

When the discrete inputs are used to set the position demand, and the VariStroke is first reset or shut down, the manual demand (discrete demand) value is set at 0%. To make the actuator operable, the user must initiate a manual opening via the discrete input and raise the manual demand up to the desired upper position limit.

The manual demand via discrete inputs operates based on a ramp over time approach. An example trend during operation is shown below.

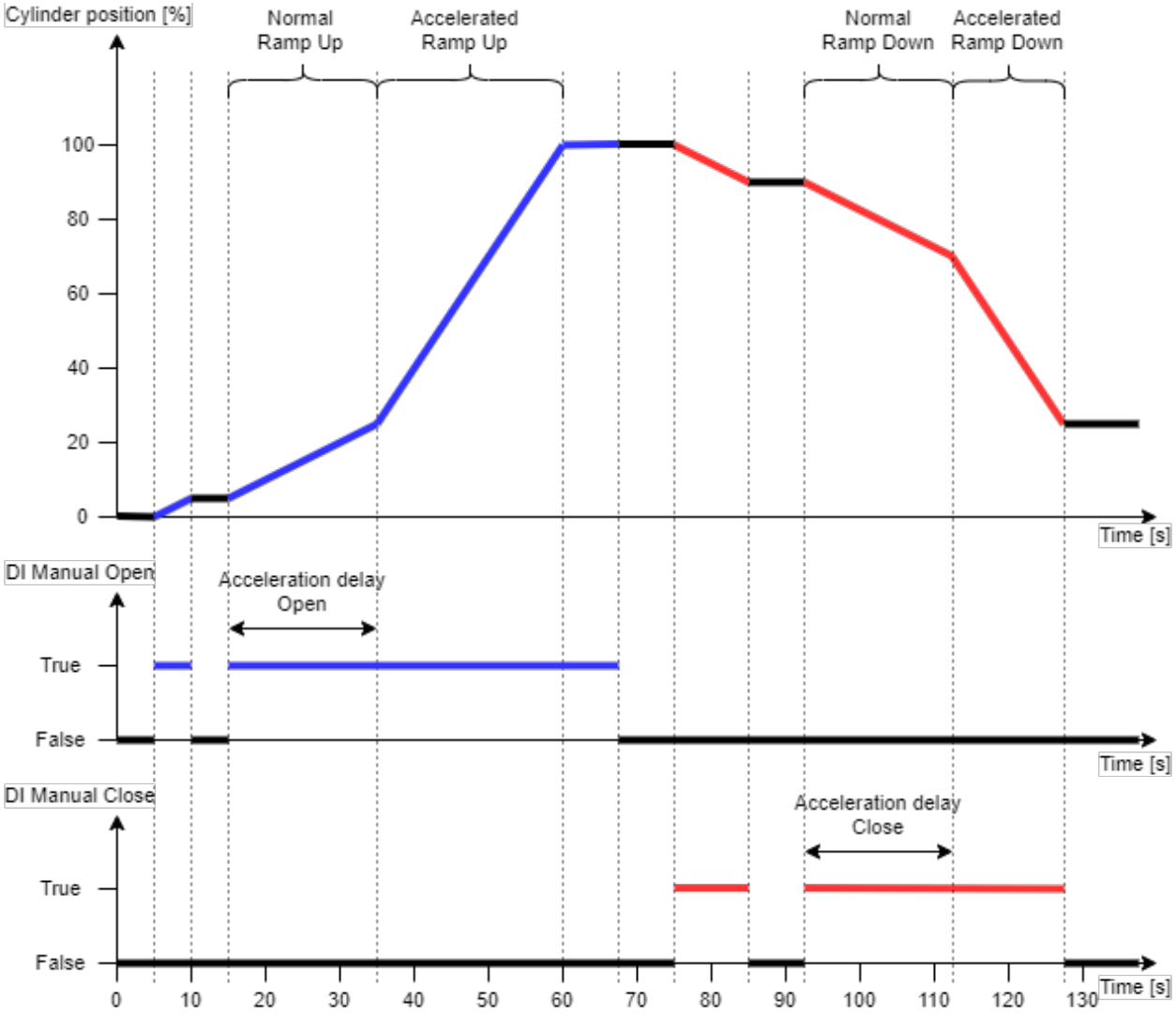


Figure 5-10. Trip and Throttle Manual Demand Operation

Manual Open Settings

This group of parameters controls the ramp behavior of the position demand based on the state of the open discrete input.

Ramp Acceleration Delay: This parameter sets a time delay after which the ramp slew rate is multiplied by three. If a constant rate is desired, set the value to the maximum range of 1000s.

Ramp Slew Rate: This parameter sets the ramp rate in the opening direction when the open discrete input is active.

Manual Close Settings

This group of parameters controls the ramp behavior of the position demand based on the state of the close discrete input.

Ramp Acceleration Delay: This parameter sets a time delay after which the ramp slew rate is multiplied by three. If a constant rate is desired, set the value to the maximum range of 1000s.

Ramp Slew Rate: This parameter sets the ramp rate in the opening direction when the close discrete input is active.

WARNING

The manual position demand is internally generated within the VS-I firmware based on the state and active duration of the discrete inputs.

Due to the low signal selection logic, the user may not observe any cylinder reaction after initial activation of the open/close command because the internally generated manual position demand is higher than the position demand settings set by the analog inputs. The manual position demand will only take control when it becomes the lowest demand provided to the system.

If the ramp acceleration time delay has elapsed, the setpoint action becomes more rapid depending on the selected settings. This could cause a sudden change in position, which could result in significant changes in the controlled process (for example, speed or load).
It is highly recommended to adjust the manual ramp slew rates and acceleration delays with caution and test this under conditions where the desired operation can be confirmed with safety.

Partial Stroke Test

The partial stroke test procedure (PST) is designed to allow verification of valve operability during normal turbine operation. The procedure can be initiated from the Customer Service Tool interface by pressing the “Activate Partial Stroke” button or by activating and keeping active the two discrete inputs simultaneously (DI Manual Open, DI Manual Close). Initiation of the PST by use of the discrete inputs is delayed by one second to avoid accidental activation.

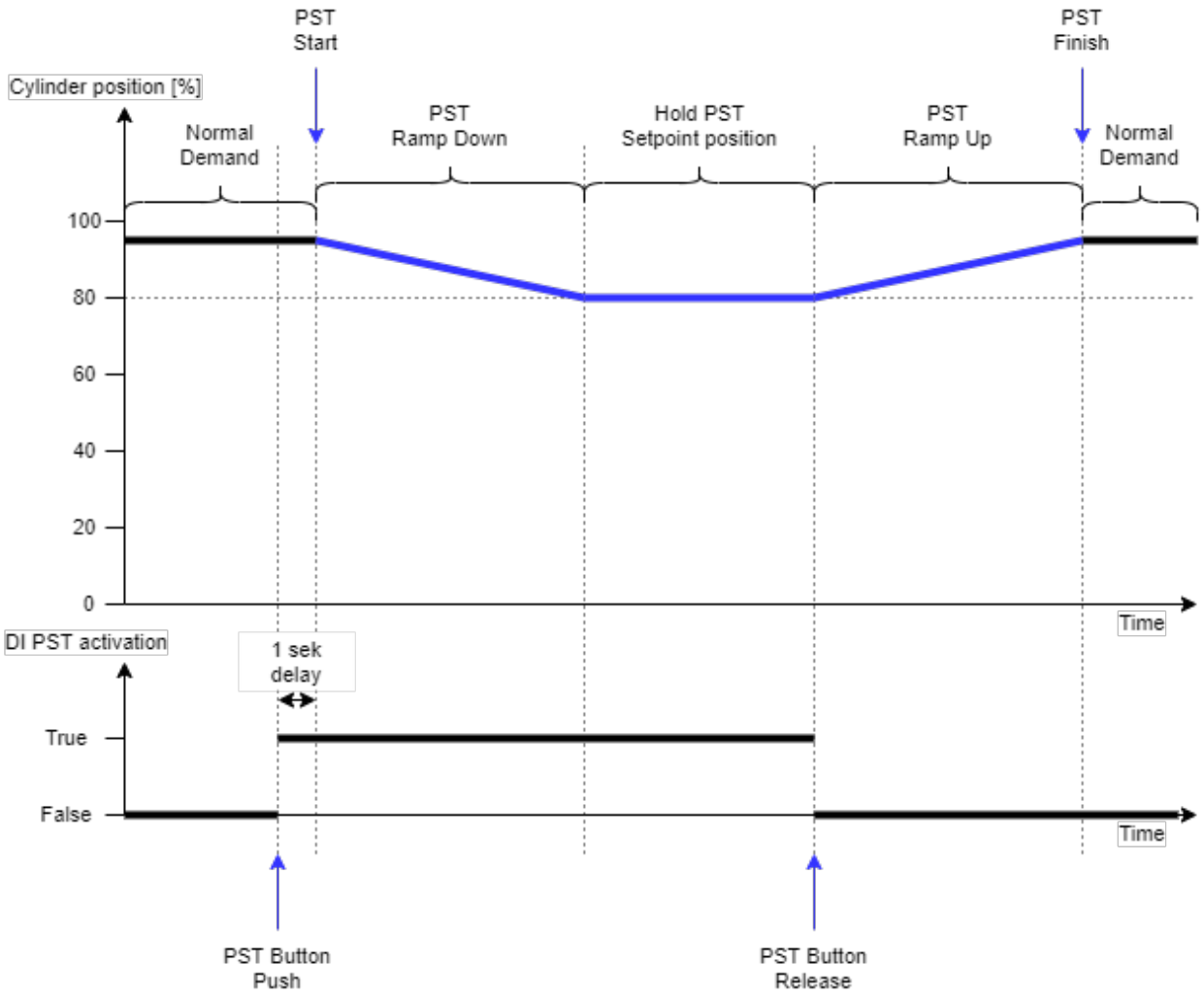


Figure 5-11. Partial Stroke Test

The PST procedure ends when it is deactivated by pressing the Customer Service Tool “Deactivate Partial Stroke” button or by releasing (inactivating) either of the two discrete inputs.

The PST activated from the Customer Service Tool will be terminated when any discrete inputs are activated.

The PST cannot be initiated from the Customer Service Tool when any manual demand discrete input is active.

The PST will not start if the current cylinder position demand is lower than the PST cylinder demand setting.

The PST will be terminated if the operating demand goes below the PST cylinder demand during the procedure.

Cylinder Demand: The PST target position demand that the VariStroke control ramps the cylinder to during the PST.

Ramp Slew Rate: The ramp rate that the demand follows during the PST. This parameter applies to both descending and raising cylinder position.

⚠WARNING

It is important to note that if the cylinder tracking diagnostic is active* and if the valve or actuator is unable to move during the PST, the cylinder tracking fault diagnostic could be triggered and result in a shut down. It is recommended to set the PST cylinder demand to a value that does not conflict with the current control position +/- the alarm and fault diagnostic thresholds (see also the "Configure Alarms/Shutdowns" section and Advanced Settings).

(*) dependent upon the user configuration settings

⚠WARNING

It is not recommended to use the normal travel speedup dump valve feature for trip and throttle application.

If the PST cylinder demand settings were to overlap with the assigned dump valve normal travel speedup settings (if used), and if the trip and throttle valve were unable to move during the PST, the difference between the actual position and the demand position required by the PST could cause the dump valve to open and result in a shut down.

If the normal travel speedup feature is needed, then the speedup activation threshold (which triggers the dump valve opening) must be set to a higher value than the difference between the trip and throttle valve current position and the partial stroke cylinder demand level (see also "Dump Valve Configuration").

IMPORTANT

To get automatic confirmation that the PST has succeeded, the user can define the cylinder position high/low indication at an appropriate value relative to the PST cylinder demand by assigning it to the selected discrete output (see "Output Configuration").

The Activate Partial Stroke button initiates the PST directly from the Customer Service Tool. Initiation of the process will be indicated on the screen by the message "Partial Stroke activated by Service Tool" as shown below.

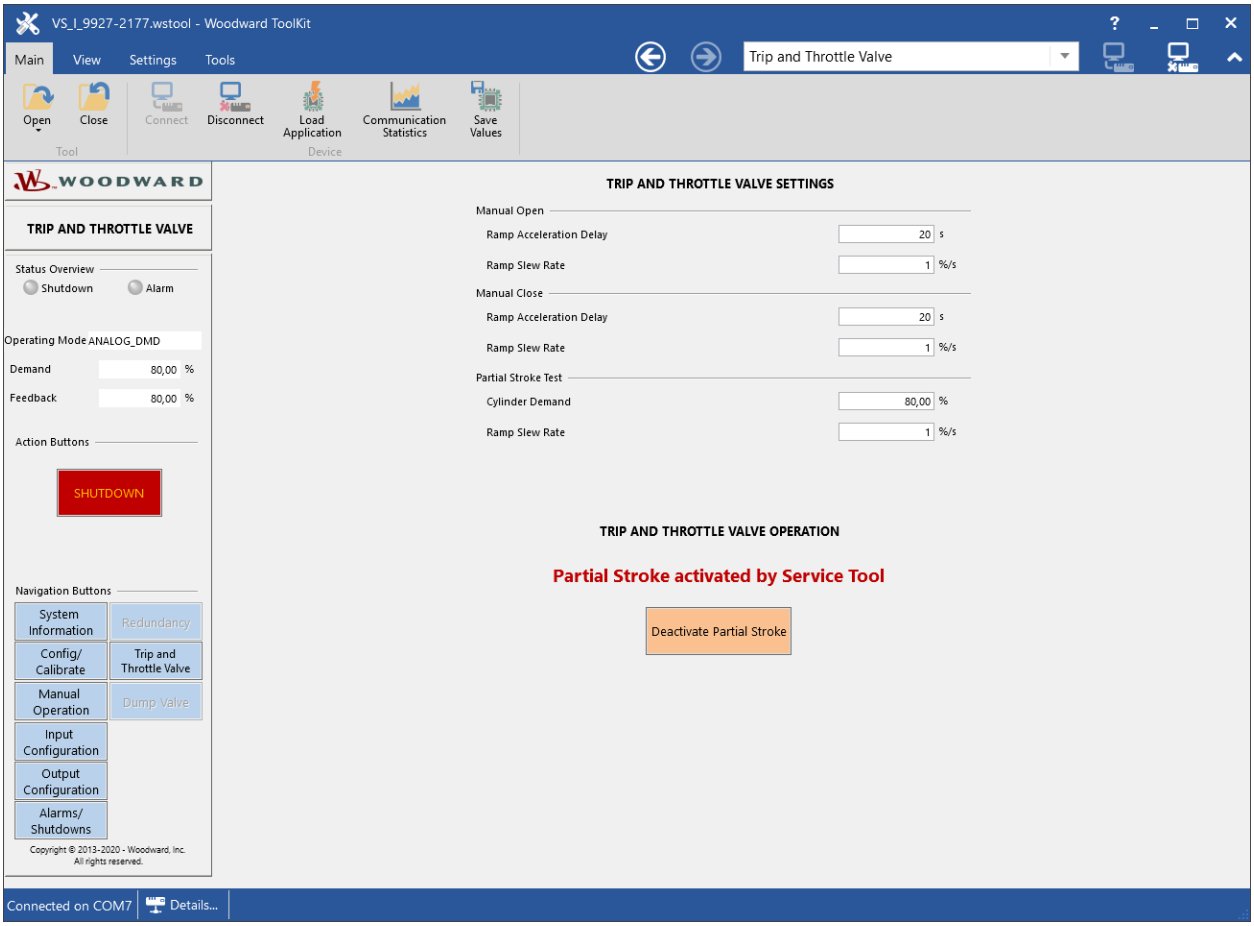


Figure 5-12. Partial Stroke Test by Service Tool Command

Deactivate Partial Stroke: Pressing this button finishes the PST. The cylinder position will return to the normal position demand at the configured ramp slew rate.

Dump Valve Configuration

Dump Valve Settings - Description of Operation

The dump valve can be used to augment the flow capacity of the servo valve to enable a faster response in the fail-safe direction.

The configuration settings for the dump valve configuration allows the user to alter the behavior of the dump valve under certain use scenarios. These include the cylinder tracking fault delay. This timer starts counting down when the dump valve is signaled to close. For the duration of the delay, the cylinder tracking fault is disabled, which allows the actuator to come into control without signaling a diagnostic fault.

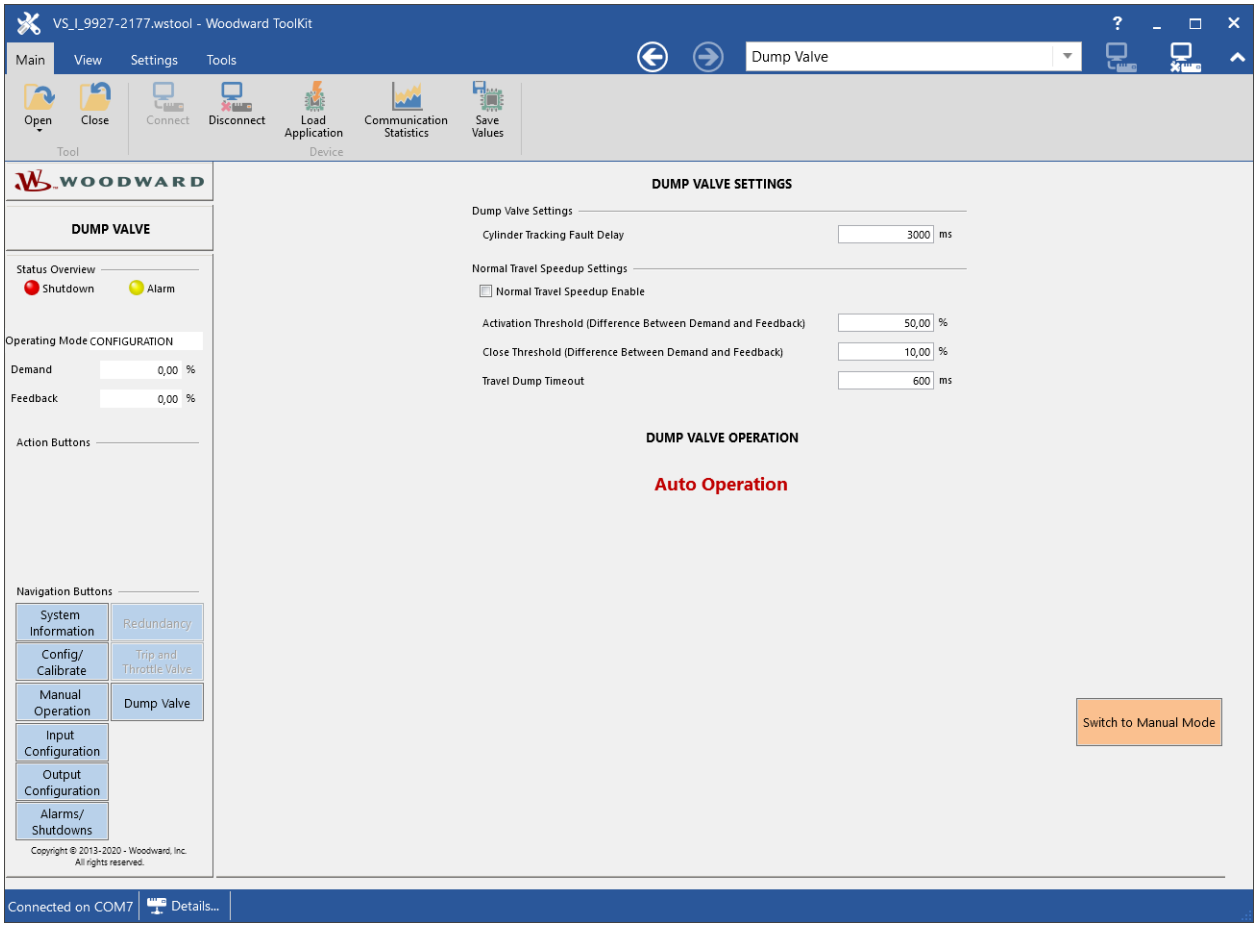


Figure 5-13. Dump Valve Settings Screen

Dump Valve Settings

Cylinder Tracking Fault Delay: This delay is applied for all dump valve operation modes because the dump valve requires a certain amount of time to close (depending on operating conditions). A typical closing time can range from 0.1 up to 2 seconds. During this period, the cylinder cannot respond precisely to the VS-I servo because pressure may not be available to actuate the cylinder. The cylinder tracking fault delay setting disables the cylinder tracking diagnostic for the set time period, allowing the VariStroke to take control. This prevents the diagnostic fault from being triggered while the dump valve is open and a possible shutdown cyclical sequence.

Normal Travel Speedup Enable: Activates the logic that opens the DV when differences occur between demanded and actual cylinder positions, helping to speed up movement towards the fail-safe direction. The logic uses the parameters of Activation Threshold, Close Threshold, and Travel Dump Timeout to control the opening and closure of the DV. When the feature is disabled, these parameters have no effect on the opening or closing of the dump valve.

WARNING

The normal travel speedup feature is not recommended for use on trip and throttle applications. In a trip and throttle application, the normal travel speedup feature could result in shut down if the settings of the dump valve and PST overlap (For more details, refer to "Trip and Throttle valve configuration – PST").

Activation Threshold (Difference between Demand and Feedback): This setting defines the threshold that triggers the dump valve to open. This is based on the difference (in % stroke) between the demand position and the actual position of the cylinder. The dump valve solenoid will be de-energized (to open) when the demand position is lower than the actual cylinder position minus the activation threshold value.

Note: The Normal Travel Speedup box must be enabled.

Close Threshold (Difference between Demand and Feedback): This setting defines the threshold that triggers the dump valve to close. This is based on the difference (in % of stroke) between the demand position and the actual position of the cylinder. The dump valve solenoid will be energized (to close) when the demand position is higher than the actual cylinder position minus the close threshold.

Note: The Normal Travel Speedup box must be enabled.

IMPORTANT

The activation threshold must be greater than the close threshold for normal travel speedup function otherwise the dump valve will not open.

Travel Dump Timeout: This parameter is valid only when the Normal Travel Speedup function box is selected. This setting limits the dump valve open time. Once this value expires, the dump valve will be energized to close. Otherwise, it will remain open until the close threshold is reached, whichever comes first. To disable the open time limitation, set the maximum value at 10000 ms.

Auto Operation: This indication identifies that dump valve operation is currently controlled by the VS-I dump valve logic, and will be opened in case of any of the following conditions: VS-I shutdown diagnostics, Run Enable DI inactive (if used), analog demand below the low limit or when normal travel speedup conditions are met.

IMPORTANT

After configuring the parameters for the dump valve, verify if the discrete output is properly configured to handle the dump valve connection in real application (see "Output Configuration").

For better understanding of dump valve settings, please review the following time charts.

The following figure shows an example of the dump valve opening sequence used to improve the actuator closing time. The sequence is ended by closure of the dump valve after the shutdown is cleared and a ramp back to position.

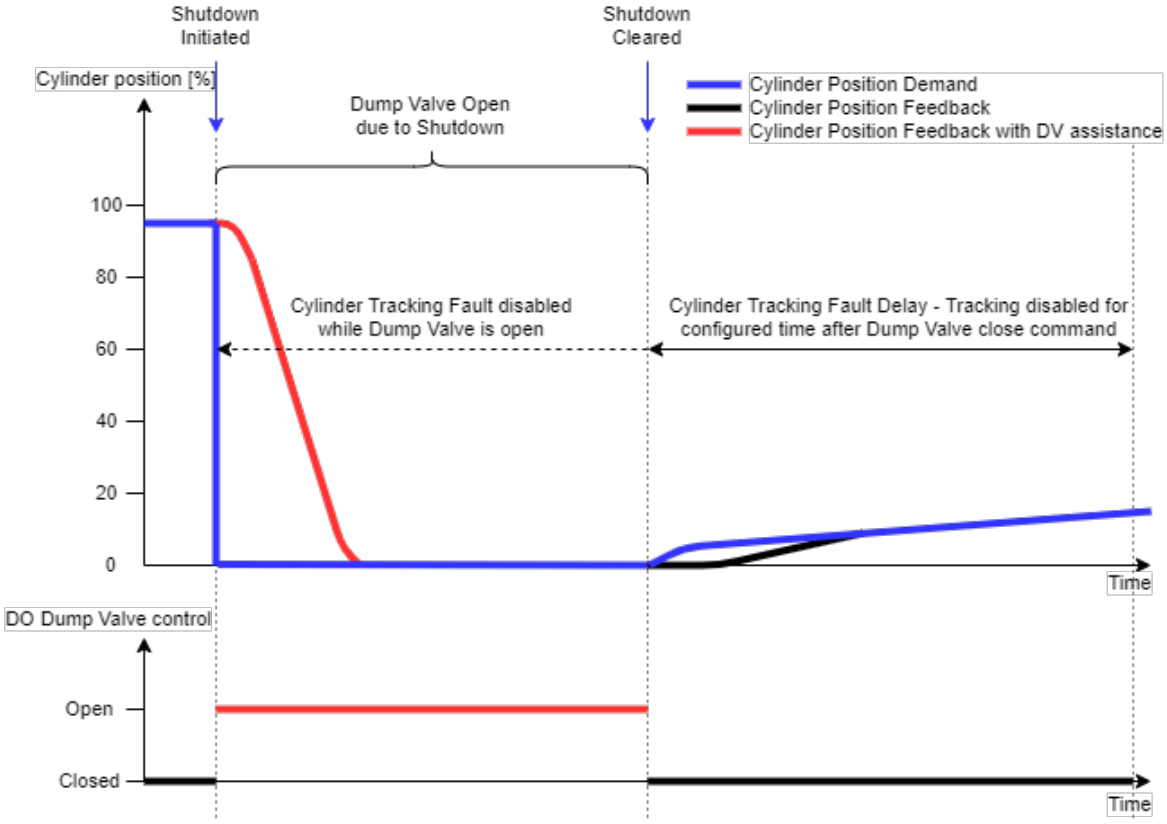


Figure 5-14. Dump Valve Operation at Shutdown

The following figure shows an example of the dump valve timing sequence when the normal travel speedup behavior is enabled using the activation and close threshold settings only.

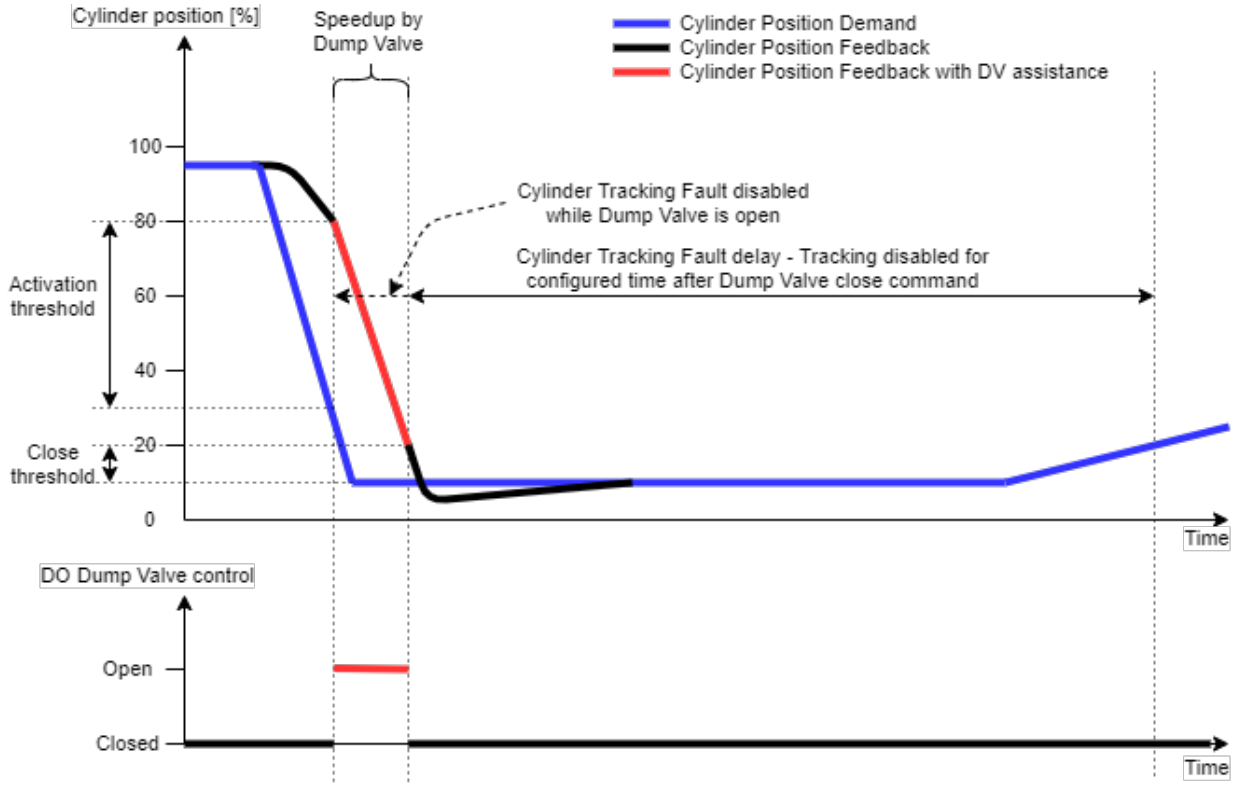


Figure 5-15. Dump Valve Speedup Operation

The following figure shows an example of the dump valve timing sequence when the normal travel speedup behavior is enabled with the opening time limited by the travel dump timeout.

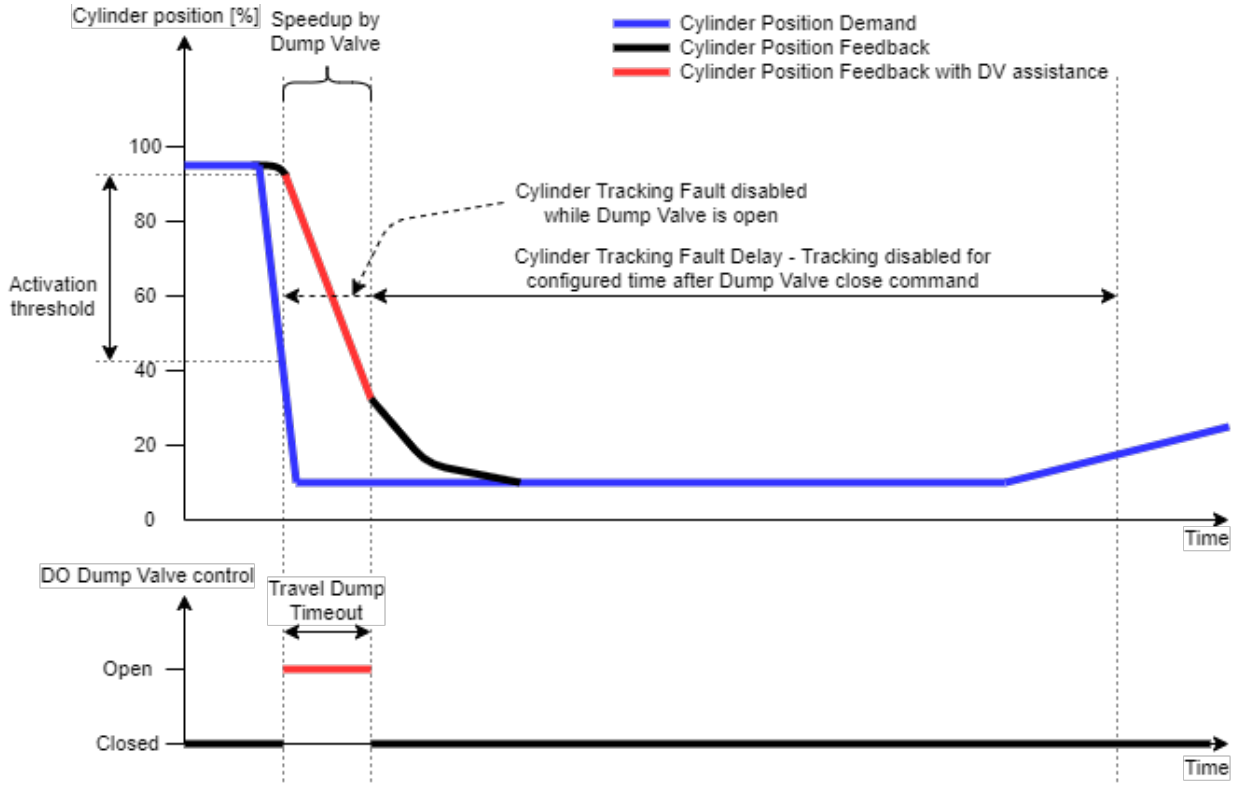


Figure 5-16. Dump Valve Speedup Operation with Timeout

Switch to Manual Mode: Pressing this button turns the control of dump valve to the user. None of the automatic triggers are effective in this mode; the shutdown or travel speedup functions executed by opening the dump valve are disabled. However, the shutdown diagnostic actions of the servo-valve are still active.

The manual mode is designed for use during the configuration/commissioning phase. This allows the user to manually initiate the dump valve opening and measure the valve shutdown time.

⚠WARNING

Manual operation of the dump valve disables any automatic action in response to any detected shutdown behavior controlled by the servo valve. As a result, the cylinder response may be slower. This mode should only be used during testing or commissioning activities where this does not result in an unsafe condition for operation of the machine or personnel.

⚠WARNING

Manual operation of the dump valve will cause rapid movement of the hydraulic actuating cylinder and actuated valves and/or the associated process. To protect personnel and equipment, ensure that proper plant operating procedures and notifications are followed before initiating the dump valve test sequence.

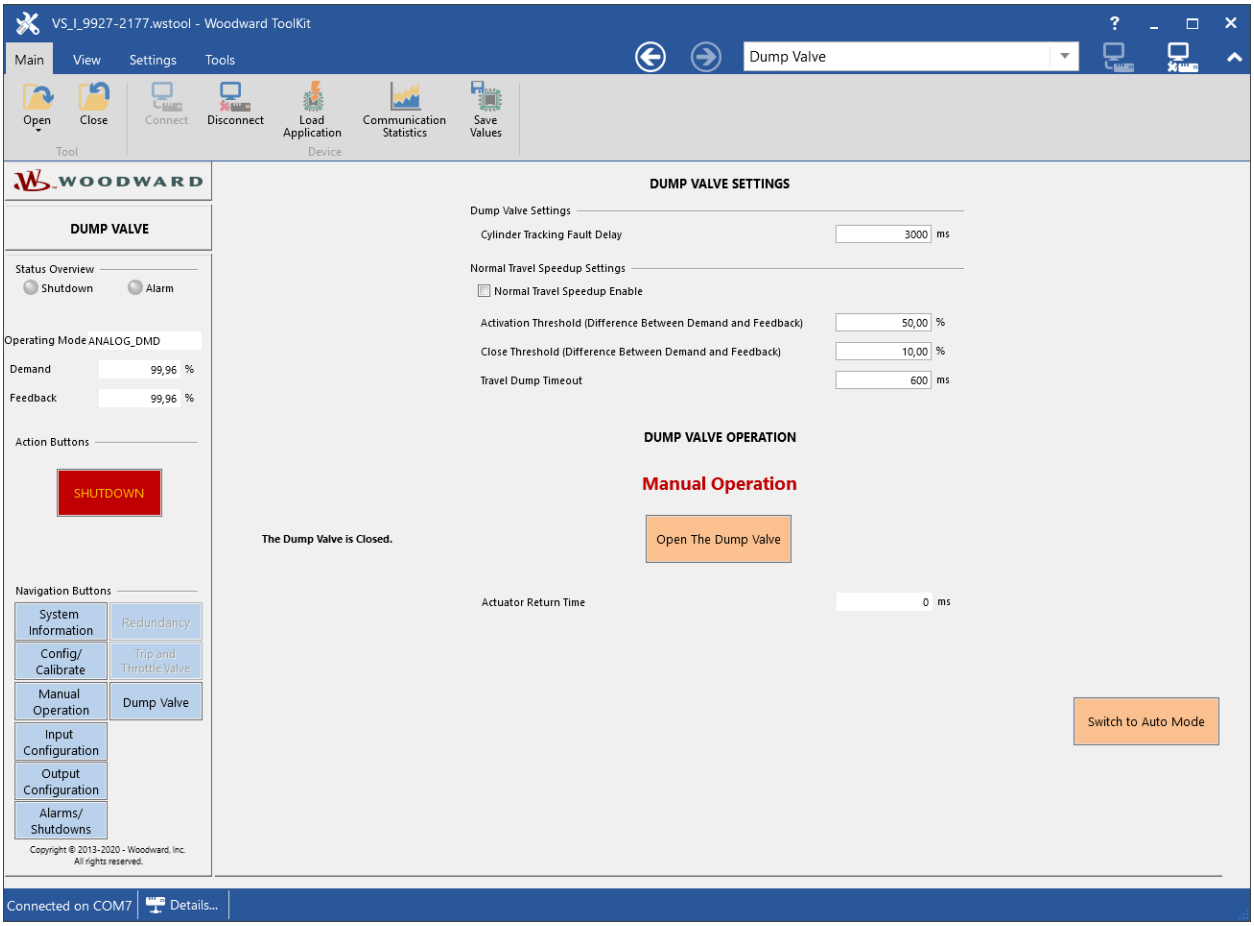


Figure 5-17. Dump Valve Manual Operation

Manual Operation indication displays that the dump valve is currently controlled by manual commands from the Customer Service Tool.

Open The Dump Valve button opens the dump valve and starts the timer that measures shut down time.

Actuator Return Time displays the measured actuator shutdown time. The counter starts when the button labeled "Manual Open the Dump Valve" is pressed. The counter stops when the cylinder feedback position falls below 0.5%.

IMPORTANT

The actuator return time value may display values from the previous return time measurement at the moment the screen opens. There will be 0 ms if no actuator return time measurements were performed since the last time the VS-I was powered up.

IMPORTANT

In case the dump valve is not physically installed, the VariStroke will execute normal shutdown as result of the command to open the dump valve. This feature allows the actuator return time to be measured for any VariStroke application where the dump valve page of the Customer Service Tool is available (note: this page is not shown for VariStroke dual acting or DX redundant models).

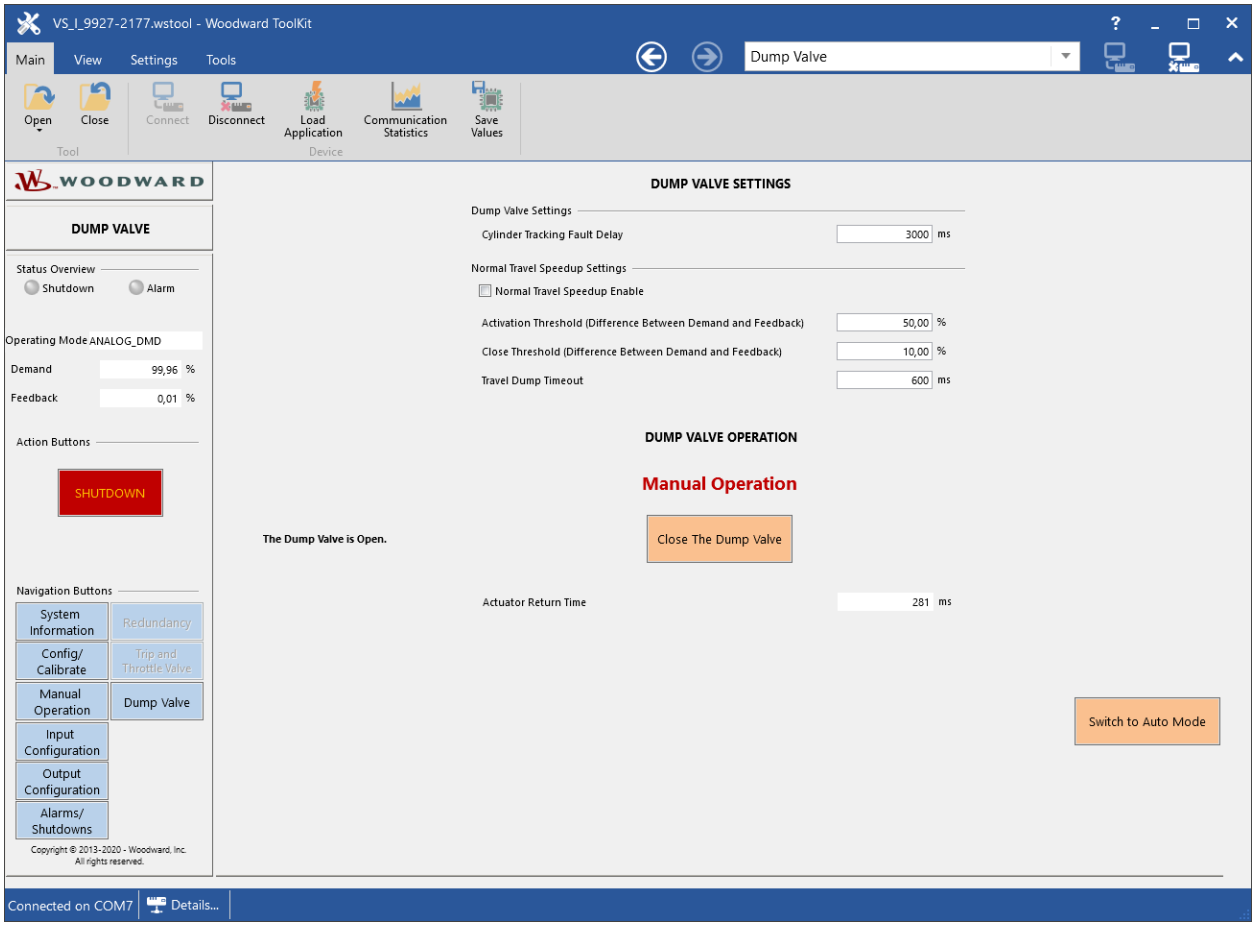


Figure 5-18. Dump Valve Shut Down Timer

Close the Dump Valve: This button allows the user to close the dump valve at any time during or after testing.

Switch to Auto Mode: This button turns dump valve control back to the VariStroke logic. If the automatic logic conditions (shutdown, normal travel speedup, etc.) requires a certain operational state of the dump valve, then pressing the “Switch to Auto Mode” button will automatically revert the dump valve to the appropriate operational state.

IMPORTANT

After testing is complete, and at all times for normal operation, the VariStroke dump valve logic should be switched to auto operation mode. This is appropriate even if the unit is not equipped with a dump valve.

Redundancy Configuration

Description of Operation

In a redundant master/slave VariStroke pair, the unit in control (master unit) is defined by the state of the "Master Designation" discrete input. The other unit not in control (slave unit) of the pair should be provided the opposite state of the "Master Designation" discrete input.

The unit designated as the master will have control of the power cylinder and the shuttle valve will be open between the master servo and the cylinder.

The unit designated as the slave will operate at a fixed position which keeps the control pressure connected to drain. This ensures that the shuttle valve is firmly seated. Therefore, there is no interaction between operation of the master and slave units.

The pair of VariStroke redundant units have a health link wired between them, which continuously shares the health status of the pair. Should the master unit fail, it will signal its fault status to the slave unit, which will then take control of the cylinder position.

The Redundancy Configuration screen is only displayed when the VariStroke unit is configured for use with the VariStroke-DX redundant skid.

> **Note:** Some parameters relate to mitigation of possible failure modes of the master/slave pair. These are described in the section below.

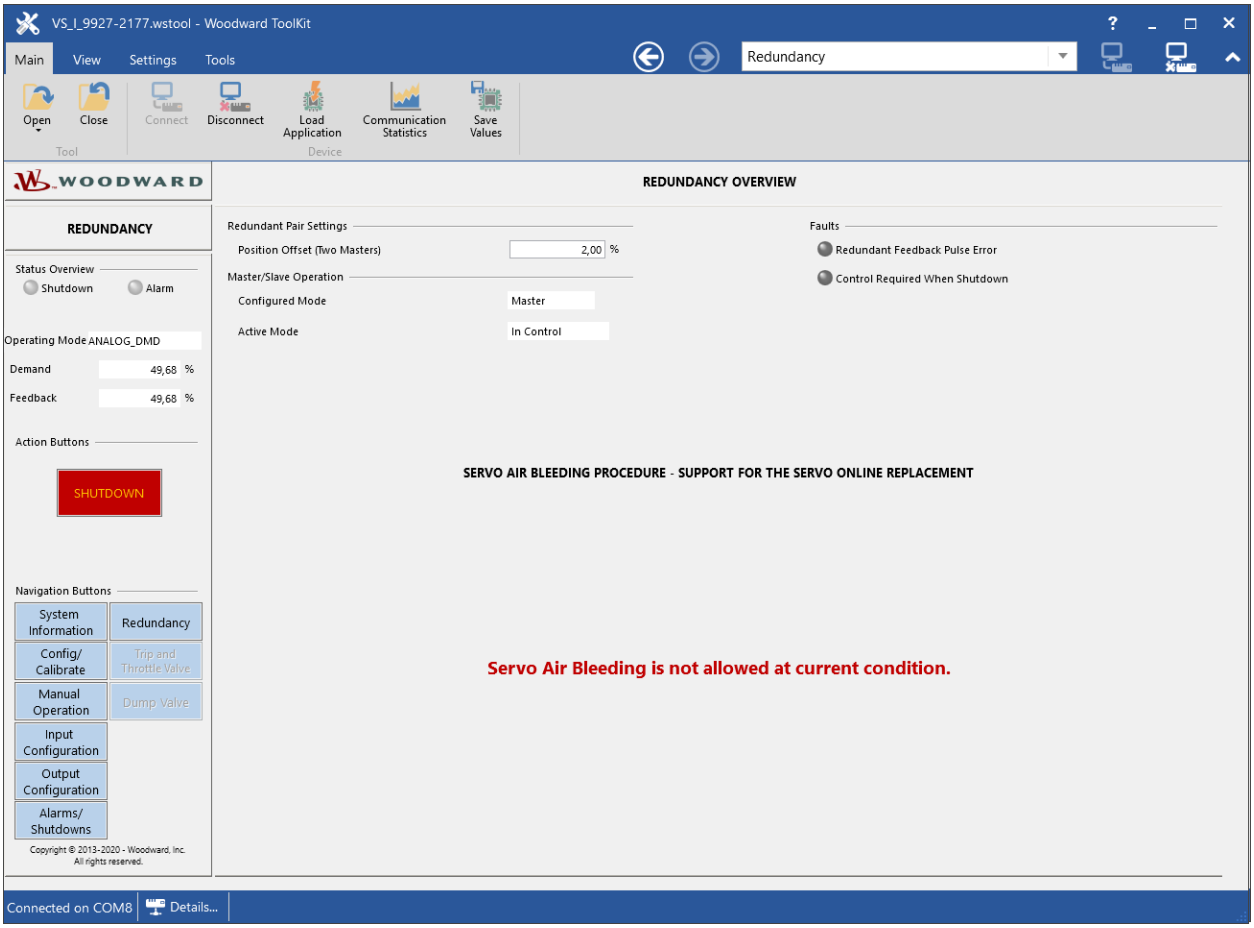


Figure 5-19. Redundancy Configuration Screen

Redundant Pair Settings

Position Offset (Two Masters): This value reduces the demand position in the unit configured as the slave in a redundant DX pair, and only in the case that there could be an error in detecting the health condition of the master unit from the redundant health link. This offset between the two units prevents a possible control contention by having one unit control just below the other, eliminating the contention in this failure mode case.

The contention of the units only occurs when a redundant feedback pulse error is detected by the slave unit. If such a condition occurs, the receiving unit will apply an offset to the position demand so that if the other unit (the master) is actually healthy, the slave unit will not interact with its ability to control.

IMPORTANT

If the redundant feedback pulse error is detected by the slave unit, and if the master unit has failed, the power cylinder will be controlled at a position lower than the demand. The difference will be as defined by the position offset (two masters) value.

Master/Slave Operation

Configured Mode: This indicates the commanded function of the unit in a redundant master/slave pair. This value reflects the state of the DI “Master Designation Input”. If this discrete input is closed, the unit will be designated as the slave, whereas the open condition designates the unit as the master.

Active Mode: This indicates whether the present state of the unit is “In Control” or “Not in Control”.

A unit will normally display an "In Control” status when it is designated as the master and has no detected critical fault condition.

A unit will normally display a "Not in Control” status when it is designated as the slave and the other unit of the pair is healthy and in operation.

Faults

Redundant Feedback Pulse Error

Control Required When Shutdown

These alarm annunciators display diagnostics related to redundant operation functions. For more details see Chapter 8.

Automatic Servo Air Bleeding Process

When the VariStroke servo is used in the redundant configuration, an automatic air bleeding process can be performed. This feature is important if a servo is replaced on-line. The automatic air bleeding process cycles the unit to help flush any trapped air in the repaired unit to drain. This ensures proper dynamic performance when the repaired unit is brought into control.

WARNING

The servo air bleeding process is not intended for cylinder or hydraulic system air bleeding. This process must not be used for hydraulic system preparation as it would cause the power cylinder to move quickly and uncontrollably.

During the servo valve on-line replacement procedure, the Redundancy screen will turn into another view allowing execution of the servo air bleeding process.

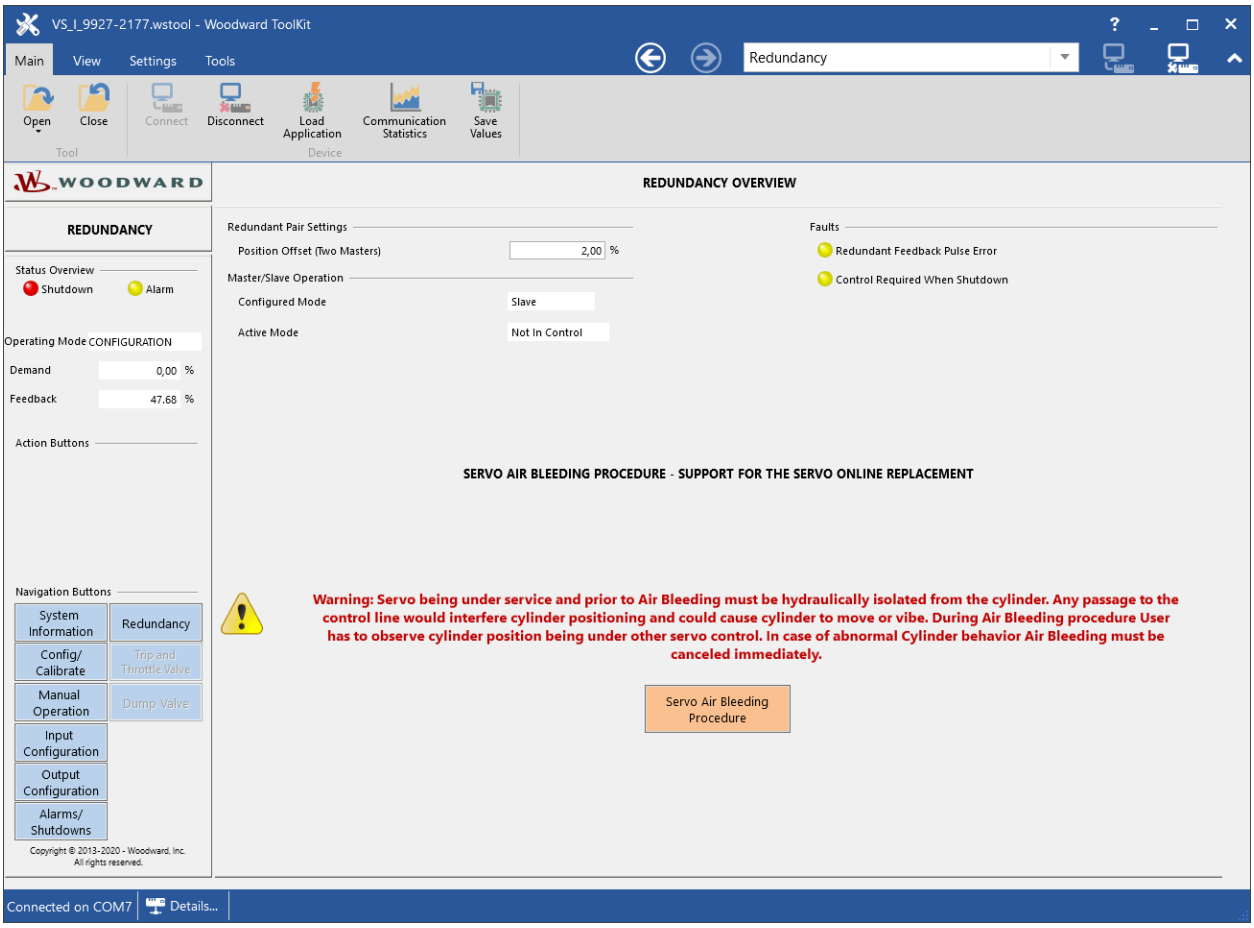


Figure 5-20. Redundancy Screen at VS-DX Servo Replacement

Servo Air Bleeding Procedure: To initiate this procedure, press the button shown in Figure 5-20 above. This launches another control screen to start the process. See Chapter 7 before using this feature.

Alarms/Shutdowns

This page displays the diagnostic information for a variety of externally caused alarms and shutdowns. These diagnostics, as well as more advanced diagnostics, are shown on the “Internal Status” page. Some alarms and shutdowns are configurable.

Logged errors remain in non-volatile memory until the user resets the log.

Illuminated alarm/shutdown status indicators show the active state. The user can reset the error system to clear the current flags, but any fault that is still active will remain set.

Chapter 8 describes these errors and their remedies in further detail.

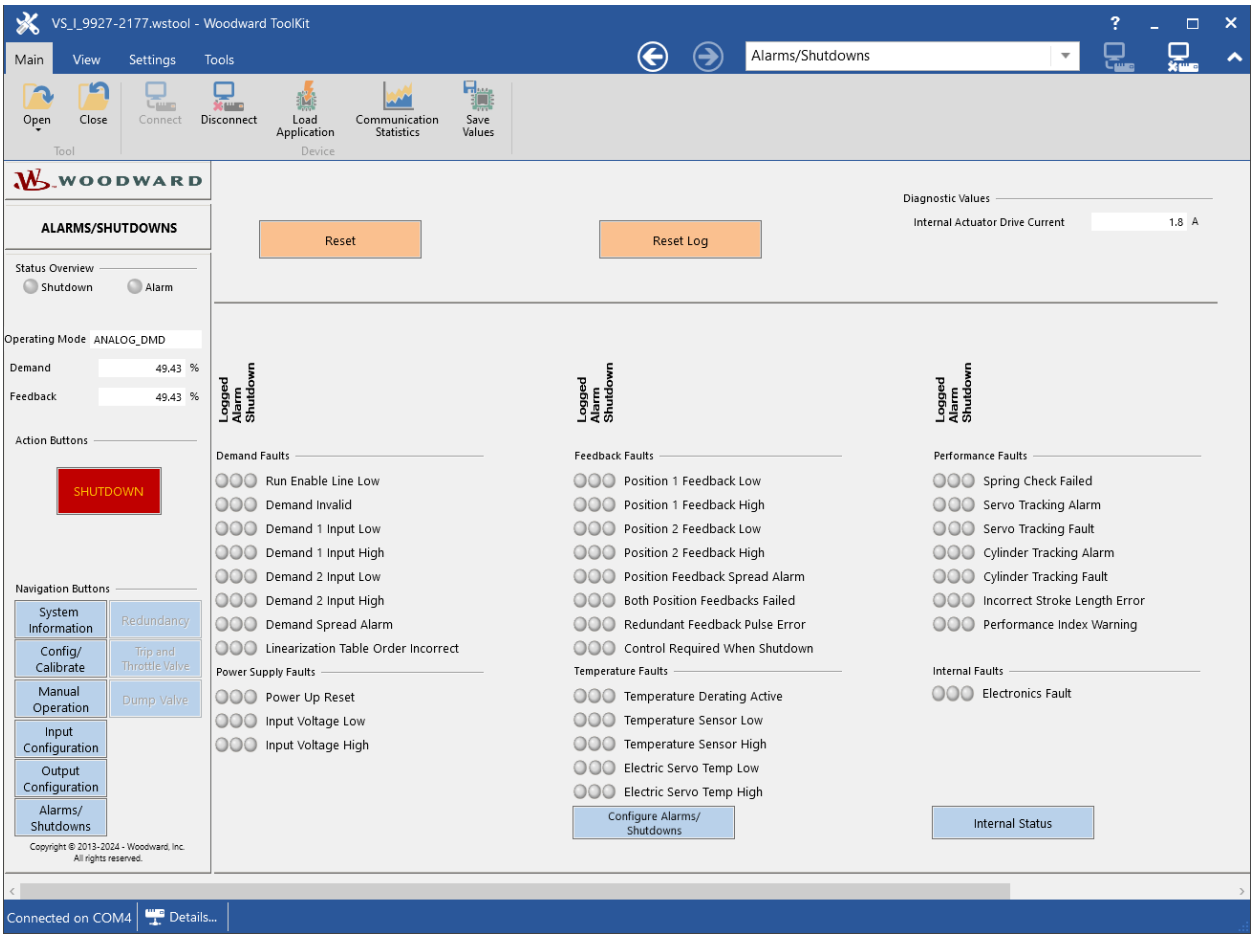


Figure 5-21. Alarms and Shutdowns Screen

Diagnostic Values:
Internal Actuator Drive Current: Indicates the actuator drive current.
Reset Button: Clears latched events that are no longer present.

IMPORTANT

Additional Reset Function: If the analog demand falls below the low limit threshold and is then raised back up into the normal range, this provides a reset action equivalent to using the “reset” button provided in the Customer Service Tool.

Reset Log button: Clears logged events.
Faults description is provided in Chapter 8.

Configure Alarms/Shutdowns button: Automatically transitions to display the Configure Alarms/Shutdown page, where the user can configure the behavior as needed for their application.

Internal Status button: Automatically transitions to display the Internal Status page, where the user can access detailed electronics diagnostics. This is especially useful in the event of an electronics fault.

Configure Alarms/Shutdowns

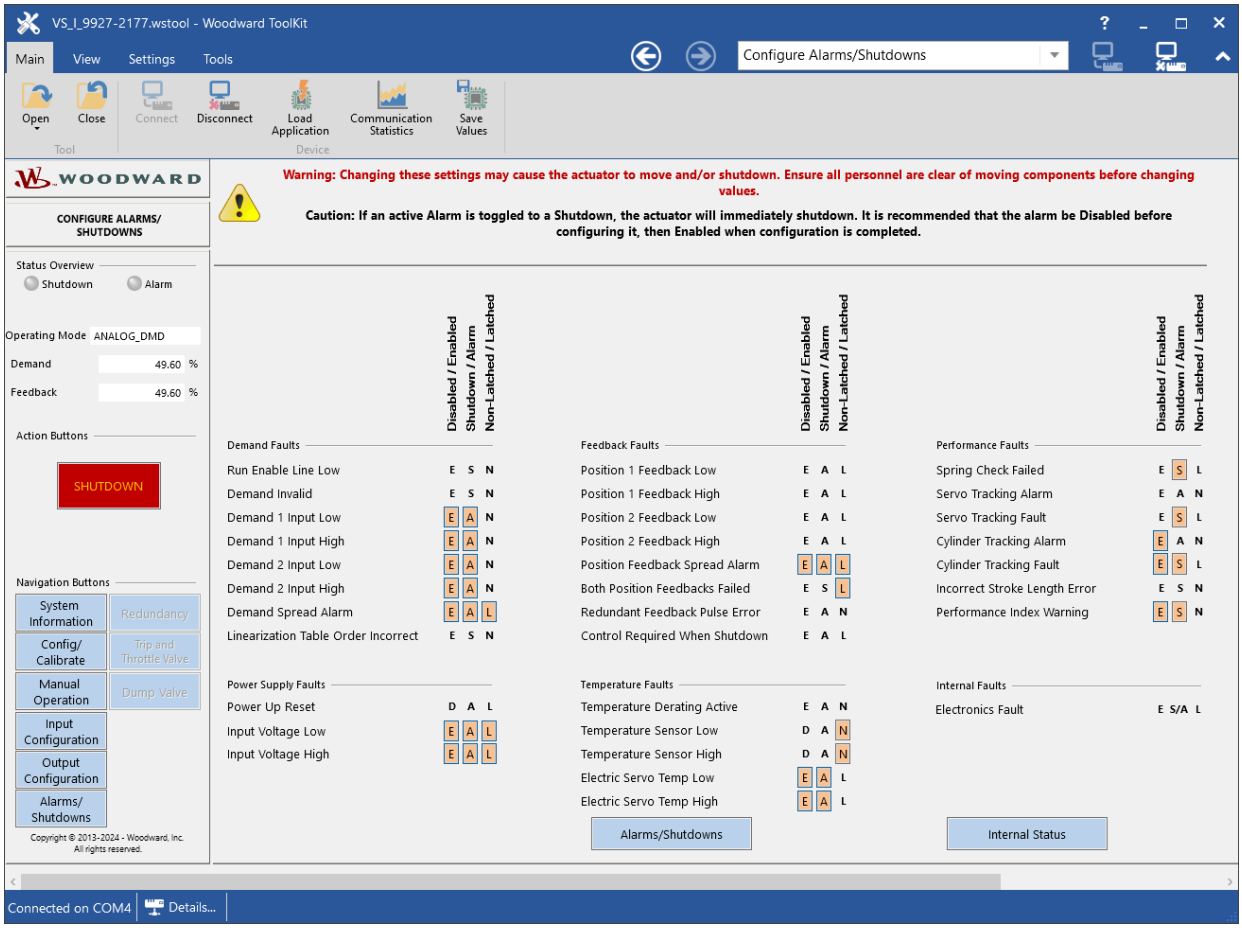


Figure 5-22. Alarms and Shutdowns Configuration Screen

From the Alarm/Shutdown Configuration screen, some of the alarms and shutdowns can be configured. Editable faults are shown as colored buttons on the page. The colored buttons can be configured as described below.

⚠WARNING

Changing these settings may cause the actuator to move and/or shut down. Ensure all personnel are clear of moving components before changing values. If an active alarm is configured to a shutdown, the actuator will immediately shut down. It is recommended that the alarm condition be corrected, or the diagnostic disabled before re-configuring it and then re-enabled when configuration is completed.

Enable/Disable (E/D): Enables or disables the alarm/shut down.

IMPORTANT

Even if an active alarm/shut down is disabled, any detected fault status is shown as active on the alarms/shutdowns screen; however, it will have no effect on the behavior of the unit. A disabled diagnostic will also block transmission of any externally transmitted fault signals, such as the digital status outputs or the fault messages on the CAN network.

Alarm/Shutdown (A/S): Determines the action that will take place when the event is active and enabled.

Latching/Non-Latching (N/L): When set to latching, a triggered event will remain active until the driver is reset. When set to non-latching, a triggered event will de-activate once the problem is remedied.

Alarms/Shutdowns button: Automatically transitions to display the Alarms/Shutdown page, with present state of diagnostics.

Internal Status button: Automatically transitions to display the Internal Status page, where the user can access detailed electronics diagnostics. This is especially useful in the event of an electronics fault.

Internal Status

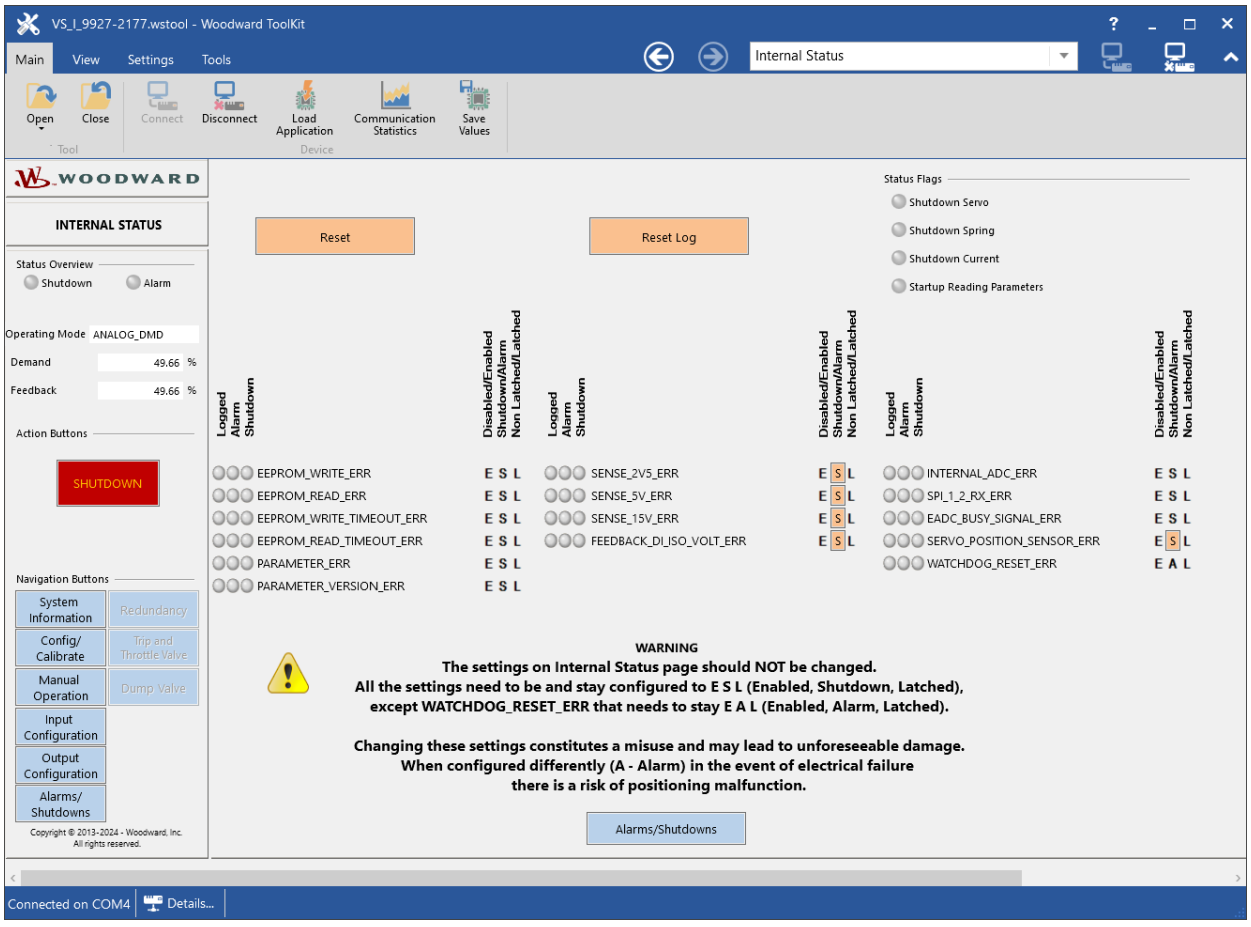


Figure 5-23. Internal Status Screen

The Internal Status screen displays the active and stored faults associated with the VariStroke electronic printed circuit board. In general, any indicated faults displayed on this screen identify a critical electronics malfunction. These faults are not typically correctable by the user. The displayed information is useful for communication to Woodward for recommended actions.

Selected diagnostics are configurable in the range of resulting actions. This is indicated by the button shape letters similarly to the configuration method on the Configure Alarms/Shutdowns page.

Reset Button: Clears latched events that are no longer present.

Reset Log button: Clears logged events.

Alarm/Shutdown (A/S): Determines the action that will take place when the event is active. Shutdown "S" option is default and recommended setting for all the Internal faults.

WARNING

The settings on Internal Status page should NOT be changed. All the settings need to be and stay configured to E S L (Enabled, Shutdown, Latched), except WATCHDOG_RESET_ERR that needs to stay E A L (Enabled, Alarm, Latched).

Changing these settings constitutes a misuse and may lead to unforeseeable damage. When configured differently (A - Alarm) in the event of electrical failure there is a risk of positioning malfunction including unintentional full-open position of the controlled valve.

IMPORTANT

VariStroke-GI Trip and Throttle Valve variant does not allow configuration to any Internal Status diagnostics. They are set and fixed to result in Shutdown. Such an approach is needed to ensure fail-safe behavior of the actuator positioning the trip valve when the electronic malfunction is detected.

IMPORTANT

VariStroke-DX duplex servo variant does not allow configuration to any Internal Status diagnostics. They are set and fixed to result in Shutdown. Such an approach is needed to ensure proper control switchover between operating (in control) and standby servo when the electronic malfunction is detected.

Alarms/Shutdowns button: Automatically transitions to display the Alarms/Shutdown page, with present state of diagnostics.

Saving and Loading Settings

It is highly recommended that the user saves the VS-I settings after calibration and configuration. Once a VariStroke has been successfully configured and tested, it is recommended that these settings be saved for future reference. These settings can also be loaded into another VS-I should the unit ever be replaced.

To save the VS-I settings, click on Settings in the ribbon at the top left of the page and select “Save from Device”.

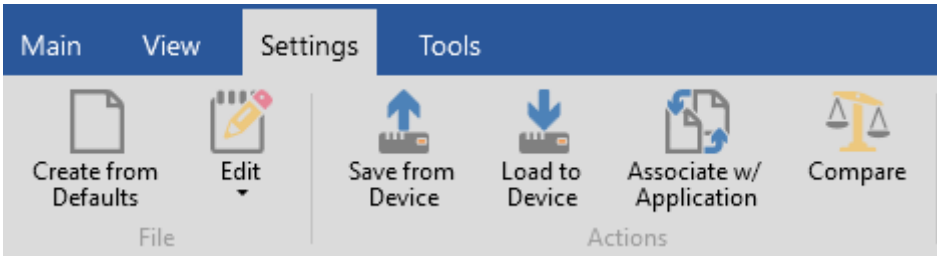


Figure 5-24. Settings Menu

To load settings from a PC to the VS-I, click on Settings in the ribbon at the top left of the page and select “Load to Device”.

IMPORTANT

Best practice is to keep settings files saved from each VariStroke installed within a plant. Files should be saved and stored after each successful/finalized configuration change or calibration performed. This provides the means for a settings backup in case of unit replacement or if additional configuration changes result in undesired behavior.

For more information, please refer to Chapter 10.

Chapter 6.
Calibration

Configuration and Calibration

⚠WARNING

To prevent personal injury or death and damage to equipment, the controlled prime mover must not be allowed to run or operate during any of the following procedures. The main steam valve or main fuel control must be turned off to prevent operation of the controlled system.

The Configuration and Calibration screen can be used to set the VS-I operating pressure to the desired value and to start the calibration process.

NOTICE

To enable the VS-I configuration and calibration functions, the user must set the RUN ENABLE line low and/or put the analog input demand(s) below 2 mA (0 mA is the suggested level).

NOTICE

If the system consists of redundant servos (VariStroke-DX) then the VariStroke that is not under configuration and calibration must be disabled from operation to ensure that only the unit being configured has control of the power cylinder.

To disable the unit not being configured, set the analog demand below the low limit, or set the Run Enable input (if in use) to inactive, or disconnect the power supply. You should also valve off this unit. For more information about VariStroke-DX commissioning, refer to manual 35132 *VariStroke-DX Duplex Hydraulic Servo Skid.*

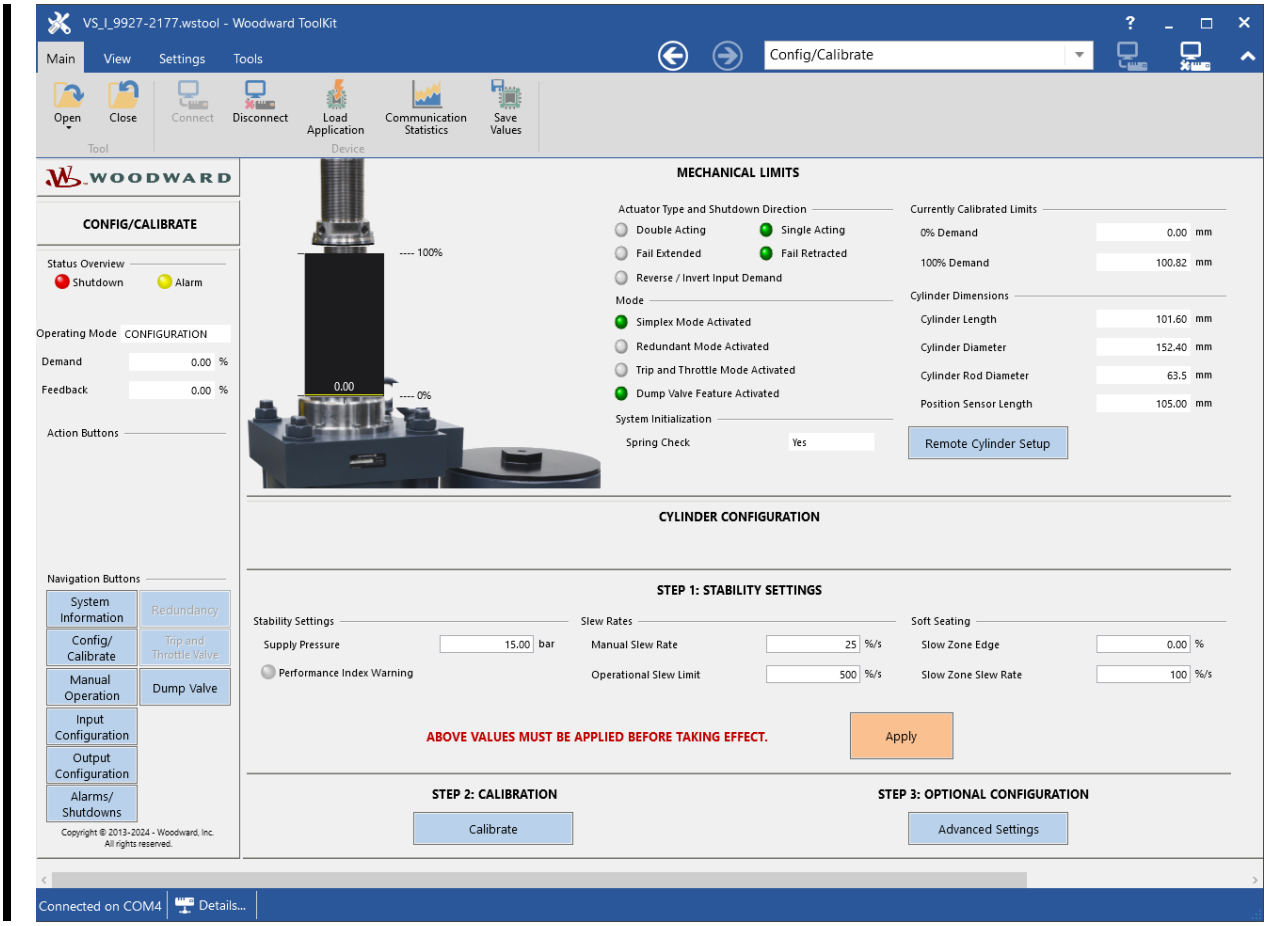


Figure 6-1. Configuration/Calibration Screen

Actuator Type and Shutdown Direction

Double Acting / Single Acting: This indicates the type of the actuator. Represents whether the servo is desired to work with double-acting or single-acting hydraulic cylinder.

Fail Retracted / Fail Extended: This indicates the fail-safe direction of the actuator. Any shut down or loss of input power will result in the actuator moving in the fail-safe direction.

Reverse / Invert Input Demand: Informs that Demand input signal is interpreted in reverse. If the indicator is active here a 4 mA signal will result in the cylinder moving to the extended position; 20 mA input means that the cylinder retracted.

Mode

Simplex / Redundant / Trip and Throttle: Indicates operating mode of the VariStroke unit. One of these three indicators shall be active.

Dump Valve Feature Activated: Indicates if the unit is configured to cooperate with Dump Valve on the Hydraulic Cylinder.

System Initialization

Spring Check: Upon startup and reset commands, the VS-I performs a brief test to ensure that the servo valve return spring is functioning properly. This is performed before moving the actuator away from the fail-safe position and will not move the actuator. This critical safety function cannot be disabled by anyone other than authorized Woodward personnel.

Currently Calibrated Limits

0% Demand: This value is the minimum travel of the cylinder stroke. Calibration is done at the factory but can be changed as part of the calibration process (Step 2).

100% Demand: This value is the maximum travel of the cylinder stroke. Calibration is done at the factory but can be changed as part of the calibration process (Step 2).

Cylinder Dimensions

Cylinder Length / Diameter / Rod Diameter and Position Sensor Length: Displays the currently entered dimensions of the cylinder. These values display for reference only. Modify these values by pressing the “Remote Cylinder Setup” button.

Remote Cylinder Setup

When the VariStroke is remotely connected to the actuator, the settings should be verified to reflect real application. Button will navigate to Remote Cylinder Setup screen where characteristic of the hydraulic cylinder can be configured

NOTICE

If the VariStroke unit came from the factory as an integrated unit with a cylinder attached, these values should NOT be changed.

Remote Cylinder Setup

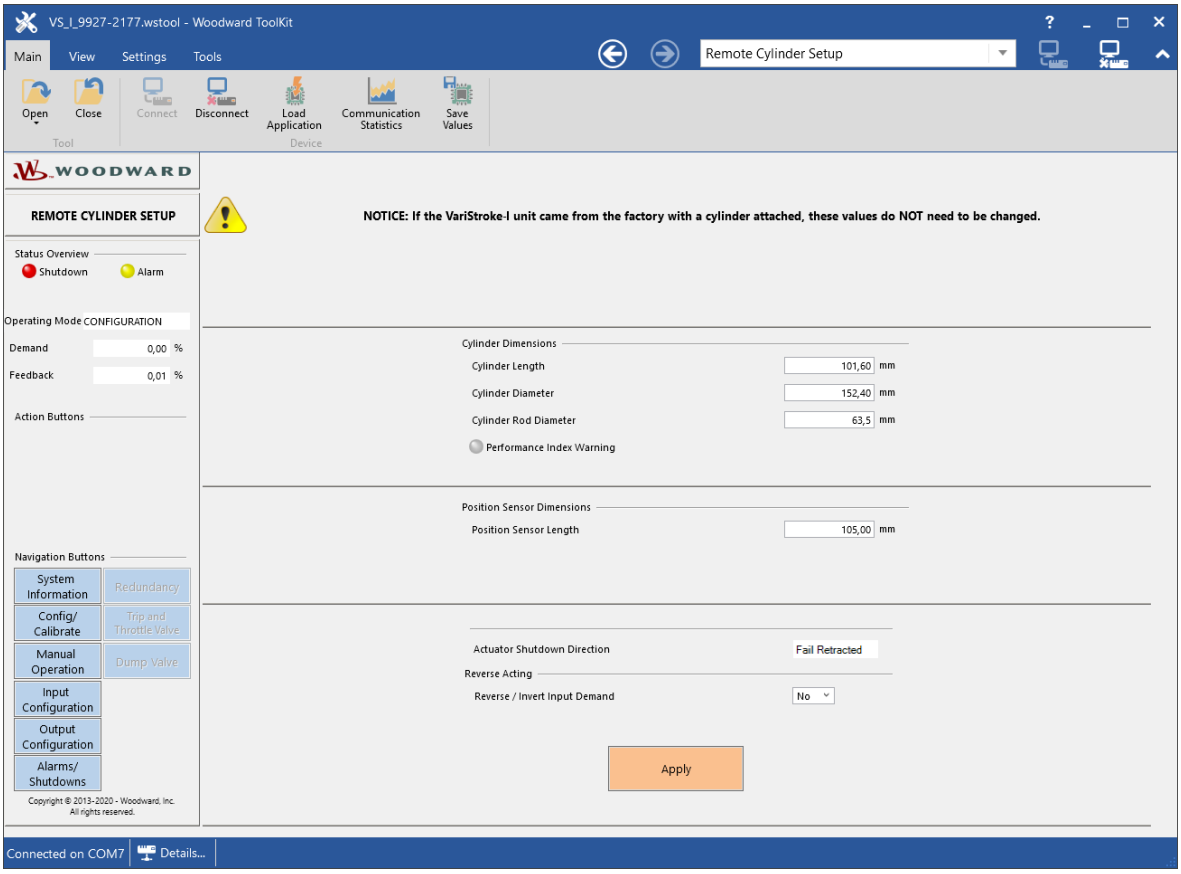


Figure 6-2. Remote Cylinder Setup Screen

This screen is used ONLY for user modification of the cylinder and position sensor parameters. This is commonly used when setting up a VariStroke servo with a Woodward remote cylinder, or a cylinder that was not manufactured by Woodward.

Cylinder Length: This value must equal the physical stroke range of the hydraulic cylinder. This dimension is used by the VariStroke controller to automatically tune the actuator.

Cylinder Diameter: This value must equal the bore diameter of the hydraulic cylinder. This dimension is used by the VariStroke controller to automatically tune the actuator.

Cylinder Rod Diameter: This value must equal the rod diameter of the hydraulic cylinder.

Performance Index Warning: Indicates that the configured pressure and cylinder volume do not fall within the desired performance index range (see manual 26727 for VS-I, or manual 35119 for VS-GI).

Position Sensor Length: Use this value to scale 0 to 100% positions of the VariStroke into millimeters. This must equal the full length of the cylinder position sensor. Position sensor length is defined as the distance measured between the 4 mA and 20 mA calibration range of the position sensor. It is recommended that the position sensor length be slightly longer than the cylinder length (stroke length) to ensure the sensor output is always within the usable (4–20 mA) range.

Actuator Shutdown Direction: This annunciation shows the configured fail-safe direction of the VariStroke servo. This behavior cannot be changed purely in software. If the value is incorrect for the application, contact Woodward for instructions to modify the fail-safe direction.

Reverse Acting: This field inverts the cylinder behavior based on the input demand. If the field is set to "Yes", the minimum input demand (4 mA) will result in the cylinder moving to the 100% position (extended position). This behavior is only user-configurable for the double acting servo configuration of the VS-I.

⚠WARNING

Settings related to cylinder directions: Actuator shutdown direction, reverse acting must be used with caution in accordance with the fail-safe configuration of the servo, the cylinder, and the hydraulic piping arrangement. Improper configuration could result in rapid movement of the cylinder to the incorrect physical stop. This is likely to cause severe control problems and could result in unsafe operation.

It is the responsibility of the user to ensure that the fail-safe function is properly implemented and verified prior to operating the turbine.

NOTICE

Typically, if the desired shutdown direction is fail-extended, the reverse acting demand should be set to Yes.
The fail-retract shutdown direction typically has the reverse/invert input demand set to No.

Single acting servos are factory configured to set the fail-safe direction. The reverse acting configuration is also factory configured.

The fail-safe direction for integrated power cylinders is defined by the model number purchased.

The fail-safe direction for remote cylinders is defined by which side of the power cylinder is connected to the servo control port and by the parameters which define the fail-safe direction.

IMPORTANT

The remote cylinder setup configuration requires the user to press the "Apply" button to make changes effective and then save values into the non-volatile memory using the "Save Values" button.
If the changes were saved (using the "Save Values" button) but not applied, then the new values will take effect after the next power cycle.

Cylinder Configuration

Before starting the configuration, the unit must be in a safe and shutdown state. The unit can be shut down by putting 0 mA into the analog inputs or by opening the Run Enable discrete input (Note: Run Enable must be set to “used”). The unit must also not have any active faults, such as a cylinder tracking fault. If there are active faults that prevent the unit from being in configuration mode, the faults should be analyzed and resolved (see Chapter 8).

Step 1—Stability Settings

Use the cylinder configuration section to input the hydraulic supply pressure.

Supply Pressure:

To set the supply pressure (Step 1):

1. Input the hydraulic supply pressure (bar) into the supply pressure control indicator and press the “apply” button. Based on this pressure, the VS-I driver will automatically tune itself to provide optimum performance.

IMPORTANT

Supply pressure can be set in the range of 3.5 bar to 35 bar in the Customer Service Tool. Refer to the respective mechanical manual for accurate limitations of the unit (VS-I manual 26727, VS-GI manual 35119, or VS-DX manual 35132).

2. For confirmation, two additional control buttons will appear— “Cancel/Revert Configuration” and “Save Configuration”. Press the “Save Configuration” button to save the new supply pressure value. Press Cancel/ Revert Configuration to revert to the previous saved pressure.

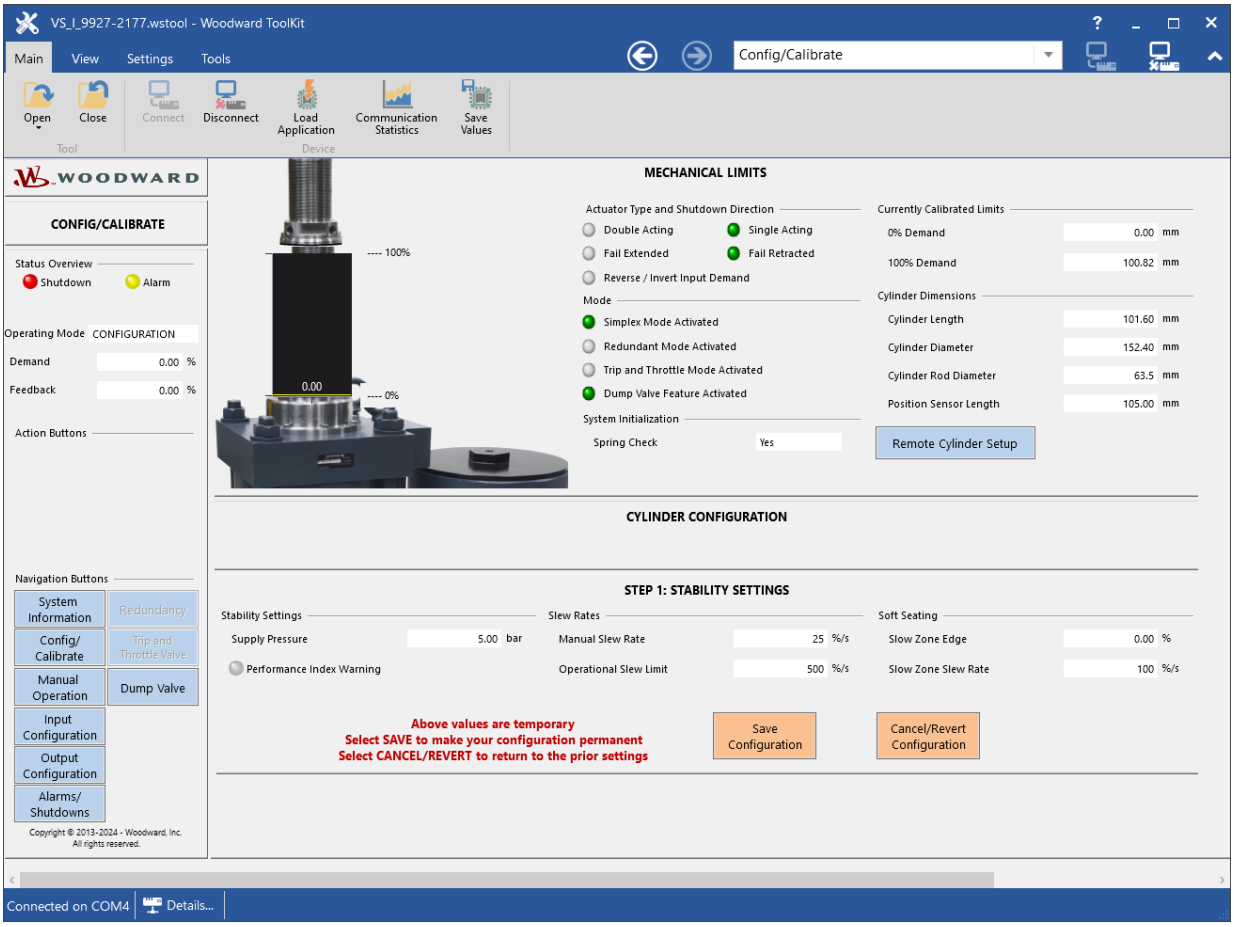


Figure 6-3. Configuration/Calibration Screen - Saving Changes

3. After pressing the “Save Configuration” button the data will be transferred to the VS-I.

NOTICE

Failure to input the correct supply pressure can result in unstable actuator performance. Ensure that this setting is correct and that the system pressure regulators do not allow more than a ±10% variation in supply pressure.

Performance Index Warning: Indicates that configured pressure and cylinder volume do not fall within the desired performance index range (see manual 26727 for VS-I, or 35119 for VS-GI).

NOTICE

Stability: Certain combinations of supply pressure and cylinder volume can cause the actuator to operate at reduced performance. See the VS-I manual or VS-GI manual for more information on this alarm.

Slew Rates:

- **Manual Slew Rate:** This adjustment allows the user to limit the slew rate when in manual operation. Consider lowering this value if the attached linkage and valve are not robust.
- **Operational Slew Limit:** This adjustment allows the user to limit the slew rate when in normal operation. Consider lowering this value if the linkage and valve attached are not robust. Also, consider using the soft seating to lower valve seating velocities.

NOTICE

The soft seating feature will not function in some shut down conditions. Loss of cylinder position feedback, loss of electrical power, or an internal electronics fault will result in loss of the soft seating functionality.

Soft Seating: The VS-I soft seating function allows the actuator to have a different slew rate limit when positioned within the lower 0% to 25% of the user-calibrated stroke. This feature provides a behavior similar to that of a conventional hydraulic cushion. You may use this function to limit the steam valve seating velocity in order to lengthen the life of the valve.

- Slow Zone Edge: This adjustment sets the position at which the actuator slew rate limit will switch from the operation slew rate limit to the slow zone velocity.
- Slow Zone Velocity: This adjustment sets the slew rate limit of the actuator when the position is below the slow zone edge value. Consider lowering this value if valve-seating velocities are higher than desired.

NOTICE

Incorrect slew rate limits and soft seating adjustments can result in high seating velocities that may damage equipment.

⚠WARNING

Configuration of the slow zone settings and slew rate limits can result in excessively slow closing speeds.

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

⚠WARNING

The soft seating feature will not work if a dump valve is installed in the system or if the VariStroke Trip & Throttle valve functionality is used.

For these applications, during a shutdown or position demand stepped to 0%, the velocity and impact on the fail-safe hard stop will not be limited by the slew rate limit or slow zone settings.

Step 2—Calibration

To calibrate, start by pressing the “Calibrate” button (Step 2). Upon pressing the “Calibrate” button, there are two options available on the left side of the page: “Find Minimum Stop” and ”Find Minimum AND Maximum Stop” (see screens and details below). Select one of these options and run before any further configuration can take place.

⚠WARNING

The calibration features will cause the actuator to move. Ensure all personnel are clear of moving components before initiating the calibration sequence.

⚠CAUTION

Potential damage to linkage and/or attachments can occur if the linkage and/or attachments are not designed to withstand the full stall force of the actuator at the supplied operating pressure. It is the installer’s responsibility to verify the structural capabilities of the linkage and/or attachments. IF the linkage and/or attachments CANNOT WITHSTAND THE FULL STALL FORCE of the actuator DO NOT USE FIND MINIMUM AND MAXIMUM STOPS. Instead, Find Minimum Stop must be used.

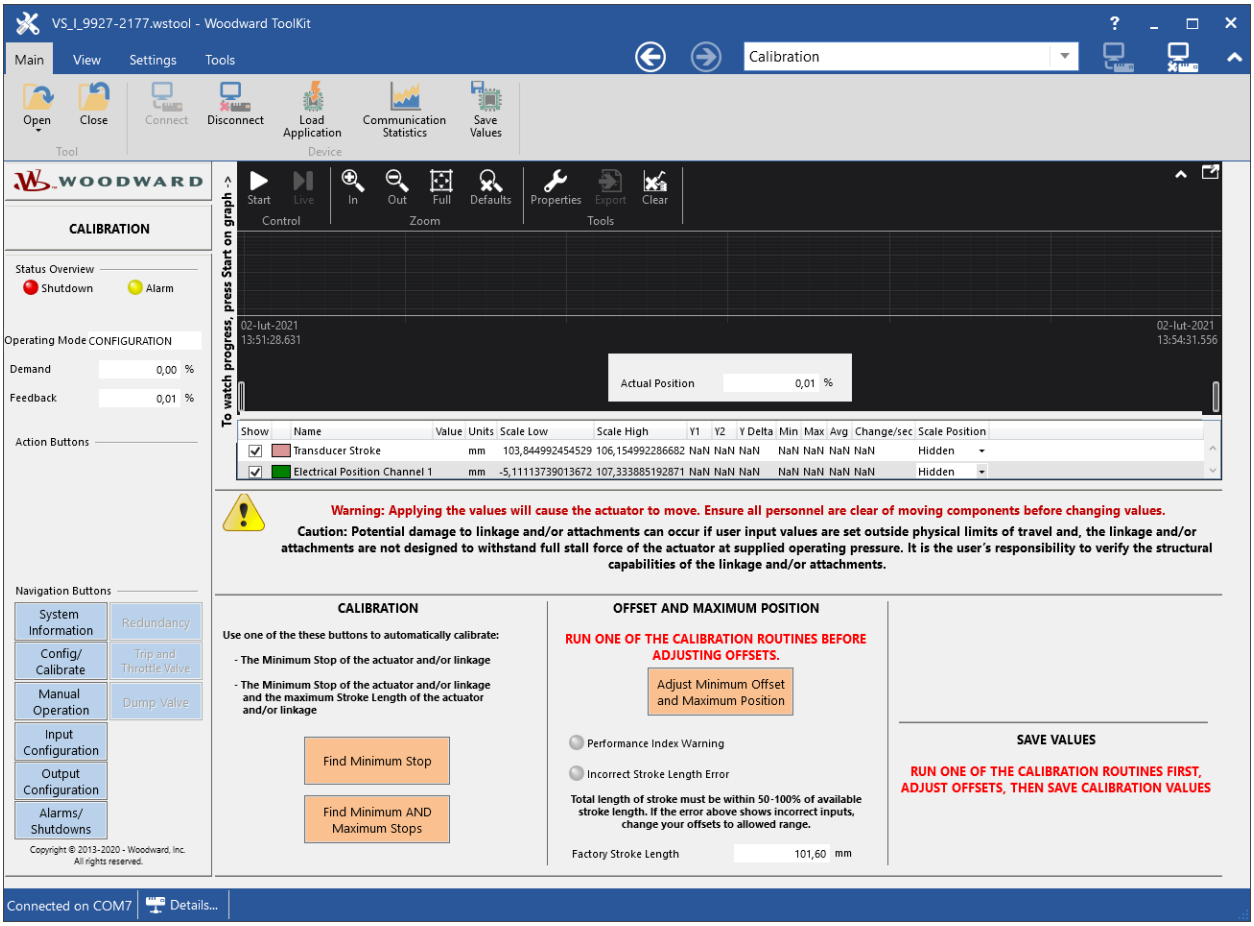


Figure 6-4. Calibration Screen

IMPORTANT

CLEAR ALL SHUTDOWNS in order to proceed with calibration. These shutdowns are displayed on the "Alarms/Shutdowns" page of the Customer Service Tool. It may be necessary to temporarily disable certain shutdowns to complete the calibration.

If the cylinder is not at the factory/default 0% position after initial installation, a "Cylinder Tracking Fault" will commonly be an active shut down. This shut down should be disabled or toggled to an alarm until calibration is complete. Navigate to "Configure Alarms/Shutdowns" screen and temporarily change setting of Cylinder Tracking Fault. Remember to get this setting back to original after the cylinder calibration completes.

Find Minimum Stop

To use the Find Minimum Stop option, press the "Find Minimum Stop" button. The Find Minimum Stop feature allows the user to scale the desired minimum position offset and maximum stop position to the 4 to 20 mA demand input range. After pressing the "Find Minimum Stop" button, the following screen will appear.

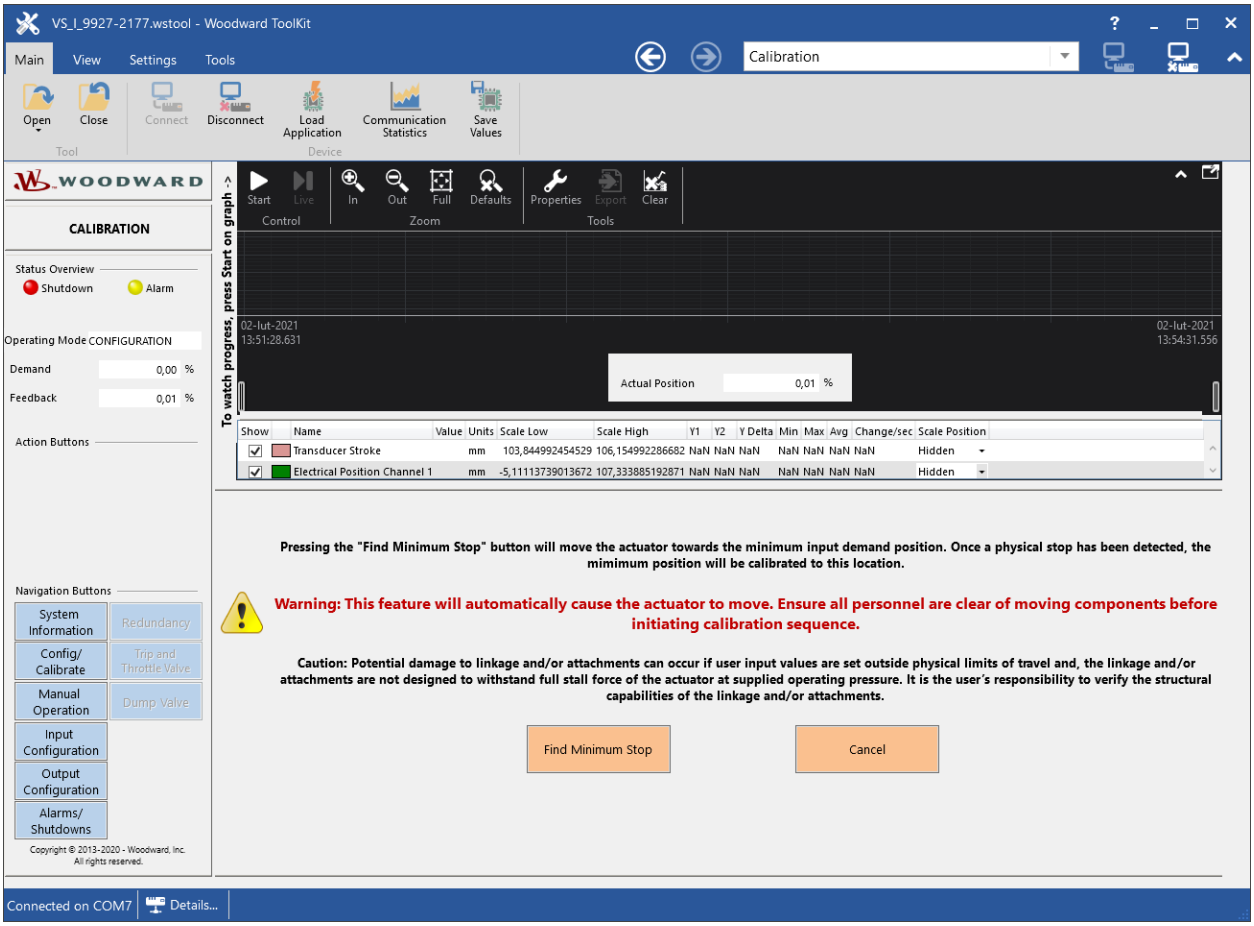


Figure 6-5. Calibration Find Minimum Stop Screen

Press the "Find Minimum Stop" button. Pressing this button will slightly open the VS-I servo valve, causing the actuator to slowly move toward the minimum/fail-safe position. Once a physical stop is contacted, the servo valve will close, and the VS-I will automatically configure this as the minimum (4 mA demand) position.

View and monitor actuator movement using the trend chart. To do so, press Start at the top left corner of the trend chart.

Cancel Button: Pressing the “Cancel” button will end the Find Minimum Stop process and the Customer Service Tool will return to the Calibration page.

Find Minimum AND Maximum Stops

IMPORTANT

ALL SHUTDOWNS must be cleared in order to proceed with calibration. These can be seen on the “Alarms/Shutdowns” page of the Customer Service Tool. It may be necessary to temporarily disable certain shutdowns to complete the calibration.

If the cylinder is not at the factory/default 0% position after initial installation, a “Cylinder Tracking Fault” will commonly be an active shutdown. This shutdown should be disabled or toggled to an alarm until calibration is complete.

The “Find Minimum and Maximum Stops” feature will determine the usable stroke range by moving the VariStroke to the minimum and maximum limits of travel at a controlled velocity. The control will slightly open the VS-I servo valve, causing the actuator to slowly move toward the minimum/fail-safe position. Once a physical stop is contacted, the servo valve will close, and the VS-I will automatically configure this as the minimum (4 mA demand) position.

Immediately after this, the VS-I servo valve will slightly open in the opposite direction to slowly move the actuator toward the maximum position. The actuator will move a small distance off the minimum stop, pause for a moment to determine an acceptable slew rate, and then continue to move toward the maximum position.

Once a physical stop is contacted, the servo valve will close, and the VS-I will automatically configure this as the maximum (20 mA demand) position. These limits of travel are automatically scaled to 4 mA (minimum) to 20 mA (maximum) demand levels.

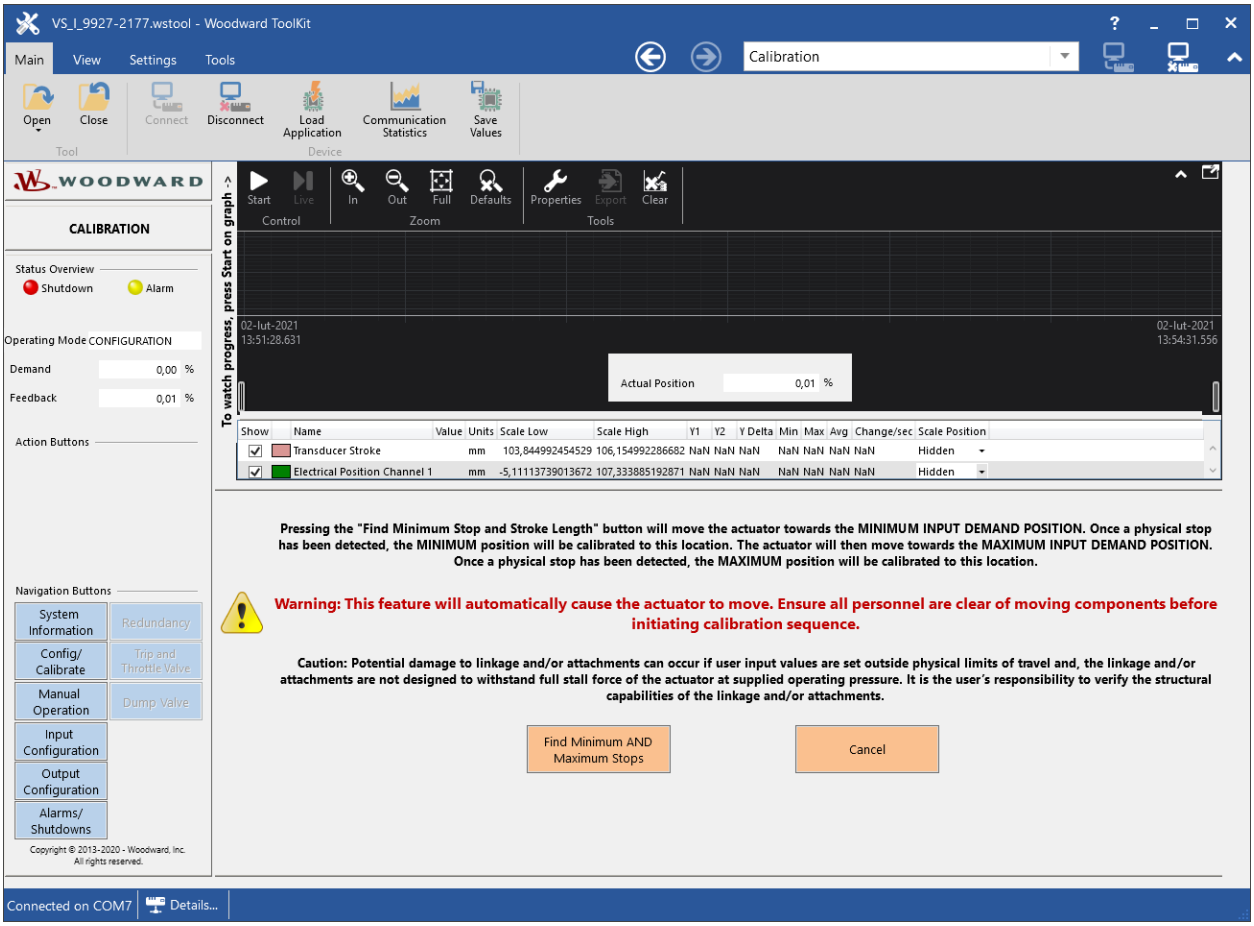


Figure 6-6. Calibration Find Minimum and Maximum Stops Screen

Press the “Find Minimum AND Maximum Stops” button. A confirmation screen will appear with two buttons “Find Minimum AND Maximum Stops” and “Cancel”. Once the “Find Minimum AND Maximum Stops” button has been pressed, the calibration cycle will start, and the following screen will appear. To cancel the Find Minimum AND Maximum Stops sequence and return to the previous screen, press Cancel.

Actuator movement can be monitored and viewed using the trend chart. To do so, press Start at the top left corner of the trend chart.

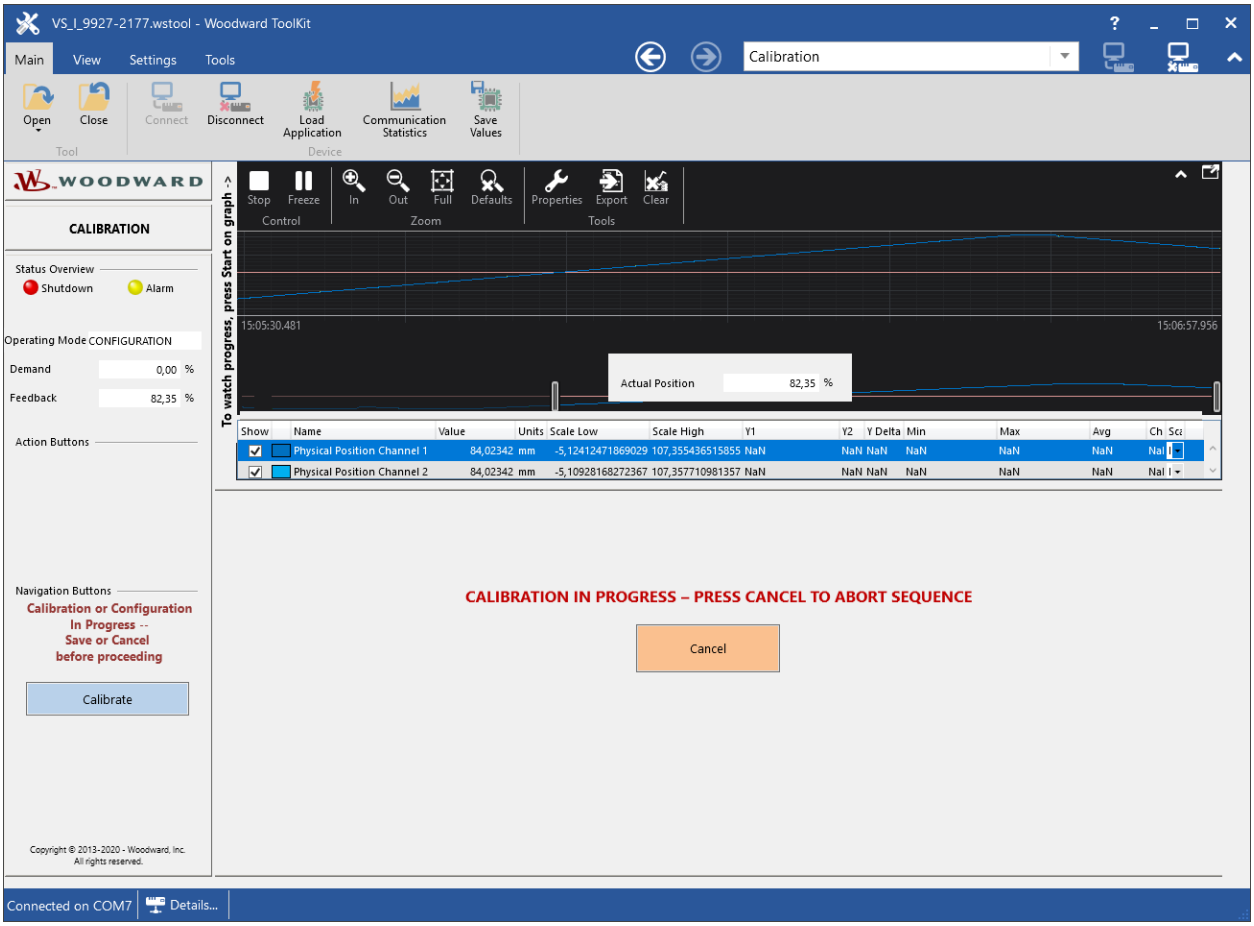


Figure 6-7. Calibration in Progress Screen

Step 3—Set Offset and Maximum Stop Position (Optional)

IMPORTANT

If one of the calibration routines has already been run, or the user wishes to adjust these values based on the factory calibration, the "Adjust Minimum Offset and Maximum Position" button may be pressed. This will skip the automatic calibration process.

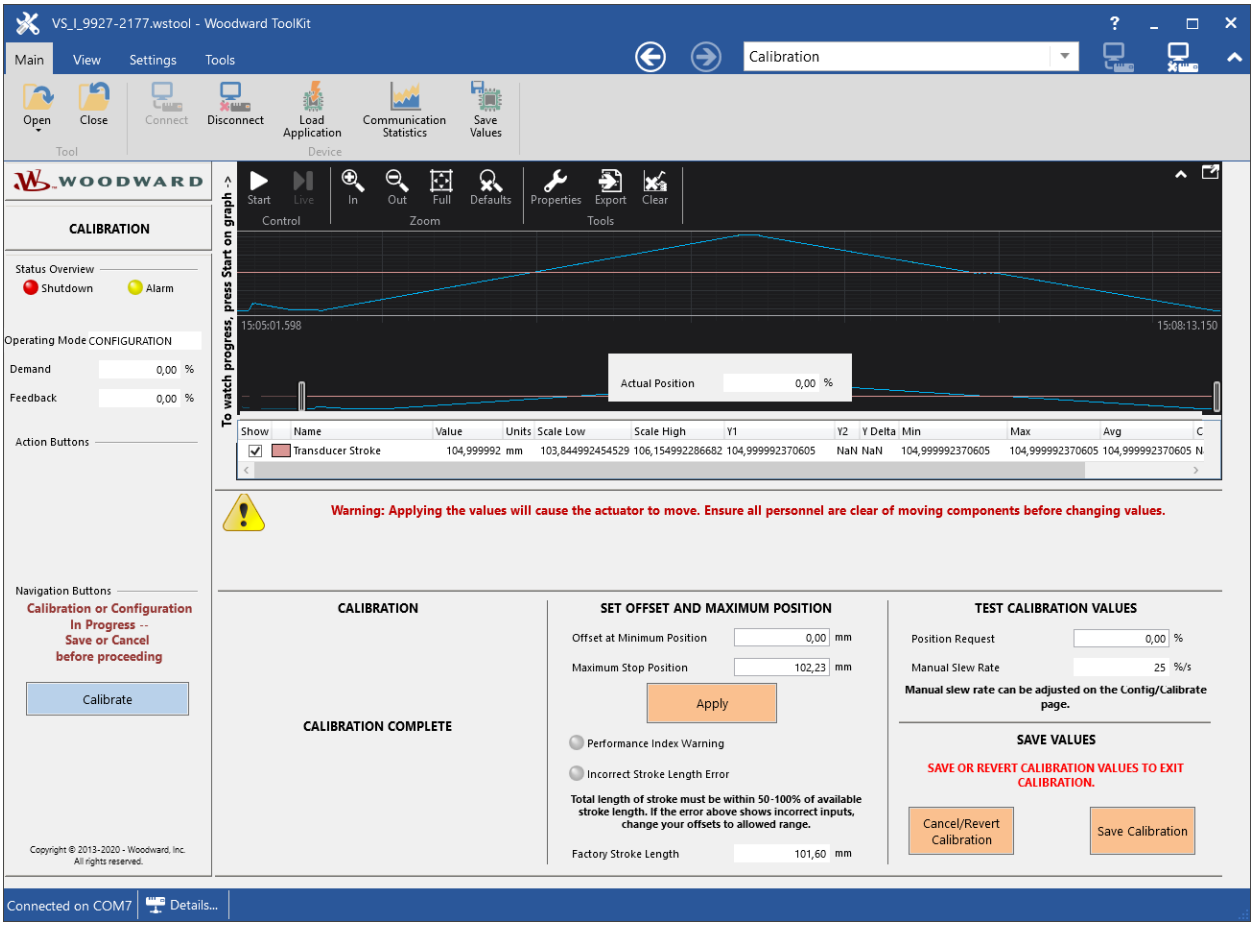


Figure 6-8. Calibration Complete Screen

After either calibration routine is run, the Customer Service Tool will return to the Calibration screen, where setting the desired "Offset at Minimum Position" and "Maximum Stop Position" is now allowed. The Maximum Stop Position minus the Offset at Minimum Position must not be less than 40% of the factory stroke length shown on the bottom of this page, or an Incorrect Stroke Length Error will appear.

The "Offset at Minimum Position" and "Maximum Stop Position" settings are presented in millimeters for user convenience. If a specific stroke length is required, the user shall adjust these parameters while verifying the actual actuator minimum and maximum positions. Some small variation between these parameters and the actual stroke is to be expected. The final stroke will be linear between the actual minimum and maximum positions.

After changing the "Offset at Minimum Position" and "Maximum Stop Position", press the "Apply" button.

During this process, the "Position Request" on the right side of the page can be used to manually position the actuator. The "Manual Slew Rate" is also shown but is for reference only. "Manual Slew Rate" can be changed on the Config/Calibrate screen, before entering the calibration mode.

IMPORTANT

If calibration was performed with linkage attached, a small negative number can be input into the "Offset at Minimum Position" field to provide additional valve seating force. It is the installer's responsibility to verify the structural capabilities of the linkage and/or attachments.

Step 4—Saving the Calibration Settings

To save the new cylinder calibration settings, press the "Save Calibration" button.

Press the "Cancel/Revert Calibration" button to discard the changed values and to exit the calibration.

It is highly recommended that the user saves the VS-I settings after calibration and configuration and that these settings are stored in a controlled archiving location for future reference. These settings can also be loaded into another VS-I should the unit ever be replaced.

To save the VS-I settings, click on Settings in the ribbon at the top left of the page and select "Save from Device".

IMPORTANT

Best practice is to keep settings files saved from each VariStroke in plant. Files shall be saved and stored after each successful/finalized configuration change or calibration performed. This is to have settings backup in case of unit replacement or further configuration modifications causing improper behavior.

For more information, please refer to Chapter 10.

IMPORTANT

If the system consists of redundant servos (VariStroke-DX models), once the unit configuration is complete, the other unit which had been disabled and valved off can now be enabled for operation. This can be done by setting the analog inputs back within their normal range (4-20 mA typically), or by activating the run/enable discrete input (if in use).

For more information about VariStroke-DX commissioning, refer to manual 35132 *VariStroke-DX Duplex Hydraulic Servo Skid*.

Manual Operation

⚠WARNING

To prevent personal injury or death, or damage to equipment, the controlled prime mover must not be allowed to run or operate during the manual operating mode. The main steam valve or main fuel control must be turned off to prevent operation of the controlled system.

⚠CAUTION

Use of the manual operation feature when trying to position the actuator at or beyond the physical limits of travel, will apply the full stall force. Potential damage to linkage and/or attachments can occur if not designed to withstand the full stall force of the actuator at the supplied operating pressure.

To enable manual Operation, the RUN ENABLE line must be low and/or the analog input demands must be at less than 2 mA (0 mA recommended). The VS-I can be put into manual mode by pressing the

"Manual Operation" button. The VS-I can be returned to normal operation by pressing the "Exit" button, by enabling Run Enable, or by supplying an analog input demand level.

When the VS-I is in manual mode, you can enter a desired position. The VS-I will move the final cylinder to that position at a rate given on the Config/Calibrate screen. If the VS-I is in normal operation, this page can be used just to track that operation.

Press the "Start" arrow in the upper left-hand corner of the graph to view trending data.

Manual Operation Screen

Once the "Manual Operation" button is pressed, the following screen displays below the trend chart. Monitor and view actuator movement using this trend chart. To do so, press the "Start" arrow at the top left corner of the trend chart. To change the cylinder position, change the position request value (see below).

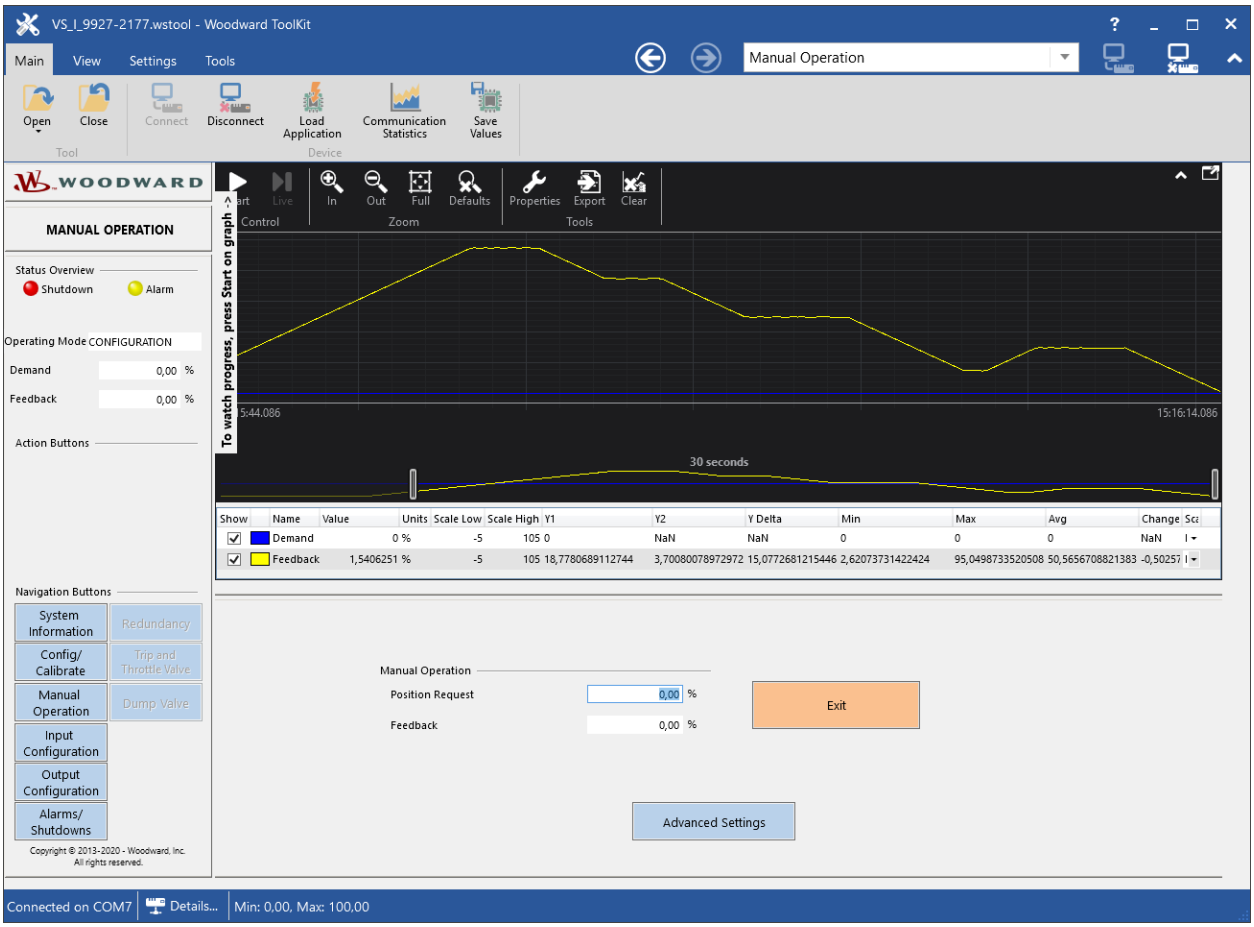


Figure 6-9. Manual Operation Screen

The Advanced Settings button allows you to jump directly to the Advanced Settings page where controller settings may be configured on-line.

Chapter 7.
Air Bleeding

⚠WARNING

The servo air bleeding process is not intended for cylinder or hydraulic system air bleeding. This process must not be used for hydraulic system preparation as it would cause the power cylinder to move quickly and uncontrollably.

The automatic air bleeding routine is designed to evacuate trapped air from the servo cavity in cases where a new "dry" servo is installed in an operating VS-DX skid. This procedure ensures that any trapped air is purged from the servo cavity. It is recommended to perform this operation to prevent trapped air, which can lead to poor controllability and/or stability. Refer to CMM-03013 *Component Maintenance, Manual Bronze Level, VariStroke-DX* for details about the VS-DX on-line servo valve replacement procedure.

⚠WARNING

If a VariStroke-DX servo has been removed and serviced prior to performing the air bleeding process, the servo must be hydraulically isolated from the cylinder. During the air bleeding process, the serviced VariStroke-DX servo will be cycled repeatedly to eliminate air from the system. If the control port isolation valve were to leak, this could interfere with the other VariStroke-DX servo's ability to control the actuator. While this process is underway, the user should observe the cylinder position under control of the other servo. In case of any abnormal cylinder behavior the air bleeding process should be stopped immediately.

The air bleeding page in the Customer Service Tool is available only for redundant servo configuration VS-DX. The page can be opened from the Redundancy screen.

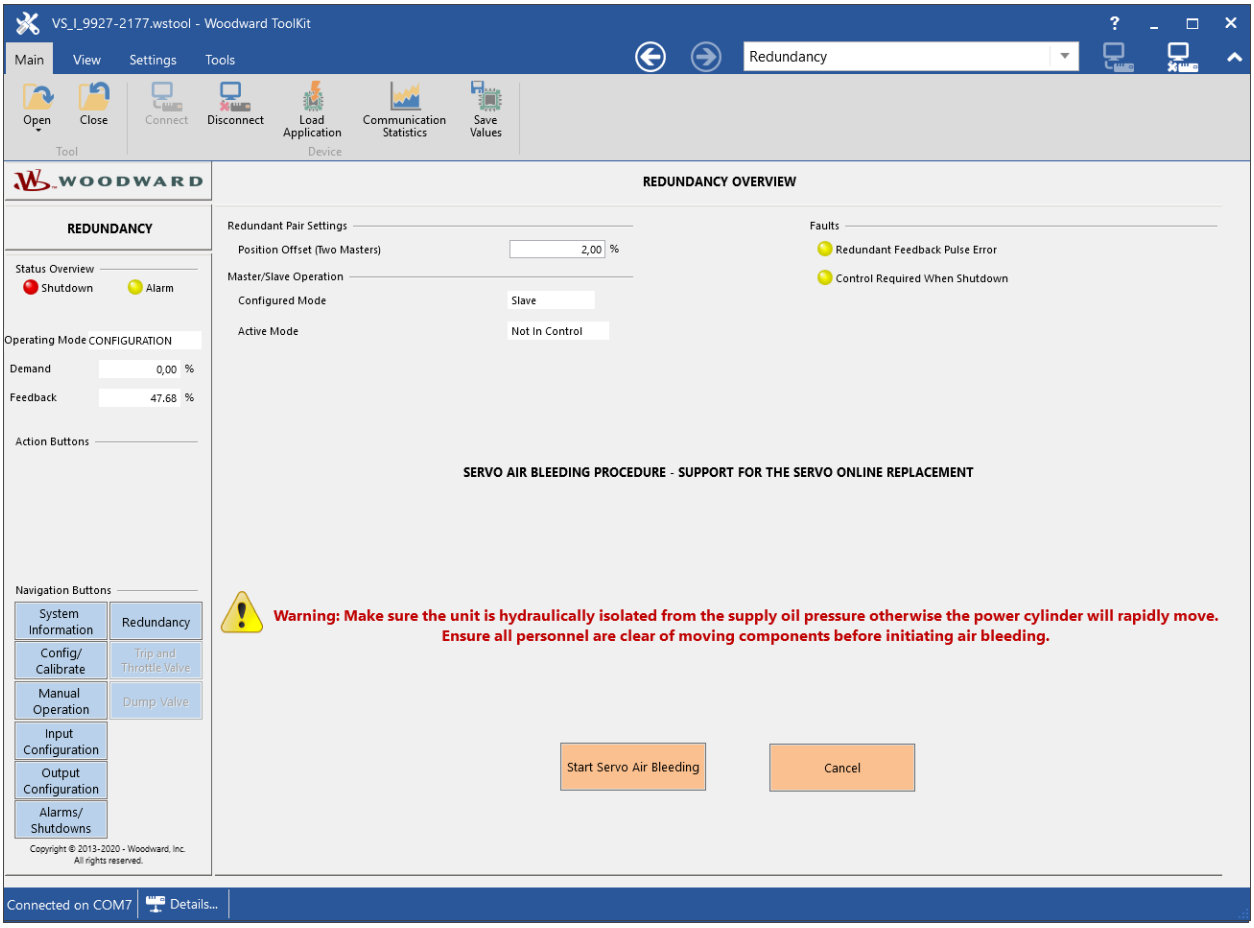


Figure 7-1. Air Bleeding Control Screen

Start Servo Air Bleeding button initiates the procedure to evacuate air residuals from hydraulic oil paths. It is typically used during on-line replacement.

Cancel button reverts back to the previous screen without proceeding with the servo air bleeding procedure.

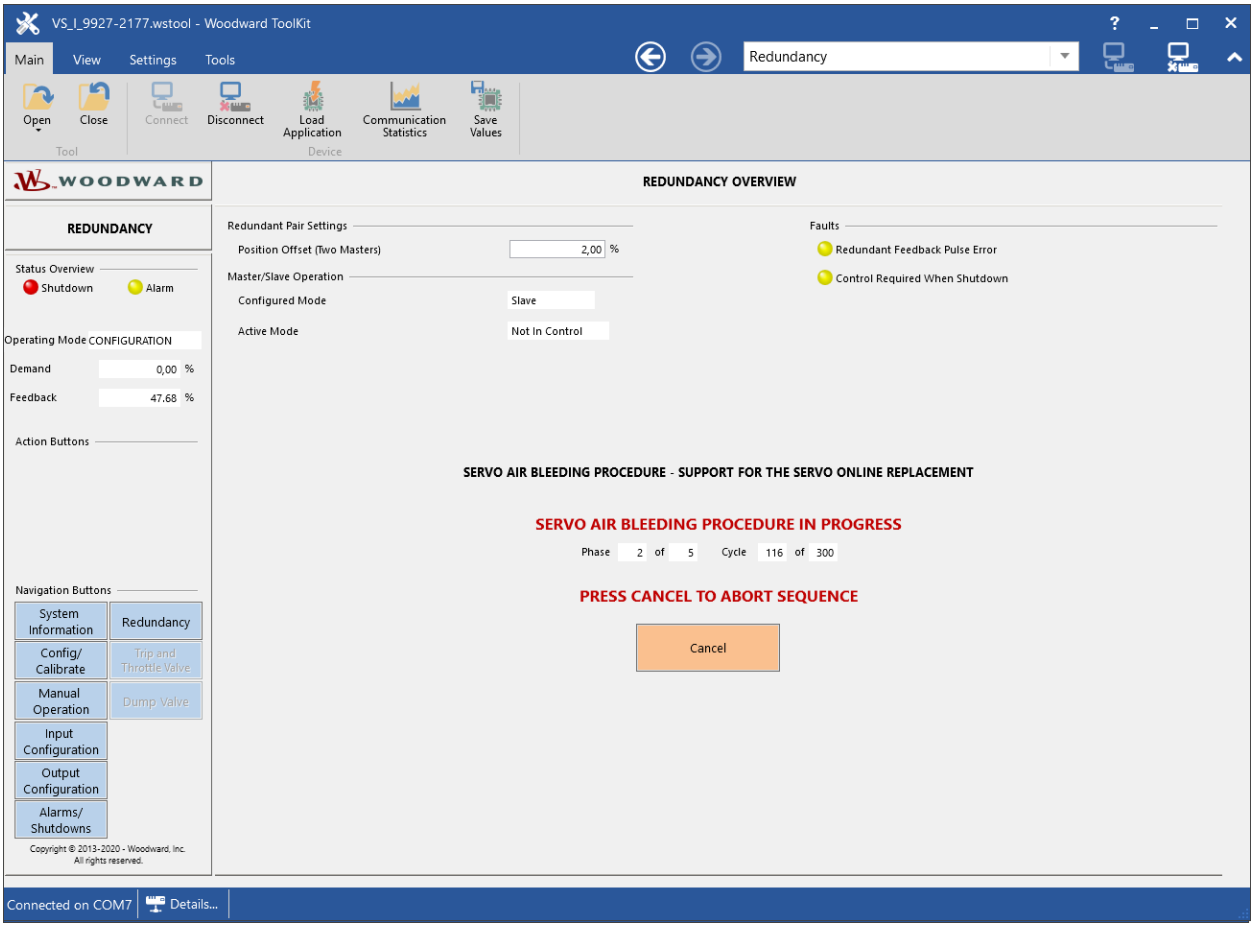


Figure 7-2. Servo Air Bleeding in Progress

During the servo air bleeding procedure, the progress is shown in the form of a phase and cycle count sequence. In case the air bleeding process needs to be terminated, press the “Cancel” button.

IMPORTANT

Servo air bleeding procedure takes about 20-30 minutes depending on the supply oil pressure. Please be patient, the progress of the procedure and confirmation of completion will be shown on the Customer Service Tool. When complete, the screen will transition to Figure 7-3.

Press OK to end the air bleeding sequence.

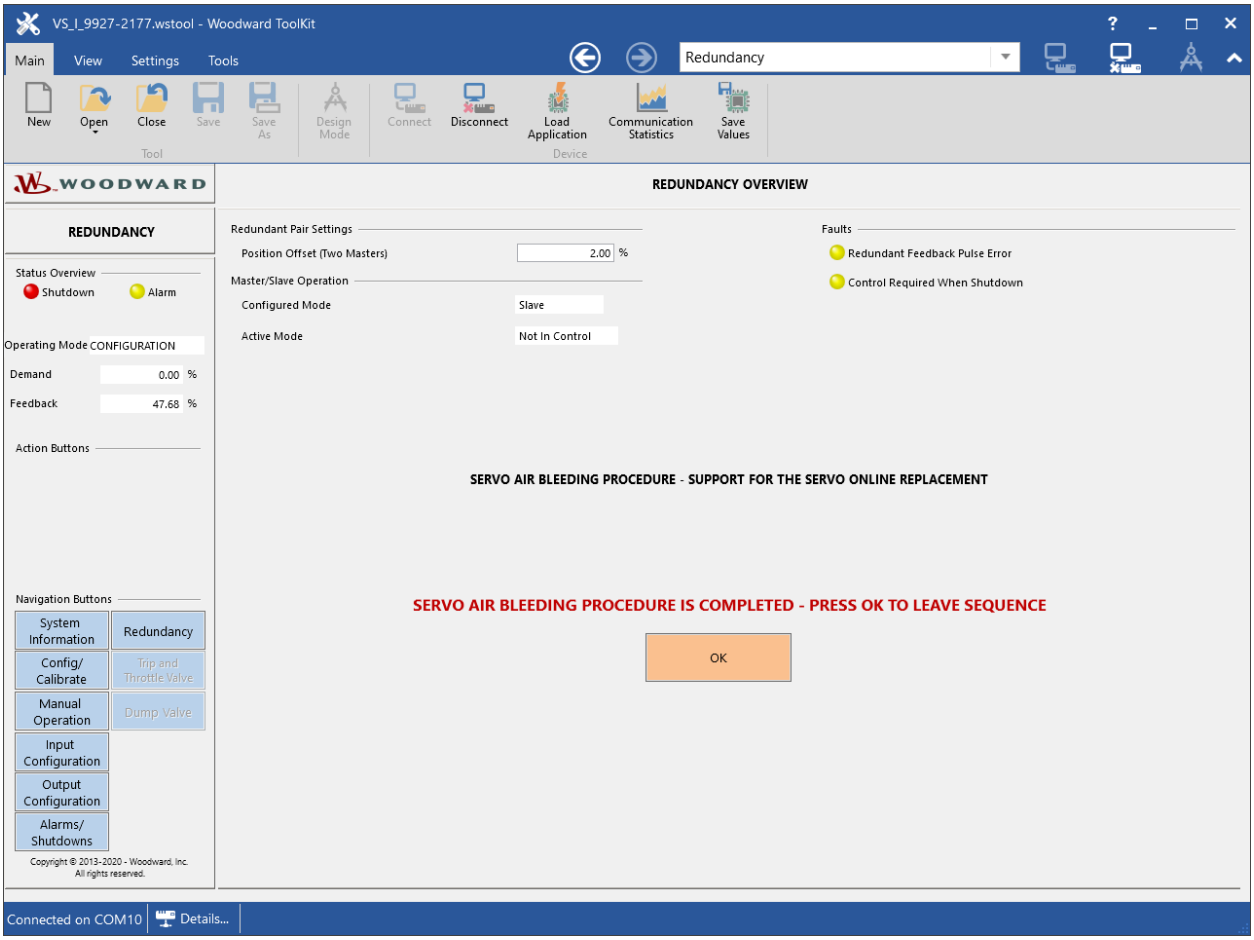


Figure 7-3. Servo Air Bleeding Completed

Chapter 8.
Monitoring and Troubleshooting

⚠WARNING

To prevent possible serious personal injury, or damage to equipment, be sure all electric power, hydraulic pressure, and rod end force have been removed from the actuator before beginning any maintenance or repairs.

⚠WARNING

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the VS-I actuator.

General

The VariStroke-I is warranted to be free from defects in materials and workmanship, when installed and used in the manner for which it was intended. For more information, see the contractual conditions.

It is recommended that all repairs and servicing of the VS-I be performed by Woodward or its authorized service facilities.

Use of a cable gland or stopping plug that does not meet the hazardous area certification requirements, thread form, or thread size will invalidate the suitability for hazardous locations.

Never remove or alter the nameplate as it bears important information, which may be necessary to service or repair the unit.

Troubleshooting

General

The following troubleshooting guide will help you isolate trouble with the servo valve, hydraulic power cylinder, control circuit board, wiring, and system problems. Troubleshooting beyond this level is recommended ONLY when complete facility control testing is available.

Troubleshooting Procedure

This table is a general guide for isolating system problems. In general, most problems are a result of incorrect wiring or installation practices. Make sure that the system wiring, input/output connections, controls and contacts are correct and in good working order. Complete the checks in order. Each check assumes completion of the preceding checks and correction of any problems.

⚠WARNING

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

⚠WARNING

EXPLOSION HAZARD—Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

⚠WARNING

ELECTRICAL SHOCK HAZARD—Follow all local plant and safety instructions/precautions before proceeding with troubleshooting the VS-I control.

WARNING

Properly connect the external ground lugs shown on the installation drawing to ensure equipotential bonding. This will reduce the risk of electrostatic discharge in an explosive atmosphere.

Table 8-1. VS-I General Troubleshooting Guide

Problem	Cause	Remedy
Shut down Detection: Shut down command sent by Customer Service Tool, analog demand out of range, digital communication protocols (CAN open), Run Enable, or diagnostic.	It is normal for this to occur when a shutdown position has been commanded from an external source, i.e., Customer Service Tool, digital communication, or discrete input. This is also normal when the analog demand signal has been turned off or set out of range.	Shut down the analog input(s) and restore them to a range within the normal 4-20 mA control range to initiate a reset. Ensure the VS-I has a valid demand signal.
	Unexpected command from digital communication.	Take away command and reset the VS-I for normal operation.
	Discrete input wiring problem.	Fix wiring problem.
	Run Enable configuration problem.	Ensure the used/not used settings inside the VS-I match the active/inactive settings of the controller. Settings can be modified using the Customer Service Tool. If the Run Enable is not used, disable this function using the Customer Service Tool.
	Critical alarm/diagnostic triggered a shut down	Using the Customer Service Tool, view the Alarms/Shutdowns page to determine the fault. Use the remainder of this chapter to determine the cause and solution to the fault.
	Position sensor loop power output overloaded (remote servo only)	Ensure position sensor wiring and power supply are connected correctly. See the “Cylinder Position Feedback Analog Inputs” chapter in the VS-I, VS-GI, or VS-DX manual
Alarm Detection: Alarm or shut down is detected.	Diagnostic triggered an alarm and/or shut down	Using the Customer Service Tool, view the Alarms/Shutdowns page to determine the fault. Use the remainder of this chapter to determine the cause and solution to the fault.

Table 8-2. VS-I Demand Faults

Problem	Cause	Remedy
Run Enable Line Low	Run Enable circuit is open or Run Enable configured incorrectly.	Ensure the used/not used settings inside the VS-I match the active/inactive settings of the controller. Modify settings using the Customer Service Tool. If the Run Enable is not used, disable this function using the Customer Service Tool.
Demand Invalid	All selected analog inputs are outside the specified range.	Check input source and connections.
Demand 1 or 2 Input Low Detection: The analog input is below the diagnostic threshold. This is a user configurable parameter (typically 2 mA).	Wiring is disconnected or loose.	Check terminals and connections.
	Short in wiring.	Check wiring for shorts to external voltages. Check wiring insulation.
	Control system 4 to 20 mA output has failed low.	Check the current to the analog input to the VS-I. Fix control system.
	Incorrect user configurable parameter in the electronics module for the min input diagnostic.	Verify the 4–20 mA diagnostic range low limit value using the VS-I Customer Service Tool.
	VS-I internal electronics failure.	Contact Woodward Technical Support for further assistance.
Demand 1 or 2 Input High Detection: The analog demand input is above the diagnostic threshold. This is a user configurable parameter (typically 22 mA).	Short in wiring to external voltage.	Check wiring for shorts to positive voltages.
	Control system 4 to 20 mA output has failed high.	Check the current to the analog input to the VS-I. Fix control system.
	Incorrect user configurable parameter in the electronics module for the max input diagnostic.	Verify the 4–20 mA diagnostic range high limit value using the VS-I Customer Service Tool.
	VS-I internal electronics failure.	Contact Woodward Technical Support for further assistance.
Demand Spread Alarm Detection: Demand inputs are configured to dual mode and one or both analog inputs are in range, however; the difference between the two signals is greater than the spread warning limit.	Incorrect input configuration and/or spread alarm limits	If dual demand signals are not being connected and used, set mode to single channel. When using dual demand signals, check source hardware and connections.
Linearization Table Order Incorrect	Demand linearization is not monotonically increasing.	Correct the table OR disable linearization.

Table 8-3. VS-I Power Supply Faults

Problem	Cause	Remedy
Power-up Reset Detection: CPU reset by a power-up event.	It is normal for the power-up reset diagnostic to be displayed upon power up of the VS-I.	Issue a reset to the VS-I.
	If this occurs while the VS-I is powered, and the diagnostic is set during a fast position transient, most likely the power infrastructure is not delivering the power needed.	During transient: Check terminal voltage at the VS-I during a 0-100% position transient, check wire gauge, fuses, or other resistive components in the power supply system.
Input Voltage Low	Input power level detected below reasonable limit.	Check power source and connections. If the battery voltage decreases slowly during power down, “Input Voltage Low” flag may be set.
Input Voltage High	Input power level detected above reasonable limit.	
(Remote Servo Only) Shut Down	Position sensor loop power overloaded due to wiring fault or failed sensor.	Check sensor current draw and ensure position sensor wiring and power supply are connected correctly. See the “Cylinder Position Feedback Analog Inputs” chapter in VS-I, VS-GI, or VS-DX manual.

Table 8-4. VS-I Feedback Faults

Problem	Cause	Remedy
Position 1 or 2 Feedback Low Detection: Power cylinder feedback 1 or 2 below low threshold (typically 2 mA).	Feedback sensor wiring fault or failed sensor channel.	Check all connections to the final cylinder, check for any impediment to motion. If problem persists, service will be required.
Position 1 or 2 Feedback High Detection: Power cylinder feedback 1 or 2 above high threshold (typically 21 mA).		
Position Feedback Spread Alarm Detection: The difference between the redundant power cylinder feedback signals is greater than the set limits.	Sensors incorrectly calibrated.	Complete one of the calibration procedures listed in Chapter 6 to recalibrate the sensors.
Both Position Feedbacks Failed Detection: Both power cylinder feedback signals are out of usable range.	Feedback sensor wiring fault or failed sensor channel(s).	Check all connections to the final cylinder; check for any impediment to motion. If problem persists, service will be required.
	Sensor temperature is too high. **Note:** This fault will typically clear after the actuator has cooled.	Ensure that the environment AND the mounting location are within the environmental specifications listed in VS-I, VS-GI, or VS-DX manual.

Problem	Cause	Remedy
Position Feedback 1 or 2 Readings are Negative or Much Greater 100% Detection: Customer Service Tool readings of Position Feedback 1 or 2.	Feedback sensor wiring fault or failed sensor channel(s).	Check all connections to the final cylinder; check for any impediment to motion. If problem persists, service will be required.
	Sensor temperature is too high. **Note:** This fault will typically clear after the actuator has cooled.	Ensure that the environment AND the mounting location are within the environmental specifications listed in VS-I, VS-GI or VS-DX manual.
Stroke / Position in Customer Service Tool Does Not Match Actual Stroke / Position Detection: Compare actual measurements (using external measurement device) with % feedback as shown in the VariStroke Customer Service Tool.	Incorrect “Position Sensor Length” input to Customer Service Tool.	Ensure that the “Position Sensor Length” input to the Customer Service Tool equals the full 4–20 mA range of the position sensor.
	Position sensor requirements for accuracy and linearity are not fulfilled.	If greater accuracy is desired, consider replacing the cylinder position sensor with a more accurate sensor.
Redundant Feedback Pulse Error Detection: Faulty redundant communication input (only VariStroke-DX)	No pulse on redundant feedback input, the input is not connected, shorted to ground, or supply, received signal is not recognized. Another servo not energized.	Check connection link between redundant units. Check continuity and insulation Verify condition of the other servo.
Control Required When Shutdown Detection: Redundancy logic commands the unit to take over control, but shutdown is active for other reason (only VariStroke-DX)	Unit in shutdown state while second unit status is faulty, or communication line does not work (status of the second unit unknown). Both units faulty.	Bring back unit to control if shutdown was commanded (Run Enable-closed/energized, Analog Demand >= 4mA). Verify condition of the other servo.

Table 8-5. VS-I Temperature Faults

Problem	Cause	Remedy
Temperature Derating Active	Current limits reduced because of high temperature. Limits will automatically reset.	Reduce ambient temperature to within specification limits.
Temperature Sensor High Detection: The control board temperature sensor indicates a temperature above operational limit.	The ambient temperature of the electronics module is higher than allowed by specification.	
	The temperature sensor is defective.	Contact Woodward Technical Support for further assistance.
Temperature Sensor Low Detection: The control board temperature sensor indicates a temperature below operational limit.	The ambient temperature of the electronics module is lower than allowed by specification.	Increase ambient temperature to within specification limits.
	The temperature sensor is defective.	Contact Woodward Technical Support for further assistance.
Electric Servo Temp High Detection: The servo electric motor temperature sensor indicates a temperature above operational limit.	The ambient temperature of the electronics module is higher than allowed by specification.	Reduce ambient temperature to within specification limits.
	The temperature sensor is defective.	Contact Woodward Technical Support for further assistance.
Electric Servo Temp Low Detection: The servo electric motor temperature sensor indicates a temperature below operational limit.	The ambient temperature of the electronics module is lower than allowed by specification.	Increase ambient temperature to within specification limits.
	The temperature sensor is defective.	Contact Woodward Technical Support for further assistance.

Table 8-6. Performance Faults

Problem	Cause	Remedy
Spring Check Failed Detection: Startup test showed a detected failure of the servo valve safety return spring.	Weak power supply	Verify the power supply has sufficient current capability. Service is required.
	Broken return spring	
	Servo valve seizure	
Servo Tracking Alarm Detection: The servo valve is unable to maintain position within the tracking error alarm limits. This will trigger an alarm. **Servo Tracking Fault** Detection: The servo valve is unable to position within the tracking error fault limits. This will trigger a shut down	Contamination in the valve/actuator system	Ensure oil supply meets cleanliness requirements. Replace/filter the oil and flush the valve with clean oil. If problem persists, service may be required.
	Excessive valve/actuator wear	Service is required.
	VS-I electronics failure	Contact Woodward Technical Support for assistance.
Cylinder Tracking Alarm Detection: The power cylinder is unable to position within the tracking error alarm limits. This will trigger an alarm. **Cylinder Tracking Fault** Detection: The power cylinder is unable to position within the tracking error fault limits. This will trigger a shut down	Seized control valve / linkage	Ensure that the force required to move the valve and linkage does not exceed the VariStroke force limits at the operating hydraulic pressure level. Refer to mechanical manual VS-I or VS-GI for more details.
	Excessive thermal growth in control valve linkage	Lower the ambient temperature of the VariStroke and/or linkage. If this is not possible, consider extending tracking limits or disabling this diagnostic.
	Contamination in the valve/actuator system	Ensure oil supply meets cleanliness requirements. Replace/filter the oil and flush the valve with clean oil. If problem persists, service may be required.
	Excessive valve/actuator wear	Service is required.
	Faulty/erratic position sensor feedback	Check all connections to the final cylinder, check for any impediment to motion. If problem persists, service will be required.
Incorrect Stroke Length Error Detection: The maximum stop position has been set to less than 40% of the physical cylinder length.	Incorrect cylinder or position sensor configuration OR incorrect calibration limits	Ensure that calibrated maximum stop position is greater than 40% of the physical cylinder length and sensor length. Check that the settings in the remote cylinder setup are correct.

Problem	Cause	Remedy
Performance Index Warning Detection: The settings for supply pressure, offset at minimum position, and maximum stop position result in a violation of the performance relationship.	Incorrect configuration and calibration settings. The VS-I servo valve is too large for the set cylinder volume.	See the “Performance Index” chapter in the VS-I or VS-GI manual for the details of this alarm.
Slow Slew Rates	Loss or reduction in hydraulic supply pressure Applied load on the actuator is too high. Excessive wear of actuator/linkage/valve	Ensure that hydraulic pressure does not drop more than 10% of its nominal value during a full slew. Consider adding a high-volume hydraulic accumulator to the supply line. See the “Hydraulic Specifications” chapter in the VS-I or VS-GI manual. Verify mechanical condition of actuator/linkage/valve.
Cylinder Position Oscillation Detection: Unstable output cylinder shaft control with constant input demand setting	Hydraulic fluid flow not sufficient.	Verify hydraulic system capability. Refer to mechanical manual VS-I, VS-GI, or VS-DX for more details.
	Oil filter restricting flow	Clean and replace the hydraulic system filter.
	Air present in hydraulic system	Purge air from the system by cycling the demand signal up and down several times when turbine is shutdown. Check hydraulic supply and control line piping for areas where air could be trapped and change piping to correct if needed. Install syphon in drain line if needed (to be considered for remote cylinder applications).
	Drain line under pressure	Remove all flow restrictions from drain line, install larger drainpipe if needed. Refer to mechanical manual VS-I, VS-GI, or VS-DX for more details.
	Single acting actuators only – spring/valve closing load/force too weak	Check if the return spring and valve force is in proper range to close actuator/valve effectively. Refer to mechanical manual VS-I, VS-GI, or VS-DX for more details.

Table 8-7. Internal Faults

Problem	Cause	Remedy
Electronics Fault	An internal error has occurred in the driver.	Service required.

Chapter 9.
Trend Charts

Trend Plot Control

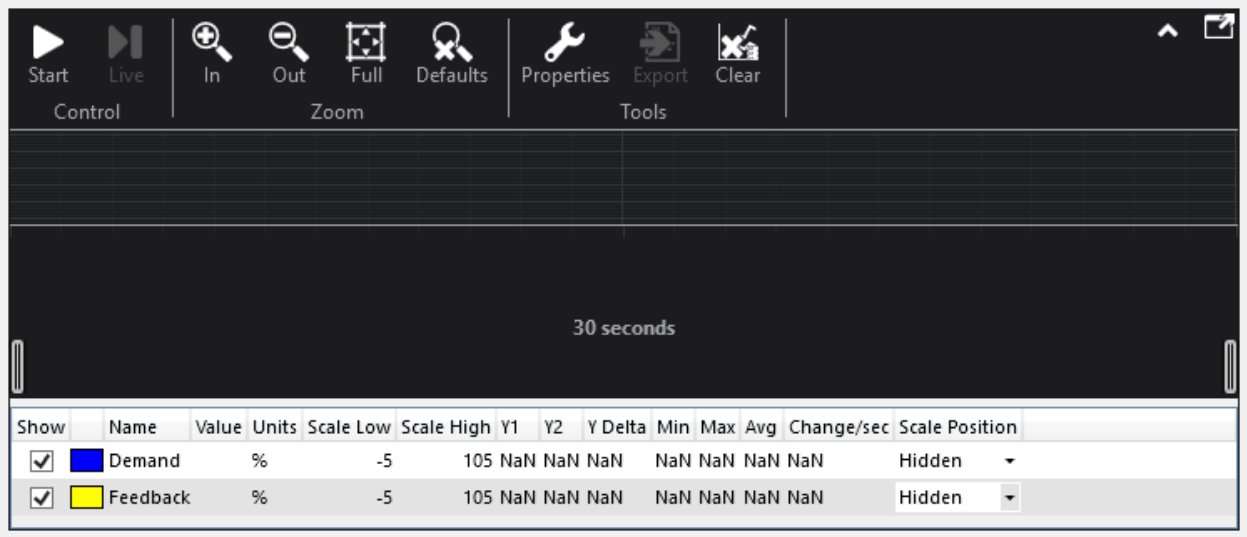


Figure 9-1. Trend Plot

The trend plot displays the time varying values of demand and feedback position.

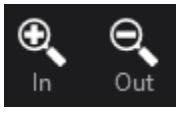
Trend Plot

Start - To start the trend plot, press the Start arrow.

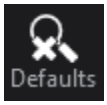
Stop - To stop and hold the current display, press the “Stop” button.
Freeze - The user can freeze the trend chart's display without stopping the data collection. To freeze the display, click the **Freeze** button on the trend chart toolbar. To resume display of the live data, click on the **View Live** button on the toolbar.

Zooming

The trend chart allows zooming on the plot data. There are multiple ways to zoom the plot data.

1. 

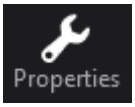
Click on the **In** or **Out** buttons on the toolbar to zoom in or out.
2. 

Click on the zoom **Full** button to zoom out to the extents of the plot data.
3. 

Click on the zoom **Defaults** button on the toolbar to zoom to the default settings in the trend chart and plot properties.
4. To zoom a region on the plot surface, click and drag in the plot surface to select the region to be zoomed into.

5. To zoom in on only the time direction, hold the **Shift** key and click and drag left or right in the plot surface to select the region to be zoomed into.
6. To zoom in on only the plot range direction, hold the **Ctrl** key and click and drag up or down in the plot surface to select the region to be zoomed into.
7. Click and drag one of the grab handles on the scroll bar and drag the handle left or right to select the region to be zoomed in or out.
8. Double click anywhere on the plot surface to zoom out to the extents of the plot data.
9. Click and drag anywhere on the time span below the plot surface to zoom in or out in the time direction.
10. If a plot scale is displayed, click and drag anywhere on the plot scale next to the plot surface to zoom in or out in the plot range direction.

Trend Properties

Trend properties can be changed. Click the Properties 

button to open the Trending Properties window.

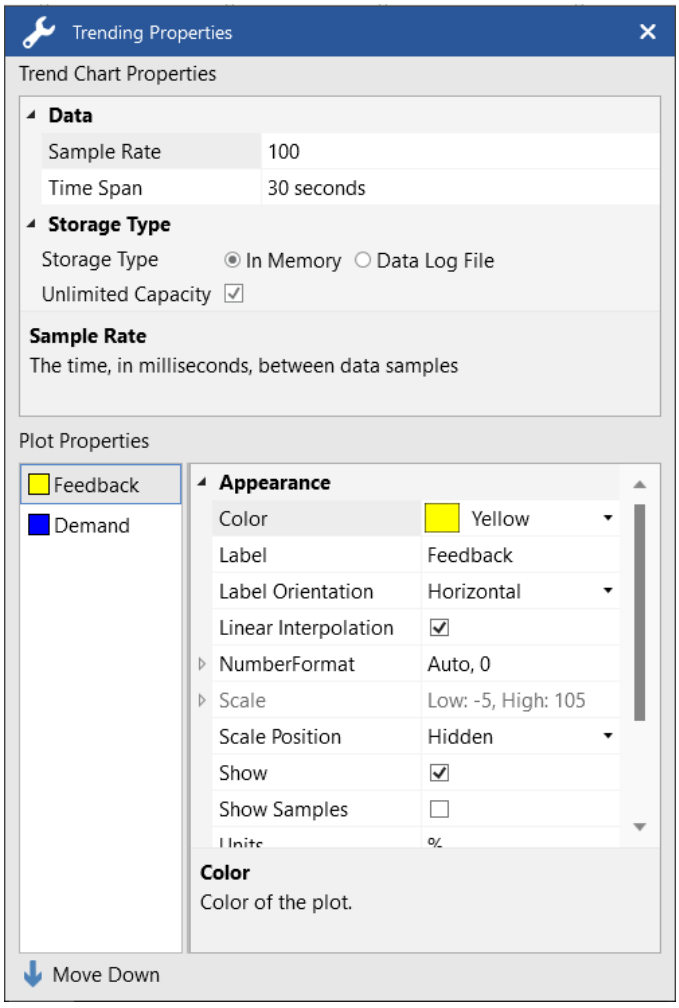


Figure 9-2. Trending Properties Window

From this window the trend time span, sample rate, pen colors, high and low range scaling, and number format can be changed.

Checking the **Show Samples** option causes the trend plot to display only the values collected from device. Only the separated points will be displayed, the values between the points will not be extrapolated as solid lines.

Click **Color** to select a different plot color for the highlighted plot.

Export

The trend chart component allows you to export the trend values that are currently visible in the plot surface to an html (.htm) file for use in other programs. To export trend values:

1. Stop plotting.
2. Click on the 

Export button on the toolbar.
3. Select or type the desired file name in the **Save Dialog**.
4. Click the **Save** button on the **Save Dialog**.

Clear All Trend Values

All the values for every plot can be cleared out of the trend, as well as the data log, by clicking the 

Clear Data button on the toolbar. A prompt will be displayed informing that all the data will be lost.

Creating a Custom Trend (Trend on the Fly)

The Customer Service Tool allows you to trend any parameter value even if a trend chart is not part of the tool.

To trend on the fly:

1. Right mouse click on the component containing the parameter value you wish to trend.
2. Left mouse click the **Add to trend** pop-up menu item.

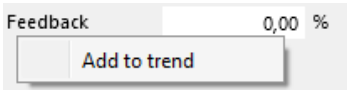


Figure 9-3. Adding Selected Parameter to Trend Chart

3. The **Trending** window will open with the parameter value just selected.
4. To add additional parameters to the trend, repeat steps 1 and 2 for each parameter.

Chapter 10.
Settings Files

Save Device Settings to a File

1. Connect to the device. For the connection procedure, refer to Chapter 3 “Connecting to VariStroke”.
2. From the main Customer Service Tool window, click the **Settings** ribbon tab then select **Save from Device**.

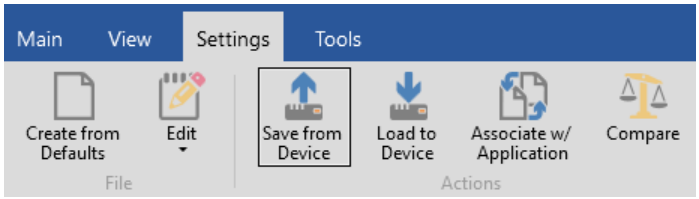


Figure 10-1. Save from Device Icon Location

3. Follow the steps in the Save Settings Wizard.
   3.1 Select existing or type a new file name for the settings to be saved. Press the “Next” button.

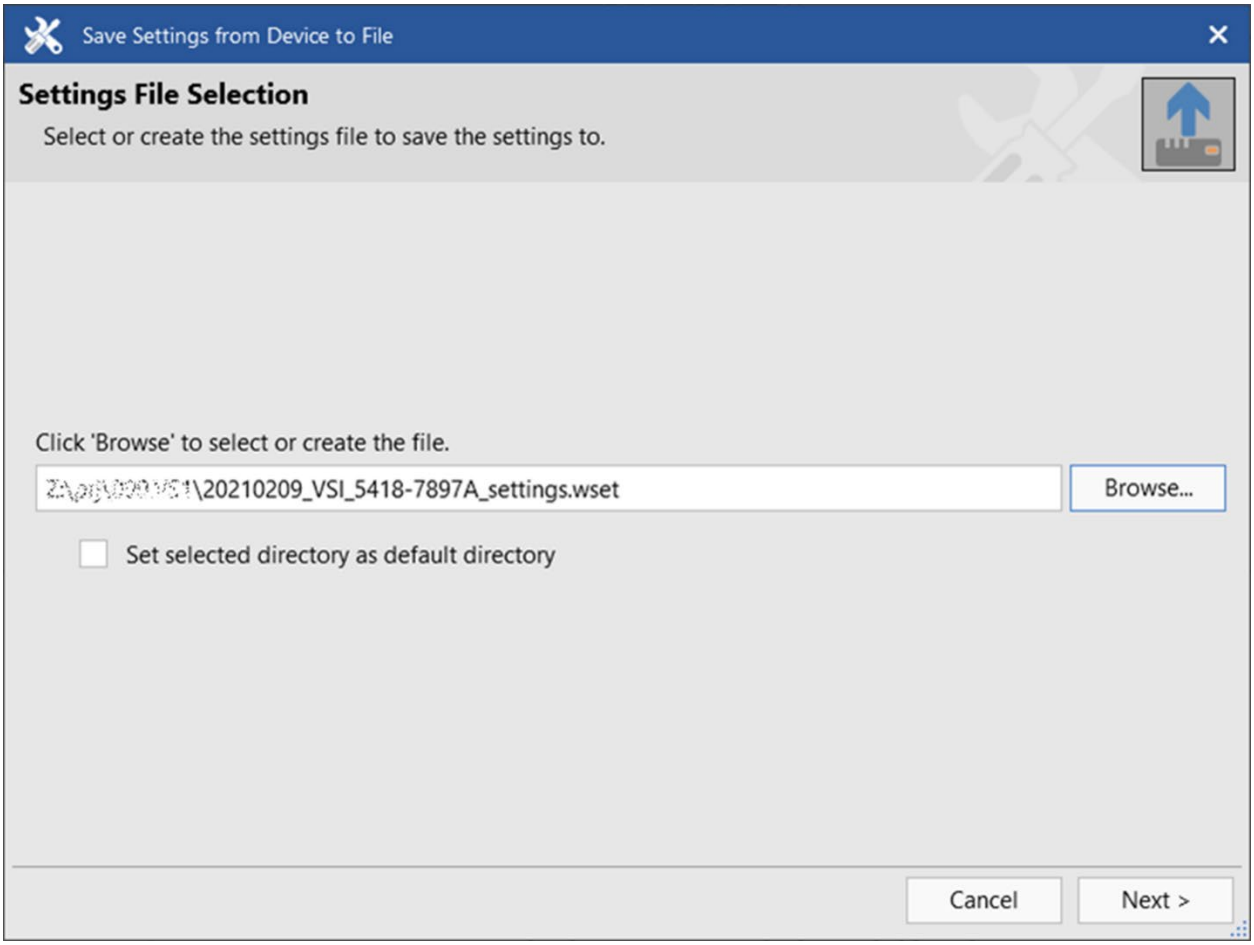


Figure 10-2. Save from Device - File Selection

   3.2 Write settings file notes (optional). Pressing the “Next” button will start the transfer of the settings to file.

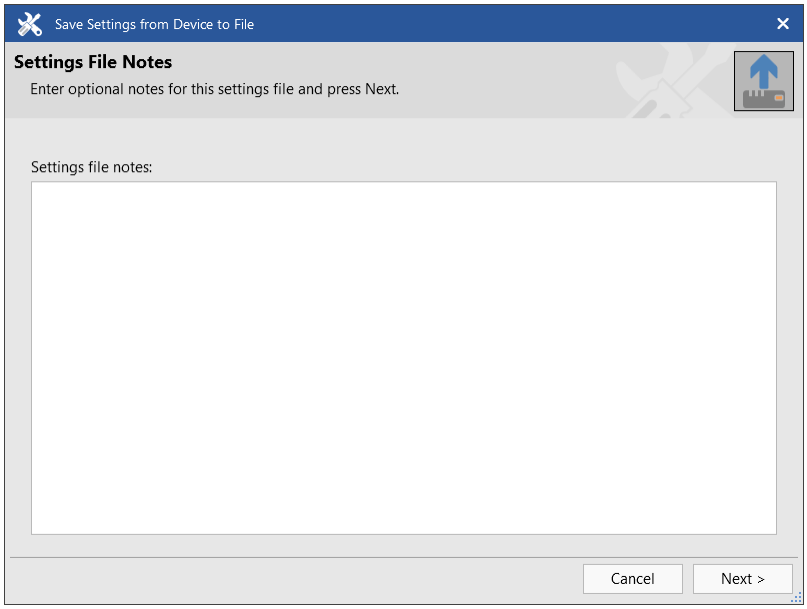


Figure 10-3. Save from Device - File Notes

3.3 Close the wizard window when the procedure for saving settings is finished.

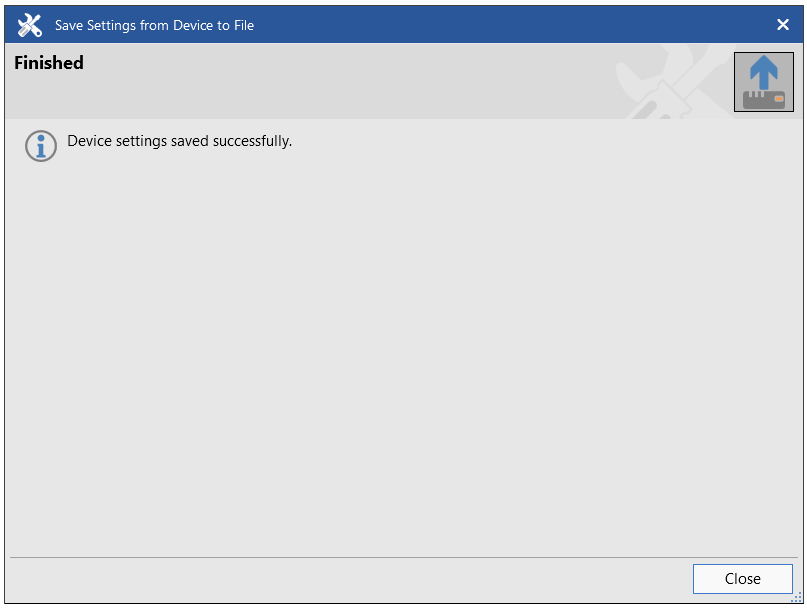


Figure 10-4. Save from Device - Complete

An error while saving a single setting does not stop subsequent settings from being saved; the save operation continues. If an error occurs while reading settings from the device, the Customer Service Tool continues to read the remaining settings, the user is informed that the save process has failed, and detailed error messages are created in the diagnostics log.

Load Settings into a Device

1. Connect to the device. For the connection procedure, refer to Chapter 3 “Connecting to VariStroke”.
2. From the main Customer Service Tool window, click the **Settings** ribbon tab then select the **Load to Device** icon.

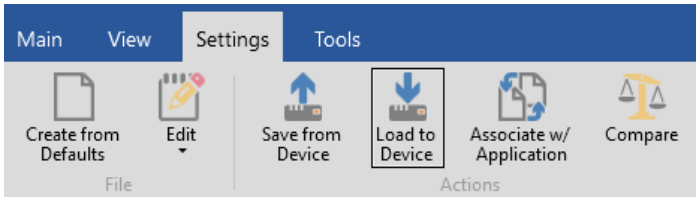


Figure 10-5. Load to Device Icon Location

3. Follow the steps in the Load Settings Wizard.
   3.1 Select the settings file to load and press the “Next” button.

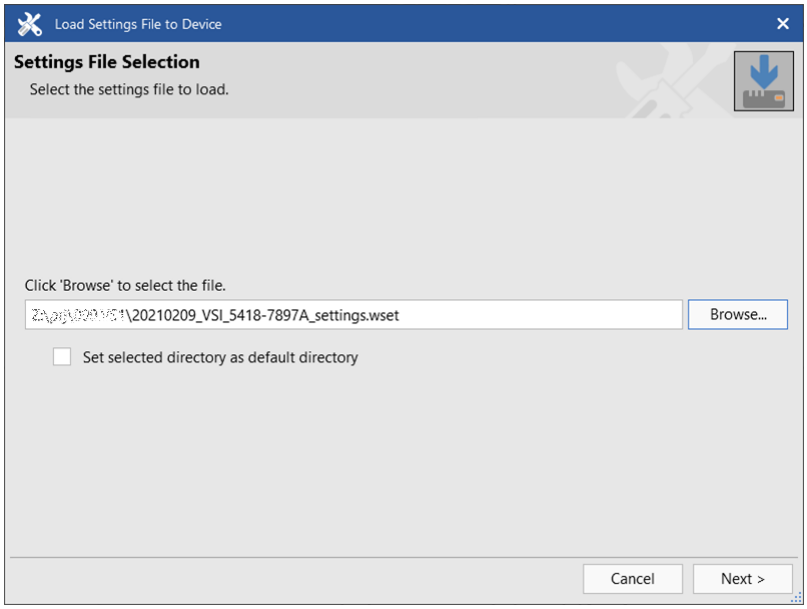


Figure 10-6. Load to Device - File Selection

   3.2 Before file upload, the safety warning is displayed:

“The device will be I/O locked while settings are loaded. Verify that the device and what it is controlling are in the safe state before proceeding. Failure to do so may result in personal injury or damage an equipment.”

To proceed with uploading press the “Next” button.

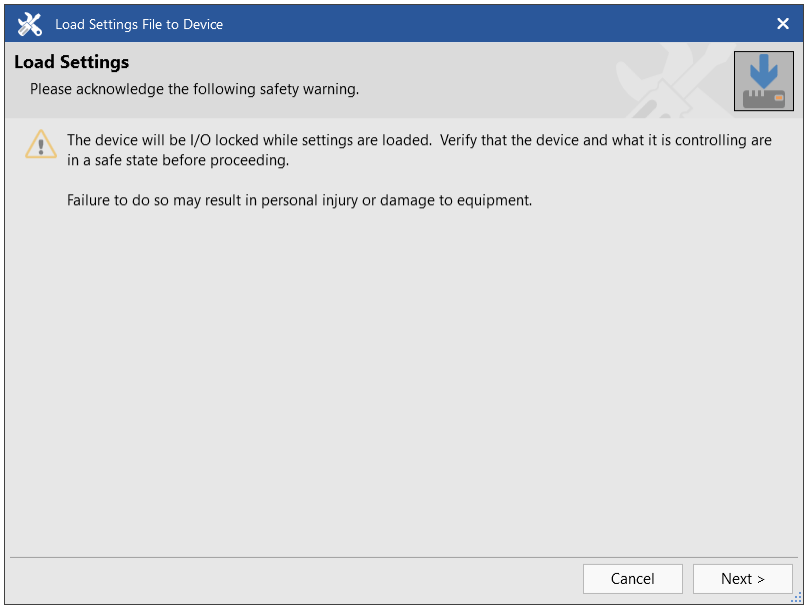


Figure 10-7. Load to Device - Warning

3.3 Close the wizard window when Load Settings is finished.

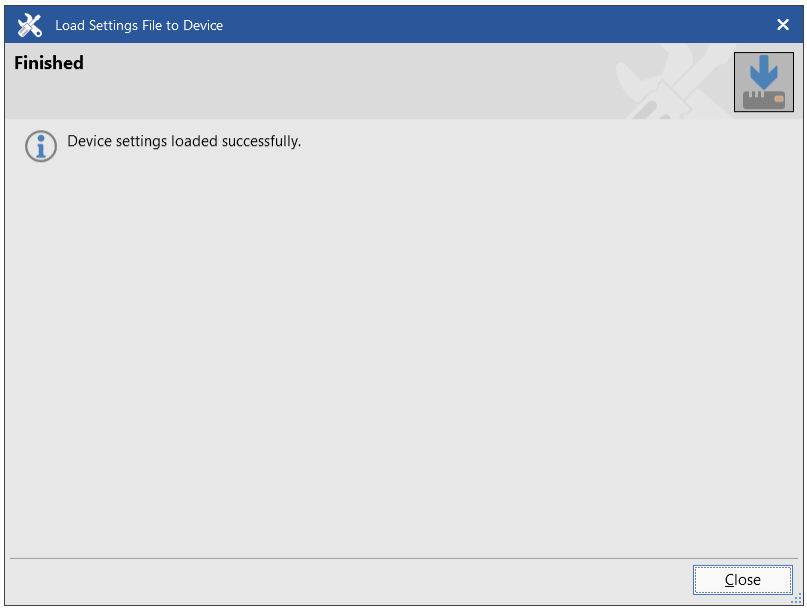


Figure 10-8. Load to Device - Complete

An error while loading a single setting does not stop subsequent settings from being loaded; the load process proceeds to completion. If an error occurs while writing settings to the device, the user is informed that the write had failures and detailed error messages are created in the diagnostics log.

View / Edit / Create Settings File Contents

VS-I settings files are NOT viewable/editable. They also cannot be created from default parameter values using main menu Settings -> Create from Defaults. This is an intended behavior. Settings can be modified only by changing them using Load Settings into a Device and Save Device Settings to a File (refer to respective sections above in this Chapter). Any attempt to edit the settings file (by choosing the settings file from menu Settings -> Edit) will result with the message box:

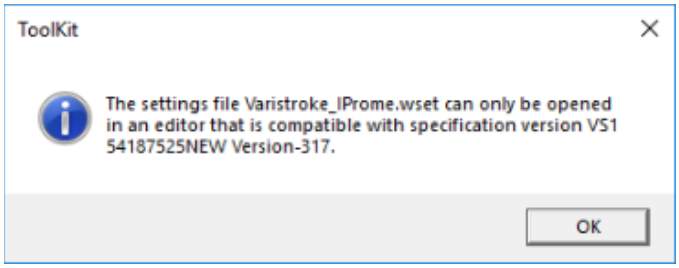


Figure 10-9. Setting File Edition Error

Compare Settings Files

1. From the main Customer Service Tool window, click the **Settings** ribbon tab then select the **Compare** icon.

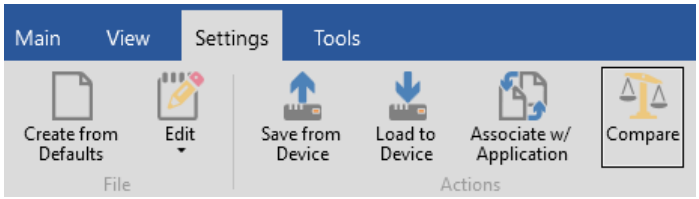


Figure 10-10. Compare Icon Location

2. A settings file selection dialog will appear that allows you to select the files to be compared.
3. Select the files to be compared.

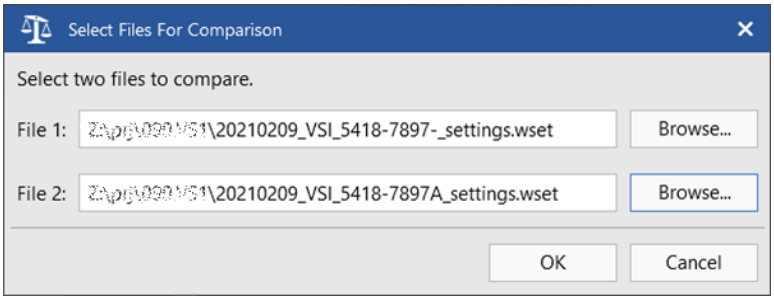


Figure 10-11. Setting Files Comparison - Files Selection

4. The Settings Differences dialog will display.
5. The **Value Differences** tab displays all the value differences.

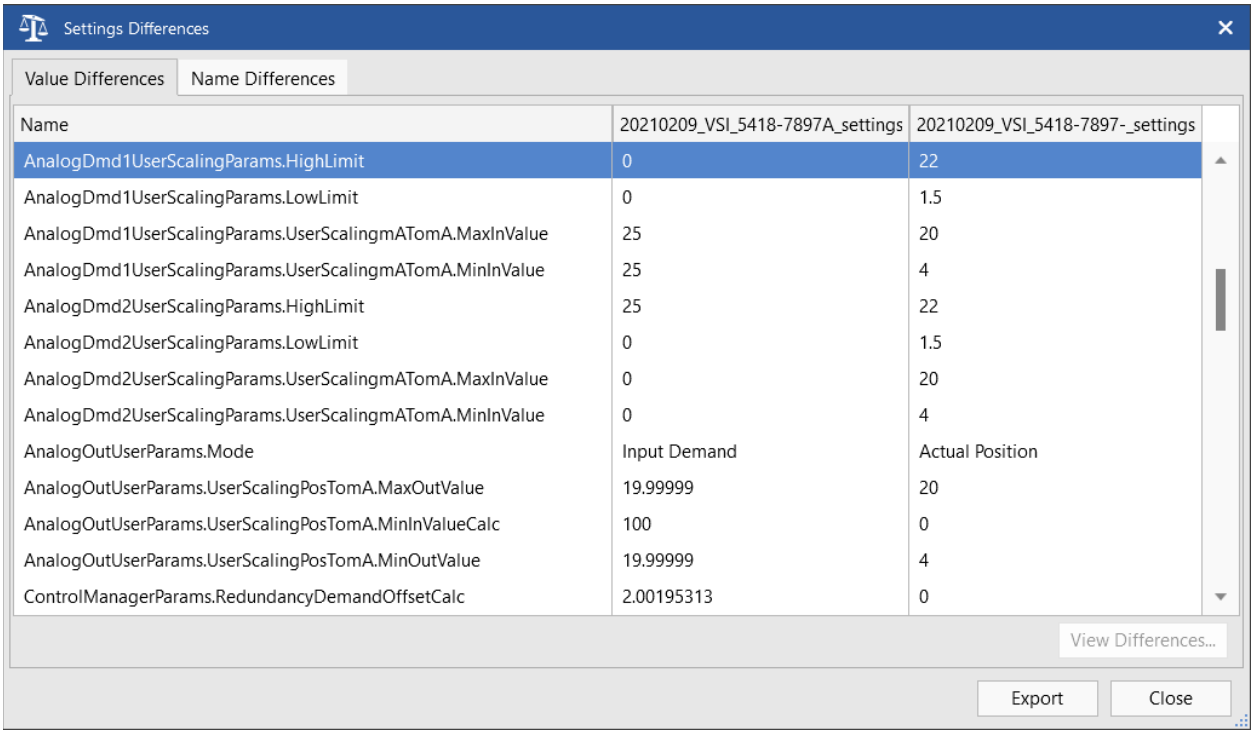


Figure 10-12. Setting Files Comparison - Value Differences

6. The Name Differences tab displays the parameters that are different in the two files. The tab identifies which parameters are missing in one file that are present in the other.

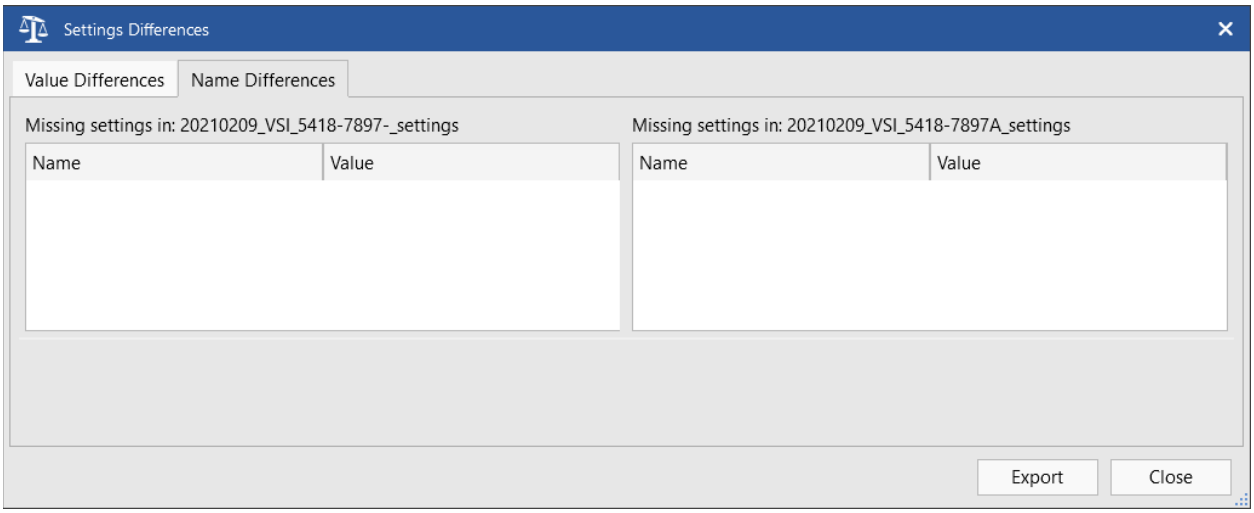


Figure 10-13. Setting Files Comparison - Name Differences

7. Export Differences

The differences resulting from comparing two settings files can be exported to an html file that can be easily viewed with a web browser or Excel. Colored formatting makes it easy to see differences in complex data. To export the differences, click the **Export** button on the Settings Differences Dialog and select the export file name.

Chapter 11.
Product Support and Service Options

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.

A current list of Woodward Business Partners is available at:
https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner

Product Service Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- Return authorization number
- Name and location where the control is installed
- Name and phone number of contact person
- Complete Woodward part number(s) and serial number(s)
- Description of the problem
- Instructions describing the desired type of repair

Packing a Control

Use the following materials when returning a complete control:

- Protective caps on any connectors
- Antistatic protective bags on all electronic modules
- Packing materials that will not damage the surface of the unit
- At least 100 mm (4 inches) of tightly packed, industry-approved packing material
- A packing carton with double walls
- A strong tape around the outside of the carton for increased strength

NOTICE

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

Replacement Parts

When ordering replacement parts for controls, include the following information:

- The part number(s) (XXXX-XXXX) that is on the enclosure nameplate
- The unit serial number, which is also on the nameplate

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at **https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner**

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **https://www.woodward.com/support**, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (32) 422-5551
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (32) 422-5551
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (32) 422-5551
The Netherlands	+31 (23) 5661111
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number

Prime Mover Information

Manufacturer _____

Turbine Model Number _____

Type of Fuel (gas, steam, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Revision History

Changes in Revision C—

- Updated Figure 5-2
- Added Figure 5-3
- Added description of new field - Demand from Discrete Inputs in Chapter 5
- Updated Figure 5-21, Figure 5-22, and Figure 5-23
- Added new descriptions, Warning, and Important boxes under Internal Status section related to configuration of Internal Faults resulting action in Chapter 5
- Added Modes, Types, Cylinder Dimensions descriptions related to updated Config/Calibrate screen in Chapter 6
- Updated Figure 6-1 and Figure 6-3
- Updated service and support sections in Chapter 11

Changes in Revision B—

- Updated system requirements in Chapter 2
- Updated Figure 5-2, Figures 5-8a through 5-8h, and Figure 5-20
- Added new Warning, Notice, and Important boxes throughout the manual
- Added Feedback Thresholds to Chapter 5
- Added additional rows to Table 8-6

Changes in Revision A—

- Replaced all original screenshots
- Added new chapters Trend Charts and Settings Files
- Reformatted Tables 1-1 and 1-2
- Replaced Manual 35133 reference with CMM-03013 in Table 1-2
- Replaced MS .NET Framework version and screen resolution values
- Added Toolkit Version
- Added Important box to pg. 25
- Added multiple figures to Chapter 5.
- Added new content below Dump Valve Configuration heading.
- Added new content including three figures above Switch to Manual Mode section.
- Added new Important box below Manual Operation section
- Added content including new figure above the Alarms/Shutdowns section
- Added new figures in Chapter 6.
- Added two new Important Boxes above Find Minimum Stop
- Added two Important Boxes below Find Minimum AND Maximum Stops
- Added new content above Manual Operation Section
- Added new figure to Chapter 7

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We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 35148.

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Complete address / phone / fax / email information for all locations is available on our website.