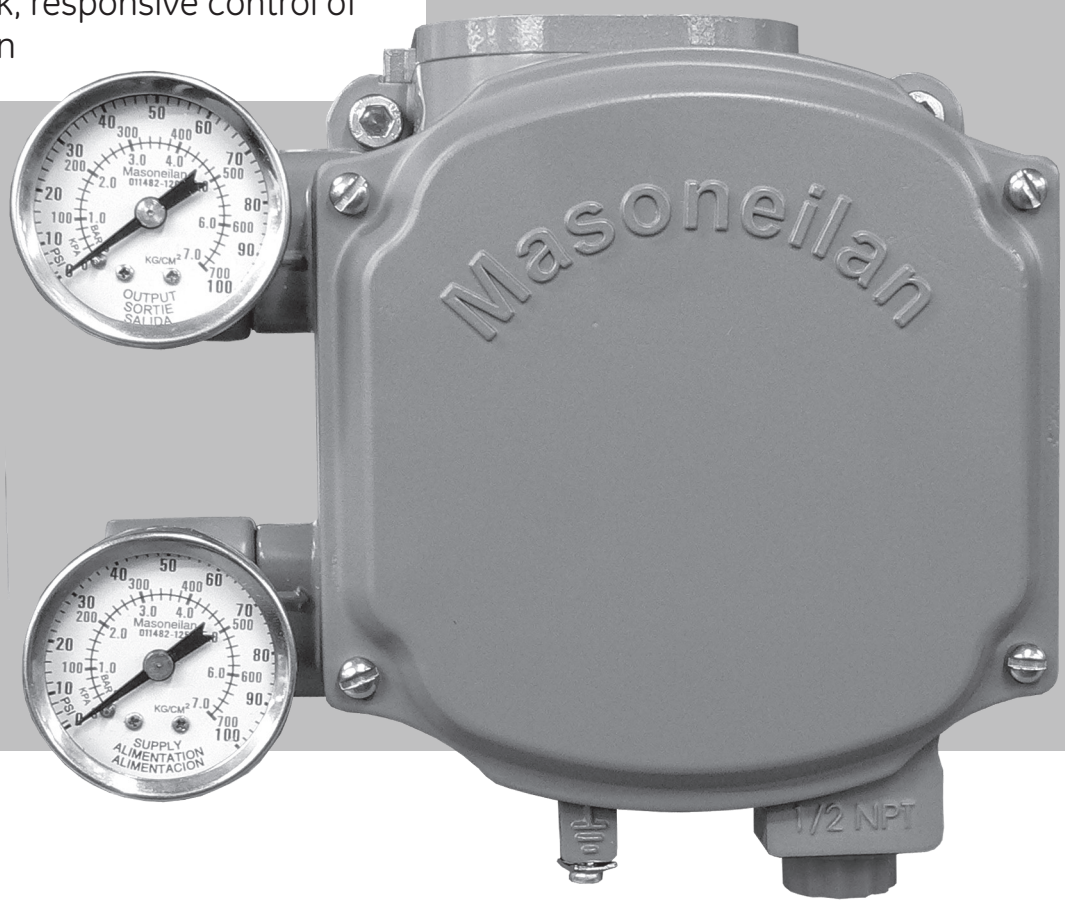
GE Energy

Masoneilan* Valves SVi*1000 Positioner Instruction Manual

Electro-pneumatic Positioner

- Extreme accuracy and reliability
- Precise, quick, responsive control of valve position



imagination at work

Warranty

Items sold by GE Energy are warranted to be free from defects in materials and workmanship for a period one (1) year from first use or eighteen (18) months from delivery provided said items are used according to GE recommended usages. GE reserves the right to discontinue manufacture of any product or change product materials, design or specifications without notice.

Software is warranted for ninety (90) days from delivery.

This instruction manual applies to the following instruments and approved software: SVI* II AP Positioner and ValVue* software.

The SVi1000 positioners are warranted for use only with interface software approved by GE. Consult GE factory locations for approved software listing.

About this Guide

This instruction manual applies to the following instruments and approved software:

- SVi1000*
  - with Firmware version 1.1.1
  - with ValVue version 2.70 or greater
  - with AMS* ValVue SNAP-ON* version 2.4 or greater
  - with ValVue PRM Plug-in
  - with Model HH375 HART* Communicator with DD published for SVi1000

The information in this manual is subject to change without prior notice.

The information contained in this manual, in whole or part, shall not be transcribed or copied without GE's written permission.

In no case does this manual guarantee the merchantability of the positioner or the software or its adaptability to a specific client needs.

Please report any errors or questions about the information in this manual to your local supplier or visit www.masoneilan.com.

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PN 720013363-779-0000 Rev. A

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Safety Information

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This section provides safety information and defines the documentation symbols.

Documentation Symbols

SVi1000 instructions contain **WARNINGS**, **CAUTIONS** labels and **Notes**, where necessary, to alert you to safety related or other important information. Read the instructions carefully before installing and maintaining your instrument. Total compliance with all **WARNING**, and **CAUTION** notices is required for safe operation.

WARNING

Indicates a potentially hazardous situation, which if not avoided could result in serious injury.

CAUTION

Indicates a potentially hazardous situation, which if not avoided could result in property or data damage.

NOTE

Indicates important facts and conditions.

SVi1000 Product Safety

For SVi1000 positioners intended for use with industrial compressed air: Ensure that an adequate pressure relief provision is installed when the application of system supply pressure could cause peripheral equipment to malfunction. Installation must be in accordance with local and national compressed air and instrumentation codes.

General installation, maintenance or replacement

- ❑ Products must be installed in compliance with all local and national codes and standards by qualified personnel using safe site work practices. Personal Protective Equipment (PPE) must be used per safe site work practices.
- ❑ Ensure proper use of fall protection when working at heights, per safe site work practices. Use appropriate safety equipment and practices to prevent the dropping of tools or equipment during installation.
- ❑ Under normal operation, compressed supply gas is vented from the SVi1000 to the surrounding area, and may require additional precautions or specialized installations.

Intrinsically Safe Installation

Products certified for use in intrinsically safe installations *MUST BE:*

- ❑ Installed, put into service, used and maintained in compliance with national and local regulations and in accordance with the recommendations contained in the relevant standards concerning those environments.
- ❑ Used only in situations that comply with the certification conditions shown in this document and after verification of their compatibility with the zone of intended use and the permitted maximum ambient temperature.
- ❑ Installed, put into service and maintained by qualified and competent professionals who have undergone suitable training for instrumentation used in such areas.

WARNING *Before using these products with fluids/compressed gases other than air or for non-industrial applications, consult GE. This product is not intended for use in life support systems.*

WARNING *Do not use damaged instruments.*

WARNING *Installation in poorly ventilated confined areas, with any potential of gases other than oxygen being present, can lead to a risk of personnel asphyxiation.*

Use only genuine replacement parts which are provided by the manufacturer, to guarantee that the products comply with the essential safety requirements of the European Directives.

Changes to specifications, structure, and components used may not lead to the revision of this manual unless such changes affect the function and performance of the product.

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Introduction

2

About This Manual

The SVi1000 Instruction Manual is intended to help an experienced field technician efficiently install and setup an SVi1000. If you experience problems that are not documented in this guide, call your local GE representative, go to www.masoneilan.com, contact our helpdesk at (+1) 508-427-8999 or email svisupport@GE.com. Sales offices are listed on the last page of this document.

The SVi1000 is a high performance, digital valve positioner that combines a local display with remote communication and diagnostic capabilities. The SVi1000 offers a multitude of options that fulfills the broadest range of applications. It also communicates using the HART protocol.

The local user interface and LEDs enables local operations of calibration and configuration functions. Remote operations can be performed with ValVue software or any HART Registered host interface that has been pre-loaded with the Device Description file (DD) for SVi1000.

This section gives an introduction to the positioner and its components.

The SVi1000 is provided with GE's ValVue software.

Conventions Used in This Manual

Conventions used in this manual are as follows:

- ❑ Uppercase, *italicized* letters are used when referencing a term used in the SVi1000 display window. For example, when indicating the term *mode*, as in setup mode, and referring to the display/software operation the convention is to spell mode is all uppercase letters: *MODE*.
- ❑ Italics is used for emphasis on important items.
- ❑ Fields where data is entered or user-entered data is *italicized*.
- ❑ Actions performed on buttons, checkboxes, etc. appear bolded. For example: Click **Done**.

ValVue Software

ValVue Lite

ValVue Lite software is shipped with each SVi1000 for positioner calibration and configuration. ValVue Lite software is freeware and does not require any registration. It provides functions to properly set up and start up an SVi1000 positioner on any type of control valve.

System Requirements

ValVue Lite runs on IBM compatible computers. Minimum requirements for all versions of ValVue software are Windows 2002 Server, Windows 2008 Server, XP, Windows 7, Windows Vista, 64 MB RAM, serial or USB port connected to a HART modem, and a CD-ROM drive.

ValVue Trial Version

The SVi1000 is provided with a trial version of ValVue. For 60 days after the initial installation, ValVue provides the capability of configuring, calibrating, diagnosing, cloning, trending and much more. After the 60 trial period ValVue must be registered for use.

ValVue is a user-friendly, graphical interface that allows an efficient setup of an SVi1000 mounted on any control valve assembly. Because of its What-You-See-Is-What-You-Get (WYSIWYG) software environment, it is a very simple user-interface.

ValVue functionality includes:

- ❑ Setup Wizard
- ❑ Remote display of valve position, actuator pressure (s)
- ❑ Set calibration parameters
- ❑ Set configuration parameters
- ❑ Monitor status/error indicators
- ❑ Input/Output configuration
- ❑ Remote calibration of the SVi1000
- ❑ Remote configuration of the SVi1000
- ❑ Remote operation of the SVi1000
- ❑ Backup and restore configuration
- ❑ Trend setpoint, valve position, actuator pressure

Operational Overview

The SVi1000 is a smart electro-pneumatic positioner that receives a 4 - 20 mA electrical position setpoint signal from the controller and compares the position setpoint input signal to the valve position feedback sensor. The difference between the position setpoint and position feedback is analyzed by the position control algorithm that sets a servo signal for the I/P converter. The output pressure of the I/P is amplified by a pneumatic relay that drives the actuator. Once the error between the setpoint and the valve position feedback is within range, no other correction is applied to the servo signal in order to maintain valve position.

The local user interface and LEDs provide configuration or calibration mode in all operating environments.

SVi1000 Features

The SVi1000 Positioner (see Figure 1 on page -9) is suitable for installation indoors or outdoors, and in a corrosive industrial or marine environment and is equipped with the following features:

- ❑ Extreme Accuracy
- ❑ Extreme Reliability
- ❑ Extreme Digital Precision
- ❑ Automated Valve Commissioning
- ❑ Precise, Quick, Responsive Control of Valve Position
- ❑ Valve Position Autotuning
- ❑ One Model for Rotary or Reciprocating Valves
- ❑ Local Operation⁄calibration⁄configuration with a local user interface and LEDs
- ❑ Compatible with Air-to-Close or Air-to-Open Actuators
- ❑ Non-contact Magnet Coupled (Hall Effect) Position Sensing for Rotary and Reciprocating Control Valves
- ❑ Sealed Housing with No Moving Shafts, No Shaft Penetration, and Fully Potted Electronics
- ❑ Split range capability
- ❑ User-adjustable Response Times
- ❑ Configurable High and Low Position Limits
- ❑ Characterize Stroke
  - ❑ Linear
  - ❑ Equal Percentage 50:1

- ❑ Equal Percentage 30:1
- ❑ Quick Opening
- ❑ 11 Point Custom Characterization
- ❑ Camflex* Percentage

❑ Optimized Performance Regardless of Actuator Size

❑ Linearity Compensation for Actuator Linkages with ValVue Software

❑ User Configurable Tight Shutoff at Adjustable Input Signal

❑ HART Compatible

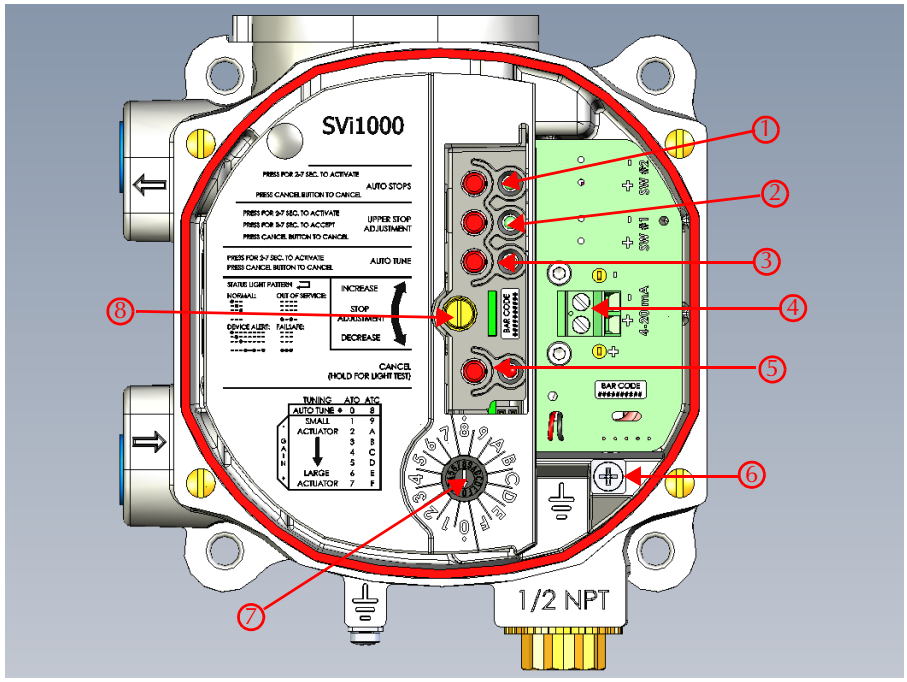
❑ HART Remote Operation, Calibration, and Configuration using ValVue software or a HART Handheld Communicator, HH375 and any HART Compatible Host

Functionality

All connections to electronic module in the unit are made through the interface board. The SVi1000 standard interface board has a terminal block with screw connectors.

Optionally, you can order a unit configured with two digital switches.

Figure 1 shows the standard interface board.



① **Auto Find Stops Button and LED 1**

② **Upper Stop Button and LED 2**

③ **Auto Tune Button and LED 3**

④ **4- 20 mA Input Signal**

⑤ **Cancel/ Status Button and LED 4**

⑥ **Ground**

⑦ **Configuration Selection Switch**

⑧ **Open Stop Adjustment Screw**

Figure 1 Operator Controls - Standard

Modes

The SVi1000 provides the following modes of operation:

- ❑ Normal mode
- ❑ HART Override mode (Formally Manual and Setup Modes)
- ❑ Failsafe mode
- ❑ Commission Process (Via Local User Interface)
  - ❑ Find Stops via Local User Interface
  - ❑ Manual upper stops adjustment via Local User Interface
  - ❑ Autotune via Local User Interface

The SVi1000 always starts up in the mode that the unit was last in before power down, except for failsafe mode when the condition causing fail safe has been corrected.

WARNING *Always ensure the SVi1000 has returned to Normal mode after any configuration activity.*

Normal Mode In this mode the valve follows the 4-20 mA input signal.

HART Override mode In HART override mode, the local user interface buttons are disabled until any button is pushed, then local control is reestablished.

This, from the instrument interface, functions as Manual and Setup mode from the optional laptop-based software and other HART interface tools.

In HART Override Mode the following tasks are supported over HART by ValVue or DTM based interface:

- ❑ Set Characterization (Linear, Equal%(30,50,Camflex), Quick Open and Custom
- ❑ Set Near Closed Value
- ❑ Configure Tight Shutoff
- ❑ Configure Position Fault Limits (Position Error Band and Time 1)
- ❑ Run Find Stops
- ❑ Perform a Manual Find Stops
- ❑ Set Valve Position
- ❑ Enable or Disable Bumpless Transfer
- ❑ Allow Tune to Override limits
- ❑ Set Lower and Upper Position Limits
- ❑ Configure Switch I/O
- ❑ Run AutoTune (Provided the option is set at the local user interface)
- ❑ Set Open Stop Adjustment
- ❑ Command valve to full open or closed

Configuration Selection Switch

This switch provides control to the following functions:

- ❑ Actuator Air Action
- ❑ Select autotuned or preset tuning parameters

Auto Find Stops

This function automatically sets the lower and upper stops. See “Auto Find Stops” on page 35 for this procedure.

Open Stop Adjustment

Use the Open Stop Adjustment Screw to perform an upper stop adjustment and save it to the device. See “Open Stops Adjustments” on page 35 for this procedure.

Autotuning

The autotune process determines optimum tuning parameters for the valve being commissioned. This function is only active when the Configuration Selector Switch is set to *AutoTune*. See “Auto Tune” on page 36 for this procedure.

Figure 2 shows the optional interface board and gauges.

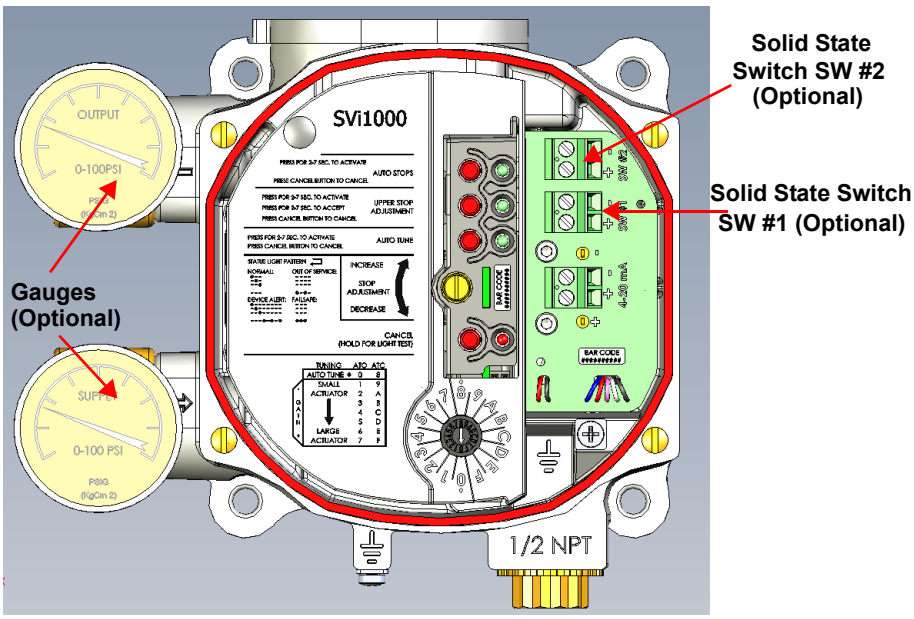


Figure 2 Operator Controls - Optional Digital Switches and Gauges

Failsafe Mode

When a fault results in Failsafe mode being activated, the output pressure of the SVi1000 is set low and the red status LED illuminates continuously. If the fault is considered self-clearing, then once corrected, the unit returns to Normal mode. If the fault is not self-clearing, then the unit requires a reset after correcting the failsafe condition.

Commission Processes

These are temporary states activated when a local user interface issued command dictates their use. When the positioner is in a Commission Processes a status light indicates this activity (see “LED Light Functions” on page 12). Examples of Commission Processes are Auto Find Stops and Auto Tune. Once a task completes the unit returns to Normal mode.

LED Light Functions

Figure 3 shows the local user interface LEDs and explains their patterns and timings.

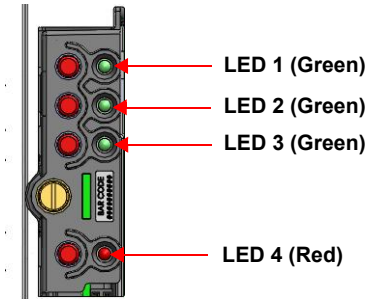


Figure 3 SVi1000 LEDs

In Table 1 dots represent an LED being active and dashes represent the LEDs off. The pattern shown recurs as long as that condition exists.

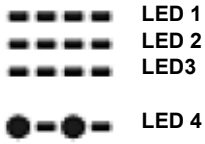


Figure 4 Example LED Pattern

Table 1 LED Light Patterns and Troubleshooting

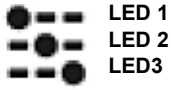
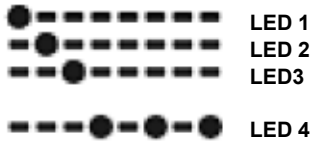
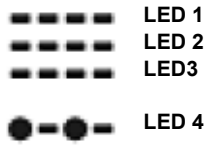
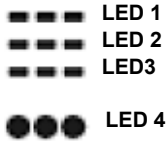
Indication	Pattern
Normal mode	
Device Alert (Fault mode (self-correcting))	

Table 1 LED Light Patterns and Troubleshooting (Continued)

Indication	Pattern
Out of Service (HART Override mode)	
Failsafe mode	
Device is not powered or in Low Power mode	All LEDs off. Power is not sufficient.
Troubleshooting	
Device is not powered or in Low Power mode	All LEDs off. Power is not sufficient.
Process Failure	 Pattern depends on which process failed and repeats until Cancel button is pushed.
Setting out of range	If a setting is out of range the associated Green LED flashes at twice the rate as normal until an acceptable range is applied.

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Installation and Set Up

3

Overview

CAUTION

Prior to beginning the installation process review the safety information at the beginning of this manual.

Figure 5 shows the unit's major components for reference.

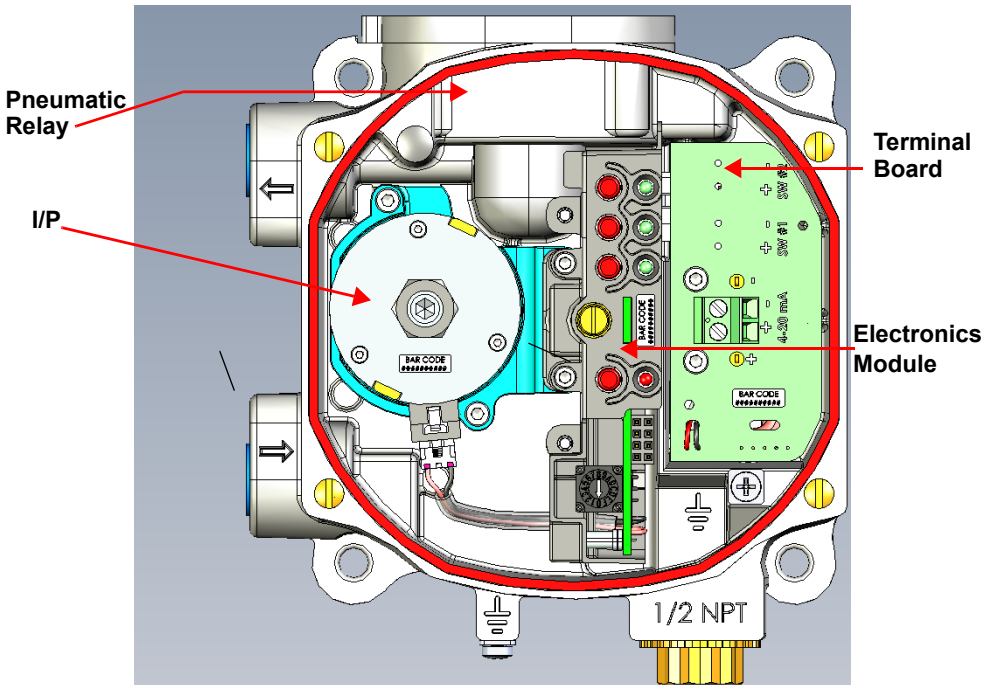


Figure 5 SVi1000 Components

SVi1000 Dimensions

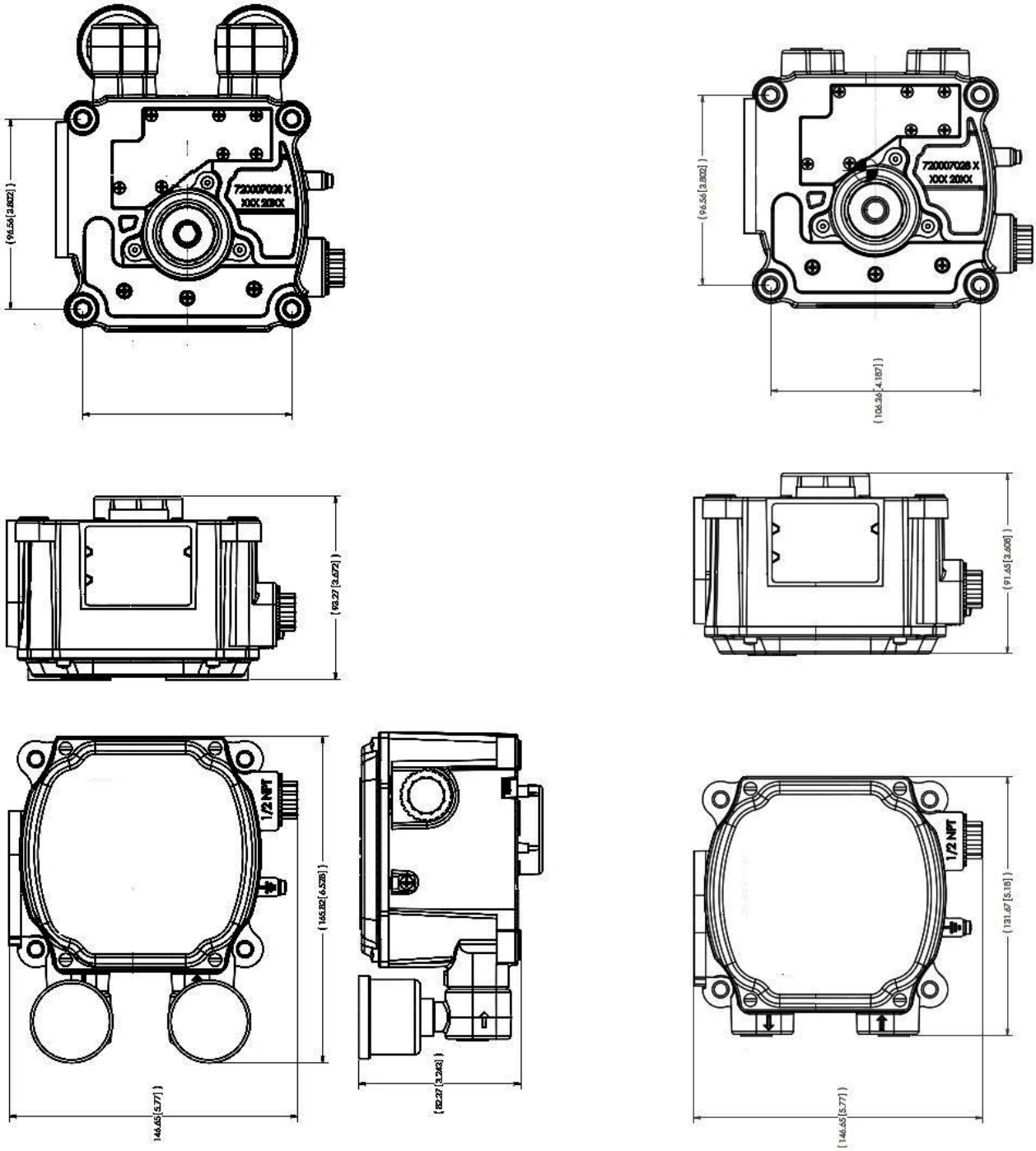


Figure 6 SVi1000 Dimensions With and Without Gauges

Pre-Installation Issues

Storage

If the SVi1000 is stored for a long duration, you must keep the housing sealed against weather, fluids, particles, and insects. To prevent damage to the SVi1000:

- ❑ Use the plugs provided with shipment to plug the ¼ NPT air connections, on the positioner and on the air filter regulator set.
- ❑ Do not allow standing water to accumulate.
- ❑ Observe storage temperature requirements.

Unpacking

Exercise care when unpacking the control valve and its mounted accessories. The SVi1000 container includes a CD-ROM with ValVue Lite, ValVue Trial Version, and Quick Start manual.

Mounting and Wiring

This section describes how to mount and wire the SVi1000, which includes:

- ❑ “Step 1: Mounting the SVi1000” on page 18.
  - ❑ “Step 1: Mounting the SVi1000 on Rotary Valves” on page 19
  - ❑ “Step 1: Mounting the SVi1000 on Reciprocating Valves” on page 23
- ❑ “Step 2: Connecting the Tubing and Air Supply” on page 27
- ❑ “Step 3: Wiring the SVi1000” on page 28

WARNING

Failure to adhere to the requirements listed in this manual may cause loss of life and property.

*Before installing or using this instrument, **READ THE INSTRUCTIONS CAREFULLY**. Refer to “Wiring Theory for an SVi1000” for detailed instructions.*

Step 1: Mounting the SVi1000

This guide provides installation instructions for mounting an SVi1000 on both rotary and reciprocating style valves. The mounting process can be broken down into the following:

1. Attach the mounting bracket to the actuator.
2. Install the magnetic assembly.
3. Assemble the SVi1000 on the mounting bracket.

NOTE

Mount the SVi1000 with the conduit connection down in order to facilitate drainage of condensate from the conduit.

Necessary Precautions

To avoid injury or the process being affected when installing or replacing an SVi1000 positioner on a control valve, ensure that:

- ❑ If the valve is located in a hazardous area, ensure the area has been certified as *safe* or that all electrical power to the area has been disconnected before removing any covers or disconnecting any leads.
- ❑ Shut off air supply to the actuator and to any valve mounted equipment.
- ❑ Ensure the valve is isolated from the process by either shutting off the process or using bypass valves for isolation. Tag shutoff or bypass valves to guard against a *turn-on* while work is in progress.
- ❑ Bleed air from actuator and check that valve is in its unenergized position.

For the procedure to install rotary and reciprocating mounting kits on valves, refer to the instructions contained in the valve's mounting box kit.

Step 1: Mounting the SVi1000 on Rotary Valves

This section describes the procedure for mounting the SVi1000 on rotary control valves that have less than 60° rotation, such as the Camflex.

Figure 7 shows the kit components.

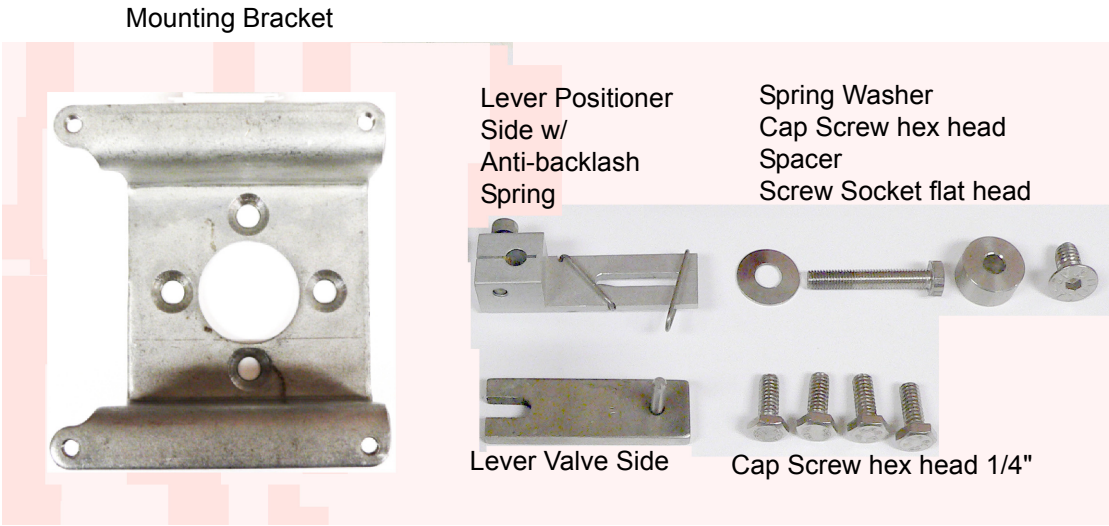


Figure 7 Rotary Kit Components

Figure 8 shows a side view of a Camflex actuator, the SVi1000, and a mounting bracket.

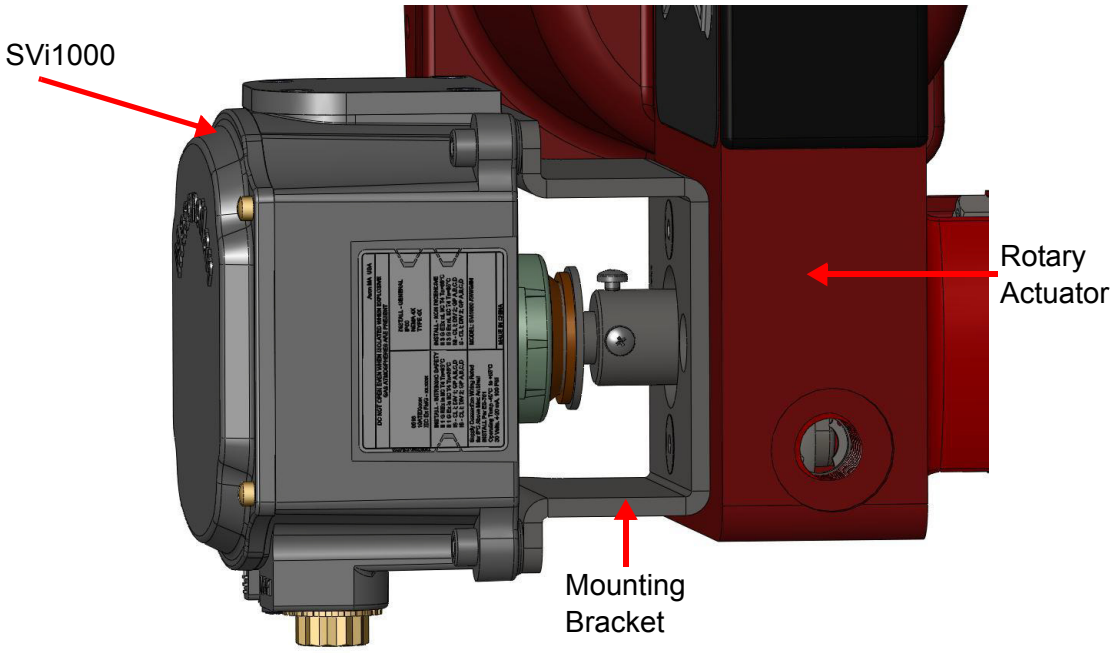


Figure 8 Camflex with Mounting Bracket (Side View)

Tools required:

- ❑ M5 Hex Key
- ❑ M4 Hex Key
- ❑ M3 Hex Key

To mount the SVi1000:

1. Attach the mounting bracket to actuator (Figure 9).

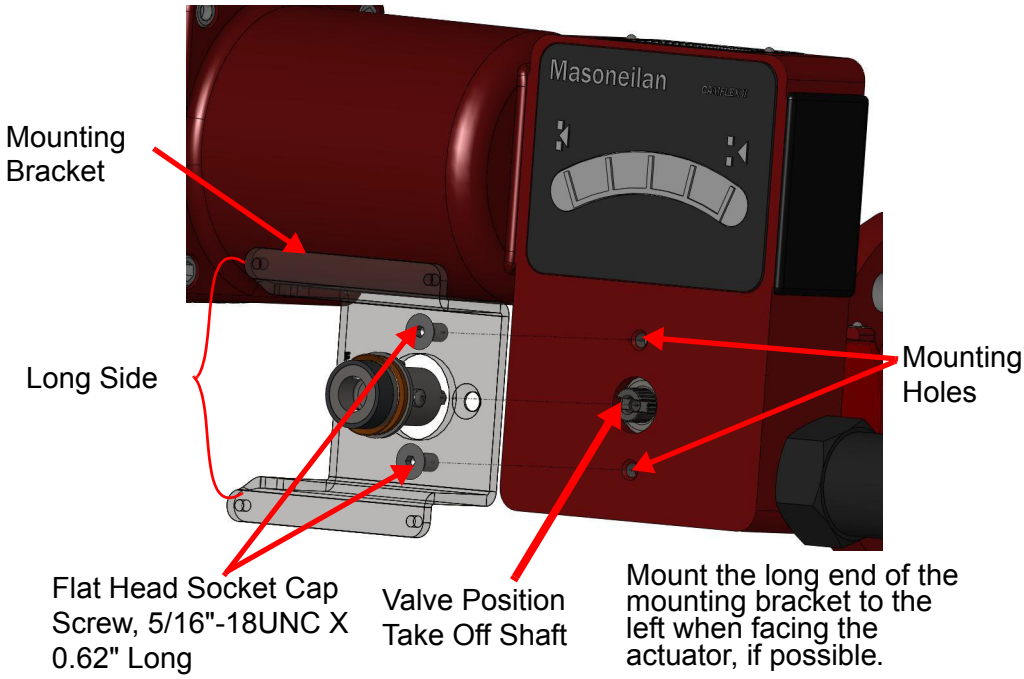


Figure 9 Rotary Mounting Bracket to Valve Actuator

2. Bolt the extension shaft to the valve position take-off shaft (Figure 10).

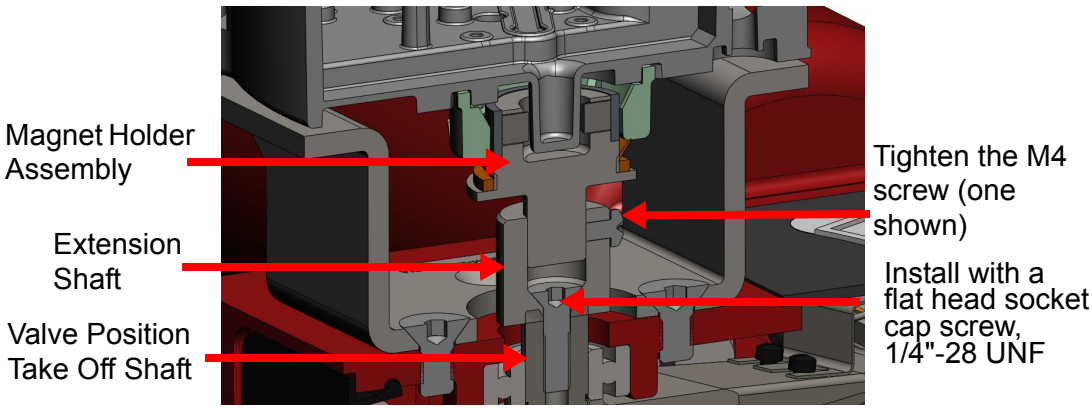


Figure 10 Extension Shaft to the Valve Position Take-off Shaft

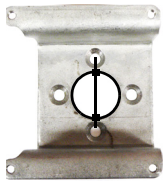
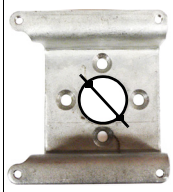
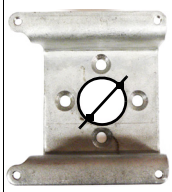
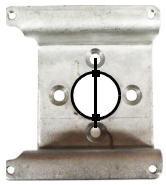
Internal valve pressure	The valve plug shaft is pushed out to the mechanical stops, usually a thrust bearing. On valves where the valve position take-off is mounted directly on the end of the plug shaft, a Camflex for example, the shaft must be bearing on its stop to properly set up the SVi1000 positioner. During hydrostatic testing the shaft is thrust to its stop and a normally tightened packing retains it in that position.
Vacuum service	The valve shaft is drawn into the body by the vacuum acting on the shaft, but the magnetic coupling must be assembled flush with the mounting bracket.

3. Perform magnet install and travel sensor alignment by:

   a. Sliding the magnet holder into the extension shaft. The magnets are in the magnet holder ring. The magnetic axis is the imaginary line through the center of both magnets.

   b. Rotating the magnet holder so that the magnet axis is vertical when the valve is in the closed position (Table 2). If mounting kit is installed on fail-open valve, apply air to the actuator to close the valve before installing magnet holder.

Table 2 Travel Sensor Alignment

Rotary Mounting System	Stroke Direction	Magnet Orientation	Valve Position	Sensor Counts
Rotary	<60° Rotation Clockwise or counterclockwise rotation	 (0°)	Closed (0%)	0 +/- 1000
	>60° Rotation Clockwise with increasing setpoint	 (-45°)	Full Open or Full Closed	-8000 +/- 1500 or +8000 +/- 1500
	>60° Rotation Counter Clockwise rotation with increasing setpoint	 (+45°)	Full Open or Full Closed	-8000 +/- 1500 or +8000 +/- 1500
General Rule for other configurations	Any amount of rotation Clockwise or counterclockwise	 (0°)	50% Travel (Mid-Stroke)	0 +/- 1000

c. Aligning the end of the magnet holder flush with the end of the mounting bracket. Secure the magnet holder with two M4 set screws.

d. Sliding the V-Seal over the magnet holder. You can also check the magnet using ValVue software by reading sensor counts and comparing them to Table 2.

4. Secure the SVi1000 onto the mounting bracket using four M6 x 20 mm socket head cap screws.

5. Ensure no interference exists with the position sensor protrusion.

6. Ensure that the V-Seal makes contact with the skirt around the alignment ring on the SVi1000 (Figure 11).

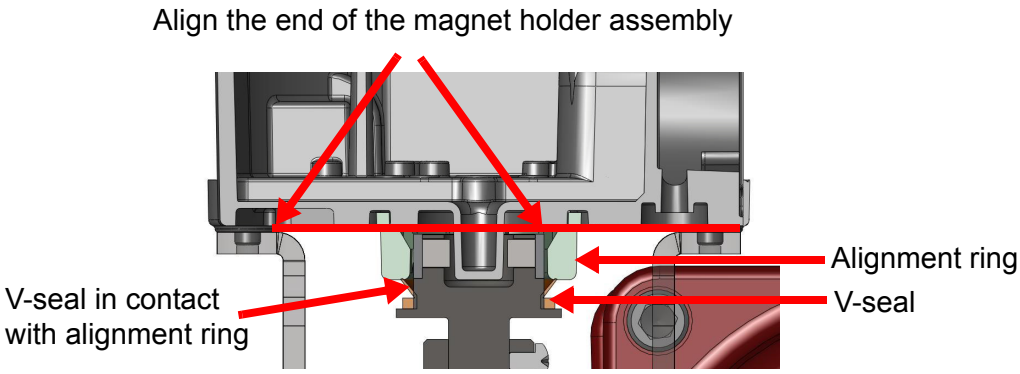


Figure 11 Camflex V-Seal

Step 1: Mounting the SVi1000 on Reciprocating Valves

This section describes the procedure for mounting the SVi1000 on Reciprocating Valves, using GE's 87/88 Multi-Spring actuators as an example. Figure 12 on page -23 shows the standard lever for all size installations. See "Integrated Magnet Assembly" on page 26 for the optional IM assembly.

Tools required:

- ❑ 7/16" Combination Wrench (2 required)
- ❑ 3/8" Combination Wrench
- ❑ 1/2" Combination Wrench
- ❑ Phillips Head Screw Driver
- ❑ M4 Hex Key
- ❑ M3 Hex Key

1. Mount the standard reciprocating mounting bracket to the valve using two (2) 5/16 - 18 UNC cap screws.

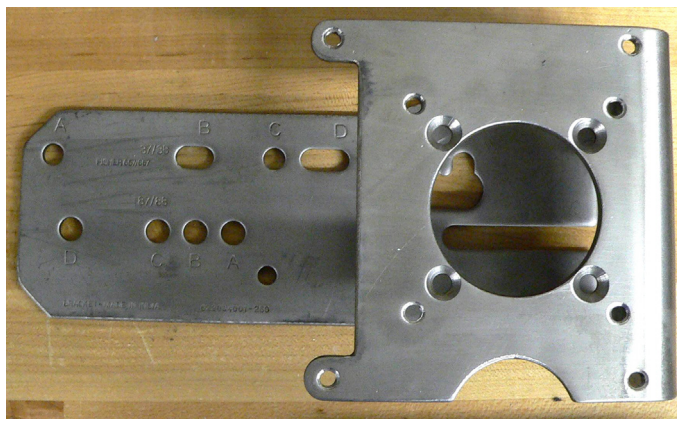


Figure 12 Reciprocating Valve Mounting Bracket for Standard Lever

2. Ensure that the lever is pinned to the magnet assembly and held securely by an M5 flat head screw to ensure that the magnet axis is vertical when the lever is in the valve closed position. Tighten the lever screw securely (Figure 13).

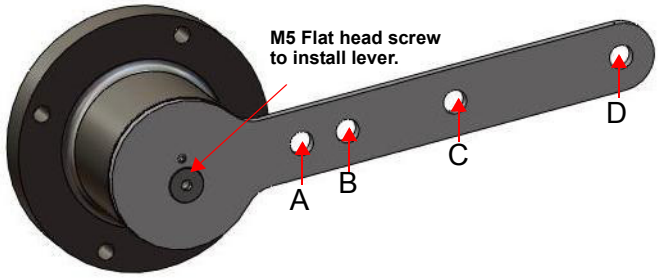


Figure 13 Magnet Holder and Standard Lever for Reciprocating Valves

3. Select mounting hole for the stroke of the valve. Unless otherwise specified, the SVi1000 mounting assumes that the actuator is in the normal upright position. The mounting hole in the slotted opening of the mounting bracket must be left when facing the actuator, with the actuator in the upright position.

Table 3 Reciprocating Valve Mounting Hole and Turnbuckle Length

Actuator Size GE 87/88	Stroke	Mounting Hole	Lever Hole	Turnbuckle Length
6 and 10	0.5 - 0.8" (12.7 - 20.32 mm)	A	A	1.25" (31.75 mm)
10	0.5 - 0.8" (12.7 - 20.32 mm)	A	A	1.25" (31.75 mm)
10	>0.8 – 1.5" (20.32 - 41.5 mm)	B	B	1.25" (31.75 mm)
16	0.5 - 0.8" (12.7 - 20.32 mm)	B	A	2.90" (73.66 mm)
16	>0.8 – 1.5" (20.32 - 41.5 mm)	C	B	2.90" (73.66 mm)
16	>1.5 – 2.5" (41.5 - 63.5 mm)	D	C	2.90" (73.66 mm)
23	0.5 - 0.8" (12.7 - 20.32 mm)	B	A	5.25" (133.35 mm)
23	>0.8 – 1.5" (20.32 - 41.5 mm)	C	B	5.25" (133.35 mm)

Table 3 Reciprocating Valve Mounting Hole and Turnbuckle Length (Continued)

Actuator Size GE 87/88	Stroke	Mounting Hole	Lever Hole	Turnbuckle Length
23	>1.5 – 2.5" (41.5 - 63.5 mm)	D	C	5.25" (133.35 mm)

4. Thread the take-off rod to the actuator stem connector (Figure 14).

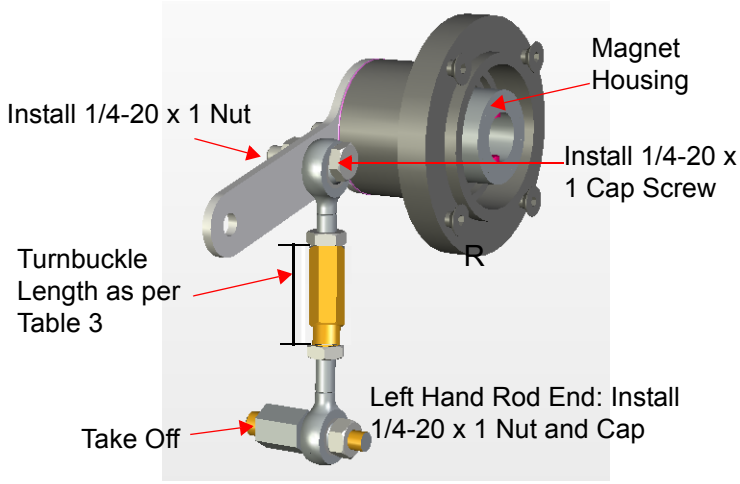


Figure 14 SVi1000 Take Off Rod Mounting

5. Attach the right hand threaded rod end to the lever using a 1⁄4 - 20 x 1" cap screw and nut (Figure 14).
6. Thread the right hand lock nut and turnbuckle onto the right hand rod end approximately two turns. Turnbuckle length is a function of actuator size. Refer to Table 3 on page -24.
7. Secure the magnet housing assembly, including the lever and right hand rod end, to the bracket using four M5 X 10 mm flat head screws.
8. Attach the left hand threaded rod end to the take-off rod with 1⁄4 - 20 UNC nut and thread the left hand lock nut onto the rod end.
9. Move the valve to its closed position. For air to:
   - ❑ Close: Requires using air pressure in the actuator to fully stroke the actuator.
   - ❑ Open: Vent the actuator of air pressure.
10. Thread the turnbuckle onto the left hand threaded rod end (Figure 14).
11. Adjust the turnbuckle until the hole in the lever is aligned with the alignment hole in the bracket. Tighten both turnbuckle lock nuts (Figure 14).

12. Ensure the adjustable link turnbuckle is parallel to the valve stem. Verify that the hole in the lever aligns with the alignment hole in the bracket when the valve is in the closed position. Check that the bracket is mounted using the proper holes (Figure 15).

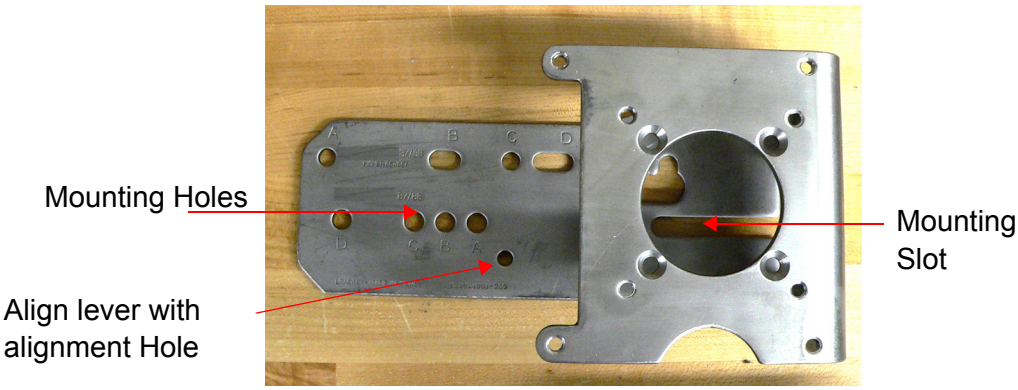


Figure 15 Ensure Position Linearity

13. Mount the SVi1000 to the bracket and secure with four M6 socket head cap screws.

Integrated Magnet Assembly

The IM (Integrated Magnet) assembly kit is an optional assembly intended for custom mounting by the end user for reciprocating actuators (Figure 16). This kit allows for more leeway in installation.

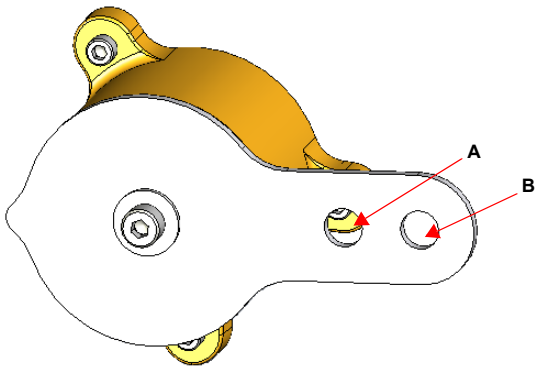


Figure 16 SVi1000 Lever Installed to IM Assembly

NOTE

You can use a custom bracket with the IM option. Refer to drawing #720012413 for assistance.

Step 2: Connecting the Tubing and Air Supply

To connect the air supply:

1. Install the tubing to the air supply port. Minimum tubing diameter 1⁄4" (Figure 17).

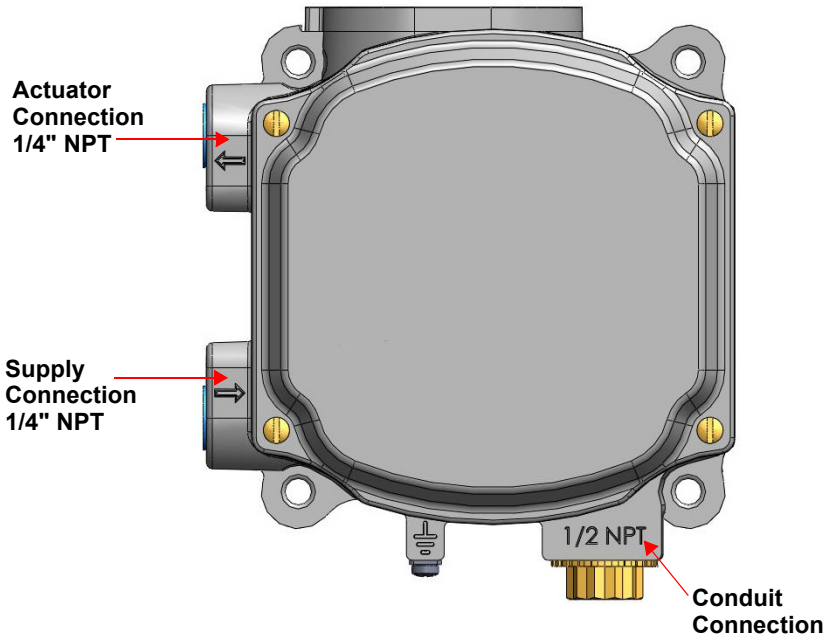


Figure 17 Air Ports

2. Pipe the output air from the output pressure port to the actuator. Minimum tubing diameter: 1/4".

NOTE

The SVi1000 is designed to operate with clean, dry, oil-free, instrument grade air to ANSI-ISA-57.3 1975 (R1981) or ISA-S7.3-1975 (R1981).

3. Ensure the air supply falls within the parameters in Table 4.

Table 4 Air Supply Requirements

Dew Point	At least 18° F (10° C) below minimum anticipated ambient temperature
Particulate Matter	Filtered to 5 microns
Oil Content	Less than 1 ppm w/w
Contaminants	Free of all corrosive contaminants

4. Supply clean, dry compressed air to the filter regulator.
5. Turn on the air supply.

6. Adjust the filter regulator.
   Supply pressure must be a minimum of 5 psi above the spring range of the actuator but may not exceed the rated actuator pressure. Refer to the valve or actuator instruction manual.

Step 3: Wiring the SVi1000

WARNING

Comply with current national and local regulations for electrical installation work.
Before carrying out any work on the device, power off the instrument.

CAUTION

Improperly or inadequately grounded installations can cause noise or instability in the control loop. The internal electronic components are isolated from ground. Grounding the case is unnecessary for functional purposes but grounding the case may be necessary to conform to local codes.

Wiring Guidelines

This list contains guidelines for a successful implementation of DC current signal, DC power, and HART communication to the SVi1000:

- ❑ Compliance voltage at the SVi1000 is 9 volts at the current of 20 mA.
- ❑ Signal to the SVi1000 must be a regulated current in the range 3.2 to 22 mA.
- ❑ Controller output circuit must be unaffected by the HART tones which are in the frequency range between 1200 and 2200 Hz.
- ❑ Frequency range of the HART tones must have a circuit impedance of more than 220 Ohms, typically 250 Ohms.
- ❑ HART tones may be imposed by the positioner and a communication device located anywhere on the signaling circuit.
- ❑ Cabling must be shielded to prevent electrical noise that would interfere with the HART tones, with the shield grounded.
- ❑ Shield must be properly grounded in only one place.
- ❑ For details and calculation methods for wiring resistance, and capacitance and for calculation of cable characteristics, refer to the HART FSK Physical Layer Specification.
- ❑ For split range installations the output voltage must be sufficient to operate two positioners (11 V @ 4 mA, 9 V @ 20 mA) and the expected voltage drop in the cable.
- ❑ Use of a low impedance voltage source damages the SVi1000. The current source must be a true high impedance current limiting device. A proper current source explicitly enables adjustment of the current in mA, not Volts.

WARNING

This process can cause the valve to move. Before proceeding be sure the valve is isolated from the process. Keep hands clear from moving parts.

To connect and power up the SVi1000:

1. Loosen the four (4) cover screws and remove the SVi1000 cover (Figure 18).

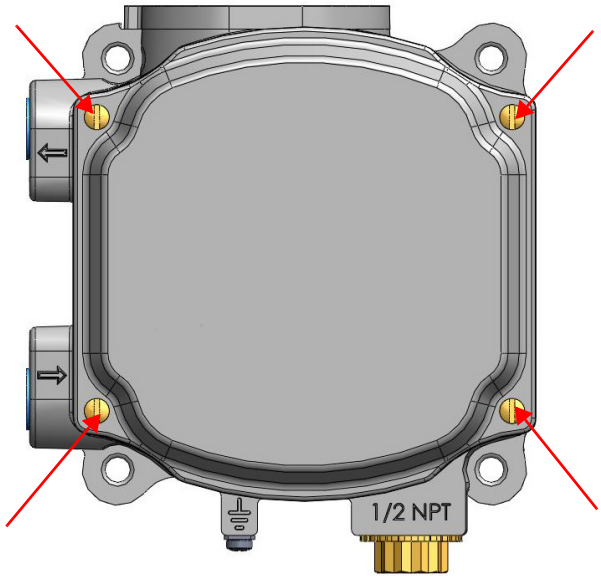


Figure 18 Front Cover

2. Connect the +/- terminals to the current source: + to + and - to - (Figure 19).

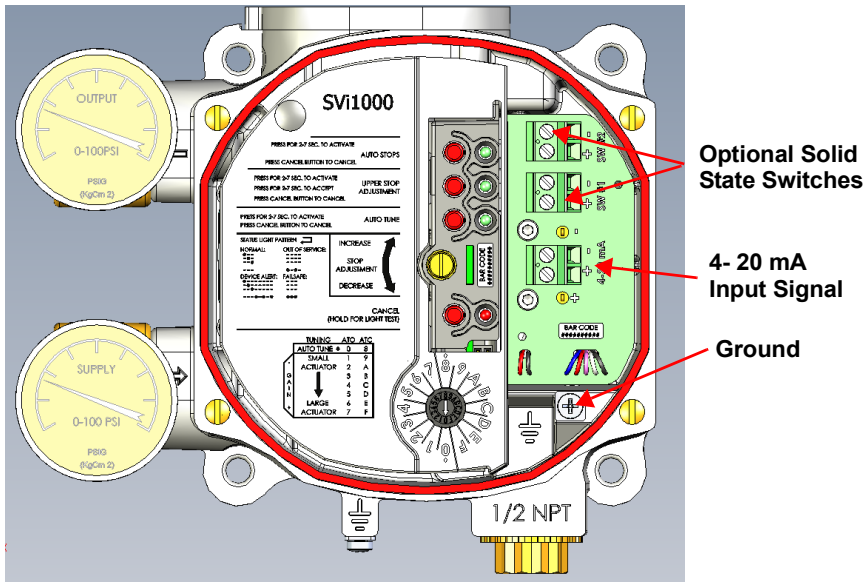


Figure 19 Connections to Electronics Module (via Interface Board)

CAUTION

For proper operation, maintain signal polarity + and - respectively.

3. Strip the insulation at the end of wires.
4. Locate the 4-20 mA connector on the interface board (Figure 19).
5. Loosen the screw at the top connector until you see the opening for wire insertion and insert the wire into the opening and tighten the screw.
6. Proceed to “Check Out and Power Up”.

To troubleshoot control loop connections:

1. Connect a DC voltmeter across the input terminals.
   - ❑ For an input current between 4 and 20 mA the voltage varies between 11V and 9 V respective.
   - ❑ When voltage exceeds 11 V check that polarity is correct.
   - ❑ If voltage is less than 9 V and polarity is correct, voltage compliance of current source is inadequate.
2. Verify that source can supply 20 mA to SVi1000 input. If 20 mA is not attainable, troubleshoot the source.

Check Out and Power Up

4

Overview

This section provides the calibration procedures to ensure proper valve positioning, including:

NOTE

Perform all procedures in this section before putting the SVi1000 into operation.

Step 1: Inspect the Actuator, Linkages, or Rotary Adapter

1. Verify that the mounting has not been damaged in shipment for a pre-mounted SVi1000, physically inspect the actuator and linkage.
2. Record the following information for the configuration checkout:
   - ❑ Valve Air to Open (ATO) or Air to Close (ATC)
   - ❑ Actuator pressure rating
   - ❑ Actuator spring range
   - ❑ Inherent trim characteristic of the control valve; linear, equal percentage, or other.

NOTE *Refer to the valve data sheet or control valve model number.*

Step 2: Verify Mounting and Linkage Adjustment

Inspect the mounting and make any needed adjustments before running the positioner and checking the digital configuration.

Step 3: Checking the Magnet

There are two methods of checking the SVi1000 magnet:

- ❑ “Perform a Visual Inspection” on page 32
- ❑ “Use ValVue to Check Magnet Position” on page 33

Perform a Visual Inspection

Rotary Valves

Ensure that mounting has been performed as per “Step 1: Mounting the SVi1000 on Rotary Valves” on page 19.

Reciprocating Valves

1. Ensure the adjustable link turnbuckle is parallel to the valve stem.
2. Ensure proper mounting by verifying that the hole in the lever aligns with the alignment hole in the bracket when the valve is in the closed position. Ensure the bracket is mounted using the proper holes (see Table 3 on page 24).

Use ValVue to Check Magnet Position

To check the magnet using ValVue:

1. Connect to the positioner in accordance with the ValVue instructions.
   a. Ensure the positioner has been installed and set up with a HART Modem in a HART compliant communications loop, if required, install ValVue on the computer that is connected to the HART modem.
   b. Run ValVue.
   c. Select the installed positioner from the list of Connected Devices.
   d. Select the **Check** tab to view the current operating conditions of the selected positioner.
2. Read Raw Position data. When the valve is:
   - ❑ Closed, the value should be between – 1000 and +1000 for a reciprocating valve or a 60° rotation rotary valve.
   - ❑ At mid-travel, the value should be between –1000 and +1000 for a greater than 60° rotation rotary valve.

Step 4: Checking the Air Supply

To check the air supply:

1. Turn on the air supply.
2. Adjust the filter regulator.
3. Supply pressure must be a minimum of 5 psi greater than the spring range of the actuator but may not exceed the rated actuator pressure. Refer to the valve or actuator instruction manual.
4. Inspect the tubing connections between the filter-regulator and the positioner for leaks.
5. Verify that the tubing is not bent or crushed.
6. Verify that all fittings are leak tight.

CAUTION

Do not use Teflon pipe seal tape. The Teflon tape can shred into particles that are harmful to the pneumatic components.

Step 5: Verify Wiring Connections

NOTE

For split range installations the output voltage must be sufficient to operate two positioners (11 V @ 4 mA, 9 V @ 20 mA) and the expected voltage drop in the cable.

Use the following procedure to ensure that the SVi1000 is properly powered:

1. Connect a DC voltmeter across the input terminals.
   - ❑ For an input current between 4 and 20 mA the voltage varies between 11V and 9 V respective.
   - ❑ When voltage exceeds 11 V check that polarity is correct.
   - ❑ If voltage is less than 9 V and polarity is correct, voltage compliance of current source is inadequate.
2. Connect a milliampmeter in series with the current signal.
3. Verify that source can supply 20 mA to SVi1000 input. If 20 mA is not attainable, troubleshoot the source.

NOTE

Improperly or inadequately grounded installations can cause noise or instability in the control loop. The internal electronic components are isolated from ground. Grounding the case is unnecessary for functional purposes but grounding the case may be necessary to conform to local codes.

Step 6: Configuration

The following section describes configuration using the local user interface pushbuttons. You can also use ValVue and a PC with a HART modem or a HART Handheld Communicator.

Prior to changing the SVi1000 configuration, check the existing configuration.

Use the procedures that follow to: auto stops, open stop adjustment and perform auto tune.

WARNING

These procedures can cause the valve to move. Before proceeding be sure the valve is isolated from the process. Keep hands clear from moving parts.

NOTE

All calibration and configuration procedures are described using the SVi1000 local user interface. See “ValVue Software” on page 6 for an overview of ValVue software functions.

Auto Find Stops

To perform auto find stops:

1. Set the air action (*0-7* for ATO or *8-F* for ATC).
2. Press auto find stops button until green LED 1 illuminates, then release (*approximately 2 seconds to turn on and release before 7 seconds*). The unit goes into a Commission Process and green LED 1 blinks until the process completes. The auto find stops process occurs. When the process is complete, the unit automatically returns to Normal mode.

   Press **Cancel** to abort the process and the green LED 1 goes off, the device returns to Normal mode and no changes occur.

Open Stops Adjustments

To perform auto find stops:

1. Press the upper stop adjustment button for two to seven seconds, until green LED 2 illuminates, then release. Green LED 2 flashes.
2. Move the valve to the desired location via the *Open Stop Adjustment Screw* (Figure 20).

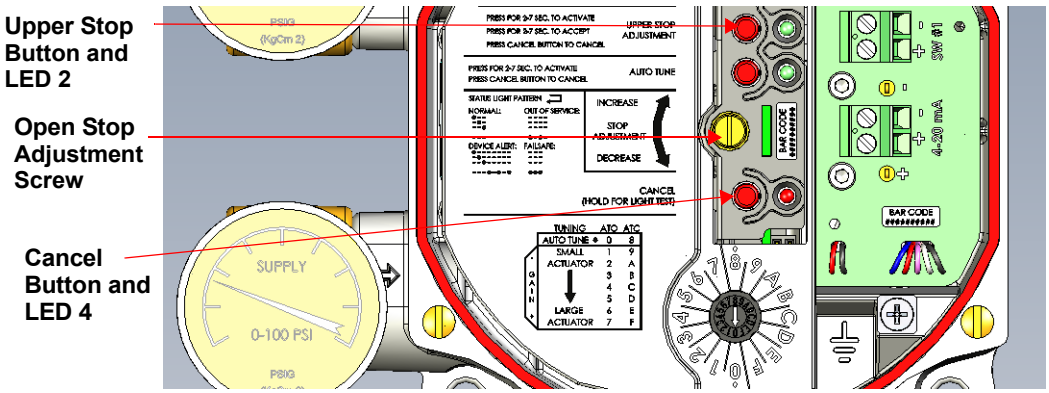


Figure 20 Open Stop Adjustment Screw

3. Press the upper stop adjustment button for more than two seconds.

   The green light goes off, the new stop is saved in the device and the unit is put into Normal mode.

   Press **Cancel** to abort the process and the green LED 1 goes off, the device returns to Normal mode and no changes occur.

Auto Tune

This process normally takes three to ten minutes and strokes the valve in large and small steps to set the PID positioning parameters for best response to an input signal change.

To auto tune the SVi1000:

1. Set the *Configuration Selector Switch* to the auto tuning parameter (Figure 21):
   - ❑ *0* for and ATO valve
   - ❑ *8* for an ATC valve.

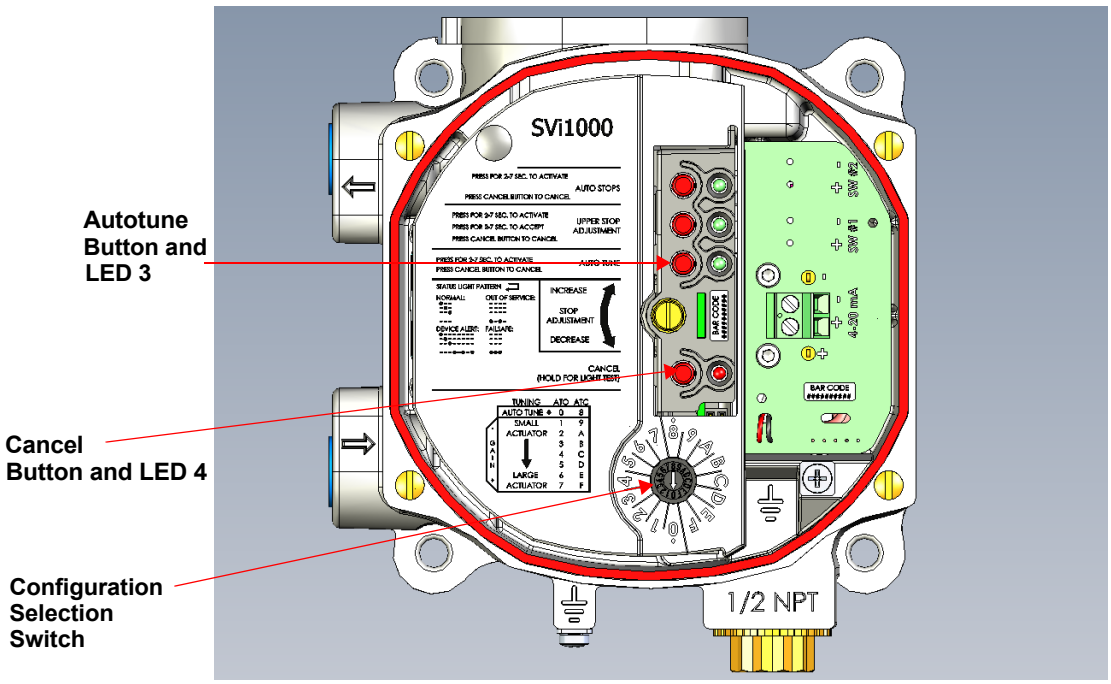


Figure 21 Configuration Selection Switch

2. Press the **Autotune** button until green LED 2 lights, then release (*approximately 2 to 7 seconds*). The unit goes into a Commission Process and green LED 3 blinks.

   The autotune process occurs.

   When the autotune process is complete the unit automatically returns to Normal mode.

   Press **Cancel** to abort the process and the green LED 3 goes off, the device returns to Normal mode and no changes to the tuning parameters occur.

Preset Tune

Preset tuning is done according to valve/actuator size. Figure 22 shows the graphic that appears on the local user interface. As valve size increases values increase from *1* to *7* and *9* to *F*. *0* and *8* are reserved for auto tuning ATO and ATC valves, respectively.

Gain increases as the tuning value increases.

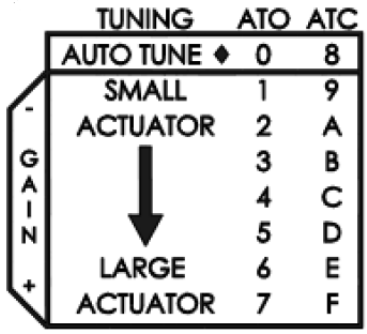


Figure 22 Preset Tuning Values

To use preset tuning values:

❑ Use the *Configuration Selection Switch* to select a preset tuning value (Figure 23).

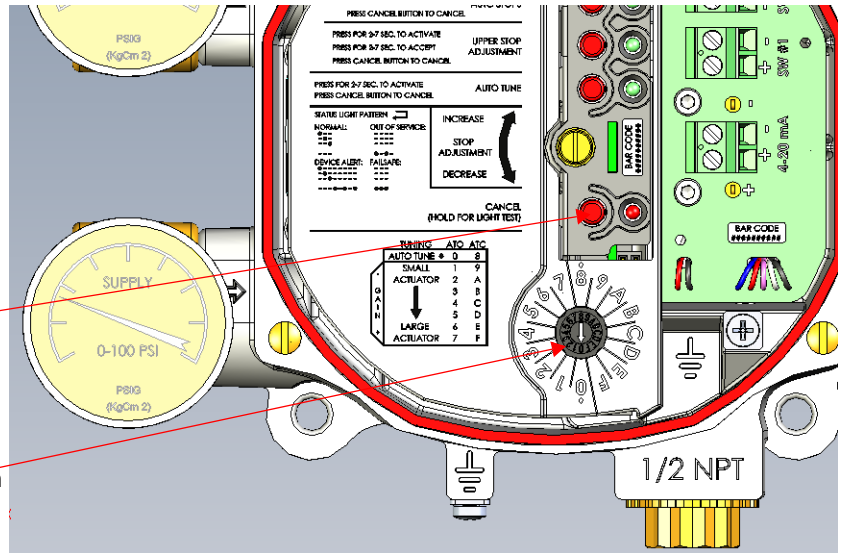


Figure 23 Configuration Selection Switch

Table 5 gives a a guideline for setting the Configuration Selection Switch with regard to actuator size.

Table 5 Actuator Settings Configuration Selection Switch Guidelines

ATO	ATC	Actuator Size	Examples
1	9	Small	1) 4.5" Camflex (7-15 SR)
2	A		2) 6" Camflex (7-15 SR)
3	B		3a) #6, 87(ATC), 3-15 SR 3b) #6, 88(ATO), 11-23 SR 3c) #10, 87 (ATC), 3-15 SR 3d) #10, 88(ATO), 11-23 SR
4	C		4s) #6, 87(ATC), 6-30 SR 4b) #6, 88(ATO), 21-45 SR 4c) #10, 87 (ATC), 6-30 SR 4d) #10, 88(ATO), 21-45 SR
5	D		5a) #16, 87(ATC), 3-15 SR 5b) #16, 88(ATO), 11-23 SR 5c) #23, 87 (ATC), 3-15 SR 5d) #23, 88(ATO), 11-23 SR
6	E		6a) 7" Camflex, 7-24 SR 6b) 9" Camflex, 7-24 SR
7	F	Large	7a) #16, 87(ATC), 6-30 SR 7b) #16, 88(ATO), 21-45 SR 7c) #23, 87 (ATC), 6-30 SR 7d) #23, 88(ATO), 21-45 SR

Configuration and Calibration

5

Configure

This section explains the use of the ValVue SVi1000 software to perform configuration tasks.

What You Can Do on the Configure Tab

In the *Setup* mode, from the *Configure* tab (see Figure 24), you can set the information that tells the SVi000 how the valve/actuator is configured by adjusting the following parameters:

NOTE

Before making any configuration changes on the Configuration tab SVi1000 must be in Setup mode.

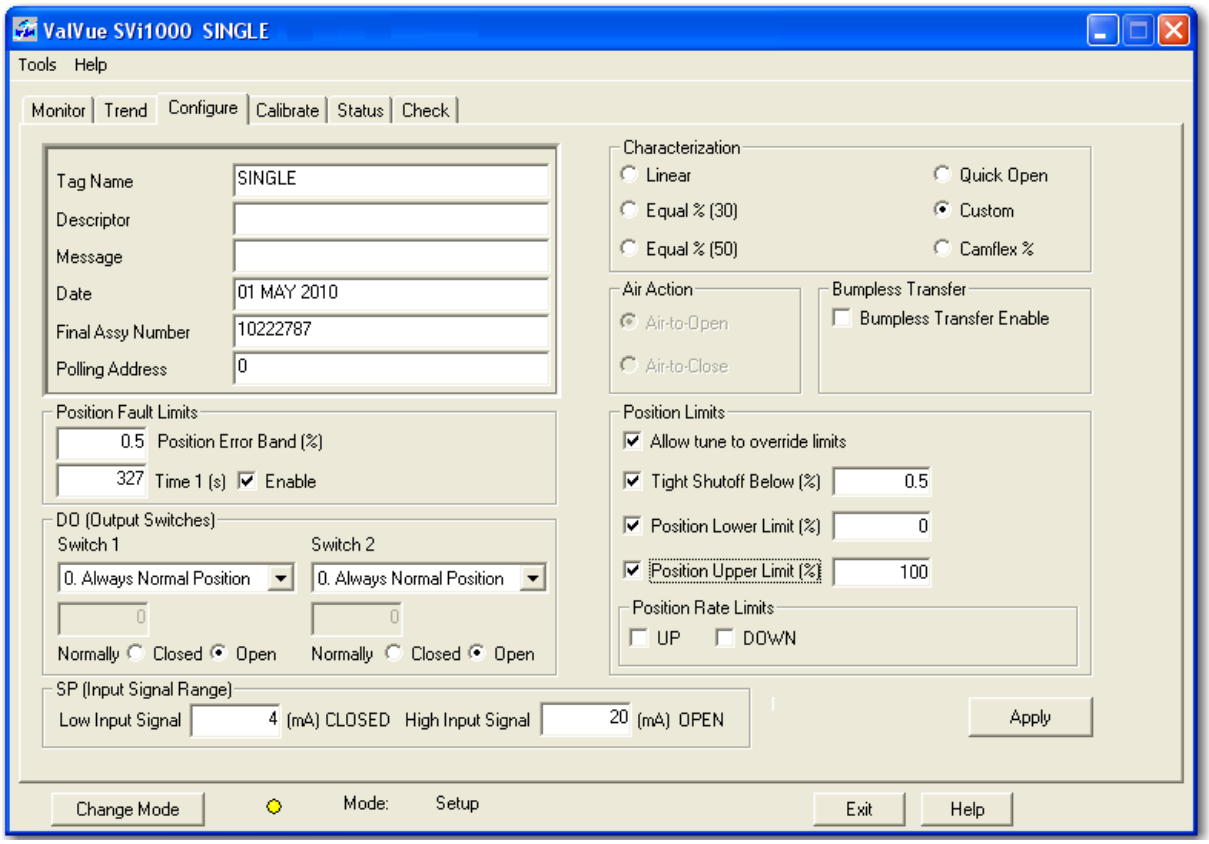


Figure 24 Configure Tab – Setup Mode

Tag Information

To change *Tag* information on the *Configure* tab:

1. In the *Setup* mode place the cursor in the *Tag* field for change.
2. Delete and type as necessary.
3. Click **Apply**.

NOTE

You can also change the tag information through the Setup Wizard.

Position Fault Limits

You can configure how position errors are handled. A position error occurs when the valve position differs from the requested position (from the input signal in normal operating mode or the manual setpoint in manual mode) by more than the parameters. When this occurs, a status flag is set which is reported during the next HART message only that a flag is set is reported.

On the *Configure* tab you can set:

Position Error Band Use this to define the error band, or the percentage of valve travel, that the requested position is allowed to vary from the actual position. The *Position Error Band* must be between 0.5% and 200%. If you set a value for *Position Error Band* outside the range an error message appears.

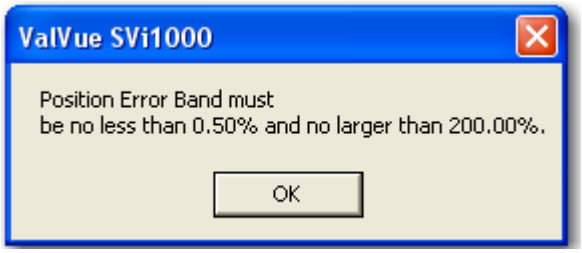


Figure 25 Position Error Band Error Message

Time 1 s Enable Use check box to enable a field to enter the amount of time a position error is allowed to exist before the valve is put in fail-safe position. This time must be between 1 and 328 seconds. If you set a value for *Position Error Time* outside the range an error message appears.

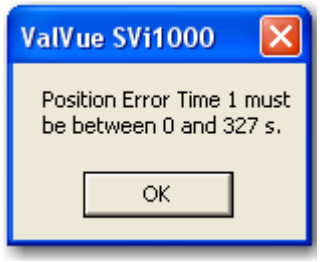


Figure 26 Position Error Time Error Message

Characterization

Use the checkboxes to select the characterization type. Control valves are *characterized* to give a specific relationship between flow capacity (Cv) and percent opening of the valve. The valve can be characterized with special purpose trim or with the positioner. Several characterizations are available:

- *Linear*: Causes the valve to open proportionally with the input signal. Select this option if non–linear trim is used in the valve.
- *Equal % (50)* and *Equal % (30)*: Two equal percentage characterizations are available, one with R=50 and the other with R=30.
- *Quick Open*: The quick opening characterization is the inverse to the *Equal Percentage 50%* characterization curve.
- *Custom*: Selecting this option displays the *Custom Characterization* dialog to format a custom curve. The curve can have up to nine points and points in between are linearly interpolated. See "Custom Characterization" on page 43.
- *Camflex %*: This characterizes the valve as a a GE Camflex valve with settings of *Linear* and *Equal 50%*.
  Figure 27 shows the characterization curves in a graphical format.

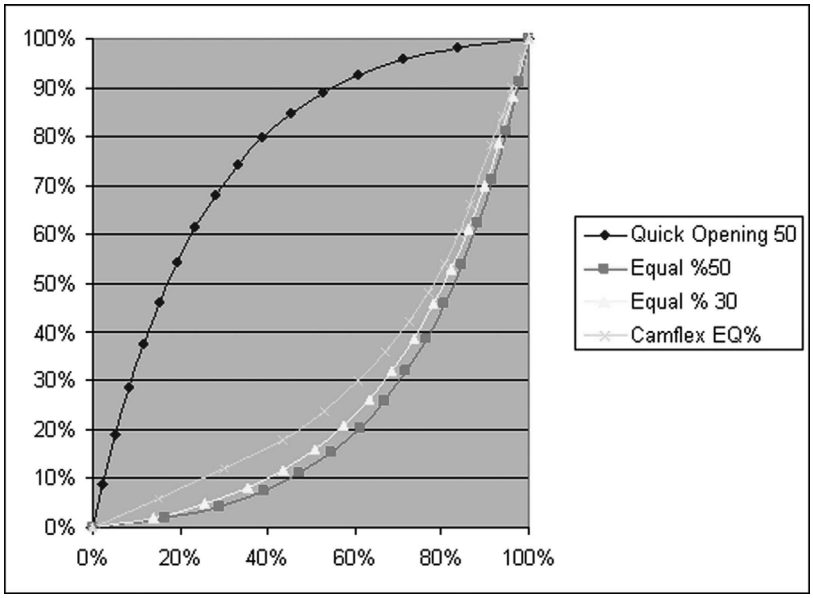


Figure 27 Characterization Curves

Custom Characterization

When mounted on a reciprocating valve, a small non–linearity in the reported valve position versus actual valve position may result from the linkage configuration. This non–linearity can be corrected using a custom characterization that matches the specific linkage used. Custom characterization must be the selected configuration option to use the generated curve. Custom characterization is accomplished using the Figure 28 dialog.

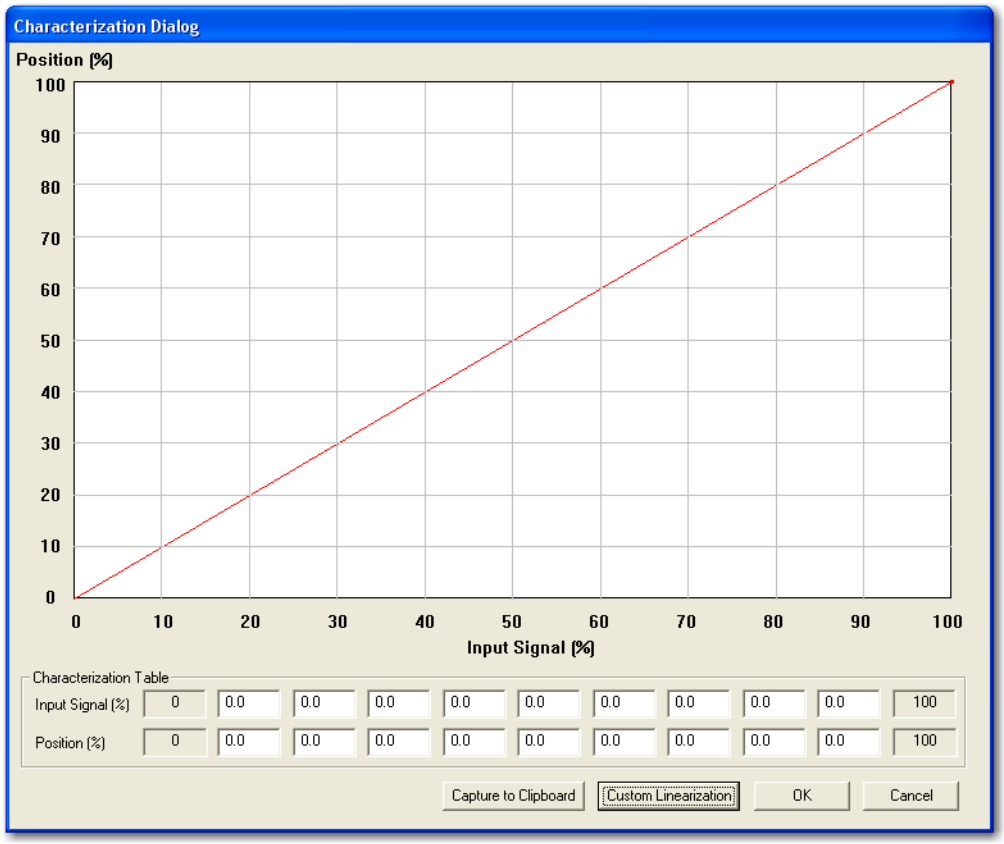


Figure 28 Custom Characterization

Setpoint (%)/Position (%) Activated by selecting **Custom** in *Characterization*.

A custom characterization defines the relationship between the input signal and the output position of the valve. The characterization may contain up to nine XY pairs and the position is linearly interpolated between the pairs. The first position is always 0, 0 and the last position is always 100,100. Both first and last positions indicate 0 and 100 percent and are not counted as any of the nine points allowed.

To create a custom characterization:

1. Click **Custom** and Figure 28 dialog appears.
2. Enter values in the *Setpoint (%)/Position (%)* fields from lowest to highest. If there is too drastic a slope change the Figure 29 dialog appears. Adjust values accordingly.

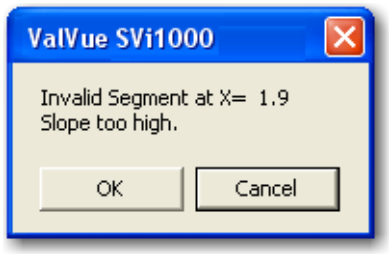


Figure 29 Invalid Segment

Setpoint (%)/Position (%) fields activate and appears.

3. Click **Close** and a dialog appears prompting you to save.
4. Click **OK**.

Custom Linearization

Two types of linkages are modeled: simple and compound. Most GE linkages use the compound linkage system.

Simple Lever Type — The simple lever has the pivot point (the potentiometer in the SVi1000) mounted a fixed distance (L1) from the valve stem pickup point. In order to compute the proper correction curve, the stroke length, the distance from the pivot to the valve stem pickup point and the valve position at horizontal must be entered. Clicking **Simple** computes the correction and display the curve.

Compound Lever Type — The compound lever linkage has two lever segments attached at one end to the pivot and the other end to the valve stem pickup point. In order to compute the proper correction curve, the user must enter the stroke length, first lever segment length (L1), second lever segment length (L2), the distance from the pivot to the valve stem pickup (L3), the valve position at horizontal. Clicking **Compound** computes the correction and display the curve.

Most GE linkages use a linkage with L3 equal to L1, i.e. the second lever arm is vertical when the first lever arm is horizontal. The correction computation will correctly compute the correction curve when L3 is not equal to L1, however L3 must be greater than 0 which requires that the valve stem pickup not be lined up with the pivot and that the pickup be on the same side of the pivot as the link between the first and second lever segments.

To create a custom linearization:

1. Select **Custom Linearization** from the *Custom Characterization* dialog and Figure 30 dialog appears.

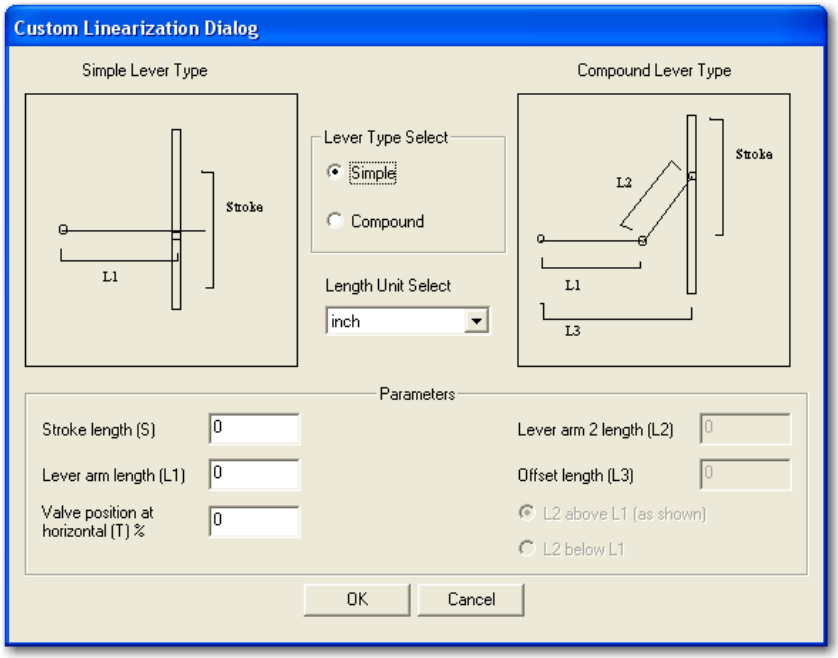


Figure 30 Custom Linearization

2. Enter values in the fields associated with either lever type and click the associated button.
3. Use the *Length Unit Select* pulldown to select either:
   - ❑ **inch**
   - ❑ **mm**
4. Click **OK**.

Air Action

Use this reset to factory defaults. *Air Action* is factory set.

Bumpless Transfer

Use the checkbox to select/deselect this option.

This option provides a means to maintain smooth valve control positioning when changing to Normal mode from Manual or Setup. Without *Bumpless Transfer*, when changing to Normal mode, the setpoint could vary in a manner that causes a significant process disturbance. *Bumpless Transfer* moves the controller signal to match the valve position so that smooth resumption of control with little disturbance results.

When *Bumpless Transfer* is selected, returning to Normal mode from Manual or Setup mode is deferred until the input signal matches the current valve position. Either the input signal or the valve position can be changed to match. If nothing is done, the system slowly changes the position until it matches the signal setpoint. The time taken to move to the position is determined by the *Transfer Time* which is a number between 0 and 255 and is approximately the number of seconds required to move the valve 100% toward the signal position.

Position Limits

Allow Tune to Override Limits	A checkbox for enabling/disabling autotuning and diagnostics to override limits.
Tight Shutoff Below (%)	Use this checkbox to enable/disable the use of *Tight Shutoff*'s value. Activates a tight shutoff below the value in the field. If the input signal would position the valve below the *Tight Shutoff* value, then air is supplied to fully seat the valve. Range: –1 and 20%.
Position Lower Limit	Use this checkbox to enable/disable the use of the value in the field. Activates a software limit stop. No valve position lower than this occurs when enabled. This is software only. During electrical/air failure, the valve moves to failsafe position. This stop is ignored during manual full open or close operations.
Position Higher Limit	Use this checkbox to enable/disable the use of the value in the field. Activates a software limit stop. No valve position higher than this occurs when enabled. This is software only. During electrical/air failure, the valve moves to failsafe position. This stop is ignored during manual full open or close operations.
Position Rate Limits	Click either/both boxes to activate a field to the right. Enter a value in seconds which is the time used for travelling full span.

DO Output Switches

Use this to define characteristics of the inputs and output switches and position retransmit.

Configuring Output Switches

You can change the following configuration parameters:

- ❑ DO (Output Switches)
- ❑ SP (Input Signal Range)

To configure the inputs and outputs:

1. Change the following configuration parameters:
   - ❑ *Output Switches* – See "Output Switches (DO2)" for descriptions of all the I/O settings.
   - ❑ *Input Signal Range* – See "Input Signal Range" on page 48 for descriptions of all the I/O settings.

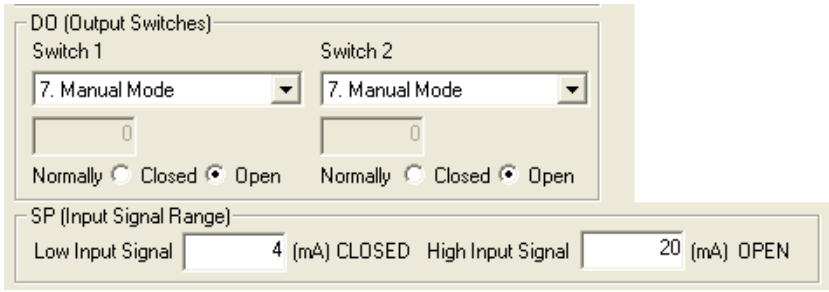


Figure 31 Configure Output Switches

2. Click **OK**.

Output Switches (DO2)

The SVi1000 supports two identical contact outputs which can be logically linked to status bits. The two output switches can be opened or closed in response to conditions that the SVi1000 detects. These conditions are:

0. *Always Normal Position*	The switch is not controlled by the SVi1000 and remains in it's default position.
1. *Failsafe*	The switch is activated when the SVi1000 is in failsafe mode.
2. Reset	The switch is activated whenever a reset has occurred and the switch remains activated until the SVi1000 status is cleared.
3. *Position Error*	The switch is activated whenever a position error has occurred and is deactivated when the position recovers to the correct position.

4. *Tight Shutoff Active*	The switch is activated whenever the device is in tight shutoff (tight shutoff is on and the valve position is less than the tight shutoff position).
5. *Position Low Limit*	The switch is activated whenever the valve position is less than the position setting of this switch control.
6. *Position Upper Limit*	The switch is activated whenever the valve position is greater than the position setting of this switch control.
7. *Manual Mode*	The switch is activated whenever the SVi1000 is in manual mode, configure mode, calibrate mode, or diagnostic mode.

Use the radio buttons to configure to default the switch as normally open or normally closed.

NOTE

The contacts are OPEN when the SVi1000 is unpowered and can be made to be open or closed when the flag is asserted after boot.

Input Signal Range

Use this parameter to adjust the current range Input Signal the low and high signal values. The low value must between 3.8 and 14 mA and the high value must be between 8 and 20.2 mA.

Configure Context Menu

When you right–click on the *Configure* tab the Figure 32 appears containing:

- ❑ *Detach Trend* – Removes the *Trend* display from the anchored tab format and creates a separate trend display
- ❑ *Help* – Displays the help file at the *Configure* tab instructions.

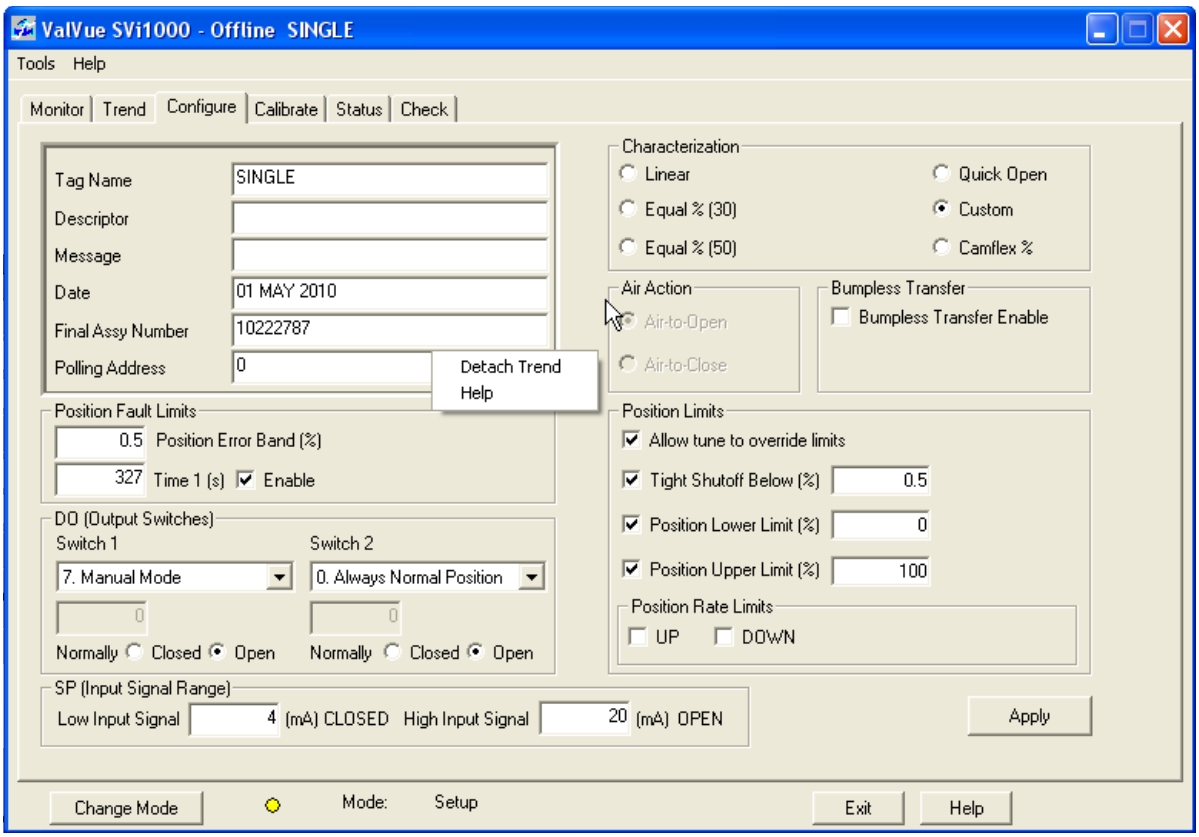


Figure 32 Configure Tab – Context Menu

Lock/ Unlock Local UI

You can lock and unlock the local user interface buttons to prevent any inputs from the unit.

The software defaults to having the local user interface buttons locked. The button on the tab appears as 

.

Click the button and the local user interface buttons are unlocked and the button changes to 

.

Calibrate

What you can do on the Calibrate Tab

Use the SVi1000 Figure 33 calibrate:

- ❑ *Calibration* – Signal calibration. See "Calibration" on page 51.
- ❑ Parameters – PID parameters and advanced parameters. See "PID and Advanced Parameters" on page 52.
- ❑ *Open Stop Adjustment*. See "Open Stop Adjustment" on page 54.
- ❑ Use the right click menu to:

- ❑ "Run Find Stops" on page 56
- ❑ "Auto Tune" on page 59
- ❑ Full Open
- ❑ Set Valve Position
- ❑ Detach Trend
- ❑ "Manual Find Stops" on page 58
- ❑ "Open Stop Adjustment" on page 54
- ❑ Full Closed
- ❑ Reset to Factory Cal

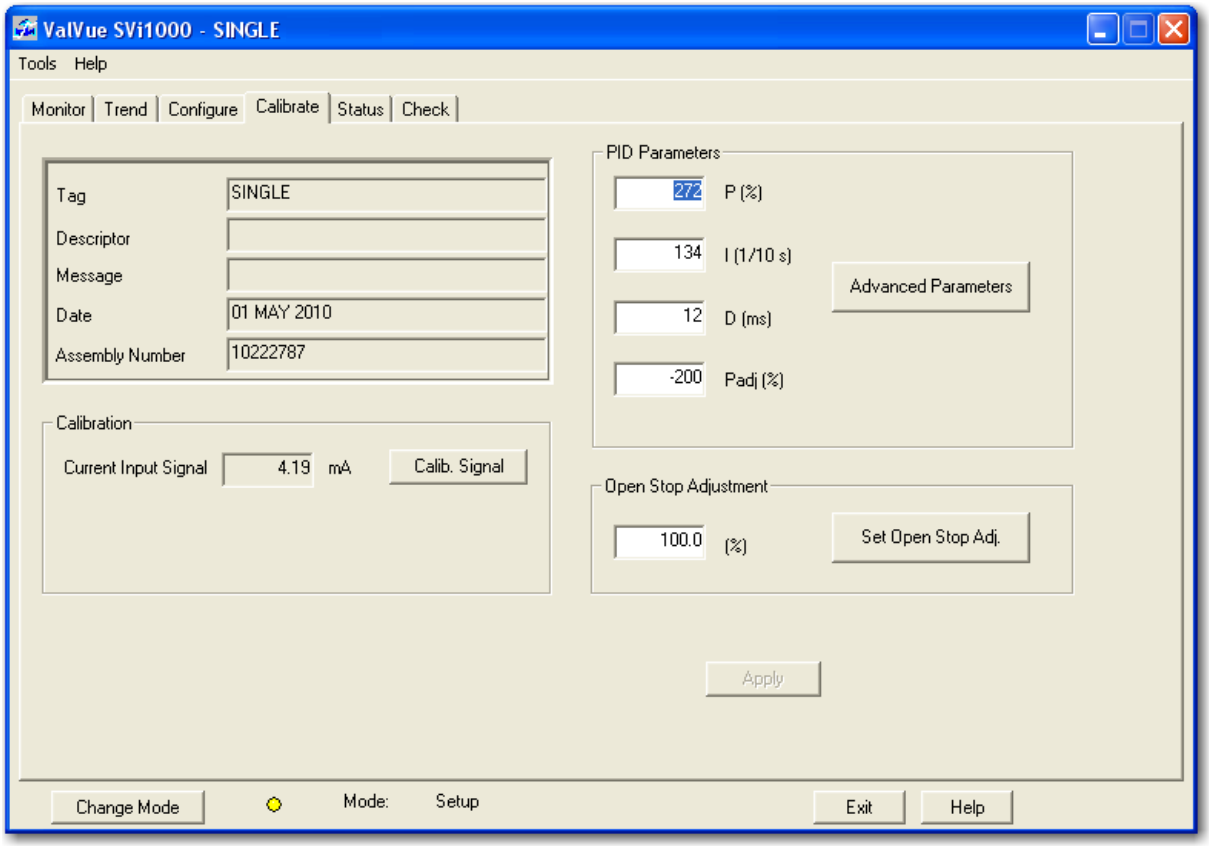


Figure 33 Calibrate Tab

Calibration

NOTE

Prior to performing pressure calibration all air must be turned off and all pressures vented. This procedure references a measuring instrument capable of reading +/– 0.01 psig.

The sensor is calibrated at the factory and does not usually require recalibration, but if needed, this dialog provides a convenient method.

To start this function:

1. Click **Calib. Signal.** and Figure 34 dialog appears.

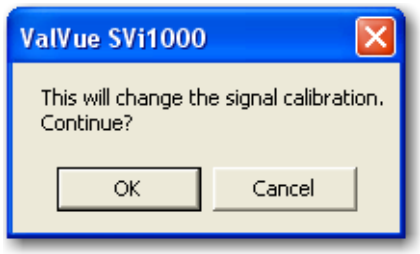


Figure 34 This Will Change Calibration

2. Click **OK** and Figure 35 dialog appears.

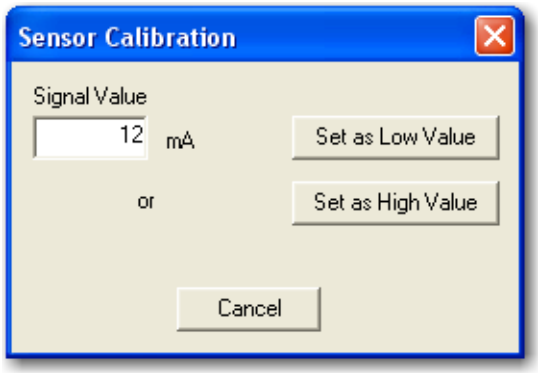


Figure 35 Sensor Calibration

3. Enter a value for either high or low and click the associated button and the Figure 36 dialog appears.

Figure 36 Calibration Has Been Changed

4. Click **OK**.

PID and Advanced Parameters

You can fine tune the SVi1000 using regular parameters or advanced parameters. On this tab you can adjust:

- ❑ *P*
- ❑ *I*
- ❑ *D*
- ❑ *Padj*

To adjust these parameters:

1. Enter values in the required fields in Figure 37.

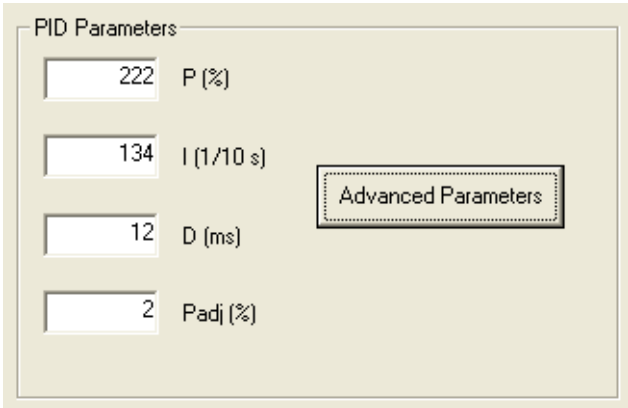


Figure 37 PID Parameters

2. Click **Apply**.

Advanced Parameters

Use this dialog to adjust:

- ❑ P
- ❑ I
- ❑ D
- ❑ Padj
- ❑ Dead Zone
- ❑ Beta
- ❑ Position Compensation Coefficient
- ❑ Boost

To adjust the advanced parameters:

1. Click **Advanced Parameters** and the Figure 38 dialog appears.

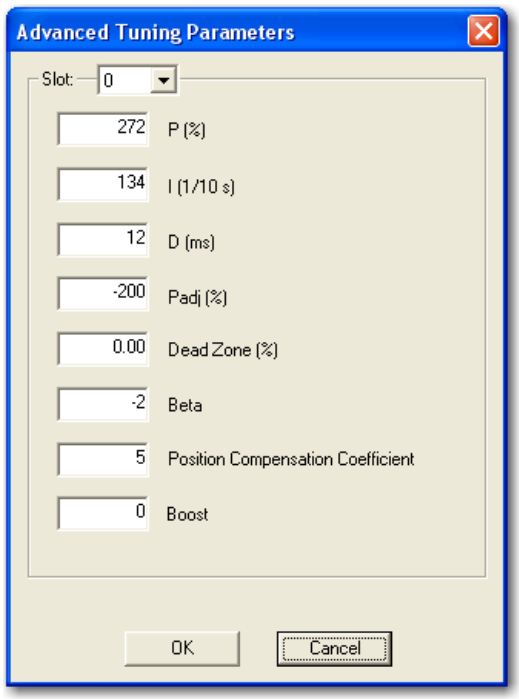


Figure 38 Advanced Parameters

2. Use the pulldown to select a slot to which the parameters will apply.

   These slots reflect the slots selected using the Configuration Selection Switch. Choosing the slot assigns these parameters to *only* that slot.

3. Adjust the parameters, then click **OK**.

   A dialog appears.

4. Click **OK**.
5. Click **Apply**.

Open Stop Adjustment

Recomputes the position scale so that at the value entered in the open stop adjustment edit box as a percent of full stops, the position reads 100%.

In some valves the travel exceeds the nominal valve travel. You can compensate for this so that the valve position reads 100% at the nominal travel.

Figure 39 shows how this works. This calibrates the position with the full travel of the valve.

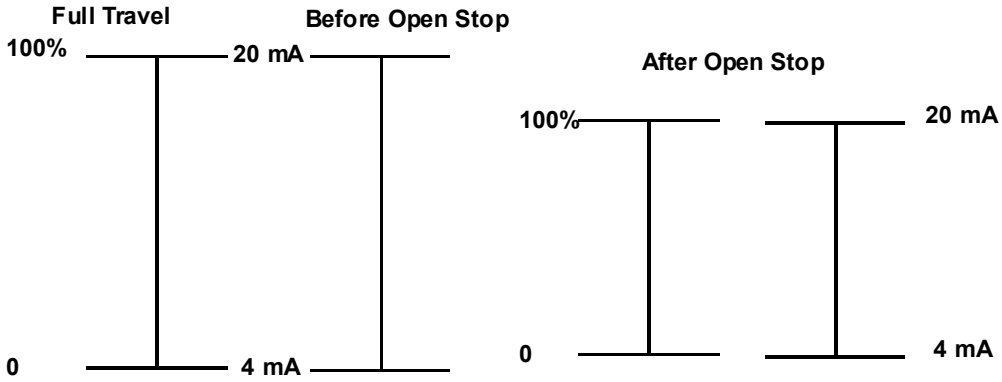


Figure 39 Open Stop Adjustment Diagram

To start this function:

1. Enter an open stop value in the edit field.
2. Click **Set Open Stop Adj.** and the Figure 40 dialog appears.

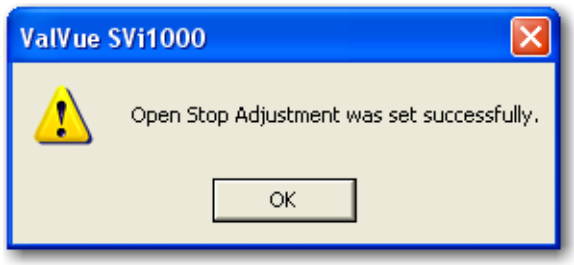


Figure 40 Open Stop Adjustment Successful

3. Click **OK**.
4. Click **Apply**.

Calibrate Context Menu

When you right–click on the *Calibrate* tab the Figure 41 appears.

NOTE

Only Detach Trend and Help are available in the Calibrate context menu for Normal and Manual modes.

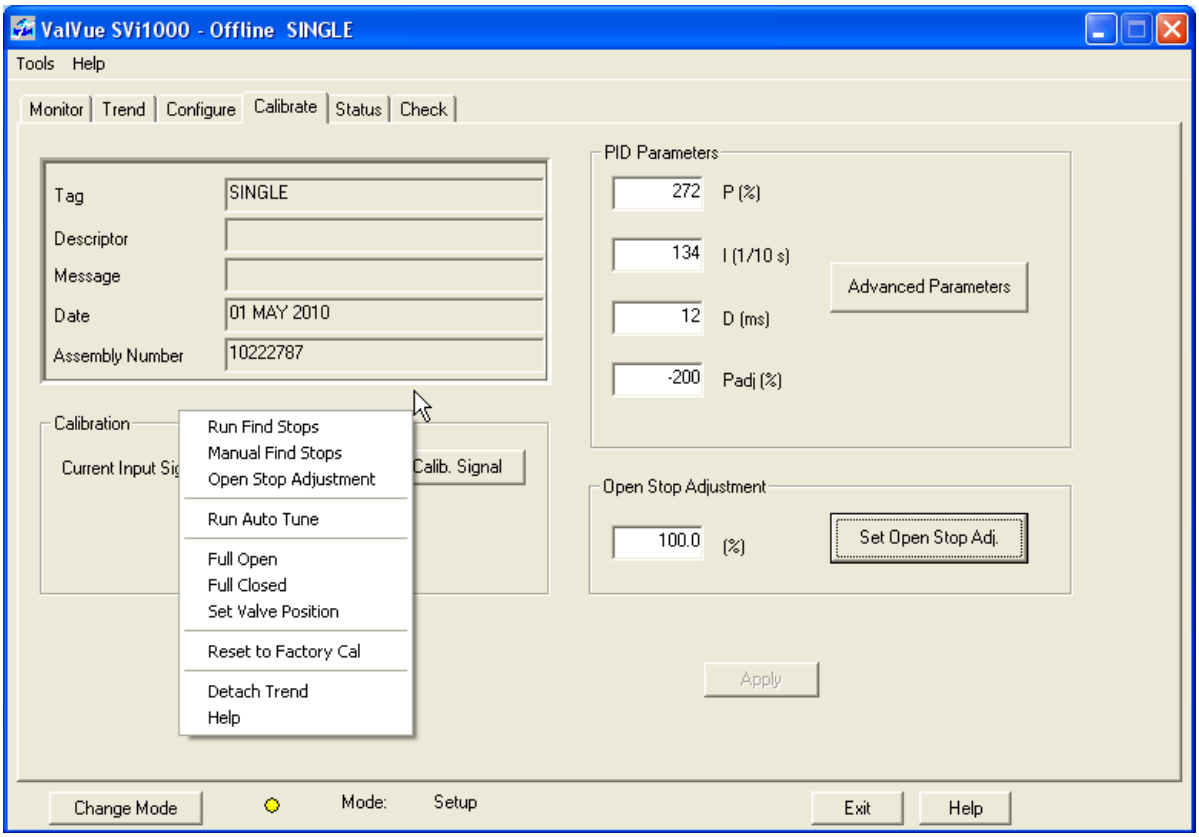


Figure 41 Calibrate Tab Context Menu

The following items are on the *Calibrate* context menu.

- *Run Find Stops* – runs the automatic position calibration process (“Run Find Stops” on page 56).
- *Manual Find Stops* – set the position calibration by moving the valve full closed and full open. On very large valves, the automatic find stops routine may timeout before the valve has reached the end of travel. Manual find stops allows calibration of these valves (“Manual Find Stops” on page 58).
- *Open Stop Adjustment* – See “Open Stop Adjustment” on page 54.
- *Run Auto Tune* – automatically finds appropriate PID parameters for the valve (“Auto Tune” on page 59).

- *Full Open* – Moves the valve to full open. This command works by taking the valve out of closed loop control and sends a high or low signal to the I/P.
- *Full Closed* – Moves the valve to full closed. This command works by taking the valve out of closed loop control and sends a high or low signal to the I/P.
- *Set Valve Position* – Allows you to set the valve to a specific position (this is accomplished by momentarily returning to manual mode, repositioning the valve, and returning to setup mode).
- *Reset to Factory Cal* – Resets the signal and pressure calibration to their factory settings.
- *Detach Trend* – Removes the *Trend* display from the anchored tab format and creates a separate trend display.
- *Help* – Displays the help file at the *Calibrate* tab instructions.

Run Find Stops

To determine valve position, the controller must measure and save the closed and open positions of the valve. This can be done automatically by running the *Run Find Stops* procedure from the *Calibrate* tab context menu.

The SVi1000 first exhausts the actuator and measures the position, then fills the actuator and measures the position. From these measurements the valve position is determined. Correction can be made for nominal valve travel if it is less than full travel. A progress tab appears while the find stops process is running.

To run *Find Stops*:

1. Right–click in the tab and select **Run Find Stops**.

   The Figure 42 dialog appears.

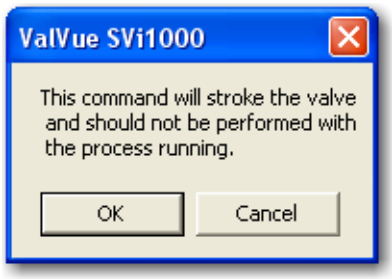


Figure 42 Starting Run Find Stops

2. Click **OK**.

When *Find Stops* is running, the Figure 43 dialog appears.

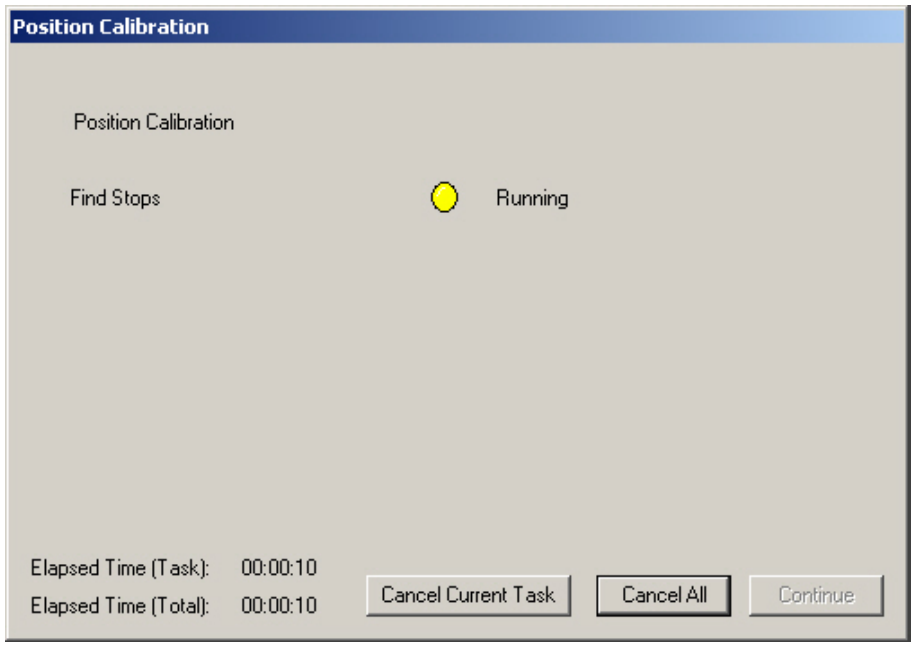


Figure 43 Find Stops

When *Find Stops* completes, the progress dialog appears as in Figure 44.

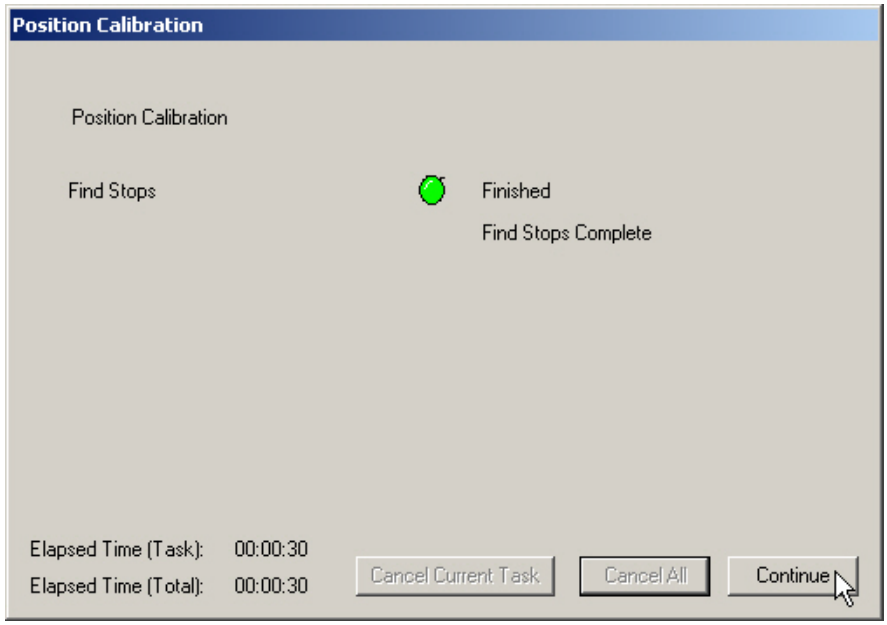


Figure 44 Find Stops Complete

3. Click **Continue** to close the dialog and return to the *Calibrate* tab.

Manual Find Stops

On some actuators it is possible that the automatic *Find Stops* procedure will not find the correct end positions of the travel. A semi–automatic method of calibrating the stop positions is provided.

When *Manual Find Stops* is selected, the valve is moved to full closed and you are asked to respond when the valve has reached the full closed position. The valve is then moved to full open and you are asked to respond when the valve has reached the full open position.

To run *Manual Find Stops*:

1. Right–click in the *Calibrate* tab and select **Manual Find Stops**.

   The Figure 45 dialog appears.

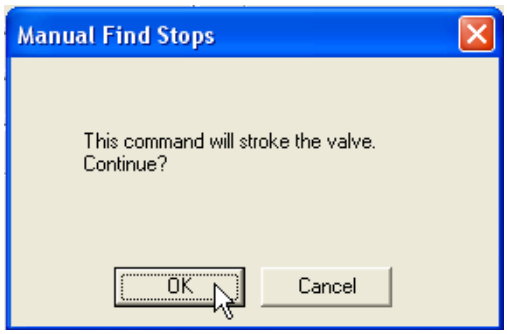


Figure 45 Stroke Valve

2. Click **OK** to continue.

   SVi1000 moves the valve to the fully closed position and launches the Figure 46 dialog.

Figure 46 Valve Closed

3. When the valve is fully closed click **OK**.

SVi1000 moves the valve to the fully open position and the Figure 47 dialog appears.

Figure 47 Valve Open Dialog

4. When the valve is fully open click **OK**.

Auto Tune

To start the Auto Tune function:

1. Right–click in the *Calibrate* tab and select **Run Auto Tune**.

   The Figure 48 dialog appears.

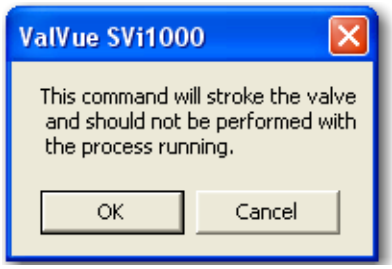


Figure 48 Start Running Autotune Warning

2. Click **OK** and the Figure 49 dialog appears.

Figure 49 Aggressiveness

NOTE

Aggressiveness: Enter a value that tends the valve to either fast response or overshoot. It is advised to increment the value one digit at a time to see the operational results.

3. Enter a value, click **OK** and the *PID Tuning* begins followed in sequence until complete.
4. Click **Continue** to return to the *Calibrate* tab.

Operation and Maintenance

6

Principle of Operation

The SVi1000 Electro Pneumatic Valve Positioner receives an electrical position setpoint signal from a controller or other device and compares the position setpoint input signal to the valve position. The difference between the position setpoint and position feedback is interpreted by the position control algorithm. This is used to compute a new output pressure. This output pressure is amplified by a pneumatic relay that drives the actuator. When the valve position agrees with the value called for by the position setpoint input signal the system stabilizes with no further movement of the actuator.

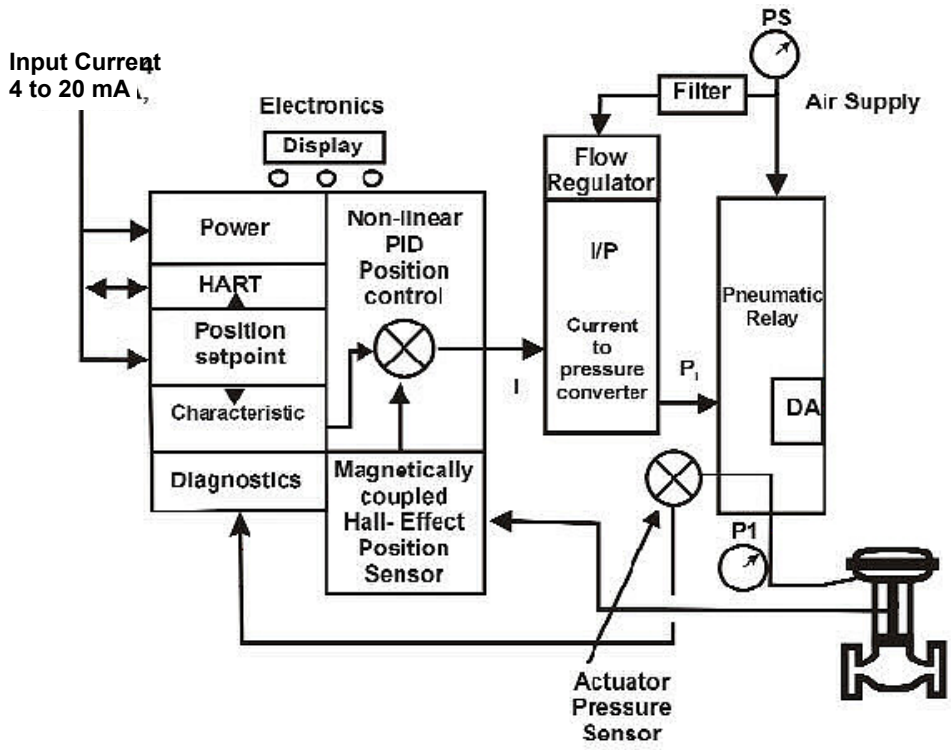


Figure 50 Block Diagram with I/P Converter and Pressure Sensor

Physical and Operational Description

The SVi1000 is housed in an industrial, tough, weatherproof, corrosion resistant poly carbonate housing. Electrical connections are made through two 1/2" NPT conduit entries. Pneumatic connections are made through two or three ¼" NPT ports.

Electronics Module

The Electronics module consists of an electronic circuit encapsulated in a housing. The electronics include a multiplexer, A/D, D/A, temperature sensor, Hall-Effect magnetic position sensor, pressure sensors, a micro controller, and a power management/ distribution circuit. The programs controlling the SVi1000 positioner are stored in a flash memory that allows for the downloading of upgraded firmware.

A separate non-volatile memory stores configuration information, and continuous diagnostic results. Expansion capabilities include two digital software switches and manifold gauges. Using the internal programmed positioner algorithm, the CPU computes the required output based on information received from the measurement sensors.

Magnetic Position Sensor

A non-contact sensor uses a magnetic field to transfer the position through the wall of the housing, without penetration, to sense the valve position. A Hall effect device, sealed within the electronics housing, senses the rotation of a magnetic assembly mounted on the end of a rotary valve shaft or on a driven linkage mounted on a reciprocating valve.

The output of the Hall sensor provides the position feedback signal to the position control algorithm. The magnetic assembly is environmentally sealed and is entirely external to the electronics housing. (See Figure 50 on page 61.) The Hall effect sensor has a maximum travel range of up to 140° rotation.

Position Retransmit

The position sensor also provides, through the electronics module, readout of valve position on the optional display and communication of valve position via HART protocol.

The position transmission option provides a 4 - 20 mA signal proportional to valve position transmitted on a separate pair of leads. A pair of contacts can signal high and low position limits.

Pressure Sensor

The pressure sensor located in the Electronics Module measures the output of the single acting relay. The pressure measurement is displayed on ValVue or read by a HART communication device.

Temperature Sensor

A temperature sensor is located in the electronics module and measures ambient temperature. This measurement is used to provide temperature compensation for the position and pressure sensors and other internal electronic components. The temperature is read via the HART communication link to provide a warning of excessive ambient temperature at the positioner.

Output Switches

The SVi1000 supports two identical contact outputs, SW #1 and SW #2 (Digital Output switches), that can be logically linked to status bits. The Digital Output switch terminals are solid state contacts, similar to relay contacts.

The switches are polarity sensitive and must be connected only to a DC circuit. When the switch is OPEN the + terminal must be electrically positive with respect to the – terminal. If the + terminal is electrically negative with respect to the – terminal, then the switch will conduct.

CAUTION

Polarity reversal will not damage the switch, but the switch will appear to be always ON.

There must be a series load in the circuit to prevent damage to the switch.

CAUTION

If the switch is connected directly across the power source the current will be limited only by the capacity of the power source and the switch will be damaged.

NOTE

A 1 Amp 24 Volt power source delivers much more than 1 Amp short circuit current.

The switch is rated for 30 V open and 1 Amp closed with a resistive load. An incandescent load (such as a lamp) draws a surge current of as much as 20 times the rated current of the lamp as the filament heats up. The switch current capacity is adequate to drive typical incandescent loads (such as annunciator panel lamps) but a 25 Watt lamp may damage the switch. An inductive load such as a solenoid valve or relay discharges the energy stored in the coil when it is on into the switch when the coil is turned off. The switch has adequate capacity to absorb the energy from a typical low power air solenoid or control relay. Using the switch to operate a large capacity motor controller may damage the switch.

Switch Settings

The two digital output switches can be opened or closed in response to conditions that the SVi1000 detects. These conditions are:

0. *Always Normal Position* - the switch is not controlled by the SVi1000 and remains in it's default position
1. *Failsafe* - the switch is activated when the SVi1000 is in failsafe mode
2. *Reset* - the switch is activated whenever a reset has occurred and the switch remains activated until the SVi1000 status is cleared
3. *Position Error* - the switch is activated whenever a position error has occurred and is deactivated when the position recovers to the correct position
4. *Tight Shutoff Active* - the switch is activated whenever the device is in tight shutoff (tight shutoff is on and the valve position is less than the tight shutoff position)
5. *Position Low Limit* - the switch is activated whenever the valve position is less than the position setting of this switch control
6. *Position Upper Limit* - the switch is activated whenever the valve position is greater than the position setting of this switch control
7. *Manual Mode* - the switch is activated whenever the SVi1000 is in manual mode, configure mode, calibrate mode, or diagnostic mode.

NOTE

The contacts are OPEN when the SVi1000 is unpowered and may be made to be open or closed when the flag is asserted after boot.

Pneumatic Module

The pneumatic module consists of an I/P and Relay assembly.

Current-to-Pressure Converter, I/P

The I/P converts a current signal to a pressure signal in the following manner:

1. A fixed coil creates a magnetic field proportional to the applied current.
2. The field magnetically pulls a flexure towards a nozzle to increase pressure on the flexure.
3. The pressure on the flexure increases in response to an increase in the coil current. Encapsulation of the coil provides protection from the environment.

Single Acting Pneumatic Relay

The single acting pneumatic relay amplifies the pressure from the I/P and increases airflow as required for stable, responsive, actuator performance. The single acting relay operates on any supply pressure that is at least 5 psi (.345 bar, 34.5 kPa) above the required actuator pressure, up to 100 psi (6.9 bar, 690 kPa).

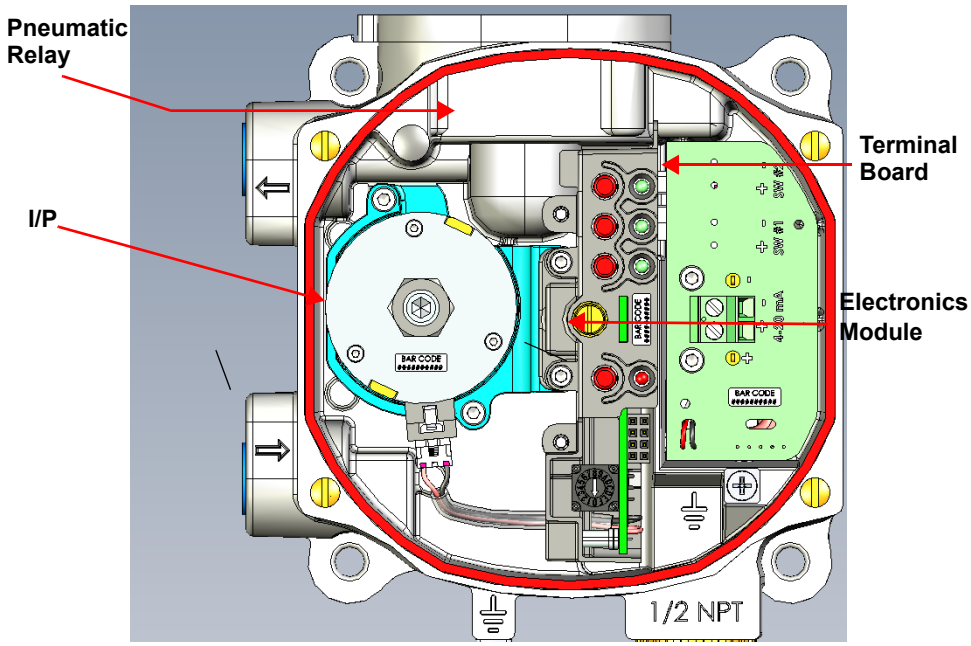


Figure 51 Pneumatic Module

SVi1000 Maintenance and Repair

Adjusting I/P Zero

The I/P Zero is calibrated at the factory prior to shipment. If there is a problem with I/P zero please contact your GE representative.

Repair by Replacement

Using ValVue and repair-by-replacement is the fastest method to service an SVi1000. See the ValVue instruction manual for details regarding uploading and downloading configuration files. Upload all configuration information from the installed positioner to ValVue, then install the replacement positioner and download the configuration file into the replacement unit. Run STOPS, and autoTUNE, and the repair is complete. The positioner that was removed can be refurbished and reused.

NOTE *Substitution of components can void safety approvals*

Internal Diagnostics

The SVi1000 performs internal self-diagnostics and hardware checks. When ValVue or HART Handheld or the local display indicates that there are error messages write them down for troubleshooting.

FAILSAFE Mode

Several of the internal diagnostics tests puts the SVi1000 into FAILSAFE mode if the errors continue for a preset time. When the SVi1000 goes into FAILSAFE, the valve is driven to its Failsafe position. It remains in that position until the posiitoner automatically clears the cause of the error and resets the instrument.

Upgrading Firmware

The SVi1000 is equipped with a nonvolatile re-writable Flash Memory for program storage. The firmware can be updated as improvements and advances are made in the embedded programs that operate the SVi1000. Firmware improvements for the SVi1000 can be obtained by contacting the factory.

Tools Required

- ❑ HART modem
- ❑ IBM PC with Windows XP or later, 16 MB RAM
- ❑ ValVue (provided with software upgrade on CD-ROM)

Installing Firmware Upgrade

It is recommended that the configuration is uploaded and saved prior to the installation procedure. Follow the ValVue instructions to save the old configuration. Follow the detailed instructions included with the software update.

To check the firmware version cycle the power off, then on, to perform a cold start. The display shows software version in upper right corner. When maintenance is complete reinstall the positioner and perform the checkout procedure detailed in “Installation and Set Up” on page 15. Consult the factory for firmware upgrade services. ValVue is the recommended tool for complete re-configuration. See “Configuration and Calibration” on page 39.

Specifications and References

A

Physical and Operational Specifications

This section provides the physical and operational specifications for the SVi1000.

Table 6 Environmental Specifications

Parameter	Storage & Transport (Packaged)
Operating Temperature Limits	-40 °F to 185 °F (-40 °C to 85 °C)
Storage Temperature Limits	-58 °F to 200 °F (-50 °C to 93 °C)
Temperature Effect	< 0.005% / °F typical; -40 °F to 180 °F (< 0.01% / °C typical; -40 °C to 82 °C)
Supply Pressure Effect	0.05% per psi (.73% per bar)
Operating Relative Humidity	5 to 100% non-condensing
Storage Relative Humidity	0 to 100% non-condensing
Humidity Effect	Less than 0.2% after 2 days at 104 F (40 °C), 95% Relative Humidity.
MTBF	The MTBF is in excess of 50 years at 55 °C.
Electromagnetic Compatibility Electrostatic	IEC 61514 Industrial-Process Control systems - methods of evaluating the performance of intelligent valve positioners with pneumatic outputs. IEC 61326 Electrical equipment for measurement, control and laboratory use - EMC requirements.
Fast Transient Burst	No effect at 2 kV (Coupling clamp EN61000-4-4 or IEC1000-4-4).
Housing	Tropicalized with positive pressure

Table 6 Environmental Specifications (Continued)

Vibration Influence Measured at SVi1000 Housing	4 mm at 5 - 15 Hz - Negligible 2 G at 15 - 150 Hz Less than 2 % of span 1 G at 150 - 2000 Hz - Less than 2% of span
Magnetic Field Influence	Negligible at 100 A/m 50/60 Hz (EN61000-4-8) CE MARK The SVi1000 conforms to the requirements of the ATEX 94/9/EC and EMC 2004/108/EC directives.

* Specifications are subject to change without notice

Table 7 Operational Specifications

Accuracy	+/- 1.0% (typical or less) Full Span
Hysteresis and Deadband	+/- 0.3% Full Span
Repeatability	+/- 0.3% Full Span
Conformity	+/- 0.5% Full Span
Start-Up Drift	Less than 0.02% in first hour
Long Term Drift	Less than 0.003% per month
Position Travel Limits	Rotary: 18 - 140° Reciprocating: 0.25” - 2.5“ (12 mm - 64 mm) *Note:* Above 2.5” (64 mm) consult factory for mounting instructions.
Tight Shut Off	0 -20% of input
Flow Characteristics Applied in addition to the control valve’s inherent characteristic.	Linear Equal Percentage (of 50:1 or 30:1) Camflex Quick Opening (inverse of 50:1 equal percentage) User Configurable

Table 7 Operational Specifications (Continued)

Position Auto Tune SVi1000 performs automatic determination of the optimal valve position control parameters. In addition to P, I, D, the position algorithm uses damping, symmetry for exhaust and fill time constants, dead zone and magnitude characterization parameters. Auto Tune is optimized for 5% step changes with negligible overshoot. After the Auto Tune process is completed, the user can further adjust the positioner tuning parameters to more conservative or to more responsive values.	Proportional gain: 0 to 5000 Integral time: 0 to 100 seconds - displayed as 0 to 1000 (1/10s) Derivative time: 0 to 200 ms Dead Zone: 0 to +/-5% (0 to 10% deadband) Padj: +/- 3000 (depends on P) Beta (non-linear gain factor): -9 to +9 Position compensation coefficient: 1 to 20 Boost: 0 to 20
Stroking Time	0 to 250 seconds
Full open position adjustment	60 to 100% of actual travel
Start Up Time (from no power)	Less than 500 ms
Minimum current to maintain HART	3.4 mA
HART Command#3 Mapping	PV= Valve Position, 0-100% SV = Actuator Pressure, configured eng. units TV = Reserved QV = Reserved

Table 8 Input Signal and Power, Specifications

Power Supply	Loop powered from 4-20mA control signal
Compliance Voltage Rating	9.0 V at 20 mA, 11.0 V at 4.0 ma
Minimum Current Signal to Start Up	3.2 mA
Minimum Input Span for Split Range Operation	5 mA
Upper Range Value for Split Range Operation	8 mA to 20 mA

Table 8 Input Signal and Power, Specifications (Continued)

Lower Range Value for Split Range Operation	4 mA to 14 mA
Wire Size	12/28 AWG
Strip Length	0.43 in / 11 mm
Digital Communication	HART Communication protocol revision 5

Table 9 Construction Material Specifications

Housing and Cover	Low Copper Aluminum Alloy
Weight	SVi1000: 3.2 lbs./ 1.451 kg SVi1000 SW/G/IM: 4.1 lbs./ 1.860 kg
Relay	Nitrile diaphragms, Polycarbonate
I/P Motor	430 stainless steel, Low Copper Aluminum Alloy, 300 series stainless steel, nitrile diaphragm
Magnet Holder	Corrosion Protected Anodized Aluminum 6061 T6
Pole Ring	416 stainless steel
Levers	300 Series stainless steel

Table 10 System Connectivity

HART Physical Device Type	Positioner; HART cmd rev 5, Device type 204 (0x00cc)
DD Registered with HART Communication Foundation	Yes
Integration with HART Host software	ValVue standalone, ValVue AMS SNAP-ON application available, Plug-In Application For Yokogawa PRM, ValVue For Honeywell FDM, Device Type Manager (DTM) for FDT Host

Table 11 Pneumatics Single Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered air (per ISA S7.3)
Action	Direct Acting
Supply Pressure	15 to 100 psi max. (1.3 to 7 Bar) Regulate 5 psi minimum above actuator spring range. Do not exceed actuator rating.

Table 11 Pneumatics Single Acting Standard Flow (Continued)

Air Supply	Dry, oil-free, 5 micron filtered air (per ISA S7.3)
Air Delivery	10.0 scfm (280 l/m) at 30 psi (2.1 bar) supply 16.6 scfm (470 l/m) at 60 psi (4.2 bar) supply 23.3 scfm (660 l/m) at 90 psi (6.3 bar) supply
Air Capacity (flow coefficient)	Loading CV = 0.30 Venting CV = 0.40
Air Consumption	0.19 scfm (5.4 l/m) at 30 psi (2.1 bar) supply 0.30 scfm (8.5 l/m) at 60 psi (4.2 bar) supply 0.40 scfm (11.4 l/m) at 90 psi (6.3 bar) supply
Air Supply Failure	On supply failure the actuator output fails to atmosphere. Some overshoot may occur when air pressure returns after a period without air supply pressure.
Loss of Input Signal	Actuator Output fails to atmosphere
Output Pressure	0-100 psi (6.9 bar) max

Table 12 SVi1000 Model Numbering

Model Number	Configuration
SVi1000	Assembly
SVi1000 /SW	Assembly with switches
SVi1000 /G	Assembly with gauges
SVi1000 /SW/G	Assembly with switches and gauges
SVi1000 /IM	Assembly with integrated magnet
SVi1000 G/IM	Assembly with gauges and integrated magnet
SVi1000 /SW/IM	Assembly with switches and integrated magnet
SVi1000 /SW/G/IM	Assembly with switches, gauges and integrated magnet

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Using the Digital Interfaces

B

Overview

This section describes the ways to communicate, configure, and calibrate the SVi1000. You can:

- ❑ Streamline the valve positioning function
- ❑ Improve precision of process control
- ❑ Communicate critical information locally and remotely

The four available communication tools listed below offer increasing levels of functionality.

- ❑ Local User Interface and LEDs. See “Functionality” on page 9.
- ❑ “Hand Held Communicator” on page 73
- ❑ “ValVue” on page 75
- ❑ Any HART capable Host loaded with the DD for the SVi1000

Hand Held Communicator

The HART handheld communicator is a universally available tool that provides all the accessibility of the local user interface. The HART tool has the functionality to upload and download configurations, enter alphanumeric messages and set the custom characteristic numerical parameters. The HHC 375, used as an example here, is approved for Intrinsically Safe use in Hazardous Areas in accordance with SVi1000 Approvals and in accordance with the HHC approvals. Additionally, you can use Emerson 475, Fluke 774, SMAR HPC301 or Merram 4X00.

For communication to a HART device, there is a Device Description Language. A Device Description, DD, is published by registration with the HART Communication Foundation. When the DD is installed in a host communication device then the host can readily access all the information in the smart field device. The SVi1000 registered DD will be available from HART Communication Foundation when it next publishes the HART DD.

While the SVi1000 is equipped with a local user interface, checkout and configuration can also be performed using the standard HART communications interface.

Connect the HART Handheld Communicator (HHC) to the SVi1000 as shown in Figure 52. Refer to the HART Communicator product manual included with the HHC or other HART Communication devices.

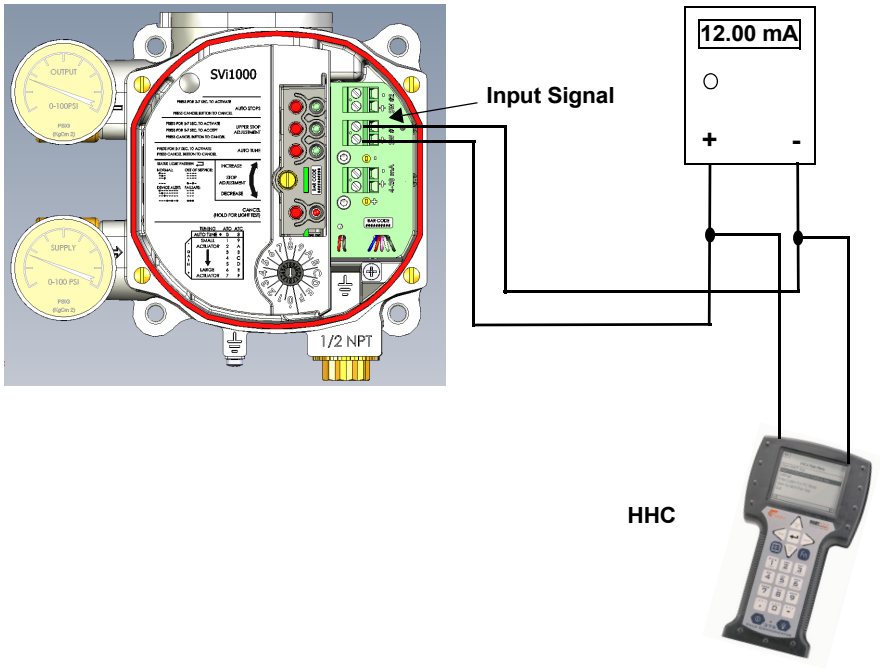

Figure 52 SVi1000 HART Communicator Connections

ValVue

ValVue combines the power of the PC with the features of the SVi1000 for ease of use and automation of positioner operation and full access to all data. ValVue Lite is provided with all SVi1000 positioners and is used for PC or laptop set up and operations. See "Configuration and Calibration" on page 39 for further information.

ValVue provides a user friendly interface that facilitates set up and operation of the positioner. ValVue is used to configure and calibrate valves with the SVi1000 utilizing HART communications protocol.

Installation of ValVue Software, and Registration

For assistance contact the nearest GE Sales Office, your local GE representative or email svisupport@ge.com.

Visit our web page at http:/www.masoneilan.com. ValVue Lite and a 60-day trial version of ValVue are included with the SVi1000. Contact the factory to purchase a registered upgrade to ValVue, or to request ValVue on a CD-ROM.

System Requirements

This section generally discusses the ValVue software that can be used to configure the SVi1000 from a HART configured laptop. ValVue Lite runs on IBM compatible computers. Minimum requirements for all versions of ValVue software are:

- ❑ Windows XP, Windows Vista, Windows 7, Windows Server 2003 and Windows Server 2008
- ❑ 64 MB RAM
- ❑ Hard drive available space 35 MB
- ❑ A CD ROM drive
- ❑ Bluetooth, available Serial or USB port
- ❑ A HART modem and appropriate cables

CAUTION

Do not connect a HART modem and PC to a control circuit unless the controller is HART compatible or has a HART filter. Loss of control or a process upset may occur if the controller output circuit is not compatible with HART signal.

WARNING

Do not connect a PC or HART modem (that is not approved as intrinsically safe) to an intrinsically safe circuit except on the safe area side of the barrier. Do not operate a PC in a hazardous area without compliance to local and plant regulations.

To configure ValVue for use:

1. Install the ValVue software in the PC in accordance with the instructions on the CD-ROM jacket.
2. Select ValVue from the program group, and double-click to begin and Figure 53 appears.

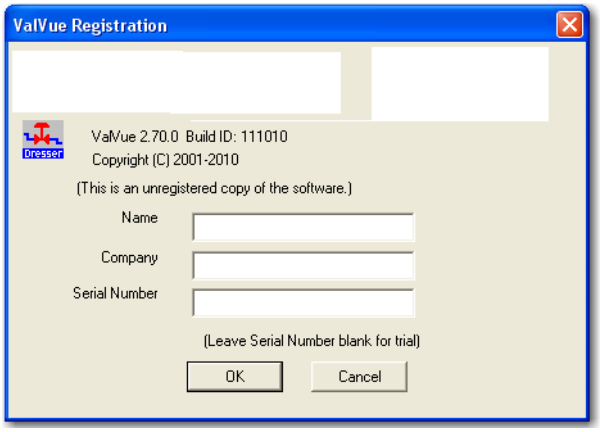

Figure 53 ValVue Registration

3. Click **OK** and a free evaluation dialog appears.
4. Click **OK** and Figure 54 appears.

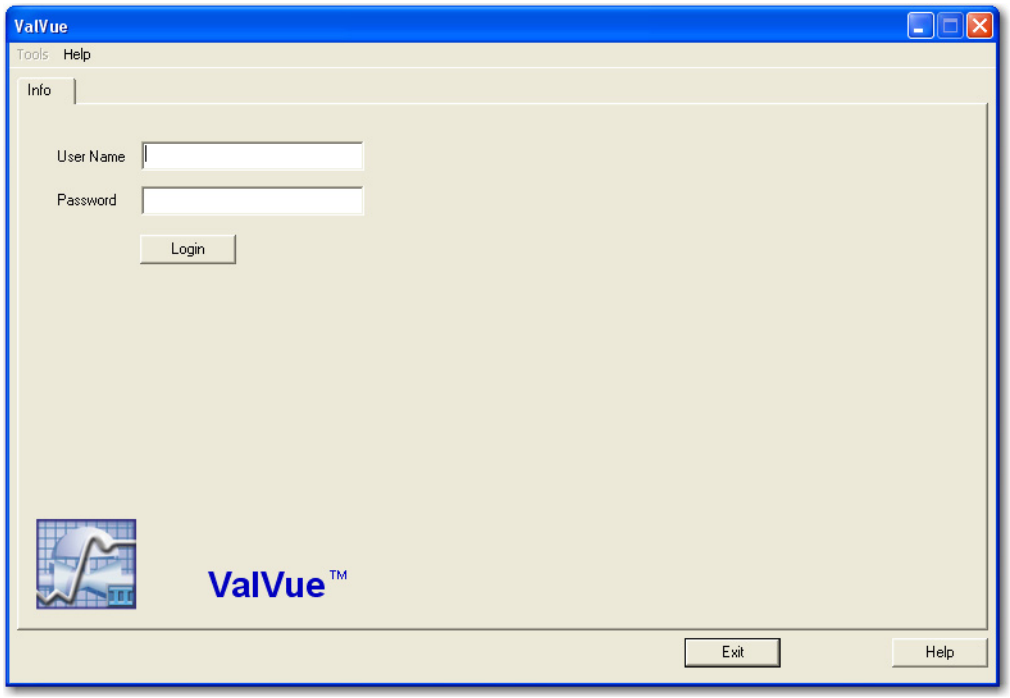

Figure 54 ValVue Login

5. Enter *admin* for *User Name*, click Login and Figure 55 appears.

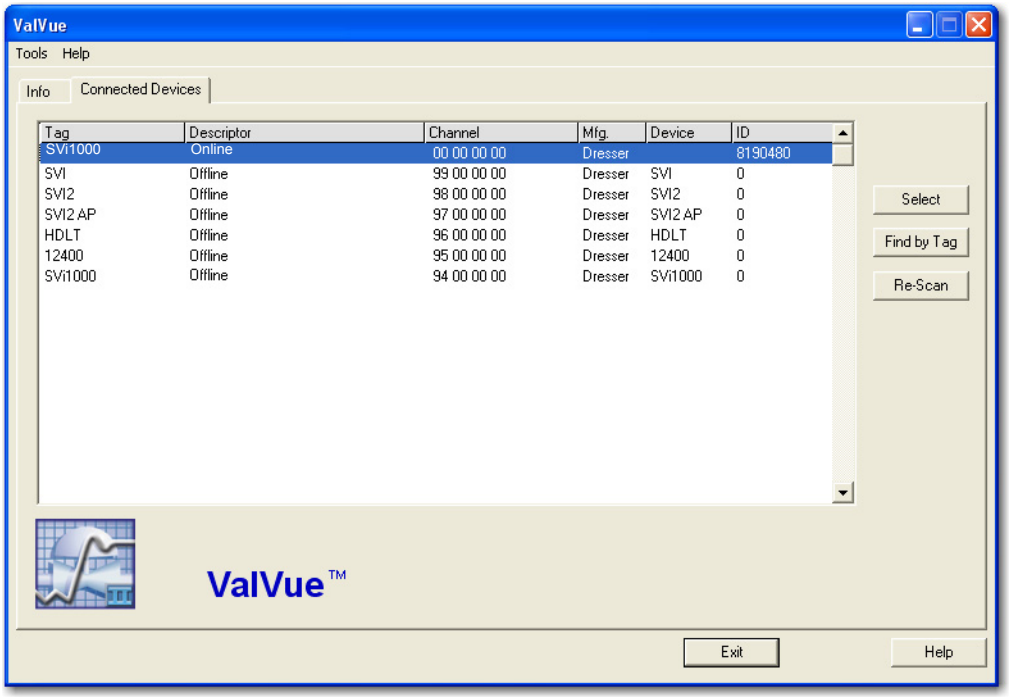

Figure 55 Connected Devices

6. Select **Tools > Set Options** and Figure 56 appears to set ValVue options. Set the COM port to the serial output connection attached to your PC modem. Checking **Allow Multidrop** slows down the search for active devices on single drop current loops and is recommended only for split range and multiplexor applications.

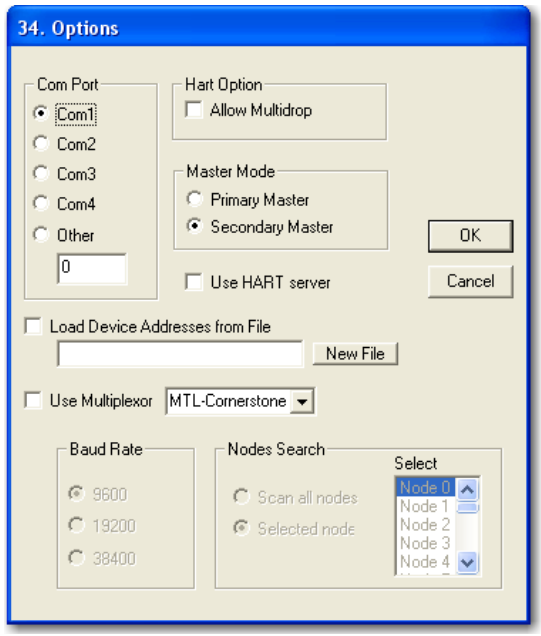

Figure 56 ValVue Options

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Wiring Theory for an SVi1000

C

Introduction

The SVi1000 provides reliable operations of control valves with utmost simplicity in setup and commissioning. It is uniquely equipped with a non-contact travel sensor allowing for accurate positioning and maintenance free operations. The pneumatic train of the SVi1000 is a dual-stage amplification system with stainless steel parts for durability. Using Hart eDDL and FDT-DTM technologies, the GE SVi1000 positioner provides interoperability with leading control systems suppliers.

SVi1000 Setups

Typical system setups are shown in Figure 57, *General Purpose Installation* schematic and Figure 58 on page 80, *Intrinsically Safe Installation* schematic.

Wiring diagrams are generalized, actual wiring must adhere to the electrical installation section of manual and local electrical codes.

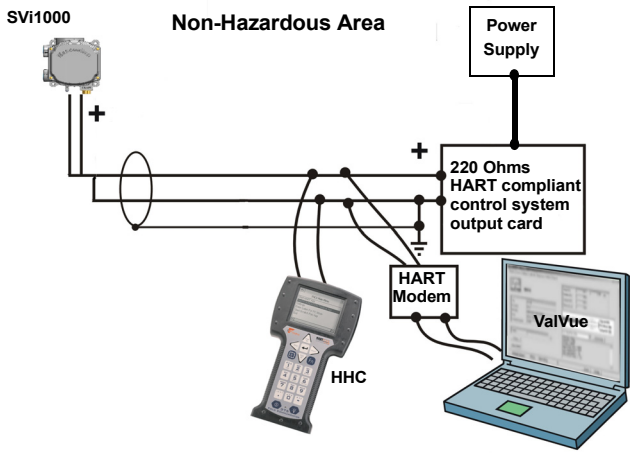

Figure 57 General Purpose Installation

In Figure 58, the SVi1000 is located in a hazardous area that is protected by Intrinsically Safe wiring practices.

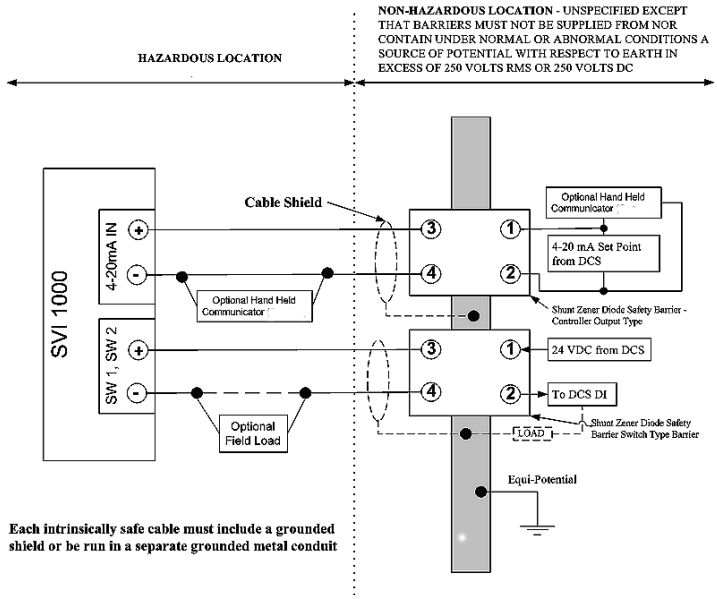

Figure 58 Intrinsically Safe Installation

Since the process control system, the source of the input signal, is located in a non-hazardous location, setup requires an intrinsic safety barrier be placed between the process control system and the SVi1000. SVi1000 can communicate with a remote PC running ValVue software via a modem connected to the PC's serial, or USB port, or using Bluetooth. The PC, which is not intrinsically safe, must be connected to the circuit on the safe area side of the intrinsic safety barrier if the valve is located in a hazardous area.

System Connections Considerations

All system connections must comply with the HART Communications Protocol Specifications. For complete technical information refer to the HART Communications Foundations Document Number HCF-SPEC-11 and the references. The SVi1000 is a HART compliant device of type *Actuator*. It is therefore a receiver of 4 - 20 mA, and cannot have a voltage source applied to its input terminals.

CAUTION

Applying a voltage can cause damage and void the warranty.

When installing the SVi1000 in a 4 - 20 mA current loop, the engineer designing the loop must consider a set of conflicting electrical requirements. The control signal to the positioner is a 4 - 20 mA current generated by the controller or DCS and transmitted to the positioner located remotely in the field. The electrical characteristics of a current loop sending a signal to the field device are different from the apparently similar loop bringing a signal to a controller from a transmitter in the field.

The positioner receives its power from the current signal. It receives its control setpoint from the value of the current and it must be able to communicate bi-directionally by superimposing signal tones upon the current signal without distorting the current signal, without the tones being affected by the electrical characteristics of the current signaling device. All these conflicting requirements must be met with equipment manufactured by various manufacturers, and work with long cables, in a noisy hostile plant environment. Energy levels are often limited for safe installation in explosive environments. Special engineering may be required to meet the signaling requirements at low energy levels.

The following will not cover all the details for a successful installation, in all cases. That is beyond the scope of this instruction. It will suffice to explain the requirements as a guide use to obtain necessary components from many sources for a successful installation.

CAUTION

Do not connect a HART modem and PC to a control circuit unless the controller is HART compatible or has a HART filter. Loss of control or a process upset may occur if the controller output circuit is not compatible with HART signals.

Install in compliance with Hazardous Area rules in accordance with local electrical codes and plant standards by trained specialists.

Do not connect a PC or HART modem (that is not approved as intrinsically safe) to an intrinsically safe circuit except on the safe area side of the barrier. Do not operate a PC in a

hazardous area without compliance to local and plant regulations.

NOTE

A control circuit must be HART compatible or have a HART filter installed. Contact the manufacturers of the controller or DCS. See "HART Filter Requirements" on page 39.

- ❑ Comply with current national and local regulations for electrical installation work.
- ❑ Before carrying out any work on the device, power off the instrument or make sure that the locale conditions permit the safe opening of the cover.

Wiring Guidelines

This list contains guidelines for a successful implementation of DC current signal, DC power, and HART communication to the SVi1000:

- ❑ Compliance voltage at the SVi1000 is 9 V at the current of 20 mA. A barrier is resistive, so there must be 12 V at 4 mA but the barrier voltage drop is acceptable if there is still 9 v at 20 mA.
- ❑ Signal to the SVi1000 must be a regulated current in the range 3.2 to 22 mA.
- ❑ Controller output circuit must be unaffected by the HART tones which are in the frequency range between 1200 and 2200 Hz.
- ❑ Frequency range of the HART tones must have a circuit impedance of more than 220 Ohms, typically 250 Ohms.
- ❑ HART tones may be imposed by the positioner and a communication device located anywhere on the signaling circuit.
- ❑ Cabling must be shielded to prevent electrical noise that would interfere with the HART tones, with the shield grounded.
- ❑ Shield must be properly grounded in only one place.
- ❑ For details and calculation methods for wiring resistance, and capacitance and for calculation of cable characteristics, refer to the HART FSK Physical Layer Specification.
- ❑ For split range installations the output voltage must be sufficient to operate two positioners (11 V @ 4 mA, 9 V @ 20 mA) and the expected voltage drop in the cable.
- ❑ Use of a low impedance voltage source damages the SVi1000. The current source must be a true high impedance current limiting device. A proper current source explicitly enables adjustment of the current in mA, not Volts.

CAUTION

When the unit is turned on, it is advisable to apply the air supply before applying the electrical input signal.

Grounding Practices

To ensure proper grounding make sure that case, signal, and ground connections are made in compliance with the plant's normal grounding practices. Any point in the loop can be referenced to ground, but there must never be more than one ground point. Normally ground is connected at the controller or at the intrinsic safety barrier.

The case grounding screws are located on the outside of the case. The case is isolated from all circuitry and can be grounded locally in accordance with applicable codes.

Compliance Voltage in Single Drop Current Mode

The SVi1000 requires 9.0 Volts at 20 mA and 11.0 Volts at 4 mA. Typical smart devices require MORE voltage at higher current. The controller supplying the current has LESS voltage available at higher current. The SVi1000 is unique in that it requires LESS voltage at higher current which compliments the characteristic of the source requiring only *9 Volts at 20 mA*.

NOTE

Improperly or inadequately grounded installations can cause noise or instability in the control loop. The internal electronics are isolated from ground. Grounding the case is unnecessary for functional purposes but grounding the case may be necessary to conform to local codes.

Table 13 through Table 15 on page 84 provide examples of several SVi1000 installations and calculating the compliance voltage necessary to supply 9 Volts at 20 mA.

Table 13 Compliance Voltage for Single Channel Zener with 22 AWG Cable

Voltage at SVi1000 at 20 mA	9.0 V
Drop in single channel zener barrier with 342 Ohms end to end resistance	6.84 V
Drop in 22 AWG cable, 3000 ft. long (30 Ohms per 1000 feet)	1.8 V
Drop in passive HART Filter*	0.0 V
Voltage required at controller	17.64 V

* Such as MTL HCU16AO

Conclusion: The control system must have a compliance voltage equal to or greater than 17.64 volts; contact the DCS vendor to verify compliance.

Table 14 Compliance Voltage for Galvanic Isolator with 22 AWG Cable

Voltage at SVi1000 at 20 mA	9.0 V
Drop in 22 AWG cable, 3000 ft. long (30 Ohms per 1000 feet)	1.8 V
Required voltage at Isolator	10.8 V
Voltage available from Isolator rated to drive 22 mA into 700 Ohms*	13.2 V
Voltage required at controller	Not applicable - Isolator supplies the power

* Such as R. Stahl Model 9318/16-22-10. Consult R. Stahl.

Conclusion: The compliance voltage issue is not present because the Isolator provides all the necessary voltage.

Table 15 Compliance Voltage for No Barrier with HART Filter and Resistor and 18 AWG Cable

Voltage at SVi1000 at 20 mA	9.0 V
Drop in 220 Ohm resistor	4.4 V
Drop in 18 AWG cable, 6000 ft. long (12 Ohms per 1000 feet)	0.6 V
Drop in passive HART Filter*	2.3 V
Voltage required at controller	16.3 V

Conclusion: The control system must have a compliance voltage equal to or greater than 16.3 volts; contact the DCS vendor to verify compliance.

Wire Size and Conduit

Electrical connections are made to the electronics module terminal board as shown in Figure 58 on page 80. The terminals accept wire sizes up to AWG 14. The SVi1000 is supplied with two 1/2" NPT conduit entries. M20 adapters are available. Internal and external ground terminals are provided for use if grounding is required.

NOTE

When an intrinsic safety barrier separates the SVi1000 from the modem or HHC a HART compliant barrier must be used.

HART Physical Layer Compliance of the Control System

Communications to a SVi1000 requires a HART-compliant communications loop. The HART protocol specifies the noise level, impedance requirements, and configuration of the loop. The controller or output card of the control system must comply with the Physical Layer Specification.

Impedance Constraints

HART communication is based on the *talking* device generating an AC current superimposed on the 4 - 20 mA control signal. Two frequencies are generated; 1200 Hz representing the digital value *1* and 2200 Hz representing the digital value *0*. The *listening* device responds to the voltage generated when the AC current flows through the loop impedance. In order to generate a voltage from a current there must be impedance. HART Protocol requires that this impedance be at least 220 Ohms at the tone signaling frequencies.

HART compliant current sources are supplied with the correct Impedance Versus Frequency Characteristic. In Non-Compliant Current Sources there may be a noise reduction capacitor across the output that lowers the impedance at higher frequencies and thus lowers the signaling voltage. To be certain that at least 220 Ohms of impedance is presented by the current source a resistor can be added in series with the current source. This reduces the effective compliance voltage of the current source by 20 mA times the value of the series resistor. An added resistor is unnecessary during tests with high impedance current calibrators such as the Altek Model 334 Loop Calibrator.

Noise Constraints

HART Communication depends on converting two frequencies (1200 and 2200 Hz) into digital values *1* and *0*. Noise can cause errors in the conversion. Conventional good wiring practice, such as use of twisted shielded pair cable with the shield and signal loop grounded at only one point, minimizes the effects of noise.

Cabling and Interconnection Requirements

Interconnections are made using shielded twisted pair cables. The shield is connected to ground at one point only. The signal loop is grounded at only one point in accordance with plant electrical standards. It is customary to ground the signal at the controller or intrinsic safety barrier. The SVi1000 is supplied with two 1/2" NPT conduit entries. M20 adapters are available. Internal and external ground terminals are provided for case grounding requirements.

WARNING

Install the SVi1000 in accordance with local and national code in both general and hazardous area locations. Substitution of components can impair suitability for use in hazardous locations.

NOTE

The internal electronic components are isolated for ground. Grounding the case is unnecessary for functional purposes. Grounding the case may be necessary to conform to local codes.

Capacitance vs. Length of Cable for HART

The HART Communications Foundations specifies cable capacitance requirements to preserve signal strength. Refer to the standards for detailed calculation methods.

CAUTION

Do not connect a HART modem and a PC to a control circuit unless the controller is HART compatible or has a HART filter. Loss of control or a process upset can occur if the controller output circuit is not compatible with HART signals.

HART Filter Required for Certain Control System Output Circuits

The SVi1000 is intended for use with all control systems. However, output circuits of several major DCS systems are incompatible with the tones used for HART signals. You must verify that the DCS or controller works reliably with the HART protocol. When the DCS is incompatible an external HART filter must be installed between the field wiring and the output card. MTL manufactures the HART filter HCU16AO. It is a 16 channel DIN rail mounted device composed of passive circuitry that introduces negligible voltage drop. For additional information, contact MTL.

NOTE

A control circuit must be HART compatible or have a HART filter installed. Contact the manufacturer of the controller or DCS. See *“HART Filter Requirements” on page 39.* *of this manual for more information*

Optional Switch Load Limits

D

General Configuration Notes

This section discusses the necessary precautions when configuring a system.

Switch V_{OUT} (Open Circuit) = 30 VDC max

Switch I_{IN} (Short Circuit) = 1 A

CAUTION

30 VDC across switch terminals and 1 A cannot exist simultaneously; doing so will result in failure of the digital output circuit.

Typical Performance Digital Switch On

V_{OUT} ≤1 V (This is the saturation voltage of the digital output element.)

Typical Performance Digital Switch Off

I_{IN} ≤0.200mA (This is the leakage current of the digital output element.)

The maximum voltage that can be applied to the digital switch outputs is 30 VDC. This is an open circuit parameter (the digital switch is in the open state). Under open circuit conditions, the switch current will be less than 0.200 mA. This means the digital switch output is dissipating 6 mW.

The maximum current rating is 1 A. However, there must be an external component (resistor) that ensures the digital switch ON output voltage is restricted ≤1 V. This ensures the digital switch output dissipates ≤1 W.

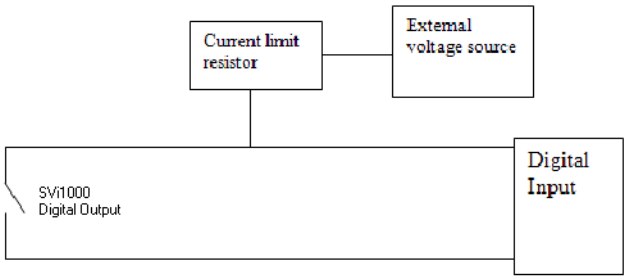

Figure 59 Simplified Switch Installation Drawing

Example:

SDV144 Input Module

Input Signal: ON: 1 kΩ maximum
OFF: 100 kΩ minimum

Current limit resistor R=750 Ω

External voltage source = 24 V

Digital output current = External voltage source / Current limit resistor = 24 V/750 Ω = 32mA

Inductive Load

An incandescent load (such as a lamp) draws a surge current of as much as 20 times the rated current of the lamp as the filament heats up. The switch current capacity is adequate to drive typical incandescent loads (such as annunciator panel lamps) but a 25 Watt lamp may damage the switch. An inductive load such as a solenoid valve or relay discharges the energy stored in the coil when it is on into the switch when the coil is turned off. The switch has adequate capacity to absorb the energy from a typical low power air solenoid or control relay. Using the switch to operate a large capacity motor controller may damage the switch.

Load Specifications

Recommended Load Specifications

Table 16 lists the operational specifications of the switches. These switches receive 32-channel 24 VDC on/off signals. With an isolated DI card (less than 24 V DC provided), the switch still sets on/off based on voltage.

Table 16 Switch Operational Specifications

Item	Specification
Rated Input Voltage (from relay)	24 VDC (sink/source)
Input ON Voltage	18 to 26.4
Input ON Voltage	5.0 V or less

Checking Switch Operation

ValVue Commands

This procedure gives an example, using the settings in Figure 60, to see if a switch is operating:

1. Click the **Configure** tab, click and Figure 60 appears.

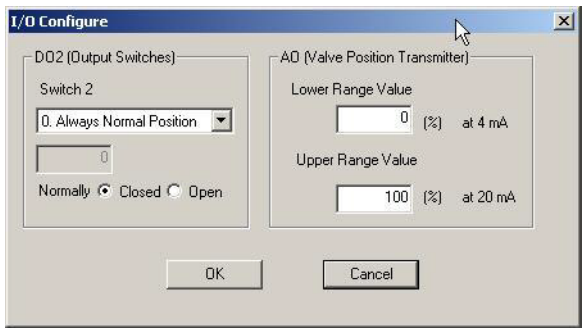

Figure 60 I/O Configure

2. Switch from *Normally Opened* to *Normally Closed* or vice versa, click **OK** and **Apply Changes**.
3. Click the **Check** tab.
4. Select **Command 142 Read Switches** from the pulldown list and click **Send Cmd**.

   The information field below populates with the configured switch states.

Ensure that the switch just reconfigured has changed state.

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Air to Open and Air to Close Actuators

E

Actuator Action

It is important to correctly assign air actuator action for each control variable throughout a control system. Even the control valve subsystem can be complex. Figure 61 and Figure 62 show the action of air to open, ATO, and air to close, ATC, valves when used with SVi1000. The figures show a direct acting positioner with linear and percentage characteristics. Some hysteresis is shown for the actuator pressure signal that is caused by friction in typical actuators. The scales are chosen to emphasize the relationships between input current and actuator pressure, so that the failsafe valve position is shown at the lower left of each graph.

NOTE

For an ATC valve, 4 mA represents 100% valve travel not the expected 0%. The controller and other human machine interfaces must correctly show that the valve is open 100% at 4 mA and closed 0% at 20.

The graph shows the valve movement and actuator pressure when the Tight Shut-off, T.S., option is set at about 5%. The valve movement and actuator pressure are also shown at the low current *lift-off* point at about 3.6 mA, below which the positioner is initializing its settings until power is stabilized.

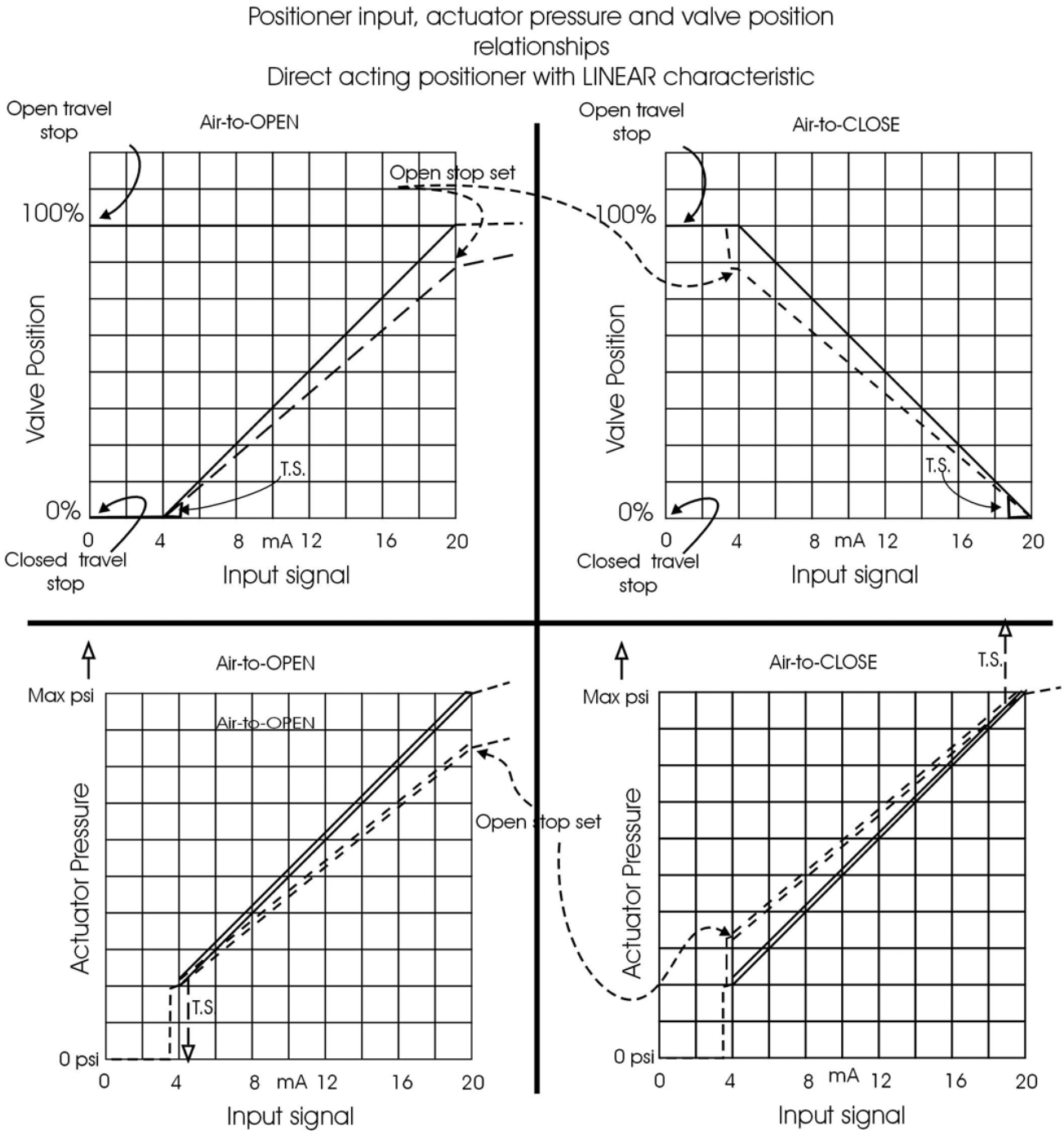

Figure 61 ATO and ATC Action with Linear Positioner Characteristics

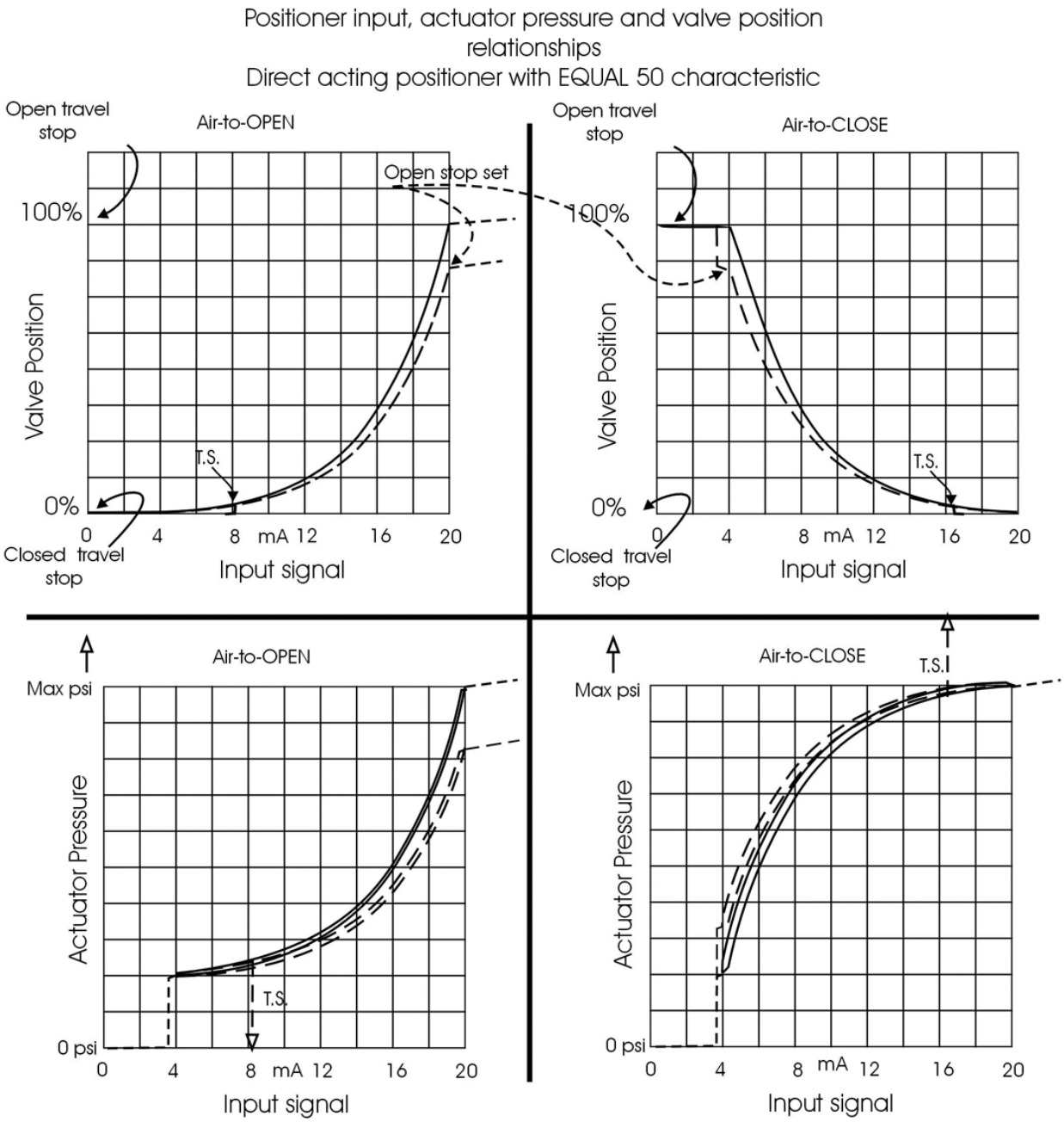

Figure 62 ATO and ATC Action in Percentage of Positioner Characteristics

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Air Supply Requirements

F

Air Supply Requirements

A high quality air supply greatly improves the quality of control and reduce pneumatic equipment maintenance costs. See ANSIISA-7.0.01-1996 - Quality Standard for Instrument Air. Air supply failure requires special attention to minimize process effects. Design and apply all process equipment to fail to a safe condition. This includes air supply failure. SViw1000 is designed to fail to a condition of low or no air pressure. Choose control valve actuators to move the valve to a safe condition when air pressure is low or absent. For example, a valve supplying fuel to a combustion process is normally equipped with an Air to Open valve. In other words, the fuel flow is shut off if air fails.

Additional process precautions can be taken. When the air supply recovers, the setpoint to the valve must be at a value that continues to hold the valve in its safe condition, or to move it to a known safe condition. To do so, put the control system sending the control valve position setpoint into manual mode and set to 0%. After the air supply has stabilized at its correct pressure, the setpoint can be moved to its operation point in accordance with the plant's safe start-up procedures. An additional precaution required on critical processes with an ATO control valve is to install a shut-off valve that supplements the control valve by moving to a safe condition on air failure, and remains in that condition until all necessary requirements for safe start-up have been met.

WARNING *Keep clear of moving parts. The SVi1000 can cause the valve to move when the air supply returns.*

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Adjusting Speed of Response

G

Adjusting Speed of Response

The SVi1000 provides in its Calibration software the ability to automatically tune the connected valve. The auto tune feature has robust tuning parameters designed to tolerate variations in process characteristics. You can adjust the control valve speed of response by adjusting SVi1000 parameters using ValVue tuning parameters, or using the HHC 375. See the SVi1000 help file for details.

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Advanced Usage

H

Technology to Maximize Savings and Process Performance

This section shows examples of techniques for achieving superior process results by using ValVue with SVi1000 to simplify maintenance and to achieve the benefits of SVi1000's advanced diagnostics capabilities. It is assumed that you are using HART communications with a modem and ValVue. Refer to the ValVue SVi1000 help file for complete instructions on these and other procedures.

Tight Shutoff Application to Protect from Seat Erosion

Program the Tight shutoff feature to prevent valve seat erosion using the full actuator force to eliminate damaging leakage. At a position setpoint of 2%, for example, this function allows full thrust to occur when the input signal is less than 2%. This solves a common cause of valve repair. Do not use tight shutoff if it is necessary to throttle the valve at very small flows.

Tight Shutoff Application to High Pressure Liquid Letdown Valve Trim

When staged trim is used in High Pressure Liquid Letdown Valves, adjust the Tight Shutoff to move the valve from the seat to begin throttling at the minimum operable CV level. Using the tight shut-off feature in SVi1000 prevents valve seat damage that can occur when throttling at clearance flows. See recommended Tight Shutoff settings in Table 17. Adjust Tight shutoff using front panel pushbuttons, with ValVue or a HART communicator.

Table 17 Tight Shutoff Parameters for HIgh Pressure Liquid Letdown Trim

GE Valve Type	Valve Trim Type	Set Tight Shutoff	Positioner Characteristics
Lincoln Log	Any	15%	Linear
41000 VRT Type S	Partial Stack	6%	Linear
41000 VRT Type S	Full Stack	3.5%	Linear
41000 VRT Type C	Cage	6%	Linear
28000	Varilog	5%	Linear
Any	Class V Shutoff	2%	Linear

Glossary

I

Accuracy	In a control valve the position is measured between mechanical motion limits in the valve. These limits can include position variations due to actuator and valve rigidity. therefore, accuracy is referenced to positions within normal travel of the valve independent of rigidity effects at the mechanical limits. Accuracy is the greatest deviation from the expected position within the normal travel, expressed as percent of normal travel.
Actuator Type	An actuator is a device that transforms an input signal (mainly an electrical signal) into motion. A HART compliant actuator receives a 4 - 20 mA control current signal and causes an actuation function. There are many types of HART actuators; a positioner is type of actuator. A device of type Actuator can not be connected to a circuit intended for a device of type Transmitter.
Algorithm	An algorithm is a procedure or formula for solving a problem. There are several algorithms entailed in SVi1000 operation. The SVi1000 has a position control algorithm that is a modified PID. Other algorithms embedded in SVi1000 include the STOPS method for calibrating stroke, and the autoTUNE method for establishing the best parameters for the PID algorithm.
ATC Air to Close	The combination of a single acting actuator and the control valve where the valve is closed when air pressure is applied to the actuator
ATO Air to Open	The combination of a single acting actuator and the control valve where the valve is open when air pressure is applied to the actuator
Characteristic	The positioner input setpoint command can be selectively modified to provide a desired relationship between setpoint and valve position. In the valve, the relationship between stroke and Cv is also called valve inherent characteristic. It is often adjusted by design, to equal percentage, for example. The positioner characteristic is applied to modify the setpoint to travel relationship of the actuator. The characteristic of the positioner must be chosen to compliment the valve. If the valve is equal percentage, set the positioner to linear. If a linear valve is installed the positioner can be set to an equal percentage characteristic to improve flow control. SVi1000 offers an eleven point custom characteristic option that can be created and edited in ValVue.

Closed	The valve position in which the flow is minimum or zero. See Tight Shutoff.
Compliance Voltage	The voltage that must be available at the control system output in order to drive the control current through the SVi1000 and all the resistive devices in series with it.
Conformity	The closeness to which the position approaches the theoretical position curve, for example equal percentage or quick opening. It is independent of effects due to valve or actuator rigidity at the mechanical limits of travel. See Accuracy.
Compliance, HART	Manufactured and tested in accordance with the HART Communications Foundation standards.
Condition Monitoring	A technology for measuring the performance of process equipment and valves over a period of time to predict the need for maintenance. The technology evolved to meet NRC requirements GL 89-10, and has proven valuable to other process industries. SVi1000 and ValVue offer a suite of diagnostic tools to implement condition monitoring.
Custom	The custom characteristic in the SVi1000 has nine points to define the relationship between the setpoint and the valve position. The ValVue software allows selection of the custom characteristic that must be downloaded as pairs of data using the HART communications from a HART master. ValVue offers a graphical drag-and-drop method to define the characteristic. It includes a method to correct for geometric non-linearity of the positioner feedback linkage.
DCS	Distributed Control System is a generic term for the common control system architecture that generally performs process control in networked computers and interacts with field devices through rack mounted I/O cards. A positioner is usually connected to a DCS output card which controls the 4- 20 mA current to the positioner.
Device Description, DD	The software object installed in the HART Handheld Communicator HHC 375 to allow it to communicate and display the custom parameters available in a field device.
EEPROM	An Electrically Erasable Programmable Read Only Memory. SVi1000 has two memories that are used for permanent storage of data that changes during operation. The micro-controller has EEPROM which permanently stores changing information such as number of actuator cycles and totalized valve travel. The program is stored in flash memory and can be upgraded.

Equal Percentage	A valve characteristic designed to compensate for the loss of pressure in a pipeline as a control valve is opened. It is intended to linearize the installed flow versus lift characteristic for improved control. *The theoretical curve is $y= a*e^{x\ln(1/a)}$, where *a* is.02, 1/R, and R=50 for a 50:1 equal percentage characteristic. However, the theoretical curve leaves the valve unseated by 2% at 0% input. The actual curve, shown here, is corrected to seat the valve at 0%. The corrected curve is $Y=(a*e^{x\ln(1/a)} -a)/(1-a)$.
Error Messages	The positioner stores the reasons for errors. The error messages can be read by HART or with ValVue.
Fail Safe	A mode of the positioner where the valve position is controlled to a predetermined safe position. This mode is forced by the positioner program in response to errors. If the errors are cleared then the positioner to the mode prior to the error.
Flash Memory	A computer memory that is not volatile. It stores all its data even when the power is off. It performs high speed reads and can be re-written many times. It is used to store programs and permanent parameters.
FSK	Frequency Shift Keying see HART protocol.
Hall Effect Sensor	A semiconductor magnetic-field sensor that measures the magnetic flux perpendicular to the sensor.
HART	HART is an acronym for Highway Addressable Remote Transducer. The HART protocol makes use of the Bell 202 Frequency Shift Keying (FSK) standard to superimpose digital signals at a low level on top of the 4-20 mA. This enables two-way communication to take place and makes it possible for additional information beyond just the normal process variable to be communicated tomorrow a smart field instrument. The HART protocol communicates without interrupting the 4-20 mA signal and allows a host application (master) to get two or more digital updates per second from a field device. As the digital FSK signal is phase continuous, there is no interference with the 4-20 mA signal.
HART Communication	The HART Communication Foundation is an independent, non-profit foundation corporation specifically organized to coordinate and support the application of HART technology worldwide. Educating the industry on the capabilities and value of this important technology is a key role. Operating costs are offset by membership and training/support service fees. Membership is open to all suppliers, end users, and others interested in the use of HART technology.

HART Filter	A filter required with certain DCS systems that are not HART compliant. It allows the 4 - 20 mA output signal to pass from control system to positioner, but blocks HART FSK tones from passing from the field wiring to the control system.
HART Master	A device, usually a PC which is controlling the communications over a HART protocol network. The HART master sends to a field device a command and requires a response.
HART Slave	A device, normally a transmitter or positioner, that communicates over a HART protocol network only in response to a command from a master.
Hazardous Area	The area of the plant where explosion hazards are present, hazards such as propane gas in a refinery, or dust in a flour mill.
HHC 375	The HART Handheld Communicator supplied by Fisher-Rosemount. It supports the DDs for all field devices. The DDs are combined into a single file and loaded into the HHC 375 memory by a manufacturer. Memory is available in several capacities.
Hot Swapable	The SVi1000 in combination with ValVue enables a very brief Mean Time To Repair by the following process: Upload all configuration information from installed positioner to ValVue, then replace the positioner and download the configuration file. Run STOPS, and autoTUNE, and the repair is complete.
I/P Converter	The current to pressure converting device. The SVi1000 sends an analog current signal to the *I/P* which produces a controlled pressure to the pneumatic amplifying relay.
ISA	The Instrument Society of America. ISA develops and publishes international standards for use in process control. See www.isi.org.
Multidrop	A variation of the HART Communications Protocol that allows many smart field devices to draw power from and to communicate over a single pair of wires. Though most suited to multiple measurement devices, it can be used with SVi1000 to permit digital communication of setpoint as well as configuration data, to multiple positioners or a combination of positioners and measurement transmitters. Such communication may not be fast enough for flow control.
Multiplexer	Several instrument suppliers offer equipment that can be connected to multiple cables to monitor and communicate with the attached positioners and transmitters using the HART protocol. Often the multiplexer is used with a DCS that does not support HART.

NAMUR	NAMUR is a European user association of process control technology in chemical and pharmaceutical industries. “Recommendations and Worksheets are experience reports and working documents prepared by NAMUR for its members among process control users for facultative utilization”. NAMUR issued a recommended accessory mounting for control valves (NE 14 Anschluß von Schwenkantrieben an Armaturen 06.08.96) which describes a method for mounting a positioner on an actuator. See at www.namur.de.
Neodymium Iron Boron	A magnet alloy which provides the highest energy magnetism available in a permanent magnet.
Non-Volatile Memory	Computer memory that is not lost when power is turned off. Used to permanently store calibration, configuration and diagnostic information in SVi1000.
NORMAL Mode	The control mode for normal use of a valve positioner. The positioner receives a setpoint from a controller or DCS and applies pressure to the actuator to move the valve to the required position.
PC	As used in this manual, a personal computer or laptop running under Windows XP or later operating system.
Position	With a reciprocating valve, the position is the distance of the plug from its seat, normally measured as a linear motion of the valve or actuator stem. With a rotary valve the position is the angle of rotation of the valve plug measured as angular rotation of the valve shaft.
Position Limit	The Actuator can be mechanically set to stop at a predetermined position by setting an adjustment, sometimes with a handwheel or screw stop. SVi1000 can be configured to provide the same limits through software control of position.
Positioner Tuning Parameters	The positioner requires six integer parameters to determine the response of the positioner to a setpoint change. Internally, the positioner uses an improved PID control algorithm to control the valve’s position.
Tuning Parameters	
P	P is a dimensionless gain factor related to the proportioning action of the algorithm. It ranges from 0 to 5000. Common values for the positioner are 50 for small valves up to 4000 for large valves.
I	(0.1 sec): Integral time or reset time, is the time constant of integral control. Higher values of I cause slower integral action. Common values are 10 (1 second) to 200 (20 seconds). A value of zero disables integral action.

D	(msec): Derivative time or rate time is the time constant of derivative control expressed in milliseconds. It ranges from 0 to 200 msec. Common values are 0 to 100. A value of zero disables derivative action.
Beta	Beta is a nonlinear dimensionless gain factor, ranging from -9 to 9. When beta is 0, the controller gain is linear. Otherwise the gain is the function of error. The larger the beta, the smaller the gain for small error. Typical beta values for a valve position controller are between –9 and 0.
Padj (%)	Valves often have significantly different response when filling versus exhausting. The proportional gain is adjusted by adding Padj to P when the valve is exhausting. Padj is normally less than P.
Position Compensation Coefficient	The response of the valve is different when the valve is nearly closed than when the valve is nearly open. The position compensation coefficient, which is a number between 0 and 9, allow the control algorithm to optimize the valve response.
Damping Coefficient	The valve response can be made slower for some applications. A value of 0 gives no damping, and a value of 9 gives maximum damping of valve motion.
Dead Zone(%)	When the valve position is within the setpoint +/- the dead zone, no additional position control is performed. This value is normally 0%, however for high friction valves (e.g. valves with graphite packing) a higher dead zone helps avoid limit cycling due to the stick/slip action of the valve. In these cases the dead zone chosen might be 0.2% to 1%.
Quick Opening	(see Characteristic)
Relay, Pneumatic	The component that amplifies the pneumatic control signals to provide a wide range of actuation pressure and to supply and vent at high flow rates for responsive control.
Safe Area	The area of a plant where there never is an explosion hazard present, such as the control room or a wire marshalling rack area.
Sig Hi	In the SVi1000 configuration, the input current setting at which the valve is fully open (ATO) or fully closed (ATC).
Sig Lo	In the SVi1000 configuration, the input current setting at which the valve is fully closed (ATO) or fully open (ATC).
Single Acting	The action of a position with a single pneumatic output for operation with a spring return actuator.

Split Range	A control configuration where a single control output is sent to two or more control valves. Each control valve positioner is calibrated to respond to a separate portion of the control signal. An example is a steam valve and a cooling water valve arranged to be both closed at 50% and the steam valve to open.
STOPS	The SVi1000 runs STOPS procedure to adjust the positioner to actual valve travel. First the output pressure is reduced to zero and the position is recorded. That position corresponds to 0%. The output pressure is raised to its maximum based on supply pressure. The position is recorded and corresponds to 100%.
Stroke	The total range of valve travel. Often used as a verb to describe the process of moving the valve.
Tag	The formal designator the control valve used in control loop documentation.
Tight Shutoff (TS)	A positioner property which is selected and adjusted when it is desired to prevent operation of the valve at or near the closed position. The positioner causes all available actuator force to be applied to the valve seat at a position set point equal to or less than the TS adjustable parameter. A dead band is applied to prevent cycling in and out of this behavior.
ValVue Lite	The GE software for calibration, and configuration that is provided with every SVi1000.
ValVue	The full featured GE software for diagnostics, calibration, and configuration of SVi1000.
VDE/VDI 3845	A Standard common in Europe for mounting positioners and accessories on rotary valve actuators.

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GEA19363 November 2011
[PN 720013363-779-0000 Rev. A]