Masoneilan™

SVI™ II AP Digital Positioner

Advanced Performance

Installation and Maintenance Manual (Rev. Y)

Baker Hughes

About this Guide

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

- SVI™ II AP -2 through SVI2 AP -3
  - with Firmware version 3.1.1, 3.1.2, 3.2.1, 3.2.3/4.1.1, 3.2.5/5.1.1 and 3.2.7/5.1.3.
  - with ValVue™ version 2.4 or greater
  - with AMS™ ValVue SNAP-ON™ version 2.4 or greater
  - with ValVue PRM Plug-in
  - with handheld communicator with DD published for SVI II AP

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.valves.bakerhughes.com.

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Document Changes

Version/Date	Changes
E/2-2011	Added to description of Switches configuration. See Operations and Maintenance.
F/2-2012	Added description relevant to introduction of the high throughput version, including: • Added text applicable to the addition of HART® 6 functionality. • Added sections applicable to the addition of the High Flow unit to the product line. • Removed reference to being SIL 2 compliant. • Updated for new ValVue 2.8 Options dialog, which includes polling address scan functions.
G/10-2012	Changed the specifications to reflect single acting supply pressure of up to 100 and double-acting up to 150 psi. Changed figure on actuator piping.
H/09-2013	Changed Simplified Installation drawing in Output Switches section and added cautions referring to that section in installation. Added Cautions in Position Low Limit and Position Upper Limit. Added text about the 4-20 retransmit galvanic isolation.
I/02-2014	Changed Simplified Installation drawing in Output Switches section and amended the text.
J/06-2014	Omitted the Remote Sensor install section. Added section to show where gas normally bleeds from the unit. Added HART® signal to the HART® Command 3 specification.
K/12-2015	Modified connection drawings for intrinsically safe in Appendices B and C. Added Fault Matrix section. Added Burst Mode section. Changed all references for ValVue to ValVue 3. Add Device Identification and Fault Matrix.
M/04-2016	Made changes to indicate upgrades for HART® 7 (Squawk command and firmware areas). Relabeled Fault Matrix to Device Status Diagnostics.
N/09-2016	Changed firmware references for 3.2.7/5.1.3. Added 475 Handheld information to Configuration and Calibration section. Changed Air Capacity specifications. Amended throughput specification in Natural Gas Install section. Updated download website throughout.

Document Changes

Version/Date	Changes
P/08-2017	Removed *Verifying Wiring* section in general install. Added section on compliance voltage testing. Changed references to HART® Foundation to Field Comm. Added Download Section for software. Added Models and Features Comparison section. Added BHGE Documentation Resources for Masoneilan Products section. Added Notes on Aggressiveness. Added Troubleshooting Autotune.
Q/12-2017	Updated Output Switches section for DCS configurations. Updated LCD Troubleshooting table.
R/01-2018	Updated Output Switches section for DCS configurations. Added section on SVI Physical Characteristic Identification.
S/01-2019	Added note about ATO tight shutoff. Add contact information. Added Return Authorization Form. Added guidance on Auto Tune failure. Added to tri-loop configuration. Changed download procedures for new site. Added to firmware versions.
T/05-2019	Modified Burst Mode section.
U/03-2020	Rebranded to Baker Hughes guidelines. Updated software download section. Updated firmware versions.
V/04-2020	Administrative changes
W/04-2020	Administrative changes
X/04-2020	Administrative changes
Y/05-2020	Added spare kit parts for electronic module for double acting with advance diagonostics

Contents

Figures

Tables

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1. Safety Information

This section provides safety information including safety symbols that are used on the SVI II AP and the safety symbol definition.

CAUTION

Read this entire section before installation and operation.

Safety Symbols

SVI II AP instructions contain **WARNINGS**, **CAUTIONS** labels and **Notes**, where necessary, to alert you to safety related or other important information. 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.

SVI II AP Product Safety

The SVI II AP digital valve positioner is intended for use with industrial compressed air or natural gas systems only.

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 SVI II AP to the surrounding area, and may require additional precautions or specialized installations.

Intrinsically Safe Installation

Products certified as explosion proof or flame proof equipment or 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 potentially explosive atmospheres.
- √ 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 areas with potentially explosive atmospheres.

WARNING

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

Under certain operating conditions, the use of damaged instruments could cause a degradation of the performance of the system, which can lead to personal injury or death.

Under certain operating conditions the SVI II AP High Flow unit can produce noise levels greater than 85 dBA. Perform proper site monitoring and testing to verify the need for engineering or administrative controls to eliminate or reduce hazardous noise levels.

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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2. Introduction

The SVI II AP (Smart Valve Interface) is the next generation of Masoneilan's intelligent digital valve positioners. The SVI II AP is a high performance, digital valve positioner that combines a local display with remote communication and diagnostic capabilities. The SVI II AP offers a multitude of options that fulfills the broadest range of applications. It also communicates using the HART® protocol. The High Flow version is capable of 2.2 C_v air throughput.

An optional pushbutton and LCD display 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 SVI II AP.

The SVI II AP is provided with Masoneilan's ValVue software. The user-friendly interface facilitates the setup and diagnostics of a control valve.

Figure 1 SVI II AP Positioner

ValVue Software

Not only does ValVue provide the ability to quickly and easily set up the SVI II AP you can also monitor operation and diagnose problems with ValVue's advanced diagnostic capabilities.

NOTE

You must use the ValVue 3 software and the SVI II AP DTM software to support HART® 7. ValVue 2.x will not work.

NOTE

If you are new to DTM technology there is a good explanation given on the fdtgroup home page. Visit: https://fdtgroup.org/technology/components/ for an explanation of basic frame and DTM concepts.

System Requirements

Minimum requirements for all versions of ValVue software are Windows® 2003 Server (SP3), Windows® 2008 Server (SP2), XP, Windows® 7, Windows® 8, Windows® Server 2012, 64 MB RAM, and a serial or USB port connected to a HART® modem. For software installation, a connection to the internet to download ValVue and the SVII AP DTM.

ValVue and SV II AP DTM DTM Trial Version

You must download the ValVue software and the SVII AP DTM software and install to configure and use the SVI II AP. For the most recent software visit our SVI II AP web site at:
valves.bakerhughes.com/resource-center.

The SVI II AP DTM software and the Valve software comes with a trial version of ValVue. For 60 days after the initial installation, The ValVue software provides the FDT frame capability in which the SVI II AP DTM software operates. The SVI II AP DTM software provides the capability of configuring, calibrating, diagnosing, trending and much more. After the 60 trial period ValVue must be registered for use. ValVue Functionality includes:

- √ Setup Wizard
- √ Set calibration parameters
- √ Monitor status/error indicators
- √ Remote calibration of the SVI II AP
- √ Remote operation of the SVI II AP
- √ Remote display of valve position, actuator pressure(s)
- √ Set configuration parameters
- √ Input/Output configuration
- √ Remote configuration of the SVI II AP
- √ Backup and restore configuration (clone device)

- √ Trend setpoint, valve position, actuator pressure
- √ Perform diagnostic test procedures (full version only)
- √ Display comparative test results (full version only)

Advanced and Online Diagnostics

The SVI II AP offers various levels of control valve diagnostics. Up to five pressure sensors that detect circuit board temperature, loop current, and reference voltage, are available for diagnostics.

For more details on the use of ValVue software, refer to the ValVue User's Guide. Contact the factory or your local representative to obtain licensing information.

Masoneilan Software Download

This installs not only the ValVue software and the SVI DTMs but the SQL Express® software, the GE NI-FBUS-H1 Comm. DTM, Microsoft® VC++ Redistributable package and the .Net framework.

If you have a previous installation of the GE NI-FBUS-H1 Comm. DTM, you need to use Control Panel to uninstall before proceeding.

During the install, SQL is installed.

It is highly recommended that you check for ValVue updates on the Baker Hughes website (valves.bakerhughes.com/resource-center) every six months to keep this program current for security issues.

During the initial installation, if you do not have SQL installed, you are prompted to reboot your system. Follow the prompts to do so and the ValVue install automatically commences after reboot.

NOTE

*For ValVue 3 or DTM registration, you must run the frame application (i.e. ValVue 3, PACTware etc) as Administrator. For instance, for ValVue3, select the icon or ValVue3 in the Start menu, right-click and select **Run as Administrator**. To reviewer: not true anymore?*

This also applies when using Masoneilan DTMs inside of PACTware or other vendor and updating licensing

If you are performing these functions on a Masoneilan DTM using ValVue3 and ValVue3 is run as an Administrator, then the DTMs inherit the Windows Administrator properties from ValVue3.

The individual SVI DTMs can be separately downloaded.

1. Go to the *Resource Library* (*valves.bakerhughes.com/resource-center*) and enter *ValVue* in the search field Figure 2.

Figure 2 Download Center: Search for Valve3

The results appear (red box in Figure 2).

2. Use the arrows to move through the selections. Select **Download** below *ValVue V3.60 Installer Download* and Figure 3 appears.

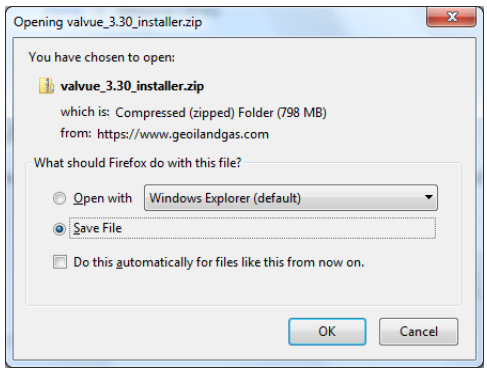

Figure 3 Opening Dialog

NOTE

The dialog that appears for download varies by the program used.

3. Click **Save File**, click **OK** and it saves to the *Windows Downloads* folder.

NOTE

For fastest installation, save the download file to your laptop/ PC. *Don't install from the website.*

4. Open *Windows Explorer* and click the **Windows Downloads** folder.
5. Unzip the files to a folder on your local drive.
6. Right-click the installer, click **Open** and follow the instructions to install.

NOTE

The last dialog contains useful information on where to find help resources (Figure 4).

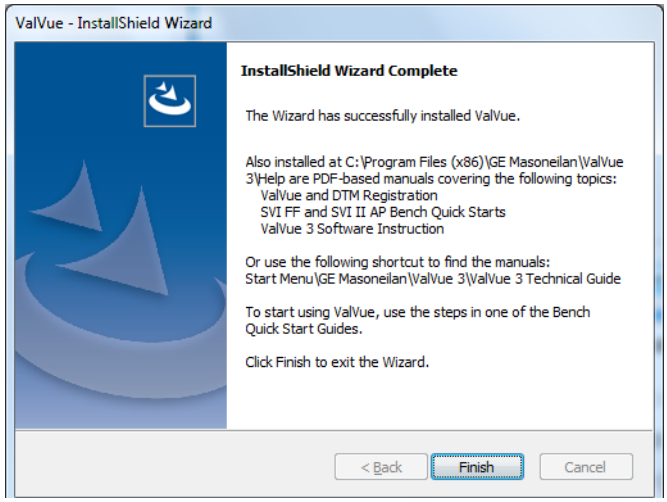

Figure 4 InstallShield Wizard Complete

Operational Overview

The SVI II AP 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 explosion proof LCD/Buttons (if equipped) display provides configuration or calibration mode in all operating environments. The limit switch⁄transmitter options board provides contact outputs that are software configurable, and an analog (4 - 20 mA) position feedback.

SVI II AP Features

The SVI II AP Digital Valve Positioner (see Figure 1 on page 19) 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 Optional Flameproof Push Buttons and LCD Digital Display
- √ 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
- √ Uniform Hazardous Area Approvals for ATEX, CSA, and FM with Other Approvals Available Upon Request
- √ Local, On-line Diagnostic Condition Monitor: Total Stem Travel, Number of Valve Cycles, Predictive Maintenance Data

- √ Advanced Valve Diagnostics with ValVue Software and the Pressure Sensor Option
- √ User-adjustable Response Times
- √ Split-range Capability
- √ 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® 5, 6 or 7, depending on firmware version
- √ HART® Remote Operation Calibration Configuration Diagnostics Using ValVue software or a HART® handheld communicator
- √ Single or Double Acting (not available for the High Flow version)

Available Options

Some of the options available for the SVI II AP include:

- √ Remote Position Sensor
- √ Two Contact Outputs User Linked to Various Status and Alarm Flags
- √ Offshore Construction - Stainless Steel Housing and Components
- √ Pushbutton Display

Model and Features Comparison

Table 1 SVI II AP Positioner Field Upgrade from SD to AD

Model	SD	AD
Positioner Signature	X	X
Step Test	X	X
Embedded Signature		X
Valve Signature		X
Seating Analysis		X

Table 2 Key Performance Indicators by Model

Key Performance	SV II AP	Model AD
Response Time	X	X
Setpoint Offset	X	X
Setpoint Error	X	X
Position Overshoot	X	X
Oscillation Frequency	X	X
Lag	X	X
Valve Friction		X
Spring Initial		X
Spring Final		X
Spring Rate		X

Table 3 Features vs. Model

		SVI II AP Version	
CATEGORY	**FEATURE**	**SD**	**AD**
Housing	Low Copper Aluminum (ASTM 360, < 0.5% Copper)	X	X
	Stainless Steel (316L)	m[1]	m[1]
	Dual 1/2 NPT Electrical Port	X	X
Sensors	Temperature: Circuit Board	X	X
	Position: Non-Contact, Hall sensor	X	X
	Pressure: Atmospheric	X	X
	Pressure: Supply Pressure	X	X
	Pressure: I/P Pressure	m	X
	Pressure: Actuator P1 (Direct Port)	m	X
	Pressure: Actuator P2 (Reverse Port, Double-Acting)	m	X

Table 3 Features vs. Model (Continued)

Input / Outputs	Remote Position Sensor	X	X
	Programmable Solid State Switches	m	m
	4-20mA Position Retransmit Feedback	m	m
Positioning	Split Ranging (Minimum Span: 5mA)	X	X
	Valve Characterization	X	X
	Autostops (Zero & Span)	X	X
	Live Tuning[2]	X	X
	Autotune	X	X
	Positioner Signature (Travel vs Setpoint)	X	X
	Multiple Step Test (Travel, Setpoint vs Time)	X	X
	Embedded Standard Signature		X
	High Resolution Extended Valve Signature		X
	Plug & Seat Profile Analysis		X
Data Historian	Cycle Counter	X	X
	Travel Accumulator	X	X
	Time Closed	X	X
	Time Near Closed	X	X
	Time Open	X	X
Alerts	Position Deviation	X	X
	Air Supply Low	X	X
	Device Integrity	X	X
	Calibration	X	X
Actuator Support	Single-Acting (S) Double-Acting (D)	S or D	S or D

m = Optional and field upgrade capable using HART

1 Factory-ordered option only. Not field upgradeable.

2 Requires ValVue Software.

About This Manual

The SVI II AP Instruction Manual is intended to help an experienced field personnel install, setup, and calibrate an SVI II AP in an efficient manner. This manual also provides in-depth information on SVI II AP software, digital interfaces, operation, intrinsic safety configurations, and specifications. If you experience problems that are not documented in this guide contact the factory or your local representative. Sales offices are listed on the back cover of this manual.

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 SVI II AP 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**.

NOTE

Indicates important facts and conditions.

CAUTION

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

WARNING

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

Baker Hughes Documentation Resources for Masoneilan Products

Baker Hughes publishes several different resources for documentation on Masoneilan products:

- √ Bench quick starts contain information related to configuration and testing in a bench top environment.
- √ Hardware quick starts contain installation information and other basic information related to getting a device installed and very generally configured.
- √ Hardware instruction manuals contain more complete information for configuration of a device. This manual also includes information on background functionality and special circumstances useful in installation, configuration and operation/ troubleshooting.
- √ Software manuals contain more complete information for the software configuration of a device. This manual also includes information on background functionality and special circumstances useful in configuration and operation (including diagnostics and their interpretation). These manuals represent the same source material as the online help.
- √ Handheld documents: Give the DD mappings for the product.

Check the website: *valves.bakerhughes.com/resource-center*.

Related Documentation for the SVI II AP

- √ ValVue documentation: The SVI II AP DTM works inside various software (such as PACTware), however it is designed to work best with out ValVue 3 software. See the ValVue 3 help or Masoneilan Products ValVue 3 Software Manual (GEA31426).
- √ Masoneilan SVI II AP Digital Positioner Advanced Performance Quick Start Guide (GEA19679)
- √ Masoneilan Products SVI II AP DTM Software Manual (GEA31429)
- √ Masoneilan SVI II AP Advanced Performance Digital Positioner Bench Quick Start (GEA32138)
- √ Emerson 475 Handheld and Push Button Guide for Masoneilan SVI II AP

Masoneilan Help Contacts

- √ Email: svisupport@BakerHughes.com
- √ Phone: 888-SVI-LINE (888-784-5463)

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3. Installation and Set Up

Overview

The SVI II AP (Smart Valve Interface - see Figure 5 and Figure 6 on page 32) is a high performance, digital valve positioner that combines a local display with remote communication and diagnostic capabilities. The SVI II AP is available with a variety of options to fulfill diverse applications and it communicates using the HART® protocol.

NOTE

Prior to beginning the installation process review the “Safety Information” on page 15.

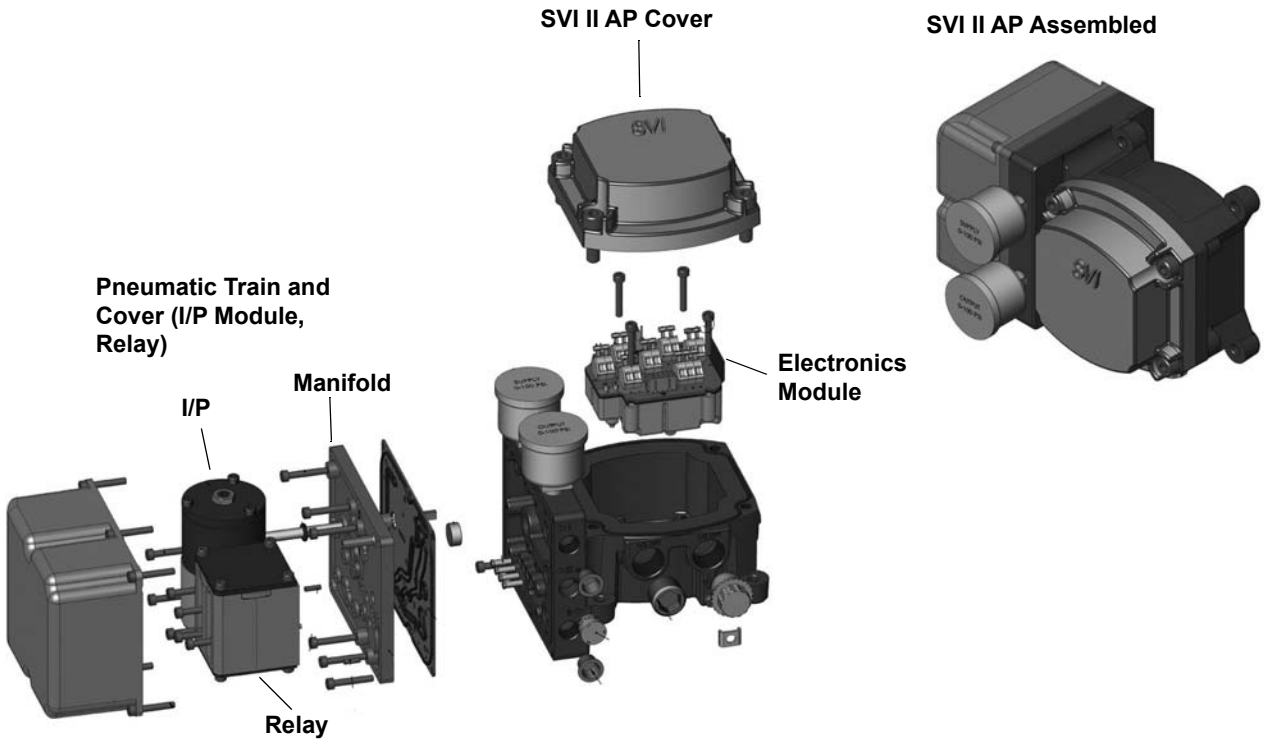

Figure 5 SVI II AP Components

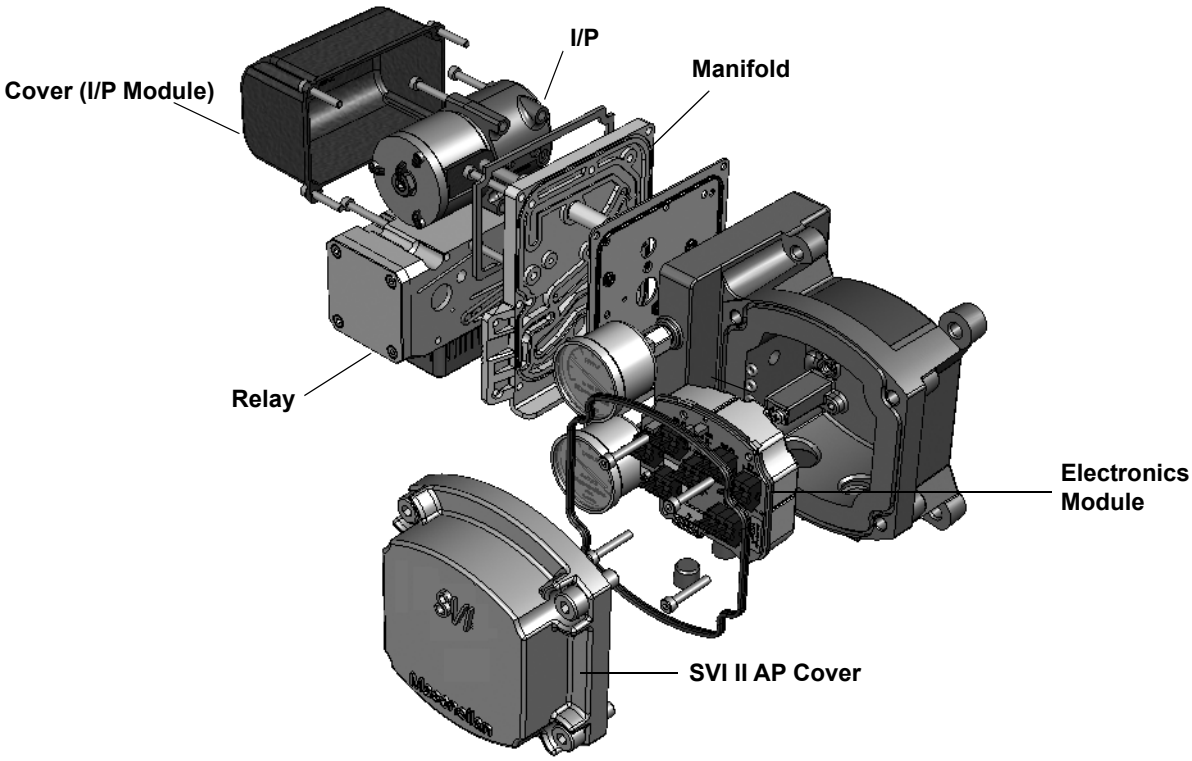

Figure 6 SVI II AP High Flow Components

SVI II AP Dimensions and Weights

Figure 7 illustrates the dimensions and weight of the SVI II AP single-acting.

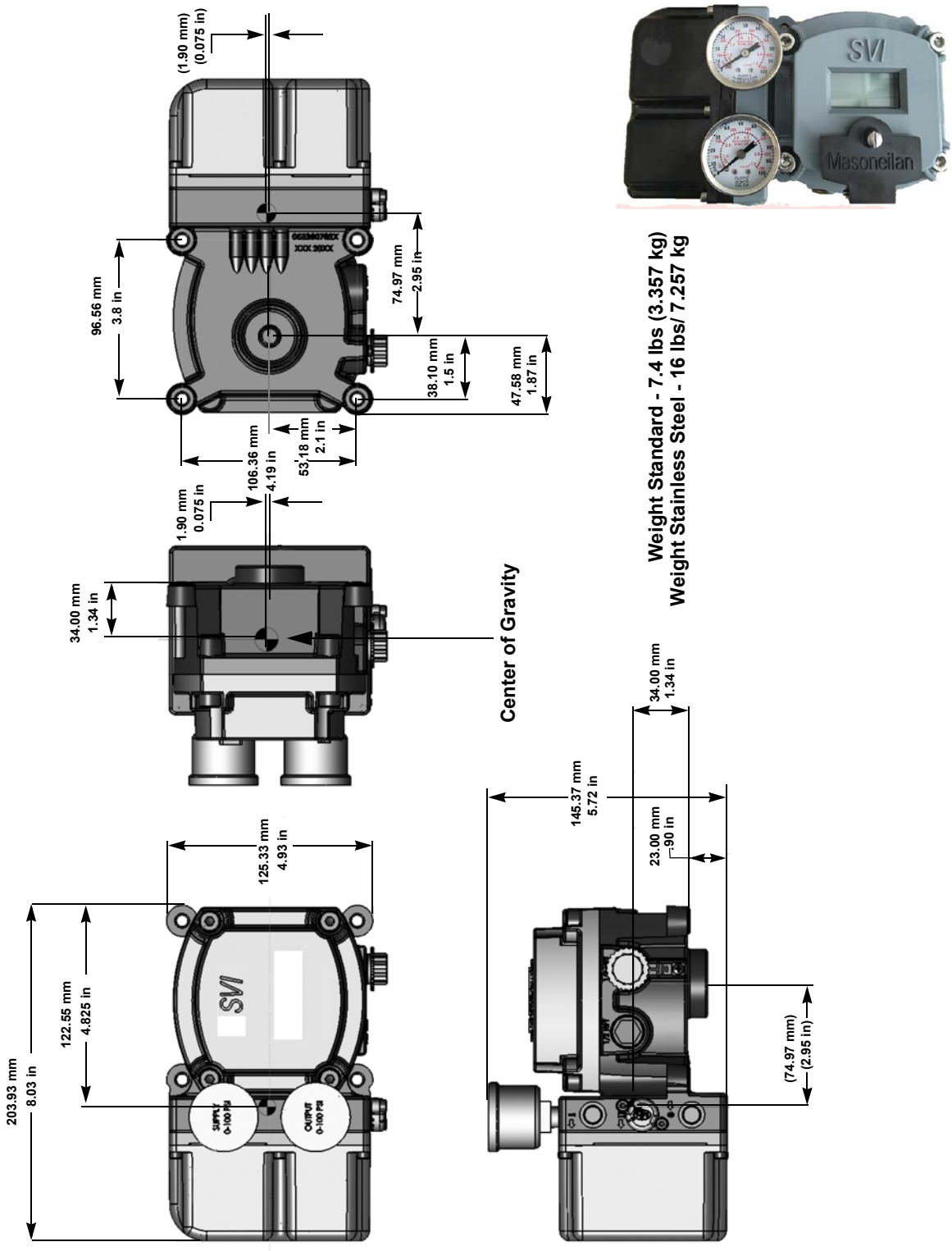

Figure 7 SVI II AP Single-Acting Dimensions

Figure 8 illustrates the dimensions and weight of the SVI II AP double-acting.

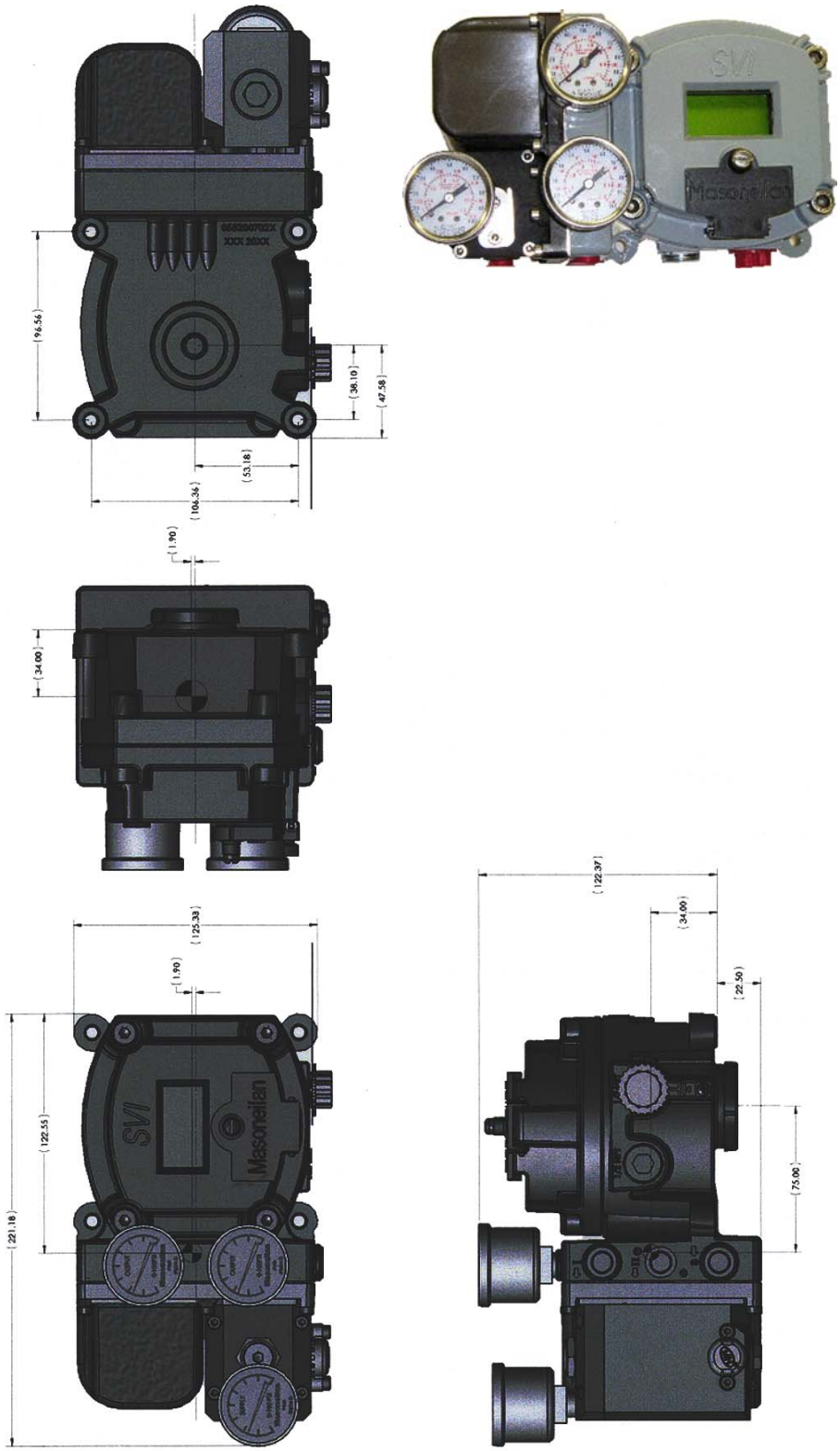

Figure 8 SVI II AP Double-Acting Dimensions

Figure 9 illustrates the dimensions and weight of the SVI II AP High Flow.

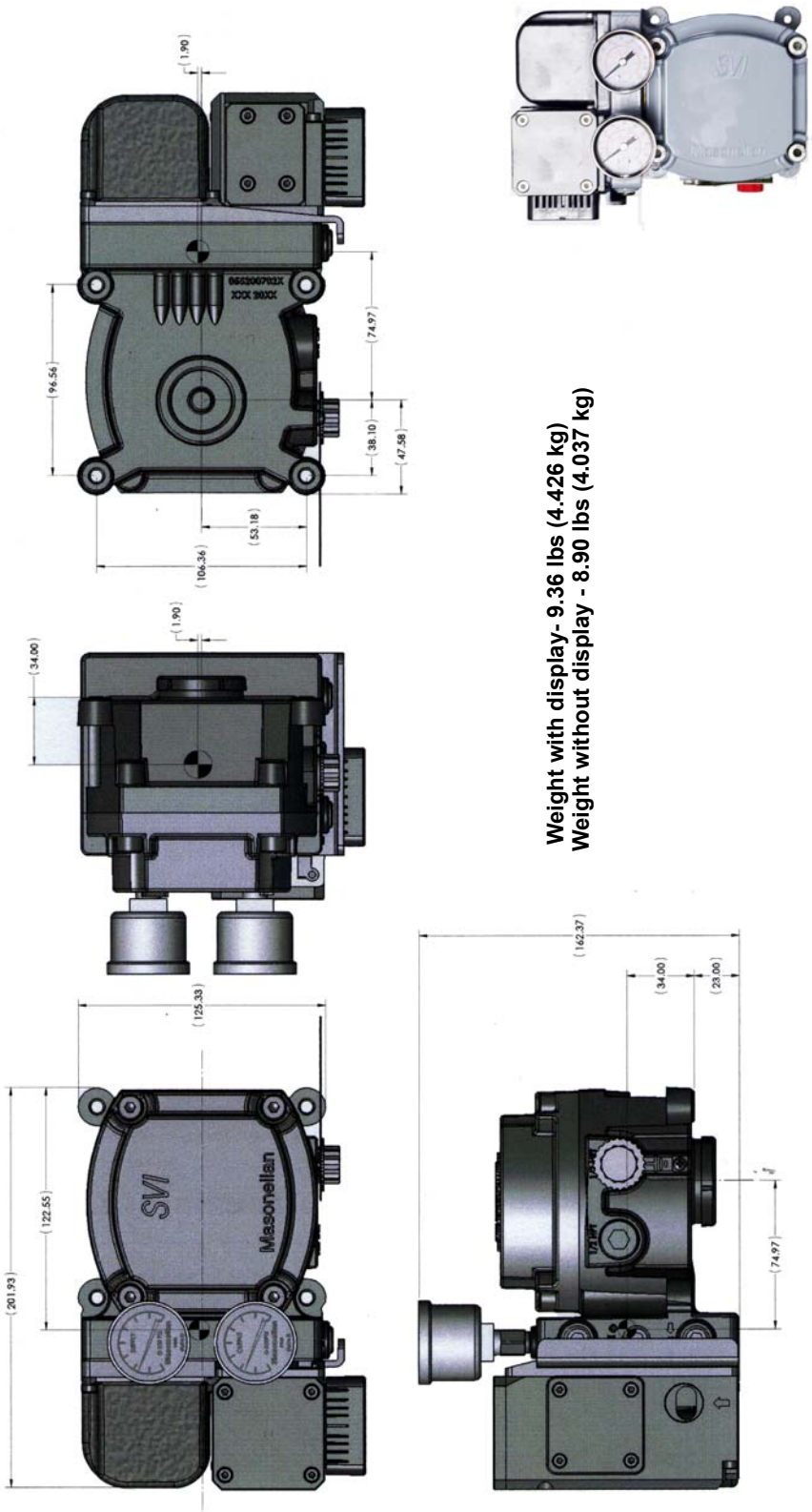

Figure 9 SVI II AP High Flow Dimensions

Pre-Installation Issues

Storage

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

- √ 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.

Installation Steps

If you experience problems that are not documented in this guide call the factory or your local representative. Sales offices are listed on the last page of this document.

Compliance voltage testing is best done before installation. See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 209.

The steps necessary to complete the SVI II AP installation and software setup are outlined in Table 4.

Table 4 SVI II AP Installation Steps

Step No.	Procedure	Reference
1	Attach mounting bracket to the actuator.	See page 339 for rotary valve and page 344 for reciprocating valve instructions.
2	Install the SVI II AP magnetic assembly (rotary valves only).	See page 343 for instructions.
3	Assemble the SVI II AP on the bracket that is mounted to the valve actuator.	See page 339 for rotary valve and page 344 for reciprocating valve instructions.
4	Install the Remote Position Sensor, if necessary.	See *GEA31195 Masoneilan Valve Solutions Remote Sensor Quick Start* for instructions.

Table 4 SVI II AP Installation Steps (Continued)

Step No.	Procedure	Reference
5	Connect the pneumatic tubing to the SVI II AP. Natural gas installation considerations.	See page 351 for instructions. See“Installing an SVI II AP in a Natural Gas Environment” on page 175 for instructions.
6	Connect the air supply to the SVI II AP.	See page 356 for instructions.
7	Connect the positioner to the HART® Control Loop segment by installing the SVI II AP wiring.	See page 356 for instructions.
8	Configure/Calibrate using LCD Pushbutton display	See page 694 for instructions
	Configure/Calibrate using a HART ® Hand Held Communicator.	See page 6101 for instructions
	Configure/Calibrate using ValVue	See page 6106 for instructions.

WARNING

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

WARNING

Before installing, using, or carrying out any maintenance tasks associated with this instrument, READ THE INSTRUCTIONS CAREFULLY.

Installation Notes

- √ The installation must comply with local and national regulations concerning the compressed air supply and SVI II AP instrument.
- √ Installation and maintenance must be performed only by qualified personnel. SVI II AP repairs beyond the scope of this manual must be performed by the factory.
- √ Area Classification, Protection Type, Temperature Class, Gas Group, and Ingress protection must conform to the data indicated on the label.
- √ Wiring and conduit must conform to all local and national codes governing the installation. Wiring must be rated for at least 85º C (185º F) or 5º C (41º F) above max ambient, whichever is greater.
- √ Approved wire seals against ingress of water and dust are required and the 1/2" NPT fittings must be sealed with tape or pipe dope in order to meet the highest level of ingress protection.

Before Powering Up

Before powering up the SVI II AP:

1. Verify that the pneumatic connections and electronic cover screws are tightened. This is important to maintain the ingress protection level and the integrity of the flameproof enclosure.
2. If the installation is Intrinsically Safe, then check that the proper barriers are installed and the field wiring meets local and national codes for an IS installation.
3. If the installation is non-incendive, then check that all the electrical connections are to approved devices and wiring meets local and national codes.
4. Verify that the markings on the label are consistent with the application.

NOTE

For Hazardous Location Installation information refer to 10 “Specifications and References” and 8 “HART® Communications with Intrinsic Safety”.

Mounting the Positioner

This guide provides installation instructions for mounting an SVI II AP on both rotary and reciprocating actuated valves. The mounting process can be broken down into:

- √ Attach the mounting bracket to the actuator.
- √ Install the magnetic assembly (rotary only).
- √ Assemble the SVI II AP on the mounting bracket.

CAUTION

Mount the SVI II AP with the conduit connections 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 a positioner on a control valve, ensure that:

- √ If the valve is located in a hazardous area make sure 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.
- √ Purge air from actuator and check that valve is in its unenergized position.

Filter Regulator and Tubing

The use of a Masoneilan filter regulator with a 5-micron filter is recommended for the air supply. Use 1⁄4" (6.35 mm) minimum tubing between filter regulator, SVI II AP and the actuator, with 3⁄8" (9.53 mm) used for larger actuators. Use a soft setting anaerobic hydraulic seal such as Loctite Hydraulic Seal 542 for sealing the pneumatic pipe threads. Follow manufacturer's instructions.

NOTE

Maximum allowable air supply pressure to the SVI II AP varies according to actuator and valve size and type. See pressure drop tables in valve specification sheets to determine correct positioner supply pressure. Minimum supply pressure should be 5 to 10 psi (.345 bar - .69 bar) (34.485 - 68.97 kPa) above maximum spring pressure.

Mounting the SVI II AP on Rotary Valves

This procedure is used to mount the SVI II AP on rotary control valves that have less than 60° rotation, such as a Camflex or a Varimax™. For valves that have rotation greater than 60° refer to "Rotary - 90°" on page 43.

Required Tools

The following tools are needed to complete the rotary valve installation:

- √ 3⁄16" Hex Key with tee handle
- √ 5⁄32", 1/2" Hex Key
- √ 3 mm, 4 mm, 5 mm Hex Key
- √ 7⁄16" Wrench

To mount the SVI II AP:

1. Attach the SVI II AP rotary mounting bracket to the valve actuator using two (2) 5⁄16 - 18 UNC flat-head cap screws. Mount the SVI II AP as shown in Figure 11 on page 41, ATO or in Figure 12 on page 41, ATC. In the preferred mounting position, the long end of the mounting bracket is on your left when facing the actuator, for any position of the valve and actuator.
2. Bolt the extension shaft to the valve position take-off shaft using a 1⁄4 - 28 UNF socket flathead screw. Secure the machine screw holding the extension shaft with a torque of 144 in-lbs (16.269 N-m).
3. Upon internal valve pressure the thrust 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 SVI II AP digital valve positioner. During hydrostatic testing the shaft is thrust to its stop and a normally tightened packing retains it in that position.

4. On vacuum service, the valve shaft can be drawn into the body by the vacuum acting on the shaft, but the magnetic coupling must be assembled flush with the mounting bracket with the shaft pulled fully out to its thrust bearing. Check that the endplay from the vacuum position to the fully extended position is less than 0.06 in. (1.524 mm).
5. Slide the magnet holder into the extension shaft. The location of the magnets is in the ring of the magnet holder. The magnetic axis is the imaginary line through the center of both magnets.
6. Rotate the magnet holder so that the magnet axis is vertical when the valve is in the closed position. See Figure 11 and Figure 12.
7. Align the end of the magnet holder flush with the end of the mounting bracket. Secure the magnet holder with two M6 set screws.
8. Slide the V-Seal over the magnet holder.
9. Secure the SVI II AP onto the mounting bracket using four M6 x 20 mm socket head cap screws.
10. Ensure no interference exists with the position sensor protrusion.
11. Ensure that the V-Seal makes contact with the skirt around the position sensor protrusion on SVI II AP housing.

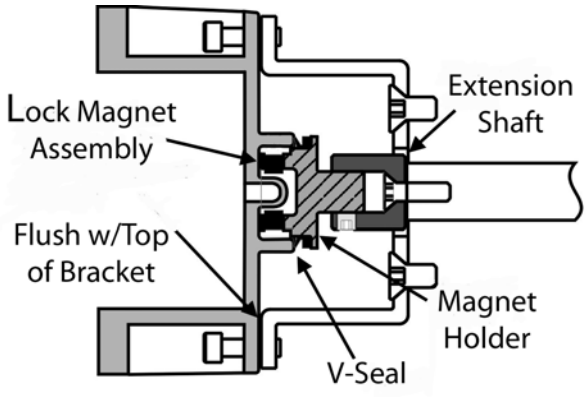

Figure 10 Camflex with Mounting Bracket (Side View)

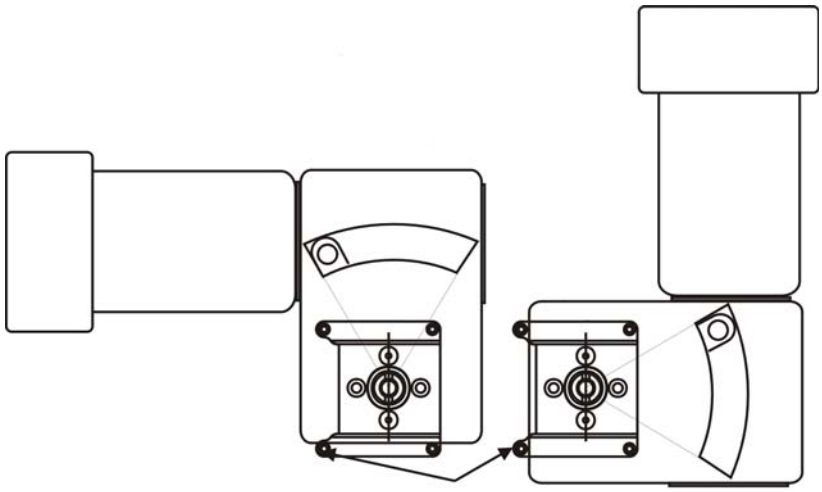

Figure 11 Camflex ATO Mounting (Front View)

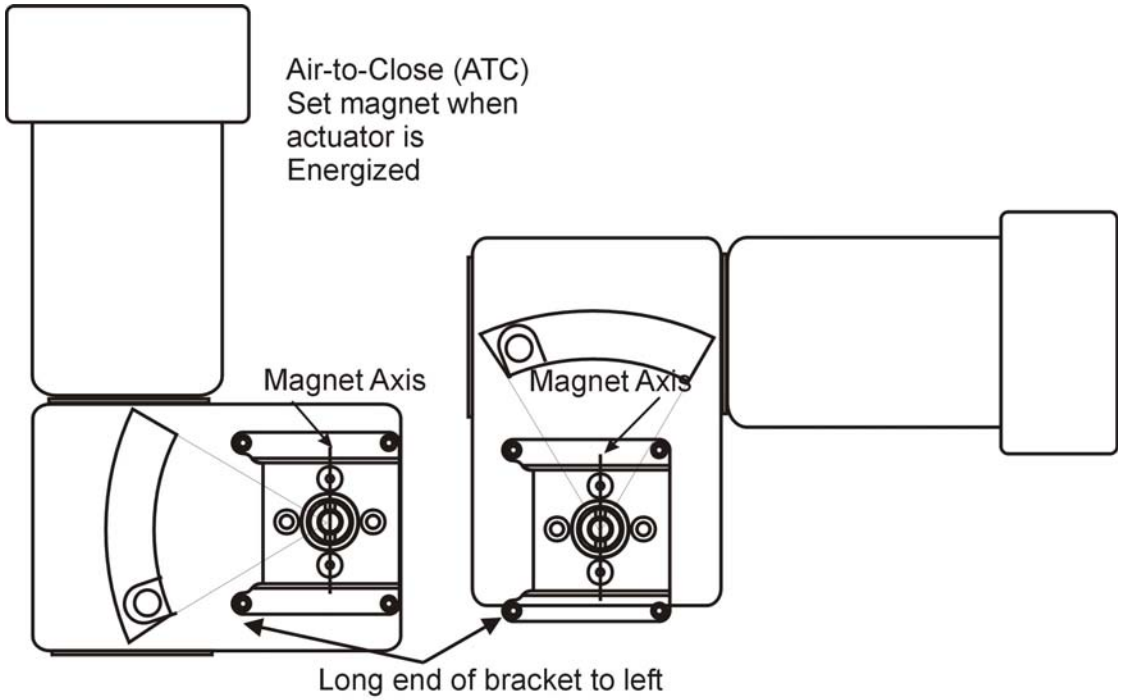

Figure 12 Mounting Bracket on Air-to-Close Actuator

Table 5 shows the general guidelines for travel sensor alignment. Review the table prior to installing the SVI II AP on a rotary valve actuator for proper alignment of the magnet.

Table 5 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

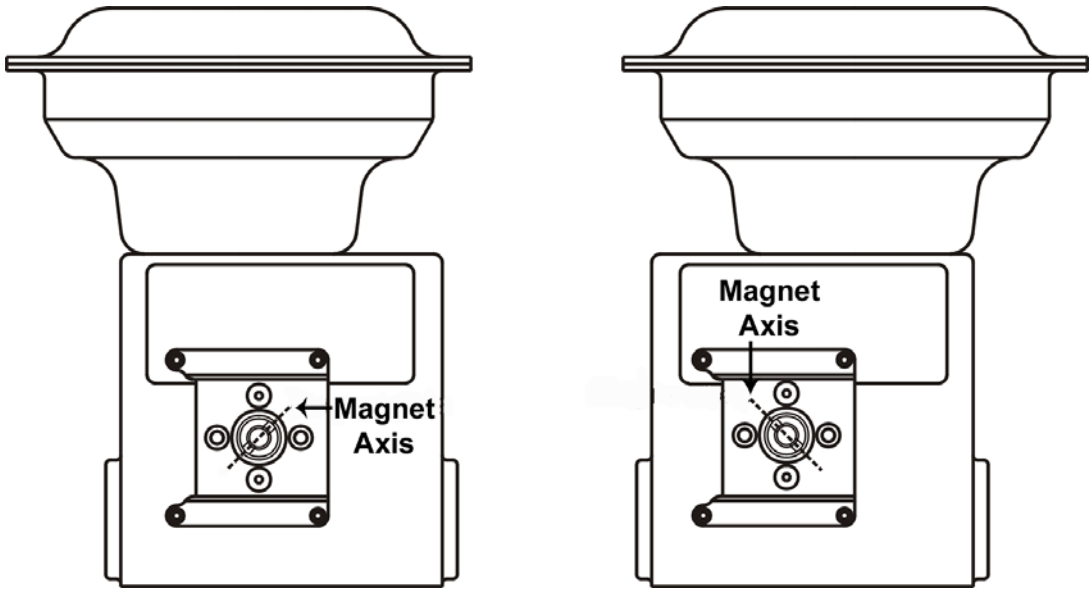

Figure 13 Model 33 Actuator

Rotary - 90°

For actuators with 60 to 120° rotation, follow the instructions in “Mounting the SVI II AP on Rotary Valves” on page 39 except mount the magnet at plus or minus 45° while the actuator de-energized as shown in Figure 13 on page 43.

Magnet Orientation on Rotary Valve Shafts

The same mounting hardware is used for Models 35, 30 actuators. For each actuator type the magnetic coupling must be properly oriented to the active sensing angle of the positioners Hall Effect sensor. The active range of the Hall-Effect sensor is plus/minus 70° from the null magnet axis. If the total valve travel is less than 60°, allowing a margin for tolerances, the best accuracy is achieved by mounting the magnet with the axis vertical in the valve-closed position. The location of the magnets in the ring of the magnet holder. The axis of the magnets is the line through the centers of both magnets. Mount the magnet holder with the magnet axis vertical on the 35, 30 when the valve is closed. If travel of the valve exceeds 60°, the magnet must be assembled to the rotary valve shaft so that the magnet axis is vertical when the valve is at mid-scale.

Dismantling the SVI II AP from Rotary Valves

WARNING

Before carrying out any work on the device, power off the instrument or make sure that the device’s location conditions for potentially explosive atmosphere permit the safe opening of the cover.

To remove the SVI II AP digital valve positioner from a rotary valve perform Steps 1 - 8 on page 336 in reverse.

Mounting the SVI II AP on Reciprocating Valves

This section describes the procedure for mounting the SVI II AP on Reciprocating Valves (using Masoneilan's 87⁄88 Multi-Spring actuators as an example).

Tools required:

- √ 7⁄16" Combination Wrench (2 required)
- √ 3⁄8" Combination Wrench
- √ 1⁄2" Combination Wrench
- √ Phillips Head Screw Driver
- √ 4, 5 mm Hex Key Wrench

Mounting the SVI II AP on a Reciprocating Actuator

1. 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.
2. Mount the SVI II AP reciprocating mounting bracket to the actuator using two (2) 5⁄16 - 18 UNC cap screws. The mounting location of the bracket depends on the size and stroke of the actuator. Refer to Figure 15 on page 45 and Figure 6 on page 46.
3. Select mounting hole A, B, C or D for the stroke of the valve. For example, hole B is shown in Figure 16 on page 45 for a size 10 actuator with 1.0" stroke. Unless otherwise specified, the SVI II AP 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.
4. Move the valve to its closed position. For air to extend, this requires using air pressure in the actuator to fully stroke the actuator. For air to retract, actuators vent the actuator of air pressure.
5. Thread the take-off rod to the actuator stem connector. Refer to Figure 17 on page 47. Ensure that the travel pointer located on the coupling is correctly positioned.
6. Attach the right hand threaded rod end to the SVI II AP lever using a 1⁄4 - 20 x 1" cap screw and nut as shown. The lever hole position to be used depends upon the specific valve stroke. Refer to Figure 16 on page 45 and the Reciprocating Valve Linkage Selection, Table 6 on page 346.
7. 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 6 on page 346.).
8. 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.
9. 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.

10. Thread the turnbuckle onto the left hand threaded rod end. Refer to Figure 17 on page 47.
11. Adjust the turnbuckle until the hole in the SVI II AP lever is aligned with the indicating hole in the bracket. Tighten both turnbuckle lock nuts. See Figure 15 on page 45.
12. Mount the SVI II AP to the bracket and secure with four M6 socket head cap screws.

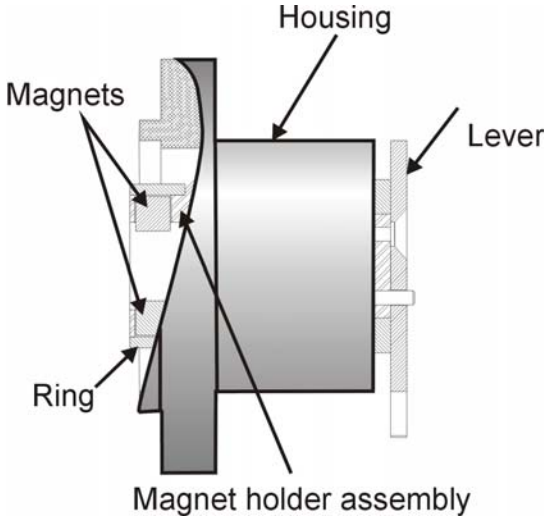

Figure 14 Magnet Holder for Reciprocating Valves

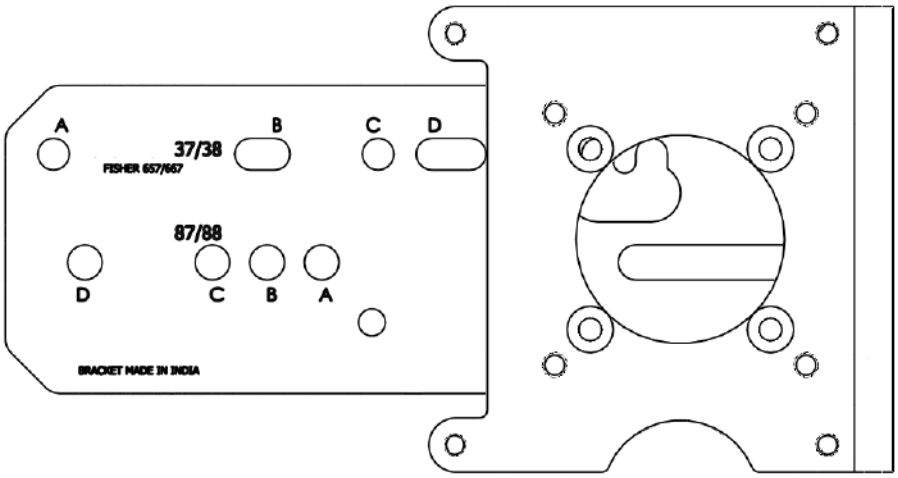

Figure 15 Reciprocating Valve Mounting Bracket

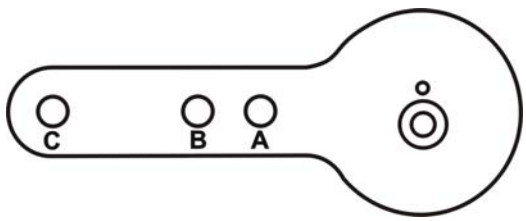

Figure 16 Lever for Model 87/88 Multispring Actuator

Table 6 Reciprocating Valve Mounting Hole and Turnbuckle Length

Actuator Size Masoneilan	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 - 38.1 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 - 38.1 mm)	C	B	2.90" (73.66 mm)
16	>1.5 – 2.5" (38.1 - 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 - 38.1 mm)	C	B	5.25" (133.35 mm)
23	>1.5 – 2.5" (38.1 - 63.5 mm)	D	C	5.25" (133.35 mm)

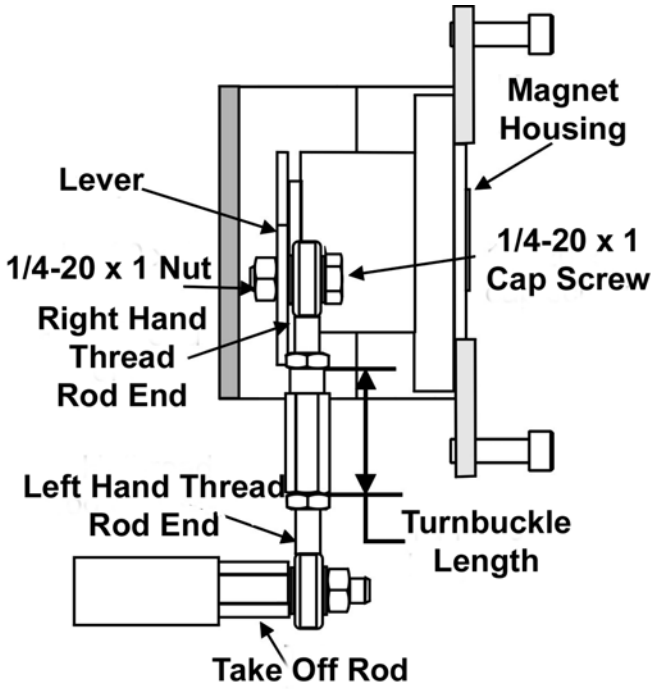

Figure 17 Reciprocating Linkage

Dismantling the SVI II AP from Reciprocating Valves

WARNING

Before carrying out any work on the device, power off the instrument or make sure that the local conditions for potentially explosive atmosphere permit the safe opening of the cover.

To remove the SVI II AP digital valve positioner from a reciprocating valve perform Steps 1 - 12 on page 339 and page 340 in reverse.

Installing the SVI II AP for Double- Acting Operation

This section explains how to mount the SVI II AP for the 84/85/86 kit for double-acting valve positioner configurations.

To mount the kit:

1. Set valve to the closed position.
2. Install the mounting assembly to the yoke (Figure 18) using helical spring washer 5/16, flat washer 5/16 and hex screw 5/16-18x44.5 [1.75] LG.

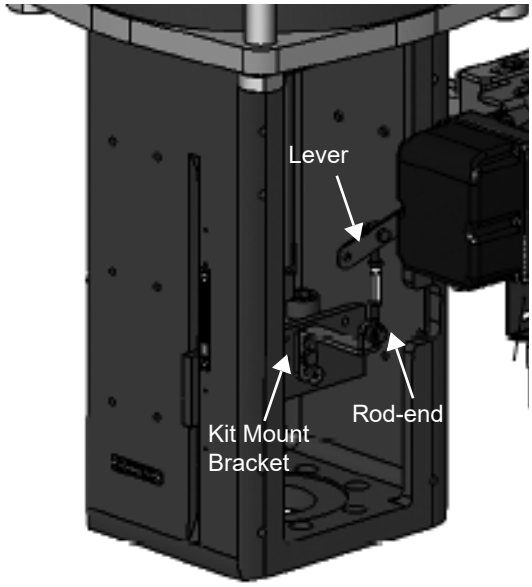

Figure 18 85/86 Valve

NOTE

Mount all components snug enough to stay in place but loose enough to tap with rubber hammer into final position.

3. Set rod-ends and brackets to stroke and size of actuator. The default setting is a 4.00” stroke. Other stroke settings are as in Figure 19.

Hole A: .50" to .80"

Hole B: 1.00" to 1.50"

Hole C: 2.00" to 2.50"

Hole D: 3.00" to 4.50"

Hole E: 5.00" to 6.00"

Figure 19 Stroke Settings

4. Mount take-off bracket to stem block at angle which keeps turnbuckle assembly parallel to stem (Figure 20) using:
   a. For top: two plain 5/16 flat washers, helical spring washer 5/16, two hex nuts 5/16-18 regular.
   b. For bottom: hex nut regular 1/4-20 and hex screw 1/4-20 UNC x 22.2 [.88] LG.

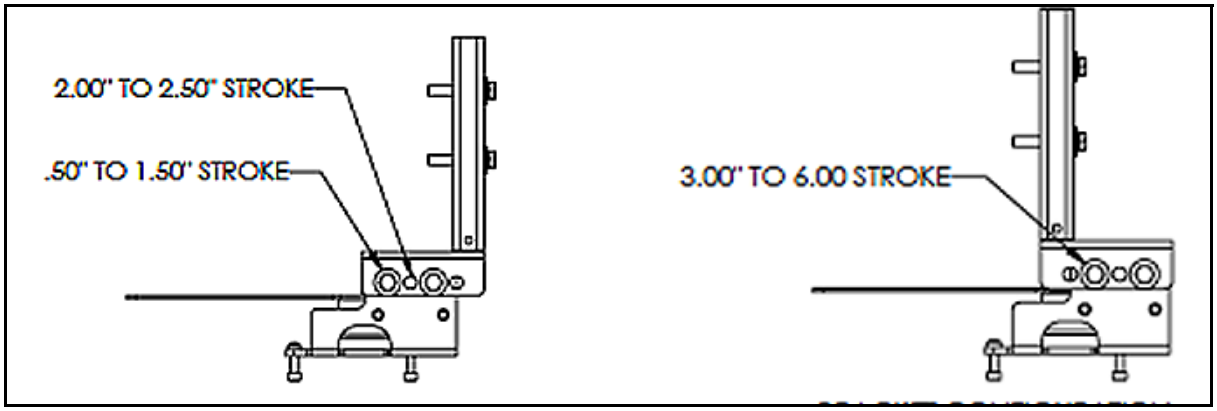

Figure 20 Bracket Configuration Strokes .5 - 2.50" and 3-6"

5. Ensure the turnbuckle assembly is parallel to the stem and the magnets are in the valve closed position (Figure 21) and connect to take-off bracket.

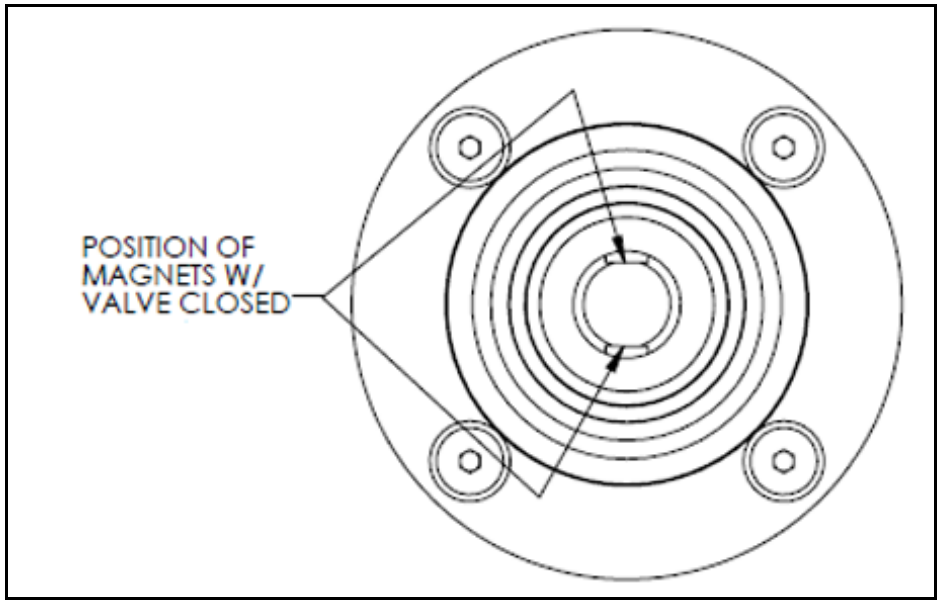

Figure 21 Magnet Position with Valve Closed

6. Verify lever is in correct position with valve closed. Adjust rod-ends, if necessary.

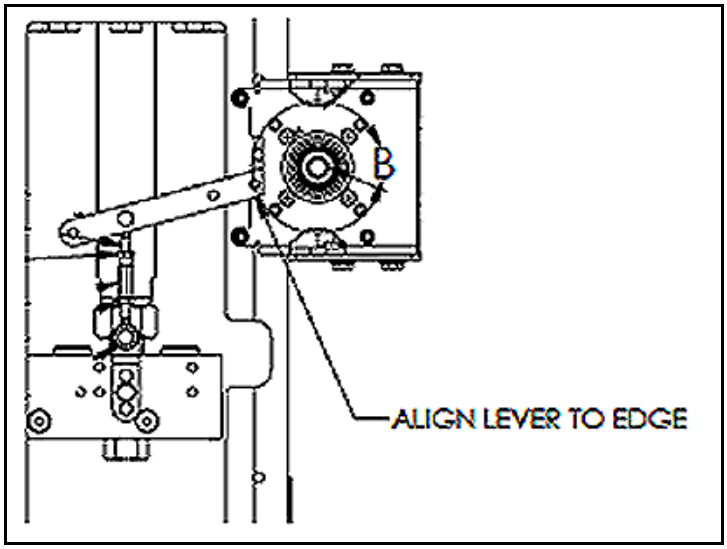

Figure 22 Lever Alignment

7. Mount the SVI-II with M6-1 screws.
8. Cycle the valve open to close verifying proper components movement and that rod-ends move free and clear from other components.

Connecting the Tubing and Air Supply

The last step in hardware installation for the SVI II AP is to connect the air supply to the positioner. This section describes the process for connecting the tubing and air supply to a single and double acting positioner.

WARNING

Isolate the valve from the process and disconnect air tubing from the positioner. Disconnect air fully to avoid injury or process damage.

1. Install the tubing to the air supply port, ←***S*** (arrow only for High Flow).
2. For a single acting actuator - pipe the outbound air from the output pressure port (←***I***) to the actuator (arrow only for High Flow).
3. For a double acting actuator - pipe output pressure port one (←***I***) for one side of the actuator and output pressure port two (←***I I***) for the other side of the actuator (arrow only for High Flow).
4. Air supply:
   - √ Supply pressure for single acting SVI II AP and AP High Flow: 20 -100 psi (1.4 - 6.9 bar) (138 - 690 kPa)
   - √ Supply pressure for double acting SVI II AP: 25 - 150 psi (1.73 - 10.3 bar) (172 - 1030 kPa)
   - √ Minimum tubing diameter 1⁄4" (6mm x 4mm)

NOTE

The SVI II AP Digital Valve Positioner 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) or with a sweet natural gas supply (SVI II AP models SVI2 AP-2 through SVI2 AP-3).

NOTE

For small actuators it may be necessary to use 1/8" tubing for Autotune to work properly.

Table 7 Air Supply Requirements

Dew Point	At least 18° F (-7° 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

CAUTION

The SVI II AP High Flow digital valve positioner cannot be placed in parallel with another volume booster. Contact the factory for further instructions regarding configuration with boosters as well as other non-standard configurations.

CAUTION

Do not use pipe thread sealant tape on pneumatic fittings. It may shred into small particles that can cause instrument malfunction.

WARNING

Never exceed the actuator maximum rated supply pressure 100 psi (6.9 bar, 689.7 kPa) for single acting or 150 psi (10.3 bar, 1030 kPa) for double acting positioner. Damage to equipment or injury to personnel can result.

CAUTION

Remove any excess pipe thread sealant from the first and second threads to prevent uncured sealant from entering the air lines.

Single Acting Positioner

The supply and output connections for the SVI II AP (Figure 23), located on bottom of the pneumatic block, are tapped 1⁄4" NPT. Output is toward the front, supply is toward the back. Two pressure gauges, output on top, supply on bottom, are located on the front of the pneumatic block.

The supply and output connections for the SVI II AP High Flow (Figure 24), located on bottom and leftside of the pneumatic block, are tapped 1⁄2" NPT.

Maximum allowable air supply pressure to the SVI II AP varies according to actuator, valve size, and valve type. See Pressure Drop tables in valve specification sheets to determine the correct positioner supply pressure. Minimum supply pressure should be 5 psi to 10 psi (.345 bar - .69 bar) (34.485 - 68.97 kPa) above maximum spring range but may not exceed the rated actuator pressure.

1. Pipe the outbound air from the output pressure port (←**I)** (arrow only for High Flow) to the valve actuator.
2. Connect air supply and actuator outputs (1⁄4" NPT or 1/2" NPT for High Flow units). Supply pressure is 20 -100 psi (1.4 - 6.9 bar) (138 - 690 kPa). Minimum tubing diameter 1⁄4" (6 mm x 4 mm).

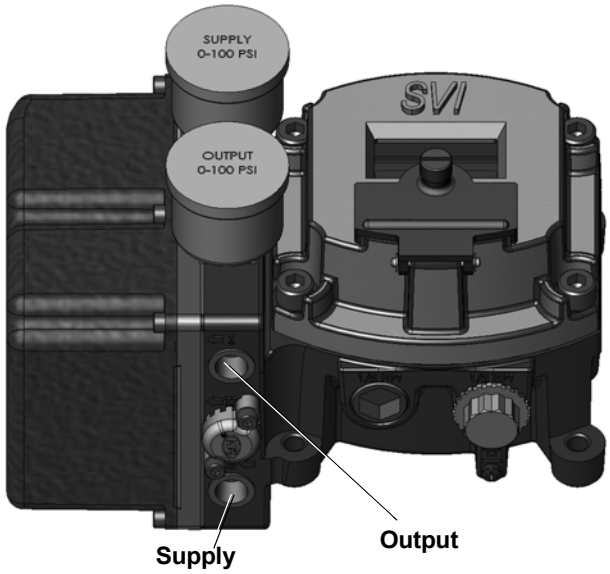

Figure 23 SVI II AP Air Ports on Single Acting Positioner

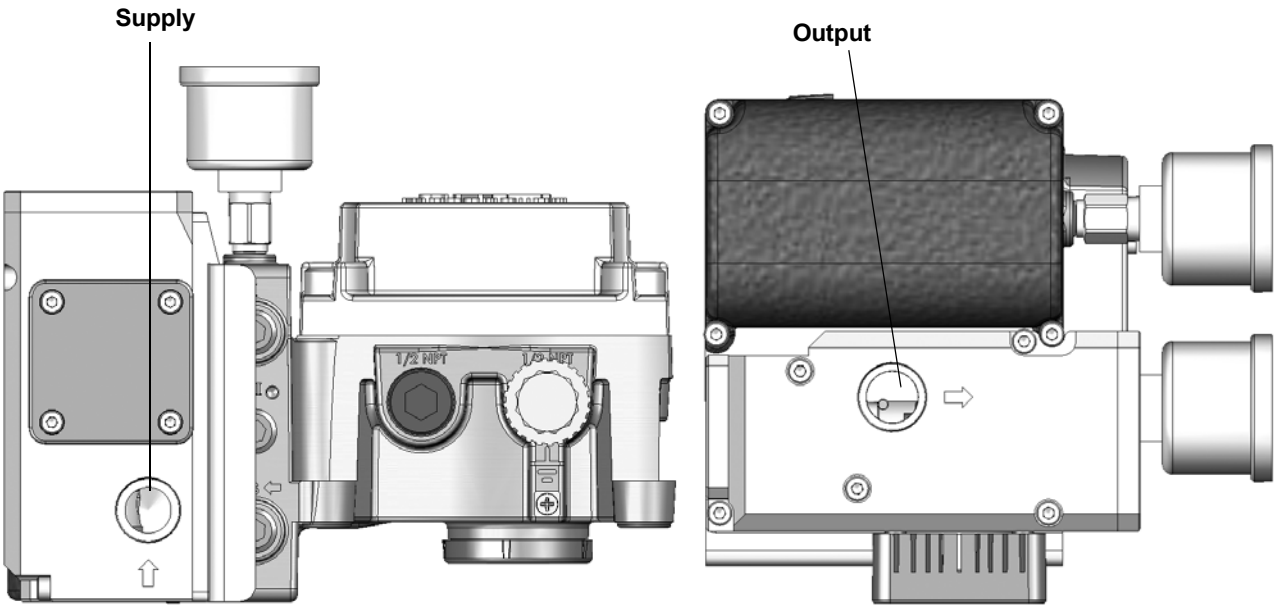

Figure 24 SVI II AP High Flow Air Ports on Single Acting Positioner

Double Acting Positioner

The Double Acting (DA) relay has a pair of opposed pneumatic outputs. When Output 1 delivers air to one side of the actuator, Output 2 vents air from the opposite side of the actuator piston. The volume of air trapped in each determines the position of the actuator.

The Action (ATO or ATC) is applied with respect to Output 1. When Output 1 is connected to deliver air to extend the actuator, the action is ATC, on a down-seating valve.

NOTE

For small actuators it may be necessary to use 1/8" tubing for Autotune to work properly.

1. Connect Output 1, labeled *(←**I**)* to the inlet port of the actuator and Output 2 labeled *(←**I I**)* to the opposing actuator port (see Figure 25).
2. Connect air supply and actuator outputs (1⁄4" NPT). Supply pressure is 25 - 150 psi (1.7 - 10.3 bar) (172 - 1030 kPa). Minimum tubing diameter 1⁄4" (6 mm x 4 mm).

Figure 25 Air Ports on Double Acting Positioner

Balance Pressure

The double-acting relay is designed to deliver pressure on both sides of a piston type actuator, so that the cylinder can provide the required thrust and stiffness. This stiffness is factory adjusted to 70% of the supply pressure. This means that, without any unbalance forces from the valve stem, both outputs deliver roughly 70% of air supply pressure.

Although it is not recommended, the stiffness can be adjusted by moving the Adjustable Seat assembly up or down.

Actuator Piping

Connect Output 1, labeled *ACT 1* to the inlet port of the actuator in accordance with Figure 26. Output 2 labeled *ACT 2* connects to the opposing actuator port.

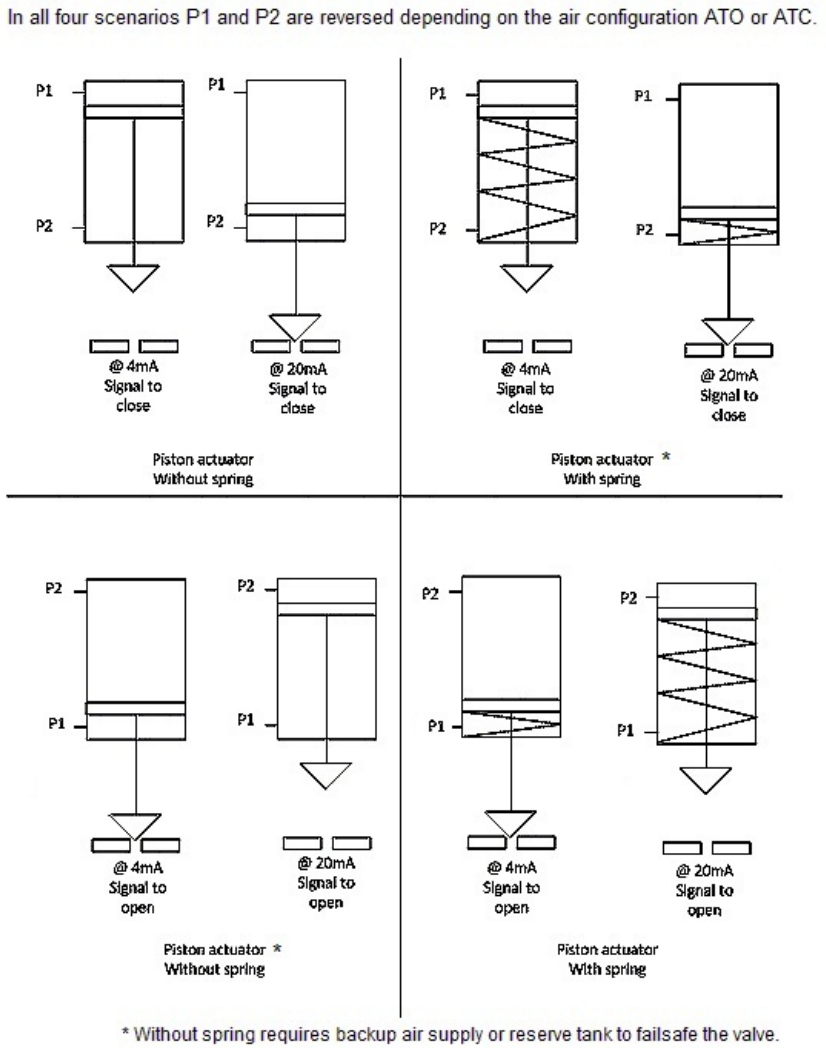

Figure 26 Double Acting Positioner ATO/ATC Settings for Reciprocating Valves

Connecting the Air Supply

After the tubing is installed, use the following procedure to connect the air supply.

1. Use a supply of clean, dry compressed air to the filter regulator.
2. Turn on the air supply.
3. Adjust the filter regulator.
4. Supply pressure must be 5 psi - 10 psi (.345 bar - .69 bar) (34.485 - 68.97 kPa) greater than the spring range of the actuator but may not exceed the rated actuator pressure. Refer to the valve or actuator instruction manual.

Wiring the SVI II AP

The procedure below outlines wiring the SVI II AP.

WARNING

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

CAUTION

Refer to“Output Switches” on page 135 for guidelines on safely wiring switch load limits.

Connecting to the Control Loop

The SVI II AP digital valve positioner *MUST BE* grounded according to local regulations. It is important to maintain correct polarity at all times, otherwise the positioner may not operate properly. Physically connect the SVI II AP to the control loop using a cable specified by the Field Comm® Group. A shielded cable is recommended.

To communicate using HART®:

1. Connect one end of the cable to the control loop's 4 - 20 mA output.
2. Remove the threaded wiring covers on the positioner.
3. Connect the other end of the cable to the SVI II AP. There are two threaded openings on the positioner. Use the opening with the red plastic insert.
4. Maintain polarity + and - respectively.

Wiring a Position Retransmit

CAUTION

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

To connect:

1. Strip the insulation at the end of the wires. Strip approximately 1/4” (6.35 mm) of the insulation at the end of wires (wire size 14 to 28 AWG, 2.5 mm2 to .08 mm2).
2. Connect the +/- terminals from the 4-20 mA Out to the position retransmit input signal: + to + and - to -. See Figure 31 on page 64.

To troubleshoot retransmit connections:

- √ Ensure that the retransmit circuit has a minimum voltage of 10 V (maximum 30 V).
- √ Ensure the minimum AO current is 3.2 mA. If the module loses power and the AO circuit remains powered, the AO signal will be 3.2 mA.

Wiring Considerations

For a detailed description of wiring guidelines refer to “Wiring Guidelines” on page 111 of this manual.

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4. Check Out and Power Up

Overview

This section provides the checkout procedures required to determine if the SVI II AP is in working order and to power up the unit.

NOTE

Perform all procedures in this section before putting the SVI II AP into operation.

Position Sensor Principles

The motion of the control valve (position) is precisely transmitted to the SVI II AP by a pair of rotating magnets located outside the instrument housing. Rotation of the magnets is sensed internally by a Hall Effect sensor. Because the only connection through the case is a magnetic field there are no seals or bearings to wear or corrode.

The rotation of the magnet is linked to the valve position by the mounting hardware provided. For a rotary control valve the magnet assembly is normally attached directly to the actuator shaft. For a reciprocating control valve the mounting kit includes the magnet assembly mounted in a sealed bearing with a lever that must be linked to the valve stem.

The positioner must be installed with the gauges to the left and the housing display and cover to the right. The ½ NPT conduit entries must be facing down to drain condensate away from the housing. The positioner can be moved on the valve for best drainage depending on the position of the valve in the pipeline.

Check Out Procedures

SVI II AP checkout consists of physical and operational checkout procedures. The physical checkout procedures include:

- √ Inspect the Actuator, Linkages, or Rotary Adapter
- √ Verify the Mounting and Linkage Adjustment
- √ Check the Magnet
- √ Check the Air Supply
- √ Check the Electronic Module Connections

CAUTION

The SVI II AP cover must be in place and secured using all four screws during operation.

Actuator, Linkages, or Rotary Adapter

Verify that the mounting has not been damaged in shipment for a pre-mounted SVI II AP, physically inspect the actuator, linkage. Record the following information for the configuration checkout:

1. Valve Air to Open (ATO) or Air to Close (ATC)
2. Actuator pressure rating
3. Actuator bench range
4. Inherent trim characteristic of the control valve; linear, equal percentage, or other.

NOTE

Refer to the valve data sheet or model number of control valve.

Verify Mounting and Linkage Adjustment

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

Checking the Magnet

There are two methods of checking the SVI II AP magnet:

- √ Perform a visual inspection
- √ Use ValVue to check the magnet

Performing a Visual Inspection

You must remove the positioner from the bracket to visually inspect the magnet orientation.

For rotary valves, such as a Camflex, or for actuators with rotation of less than 60°, the magnet assembly must be aligned as shown in Figure 27 on page 61.

For rotary valves, or for actuators with rotations greater than 60°, the magnet assembly must be aligned as shown in Figure 28 on page 61.

NOTE

For a reciprocating valve, it is not necessary to remove the positioner to visually inspect the magnet setting and linkage of a reciprocating valve.

For reciprocating valves the adjustable link turnbuckle must be parallel to the valve stem. To ensure linearity in positioning verify that the hole in the lever aligns with the indicating hole in the bracket when the valve is in the closed position. Check that the bracket is mounted on the correct holes. (See Figure 30 on page 62 for details).

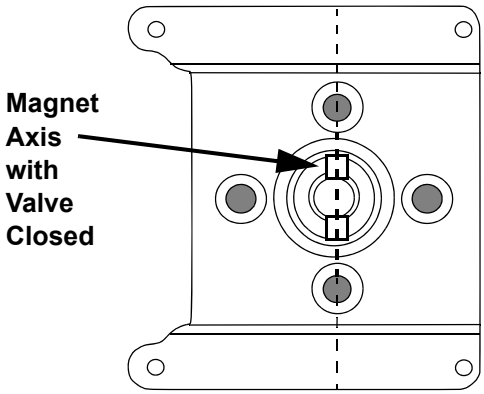

Figure 27 Magnet Orientation for Rotary Valves with Valve Closed

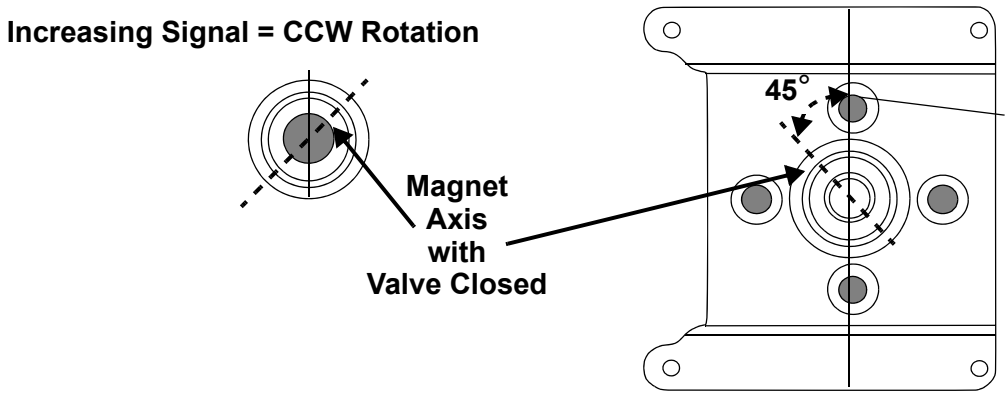

Figure 28 Magnet Orientation for 90° Valve Rotation with De-energized Actuator

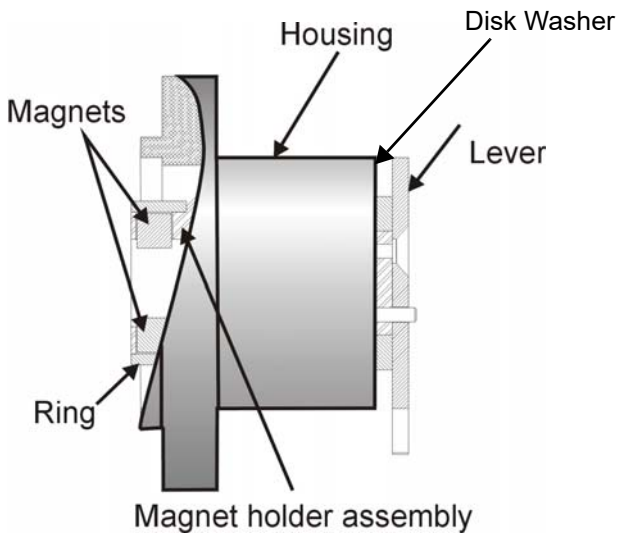

Figure 29 Magnet Holder for Reciprocating Valves

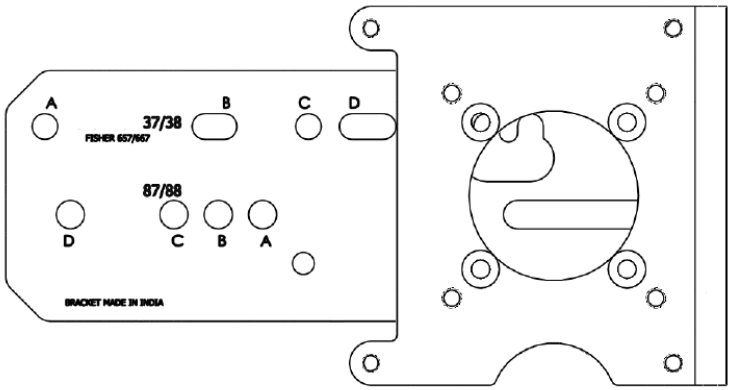

Figure 30 Reciprocating Valve Mounting Bracket

Using 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 **Raw Data** 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.

Checking the Air Supply

Use this procedure to check the air supply.

1. Turn on the air supply.
2. Adjust the filter regulator.
3. Supply pressure must be a minimum of 10 psi (.69 bar, 68.97 kPa) 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 as it can shred into particles harmful to the pneumatic components.

Checking the Electronic Module Connections

WARNING

Do not remove the instrument cover or connect to an electrical circuit in a Hazardous Area unless power is disconnected.

The SVI II AP terminal board has terminal blocks with cage clamp connectors. Not all options are available for every model. Refer to Table 8 for available functionality.

Table 8 SVI II AP Models and Functionality

Available Functionality	Positioner Model Number	
	SVI2 AP-2	SVI2 AP-3
4 - 20 mA Input Setpoint	√	√
Display/ Pushbuttons	Optional	Optional
Remote Mount Input	√	√
SW #1 and #2	Optional	Optional
4 - 20 mA Out Position Transmit	Optional	Optional

1. Confirm the correctness of all applicable connections to the electronics module.

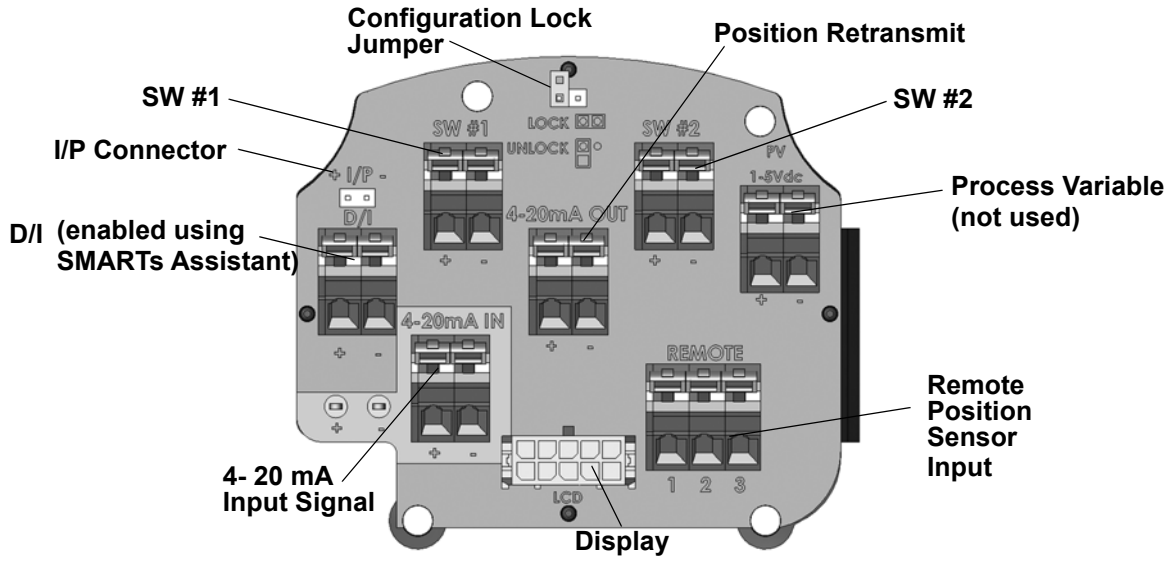

Figure 31 Connections to Electronics Module (via Terminal Board)

NOTE

When an SVI II AP is turned on, apply the air supply before applying the electrical input signal.

Making Connections to the Terminal Board

Connect the wires from the option as follows (wire size 14 to 28 AWG, 2.5 mm^2 to .08 mm^2):

1. If the wires have not been stripped, strip approximately 1/4 in (6.35 mm) of the insulation at the end of wires.
2. Locate the correct terminal block on the terminal board (see Figure 31 on page 64).
3. Push back the lever at the top connector until you see the opening for wire insertion. The connectors are spring activated and may require a lot of pressure to move the lever.
4. Insert the wire into the opening and release the lever.

Operational Checkout

The operational checkout of the SVI II AP consists of:

1. Connecting the SVI II AP to a current source.
2. Powering up the SVI II AP.
3. Checking the pushbutton locks.

Connecting to the Current Source

Connect to a DC mA current source then check and configure with the local display and pushbuttons, if so equipped. The following section describes configuration and calibration with the optional local display and pushbuttons. If the SVI II AP is not equipped with local display use ValVue and a PC with a HART® modem or a HART® Handheld Communicator.

NOTE

When an SVI II AP is turned on it is advisable to apply the air supply before applying the electrical input signal.

Powering Up the SVI II AP

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.

NOTE

When an SVI II AP is turned on it is advisable to apply the air supply before applying the electrical input signal.

CAUTION

Use of a low impedance voltage source damages the SVI II AP. The SVI II AP input must be a current controlled source. The SVI II AP will not function normally if connected directly to a voltage source. However, direct connection to a current source of up to 30 V will not damage the SVI II AP. A proper current source explicitly enables adjustment of the current in mA, not V.

To power up the SVI II AP:

1. Loosen the four (4) cover screws and remove the SVI II AP cover.
2. Connect the +/- terminals from the SVI II AP to the current source. Connect + to + and - to - (Figure 31 on page 64).
3. Reinstall the cover and display.
4. Adjust current to 12 mA. On initial power up of a newly installed SVI II AP, the positioner starts up in NORMAL mode and is operational in the default factory configuration. The positioner cycles through the NORMAL cycle menu and the following values appear:
   - √ *PRES*: (Pressure - unit of measurement and value)
   - √ *SIGNAL*
   - √ *POS* (Position)

   An exclamation point (**!**) in the top left corner of the display window indicates that there is further instrument status available.[1]
5. Proceed to Calibration and Configuration.

[1]For firmware version 3.2.1, the supply pressure appears on the LCD. Additionally, Stops results and Autotune results, stay displayed until cleared.

NOTE

If the SVI II AP is specified without local pushbuttons and display, local operation is not available. Configure and calibrate with ValVue or a Hand Held HART® Communicator.

Pushbutton Locks and Configuration-Lock Jumper

Before performing any of these functions with the local display you must first ensure that the pushbuttons are placed in the unlocked mode using ValVue. The positioner ships in the unlocked mode. See ValVue documentation for more details.

The SVI II AP offers several levels of plant security. It may be desirable, after initial setup, to lock the pushbuttons so that the SVI II AP parameters cannot be inadvertently changed by the buttons. Several levels of software modifiable pushbutton locks are provided.

Table 9 Pushbutton Lock Security Level

Level	Access
Security Level 3	Allow Local Buttons: Buttons on the SVI II AP are fully enabled.
Security Level 2	Lock Out Local Calibration and Configuration: Use the buttons to perform operations in normal operating mode and manual mode. Do not go to configure or calibrate mode.
Security Level 1	Lock Out Local Manual: Examine variables in normal operating mode but do not put the valve in manual operating mode. Access to calibrate or configure modes is not available.
Security Level 0	Lock Out All Buttons: The buttons are disabled (level 0).

Hardware Configuration Lock

Additional security is achieved using the hardware configuration-lock jumper shown in Figure 31 on page 64. When set to the secure position, by shorting the two-pin header, configuration and calibration are not possible using the local interface or any HART® communication tool. Pushbuttons, ValVue and handhelds are locked out, except to examine configuration, calibration, and position. This is similar to Security Level 1 shown in the Pushbutton Lock Security Level table.

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5. Using the Digital Interfaces

Overview

This section describes three ways to communicate, configure, and calibrate the SVI II AP. The Smart Valve Interface is truly a smart device capable of:

- √ Streamlining the valve positioning function
- √ Providing diagnostic information
- √ Improving precision of process control
- √ Communicating critical information locally and remotely

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

- √ Local Display and Push Buttons
- √ HART® Handheld Communicator
- √ ValVue 3 and SVI II AP DTM
- √ Any HART® capable Host loaded with the DD for the SVI II AP

NOTE

Starting with firmware version 3.2.7/5.1.3, if Autotune is unsuccessful the message TuneERR appears on the pushbutton display or when using the DD. Previous firmware versions reported this as TuneFail. These messages do not mean the positioner is defective but indicate a need to perform a manual tune.

Notes on Aggressiveness

Setting Aggressiveness	While the SVI II AP DTM and the DD allow you to set Aggressiveness, the pushbuttons do not. In all three methods, however, the Aggressiveness value is inherited from any previously performed tuning (Autotune or manual). Once Aggressiveness, and other tuning values are determined, they are stored in NVRAM. The SVI II AP provides a user define Aggressiveness Level for auto-tuning, the allowable range varies from -9 to +9 where 0 (Zero) is consider normal tuning. The Aggressiveness Level influences stroking speed and over-shoot. A negative value will SLOW stroking speed and help minimized over-shoot. A positive value will INCREASE stroking speed and may add some over-shoot. The recommended values for Aggressiveness is 0 for control valves without volume boosters. In applications with volume boosters and/or quick exhaust valves are used the Aggressiveness Level is not as influential. For Auto-tuning it is usually between 0 and 3. Reduce the volume boosters sensitivity by opening the integral bypass needle valve about 1 to 2 turns. Use caution when adjusting the needle valve so as to not to damage the seat, close gently to seat and then open 1 or 2 turns.
Aggressiveness Dynamic	Lower values of aggressiveness lead to lower PID values and slower response and less overshoot. Higher values lead to higher PID values and quicker response and more overshoot. Once you have a preferred aggressiveness and you tune once, all future autotunes automatically use that same value, until user-changed.

Local Display and Pushbuttons

The most basic and easiest digital interface is the local pushbutton and display option mounted on the SVI II AP. It is available at any time and provides immediate local access to most configuration, calibration, and fault messages. It is approved for use in Explosion Proof and Intrinsically Safe installations in Hazardous Areas.

Additionally, in Normal mode the local display scrolls sequentially displaying setpoint, pressure and position information. The display sequences from one variable to the next every 1.5 seconds.

HART® Handheld Communicator

The HART® handheld communicator is a universally available tool that provides all the accessibility of the local button and display. The HART® tool has the functionality to upload and download configurations, enter alphanumeric messages and set the custom characteristic numerical parameters.

The GE DPI620 is approved for Intrinsically Safe use in Hazardous Areas in accordance with SVI II AP approvals. See “HART® Communications with Intrinsic Safety” on page 127 and “Wiring an SVI II AP” on page 109 for additional information concerning this device.

ValVue

ValVue combines the power of the PC with the features of the SVI II AP for ease of use and automation of positioner operation and full access to all data. ValVue is downloaded from the website (*valves.bakerhughes.com/resource-center*) and is recommended for set up, service and maintenance where a PC or laptop is permitted. See “Configuring and Calibrating with ValVue” on page 106 for further information.

Pushbuttons and Local Display

This section covers the optional local interface consisting of the LCD alphanumeric display and pushbuttons. Operation of the SVI II AP Digital Valve Positioner as a local device is controlled through the optional device-mounted pushbuttons and digital display, shown in Figure 32 on page 72. Using the display you can read the input signal, valve position, and actuator pressure. The display sequences from one variable to the next every 1.5 seconds.

Using the pushbuttons you can exit from operating mode at any time and step through a menu structure to perform a wide range of manual operation, calibration, configuration, and monitoring functions that are described later in this section. ValVue is used to perform all diagnostics functions. The pushbuttons do not support diagnostics functions.

The SVI II AP has two operational modes: Normal (normal operating mode) and Manual (manual operating mode) and two setup modes, Configuration and Calibration. The SVI II AP also has two modes for handling of faults and power-up: Reset and Failsafe. When commissioning or checking a control valve with SVI II AP fully installed the following steps are recommended:

1. Change mode to Manual mode.
2. Examine and adjust all Configuration items.
3. Enter Calibration mode.
4. Run Stops to automatically calibrate stroke.
5. Run Auto Tune to set dynamic response.
6. Examine the device status.
7. Introduce manual set point changes to verify dynamic performance.

Pushbuttons

The local pushbuttons are located behind a hinged cover, directly below the display window. To open the cover loosen the screw and swing the cover down. Always re-fasten the cover after use to protect the pushbuttons from environmental contamination.

The three pushbuttons perform the following functions:

- √ *Left Button* - Marked with ***,** permits you to select or accept the value or parameter option currently displayed.
- √ *Middle Button* - Marked **–,** permits you to move back through the menu structure to the previous item in the menu or decrement the value currently shown in the digital display. When used to decrease a displayed value, holding the button down causes the value to decrease at a faster rate.
- √ *Right Button* - Marked **+,** permits you to move forward through the menu structure to the next item in the menu, or to increment the value currently shown in the digital display. When used to increase a displayed value holding this button down causes the value to increase at a faster rate.

NOTE

An exclamation point (!) in the SVI II AP display window indicates that there is instrument status available.

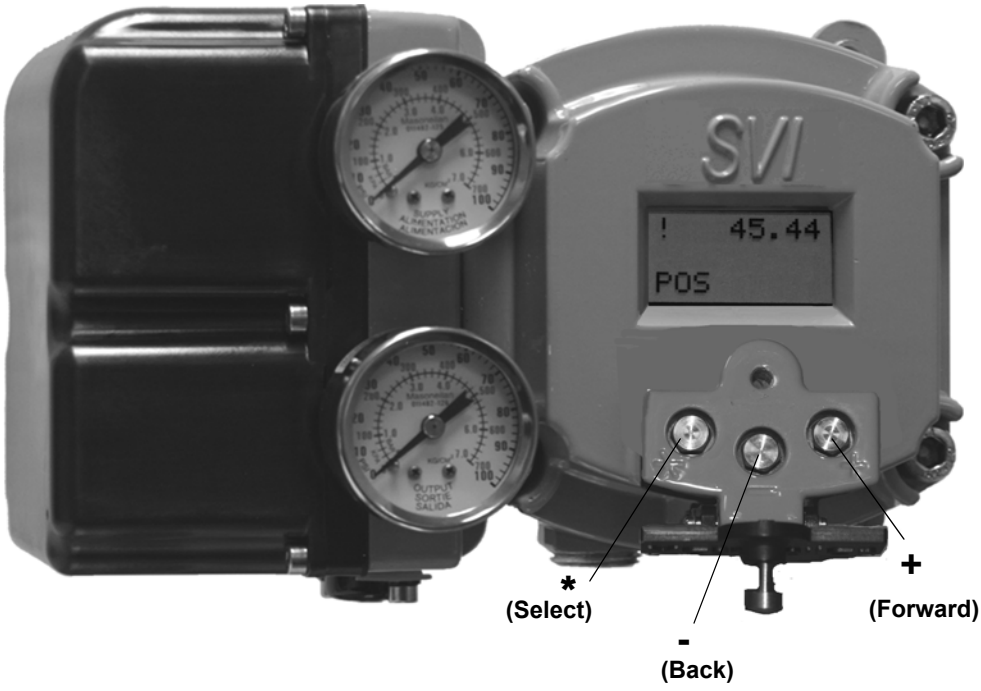


Figure 32 SVI II AP Display

To determine how to display and select a specific parameter value or configuration option, refer to the menu structure diagrams shown in Figure 33 on page 74 through Figure 36 on page 81. When using these diagrams as a map you can move through the menus to the function you needed.

NOTE

If the pushbuttons are pushed after being locked by ValVue software, the message LOCKED appears. Refer to the ValVue User's Guide for instruction about unlocking the pushbuttons.

Pushbutton Locks and Configuration-Lock Jumper

Before performing any of these functions with the local display you must first ensure that the pushbuttons are placed in the unlocked mode using ValVue. The positioner ships in the unlocked mode. See ValVue documentation for more details.

The SVI II AP offers several levels of plant security. It may be desirable, after initial setup, to lock the pushbuttons so that the SVI II AP parameters cannot be inadvertently changed by the buttons. Several levels of software modifiable pushbutton locks are provided.

Table 10 Pushbutton Lock Security Level

Level	Access
Security Level 3	Allow Local Buttons: Buttons on the SVI II AP are fully enabled.
Security Level 2	Lock Out Local Calibration and Configuration: Use the buttons to perform operations in normal operating mode and manual mode. Do not go to configure or calibrate mode.
Security Level 1	Lock Out Local Manual: Examine variables in normal operating mode but do not put the valve in manual operating mode. Access to calibrate or configure modes is not available.
Security Level 0	Lock Out All Buttons: The buttons are disabled (level 0).

Hardware Configuration Lock

Additional security is achieved using the hardware configuration-lock jumper shown in Figure 31 on page 64. When set to secure position, shorting the two-pin header, configuration and calibration are not permitted by the local interface or by remote communications. Pushbuttons, ValVue and handhelds are locked out, except to examine configuration, calibration, and position. This is similar to Security Level 1 shown in the Pushbutton Lock Security Level table.

The following pages display the menu structure for operating the SVI II AP using local pushbuttons.

Display Menus

NORMAL Operating Mode and MANUAL Mode Menus

When you leave the NORMAL mode to go to MANUAL mode the valve is placed in the last position it was in when leaving NORMAL. When in the MANUAL mode the device does not respond to the 4 - 20 mA signal. However, the SVI II AP unit can still respond to HART® commands, including HART® commands to position the valve. When you switch to the VIEW DATA or VIEW ERR menus from the NORMAL operate mode menu the valve is still in NORMAL mode and still responds to the 4 - 20 mA signal.

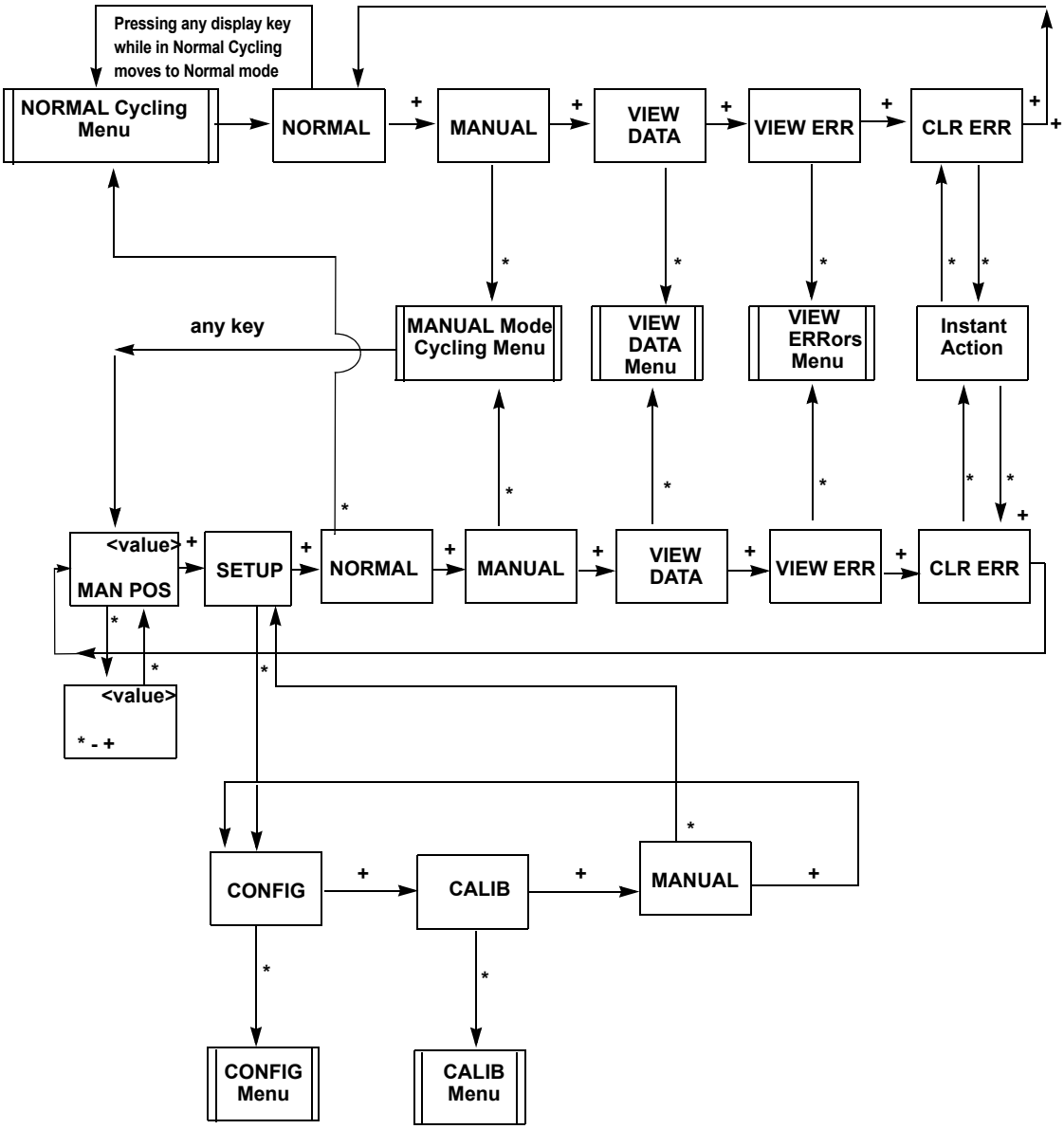


Figure 33 NORMAL Operation and MANUAL Menu Structures

Configure Menu

Because calibration depends on certain configuration options you must perform Configuration before you perform Calibration when installing the SVI II AP for the first time.

If a change is made in the Air-to-Open / Air-to-Close configuration option or if you move the SVI II AP to a different valve or make any change to the valve position linkage, you must run the find STOPS calibration again.

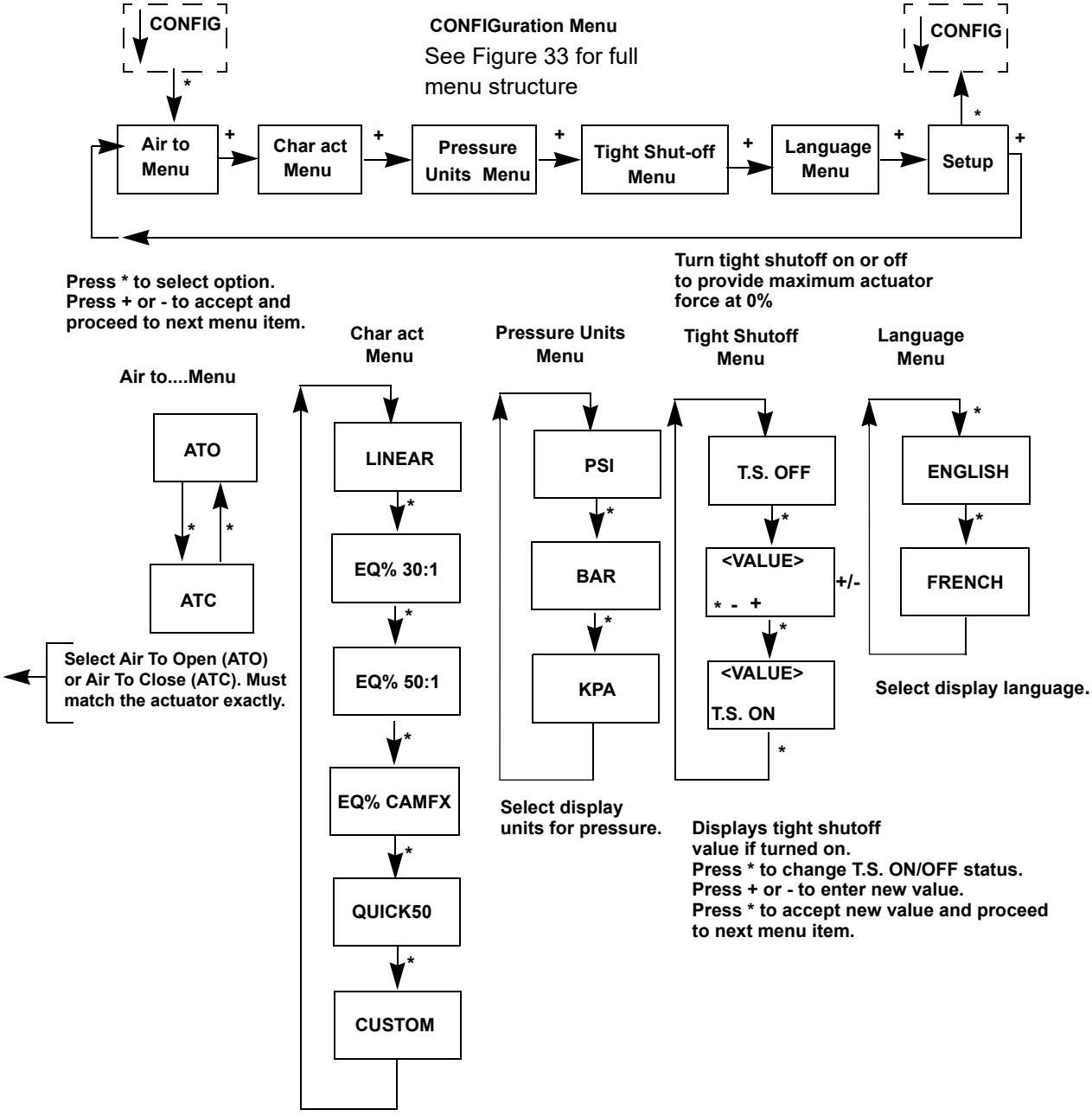


Figure 34 CONFIGure Menu

ATO / ATC

WARNING

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

The positioner must be configured as Air-to-Open, ATO, or as Air-to-Close, ATC. This parameter is toggled by the ***** button. If the positioner has a double acting relay, the action is defined for the output labeled ACT1, or Output 1.

To determine if a direct acting positioner is considered ATO or ATC perform the following test:

1. Apply the actuators rated pressure to the positioner supply. Do not exceed actuator pressure rating on the control valve specification sheet. Damage to the valve stem, shaft, or trim can occur.
2. Disconnect the electrical (4 to 20 mA) input signal from the positioner or set it to less than 3.6 mA.
3. Observe the position of the control valve. If it is closed the actuator is ATO. If the valve is open it is ATC.

Valve Characteristics

The positioner must be configured to supply the correct relationship between input signal and valve position. This is called the *position characteristic*. Figure 11 on page 78 lists configuring the positioner characteristics.

Use of a linear characteristic is recommended unless the process dynamics or control valve application calls for an alternate characteristic. SVI II AP offers a custom characteristic for specialty applications. Prior to selection of custom, the 10 parameters for the custom characteristic must be entered using ValVue.

Pressure Units

Select the display units for the optional actuator pressure sensor. The available choices are PSI, BAR or KPA.

The choice applies to both the local LCD display and to the displays with ValVue or the HART® Handheld communicator.

1. Press ***** to move from PSI to BAR to KPA.
2. Press **+** to continue to scroll through the configuration menu.

NOTE

The characteristic configured in the positioner is applied in addition to the plug characteristic built into the valve trim. Do not configure a percentage characteristic if the valve has a percentage plug.

Tight Shutoff

Tight Shutoff is an optional performance feature that prevents leakage at the closed position. Without this feature, at the closed position with an input signal of 0%, the valve may not be forced tight against the seat with maximum available actuator force or it may be only touching the seat with minimum force. In either case, it is under control.

To prevent leakage that can occur in the second case, configure TS ON and set a value of position setpoint below which the actuator applies maximum seating force. As the position signal drops toward the TS value, SVI II AP moves the valve to the TS position value. When the position reaches the TS value SVI II AP applies maximum actuator force.

The TS function has 0.5% deadband to prevent chatter. If TS is set ON at 2%, for example, then the valve begins to open when the setpoint reaches 2.5%.

Configuring TS ON

1. Press ***** to turn TS ON.
2. Press **+** to increase TS.
3. Press **-** to decrease TS.
4. Press ***** when finished to return to the CONFIG menu.

   The CONFIG menu displays TS ON.

Turning TS OFF

1. Press ***** to turn TS OFF.
2. Press **+** to continue scrolling through the menu.

Changing Language

The local display language can be English or French.

1. Press ***** to toggle from ENGLISH to FRANCAIS.
2. Press **+** to continue to scroll through Config menu.

Table 11 Guidelines for Characteristic Choice

Valve Type and Built In Characteristic	Desired Installed Valve Position Characteristic	Standard Positioner Characteristic Selection
Camflex	Linear	LINEAR
Camflex	Equal Percentage	EQUAL50 EQ% CAMFX (when replacing a 4700E)
Varimax	Linear	LINEAR
Varimax	Equal Percentage	EQUAL50
21000 series Model # 21X1X or 41000 series Model # 41X1X with LINEAR TRIM	Linear	LINEAR
21000 series Model # 21X1X or 41000 series Model # 41X1X with LINEAR TRIM	Equal Percentage	EQUAL50
21000 series Model # 21X2X or 41000 series Model # 41X2X with EQUAL PERCENTAGE TRIM	Linear	Not Recommended
21000 series Model # 21X2X or 41000 series Model # 41X2X with EQUAL PERCENTAGE TRIM	Equal Percentage	LINEAR
Ball Valve with typical MODIFIED PERCENTAGE TRIM	Linear	Not Recommended
Ball Valve with typical MODIFIED PERCENTAGE TRIM	Equal Percentage	LINEAR
Butterfly valve with typical MODIFIED PERCENTAGE TRIM	Linear	Not Recommended
Butterfly valve with typical MODIFIED PERCENTAGE TRIM	Equal Percentage	LINEAR
Reciprocating valve with LINEAR TRIM	Linear	LINEAR
Reciprocating valve with LINEAR TRIM	Equal Percentage	EQUAL50
Rotary or Reciprocating valve with EQUAL PERCENTAGE TRIM	Linear	Not recommended
Rotary or Reciprocating valve with EQUAL PERCENTAGE TRIM	Equal Percentage	LINEAR

Calibration Menu

The Calibration menu shown in Figure 35 provides access to all the calibration functions for the SVI II AP. If a change is made in the Air-To-Open/Air-To-Close configuration option or if you move the SVI II AP to a different valve or make any change to the valve position linkage, you must run the find STOPS calibration again.

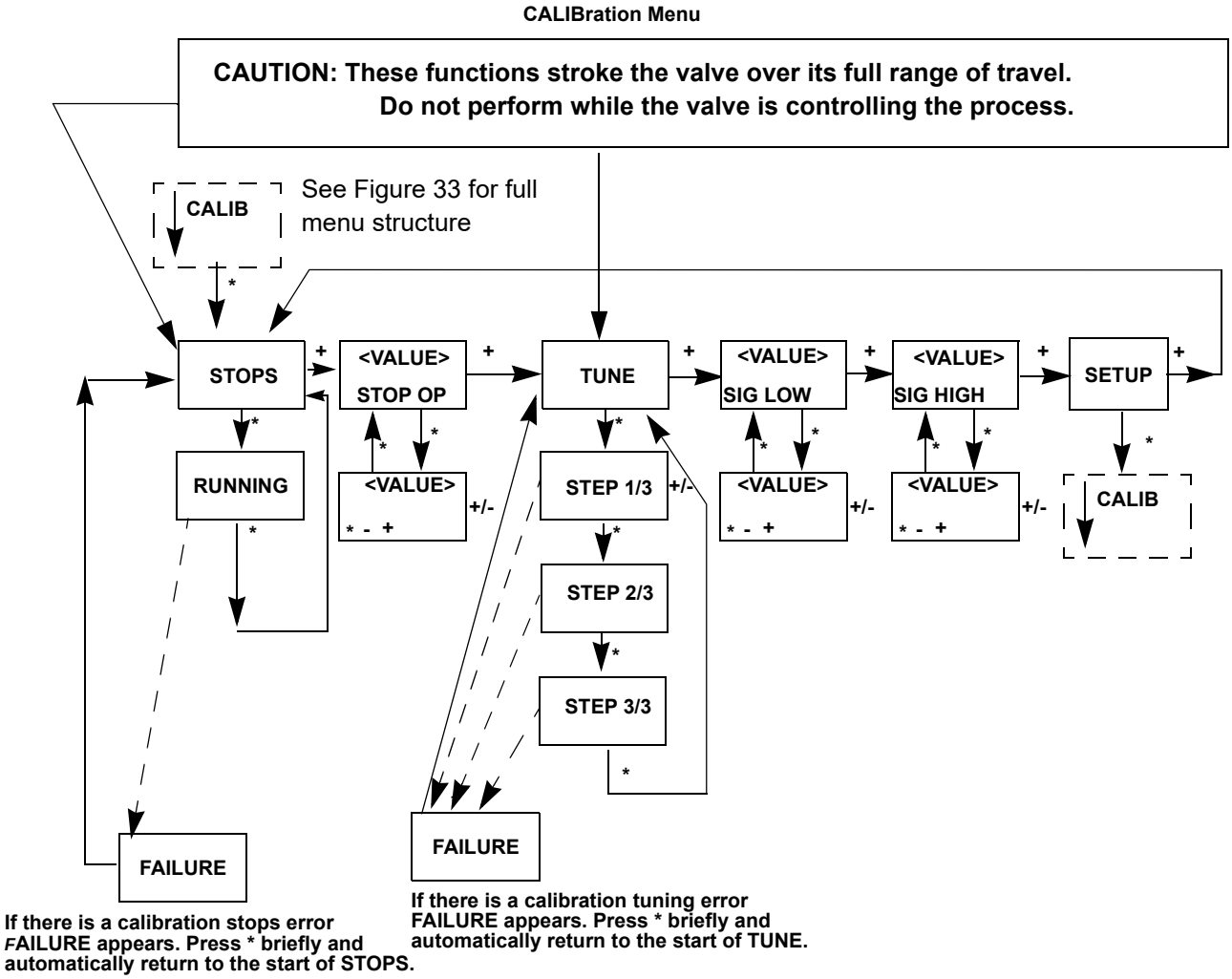


Figure 35 CALIBration Menu

VIEW DATA Menu

This menu can be entered either from the MANUAL Mode menu or from the NORMAL Mode menu.

The VIEW DATA menu allows you to read the current configuration, calibration, and status information. This information cannot be changed from the VIEW DATA menu. Exiting from the VIEW DATA menu returns the previous menu.

When entered from NORMAL mode the valve still responds to changes in set point input signal and the values displayed change in accordance with changes in input signal. When entered from MANUAL mode, the valve is locked in position. The parameters viewable by pressing **+** and **-** are:

- √ SINGLE or DOUBLE
- √ ATO or ATC
- √ LINEAR, EQ% 30:1, EQ% 50:1, EQ% CAMFX, QUICK50, or CUSTOM
- √ PSI, BAR, KPA
- √ T.S. ON, T.S. OFF
- √ SIGNAL LOW value (typically 4.00)
- √ SIGNAL HI value (typically 20.00)

Viewing Configuration and Calibration Parameters

To view configuration and calibration parameters use the following procedure:

1. If in the *NORMAL* operating mode, press any button.
2. Press **+** to move through the options until you reach the VIEW DATA menu item.
3. Press ***** to go to *VIEW DATA* menu. (This leaves the valve in *NORMAL* mode.) If in MANUAL mode, press **+** repeatedly until the VIEW DATA menu item is reached. Press ***** to select the *VIEW DATA* mode.
4. To exit from the *VIEW DATA* menu, press ***** at any menu line. You return to the last menu displayed.

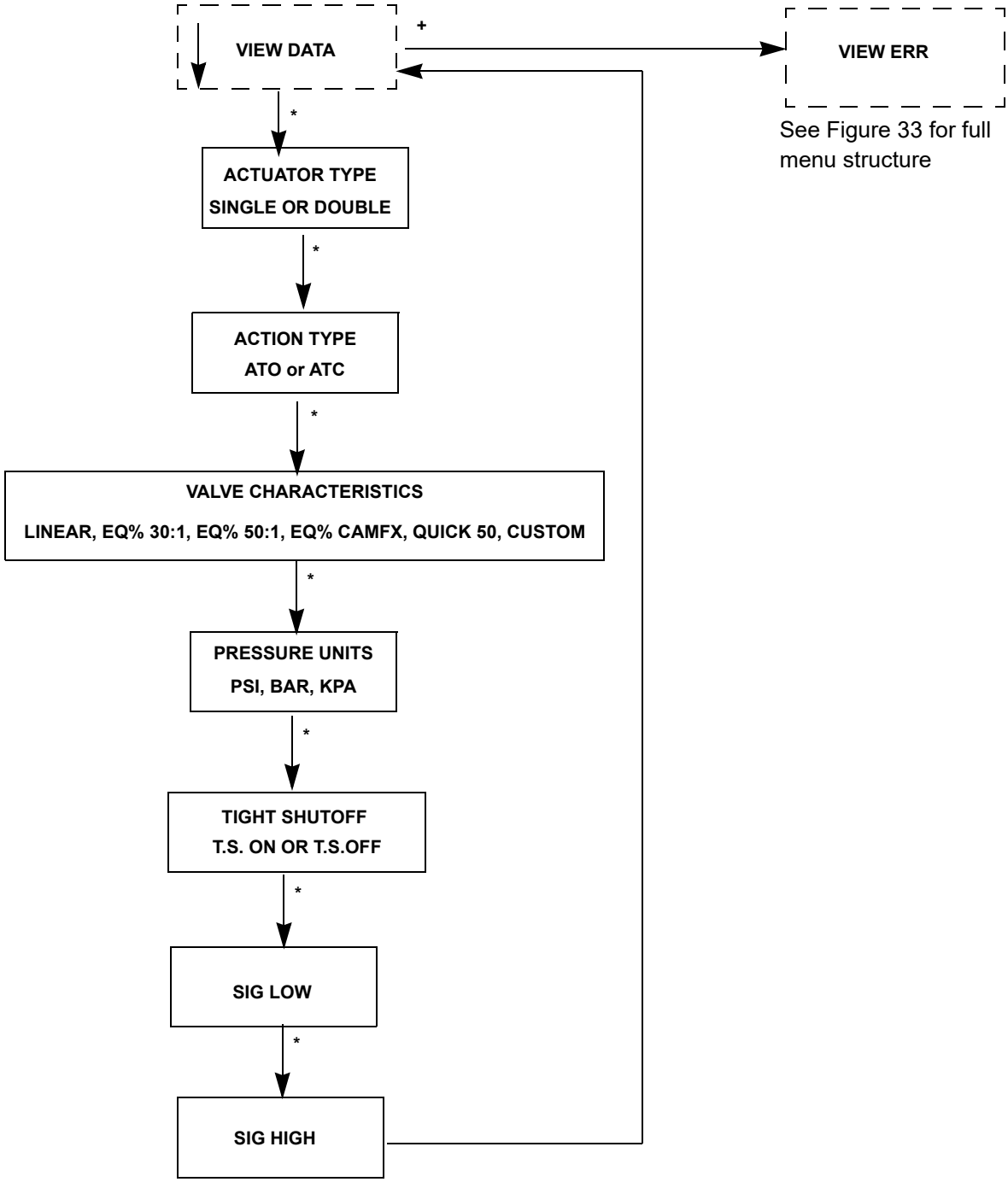


Figure 36 VIEW DATA Menu

FAILSAFE Mode

FAILSAFE mode cannot be selected from any of the previous menus. FAILSAFE mode and display are initiated by detection of a critical fault in the positioner or the valve system. There are two ways to deal with a FAILSAFE condition: correct the problem and clear the error messages *or* run through the FAILSAFE menu, view error messages, enter MANUAL mode and RESET. *RESET* restarts operation.

When failsafe occurs:

1. Press **+** to move to *VIEW ERR*.
2. Press ***** to view the first error message. Press **+** to scroll through all fault messages.
3. Correct the cause of the problem and press **+** to move to *CLR ERR*.
4. Press ***** to remove all error messages from memory.
5. Move to the *MANUAL* menu. If you have cleared the errors *RESET* no longer appears.

or

1. Press **+** to move to *VIEW ERR*.
2. Press ***** to view the first error message. Press **+** to scroll through all the fault messages in turn.
3. Move to *MANUAL* menu and enter Manual mode.
4. Select **RESET** to start the valve from its failsafe condition.
5. Identify and correct errors and select **RESET** to return to the prior mode (without removing error messages from memory).

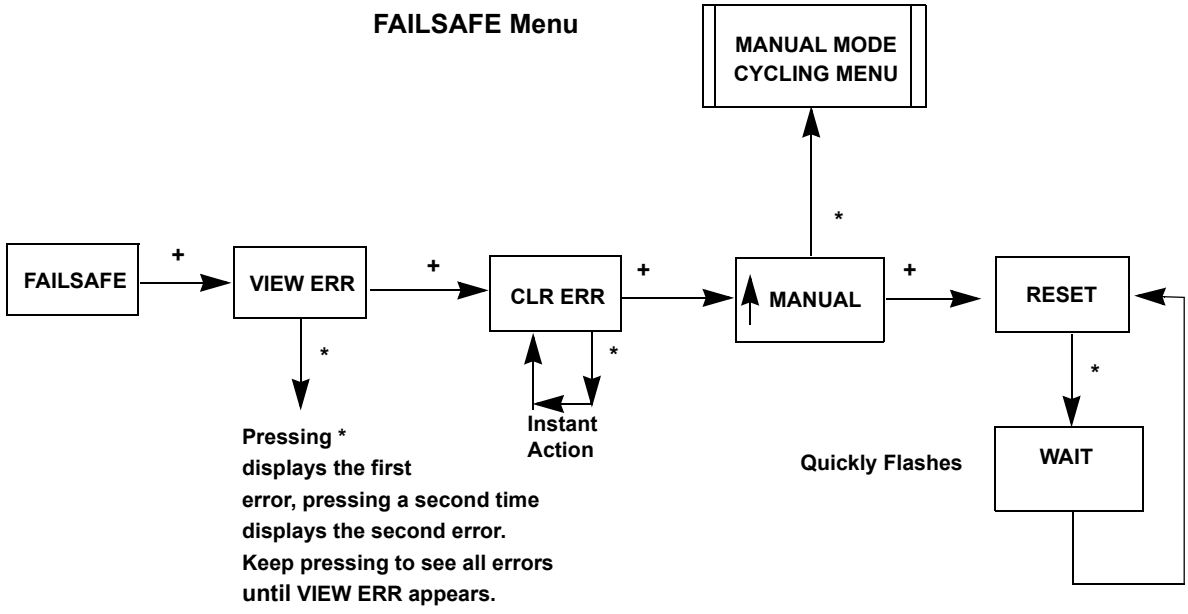


Figure 37 FAILSAFE Menu

VIEW ERR Diagnostics Messages

Diagnostic messages are viewed with VIEW ERR from the MANUAL Mode menu or from NORMAL Mode menu. The VIEW ERR menu item allows you to read the current status information.

To clear the error messages:

1. Press * at *CLR ERR* on either the *MANUAL* or *NORMAL* mode menus.
2. Exiting from the VIEW ERR menu returns the previous menu.

Table 12 Error Messages

LCD	Description	Action	Cause	Resolution
RESET	Reset occurred due to command or power up. Always present after power up.	Warning	Normal operation on power up always sets RESET. RESET is sent by HART® communications. Use CLEAR ERR to remove warning	Use CLEAR ERR to remove warning.
LOW POWER	Input current < 3.6 mA Note: The low power warning is at 3.6 mA, but the unit starts function at 3.2 mA.	Takes the device to low power	Input current < 3.15 mA; device goes into low power mode (unless in failsafe) upon setting this fault.	Check input current.
ACT ERR	Positioner unable to position a valve normally	Warning	Integral is saturated for 20 seconds; positioner is unable to position the valve normally; note saturated is different than off. 1- Air supply is insufficient. 2- Handwheel or mechanical stop present. 3- Valve stuck of sticking excessively. 4- Unbalance forces on valve trim exceeds actuator capability	1- Increase air supply above spring final value + 10 psig. 2- Verify if mechanical stop is present. 3- Perform valve signature using ValVue. 4- If possible, perform valve signature under process conditions. Validate sizing of actuator against process condition using ValSpeQ.
AIR LOW	If supply pressure option is configured AND supply pressure < 10 (single acting) or 15 (double acting) psi; Otherwise, if the I/P pressure is below 0.8 psi.	Warning	Mechanical or pneumatic problem	Usually requires fixing a mechanical or pneumatic problem.

Table 12 Error Messages (Continued)

LCD	Description	Action	Cause	Resolution
POS ERR	The position error exceeds configured limit for more than configured time	Warning after T1 and Fail-safe	Pneumatic/ mechanical, configuration, loose magnet	Pneumatic/ mechanical, configuration, loose magnet
KEYBOARD	LCD/Button Failure	Warning	Damaged buttons or LCD electronics	Replace keypad.
MARGN PWR	Input signal is insufficient to proceed	Warning	Input current is between 3.75 mA and 3.15 mA	Increase loop current.
CALIB ERR	Calibrate failed	Warning	Invalid values for current calibration and input range by HART® commands	1. Redo calibration. 2. Contact Masoneilan at svi-support@ Baker-Hughes.com.
STOP ERR	Calibration error. Find STOPS was unsuccessful.	Warning	Configuration, calibration	1. Redo calibration. 2. Contact Masoneilan at svi-support@ Baker-Hughes.com.
TUNE ERR	Auto tune failed	Warning	Mechanical or pneumatic problem causes tuning failure	1. Redo calibration. 2. Contact Masoneilan at svi-support@ Baker-Hughes.com.
STD DIAG	A standard diagnostic procedure failed to complete	Warning	Pneumatic / mechanical, configuration	Pneumatic / mechanical, configuration issue.
EXT DIAG	An extended diagnostic procedure failed to complete	Warning	Pneumatic / mechanical, configuration	Pneumatic / mechanical, configuration issue.
BIAS ERR	Position algorithm error in output bias	Warning	Pneumatic/ mechanical	Pneumatic / mechanical, configuration issue.
I/P LIMIT	I/P current too high or too low	Warning	Electronic hardware	1- Remove power to the device for two minutes and restart the device. 2- If the failure persist, replace the device.

Table 12 Error Messages (Continued)

LCD	Description	Action	Cause	Resolution
TEMP ERR	Internal circuit temperature high (>80° C, 176° F) or low (<-40° C, -40° F)	Warning	Environment	Check ambient temperature.
NVM ERR_R	An FRAM record and its copy both have CRC errors (as detected by read on initialization) or if temperature calibration table has not been written in its entirety (detected by CRC of column CRCs)	Failsafe	Electronic hardware	1- Remove power to the device for two minutes and restart the device. 2- If the failure persist, replace the device.
RAM ERR	RAM data item had a bad checksum	Warning	Electronic failure.	Notify factory at svisupport@ BakerHughes.com.
FLASH ERR	Flash memory failed checksum test	Failsafe	Flash memory failed checksum test	1- Remove power to the device for two minutes and restart the device. 2- If the failure persist, replace the device.
STACK ERR	A valid hidden record (in RAM) existing upon reset indicating that a stack overflow had occurred	Warning	Electronics failure.	Clear the condition using ValVue or HART® Host.
FCTRY-MODE	Factory mode failure	Failsafe	Enables factory commands	Notify factory at svisupport@ BakerHughes.com.
NVM ERR-T	An FRAM record and its copy both have CRC errors	Warning	Electronics failure.	1- Remove power to the device for two minutes and restart the device. 2- If the failure persist, replace the device.
REF VOLT	Temperature compensated I/P current is out of range for five reads in a row or the raw reading it out of range	Failsafe	Electronics failure.	Notify factory at svisupport@ BakerHughes.com.

Table 12 Error Messages (Continued)

LCD	Description	Action	Cause	Resolution
POS SENSR	Internal error in Hall Effect sensor. If upon request temperature compensated remote position sensor reading is outside the range [2.5, 120.0-2.5] degrees or internal position sensor reading is outside the range [–70.0 to 70.0] degrees for five reads in a row. For the internal position sensor, a raw position count of approximately > 15000 is near failure. An exact number is installation- dependent. For an RPS installation, a raw position count of approximately > 24000 is near failure.	Warning	Electronic hardware	Notify factory at svisupport@BakerHughes.com.
SIG SENSR	Internal error in sensing of 4 - 20 mA	Warning	Electronic hardware	Notify factory at svisupport@BakerHughes.com.
PRES1 ER	Temperature compensated pressure sensor 1 reading is outside the range	Warning	Electronics failure.	Notify factory at svisupport@BakerHughes.com.
PRES2 ER	Temperature compensated pressure sensor 2 reading is outside the range	Warning	Electronics failure.	Notify factory at svisupport@BakerHughes.com.
PRES3 ER	Temperature compensated pressure sensor 3 reading is outside the range or supply pressure recorded is >120 psi (8.28 bar, 828 kPa)	Warning	Electronics failure.	Notify factory at svisupport@BakerHughes.com.
PRES4 ER	Temperature compensated pressure sensor 4 reading is outside the range or pilot pressure recorded is >120 psi (8.28 bar, 828 kPa)	Warning	Electronics failure.	Notify factory at svisupport@BakerHughes.com.
PRES5 ER	Temperature compensated pressure sensor 5 reading is outside the range	Warning	Electronics failure.	Notify factory at svisupport@BakerHughes.com.

Table 12 Error Messages (Continued)

LCD	Description	Action	Cause	Resolution
NVM ERR-W	Writer to FRAM fails or data repairing in FRAM fails	Warning	Electronics failure.	1- Clear the condition using ValVue or HART® Host. 2- If condition persists, replace device and report problem at svisuport@ BakerHughes.com.
IRQ FAULT	Valid hidden record (in RAM) existing upon reset that indicates that an illegal interrupt occurred	Warning	Electronics failure.	1- Clear the condition using ValVue or HART® Host. 2- If condition persists, replace device and report problem at svisupport@ BakerHughes.com.
DATA ERR	Internal software error data overrun	Failsafe	CPU/firmware	1- Clear the condition using ValVue or HART® Host. 2- If condition persists, replace device and report problem at svisupport@ BakerHughes.com.
MCU ERR 1	Micro-Controller Self Check failed	Failsafe	CPU/firmware	1- Clear the condition using ValVue or HART® Host. 2- If condition persists, replace device and report problem at svisupport@ BakerHughes.com.
SW ERR	Software self check error	Failsafe	CPU/firmware	1- Clear the condition using ValVue or HART® Host. 2- If condition persists, replace device and report problem at svisupport@ BakerHughes.com.

Display and Clear Error Messages

Use this procedure, VIEW ERR, to view fault codes and messages listed in Table 12 of this manual. This is useful when clearing a Failsafe from the pushbuttons.

1. Press **+** in *NORMAL* or *MANUAL* mode to move through the options until you reach the *VIEW ERR* menu item.
2. Press ***** to go to *VIEW ERR* menu.
3. Press ***** to display the list of status values.
4. Press **+** to move forward trough the list in sequence.
5. Press **–** to move back through the list.
6. Press ***** at any status message to return to the *VIEW ERR* option in your previous mode.
7. Press **+** to move to *Clear ERR*.
8. Press ***** to clear all messages (recommended) or press **+** to move to the next option.

Positioner Fault Messages

Table 12 on page 584 lists the fault codes and messages that appear on the display. The table also explains the meaning of each message and a possible cause of the fault.

Return to Normal Operation

Always return the positioner to NORMAL operating mode to resume control by the input signal. Use this procedure to return to NORMAL mode from any menu.

1. Press **+** or **-** repeatedly until *MANUAL* or *NORMAL* appears.
2. Press:
   - √ ***** to return to NORMAL operating mode, if *NORMAL* appears.
   - √ ***** to return to MANUAL Mode menu, if *MANUAL* appears.
3. Press **+** repeatedly until -› *NORMAL* appears.
4. Press ***** to return to *NORMAL* mode and normal operation.

NOTE

When entered from NORMAL mode the valve still responds to changes in set point input signal and the values displayed change in accordance with changes in the input signal. When entered from MANUAL mode the valve is in locked position.

Hand Held Communicator

For communication to a HART® device, there is a Device Description Language. A Device Description, DD, is published by registration with the Field Comm® Group. 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 SVI II AP registered DD is available from the Field Comm® Group. The SVI II AP DD can be obtained from the website or by contacting your local representative.

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

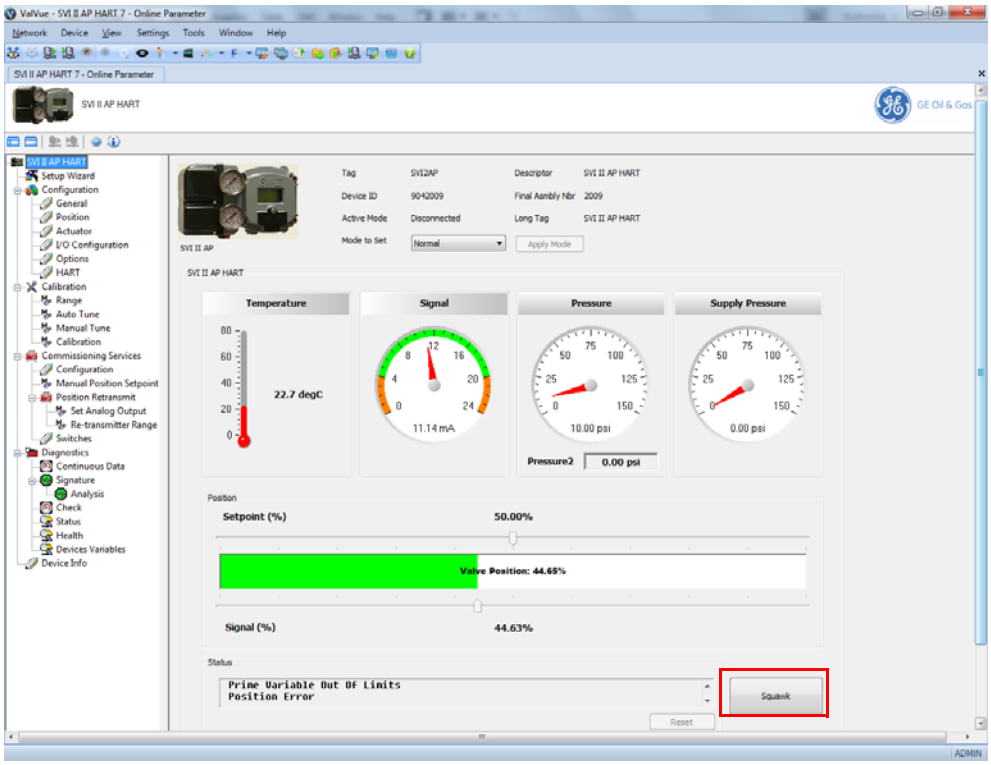
Do not connect a PC or HART®modem to an intrinsically safe circuit except on the safe area side of the barrier. Do not operate a PC in a hazardous area without compliance to local and plant regulations.

HART® 6 and 7 Squawk Command

For HART® 6 and 7 units, use the squawk command (HART® Command 72) to assist technicians to find specific devices in an installation. Send this command using ValVue and a specific device will visually indicate the reception of the command. You can clear *Squawk* from the LCD by pushing on any button on the SVI II AP. HART® 7 units can also send a temporary squawk to have the LCD display *Squawk* for two seconds.

Squawk

Non-squawked



HART® Command 72 (Squawk) from ValVue SVI II AP DTM

Figure 38 HART® Command 72 Squawk Function

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6. Configuration and Calibration Using Pushbuttons

Configuration and Calibration

This section provides procedures to:

- √ View configuration data and status messages for the SVI II AP
- √ Configure the SVI II AP
- √ Calibrate and tune the SVI II AP

Observe all warnings as the valve moves during these procedures.

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 configuration and calibration procedures are described using an SVI II AP with pushbuttons and display and ValVue software.

Configuration with Pushbutton Display

Prior to changing the SVI II AP configuration, check the existing configuration.

Verify that the mounting has not been damaged in shipment for a pre-mounted SVI II AP. Record the following information for the configuration checkout:

- √ Valve Air to Open (ATO) or Air to Close (ATC)
- √ Actuator pressure rating
- √ Actuator bench range
- √ Inherent trim characteristic of the control valve; linear, equal percentage, or other. Refer to valve data sheet or model number of control valve.

Viewing Configuration Data

To view SVI II AP configuration data:

1. Access the VIEW DATA menu from the *MANUAL* menu by pressing the **+** button.
2. In the VIEW DATA menu, press * to examine the configuration.
3. Press **+** to scroll through and observe the factory configuration.
4. Press ***** to exit VIEW DATA.
5. Press **+** until *↓MANUAL* appears.
6. Press ***** to enter *MANUAL* mode.
7. Press any key to make *MAN POS* appear.
8. When the adjustment screen appears stroke the valve open by holding + down. Notice that the rate of set point change is slow to begin, but increases speed while the + is pressed.
9. Stroke the valve to several values.
10. Verify the action is as desired.
11. Press ***** to exit *MAN POS* mode.
12. Press **+** to move to the *SETUP* menu.
13. In the SETUP menu press the ***** button to access the CONFIGuration menu.
14. In the CONFIG menu set the configuration parameters.
15. When in CONFIGure or CALIBrate, pressing ***** changes values.
16. Return to NORMAL mode. The valve moves to the Value set by the current calibrator.
17. Stroke the valve through its range to verify that the movement is as desired.

VIEW DATA Settings

Table 13 VIEW DATA Settings

Typical Setting	Optional Setting
SINGLE	DOUBLE
ATO	ATC
LINEAR	EQ% 30:1 EQ% 50:1 EQ% CAMFX QUICK 50 CUSTOM
PSI	BAR KPA
0.00 TS OFF	2.00 TS ON
4.00 SIG LO	4.00 SIG LO
20.00 SIG HI	12.00 SIG HI
ENGLISH	FRENCH

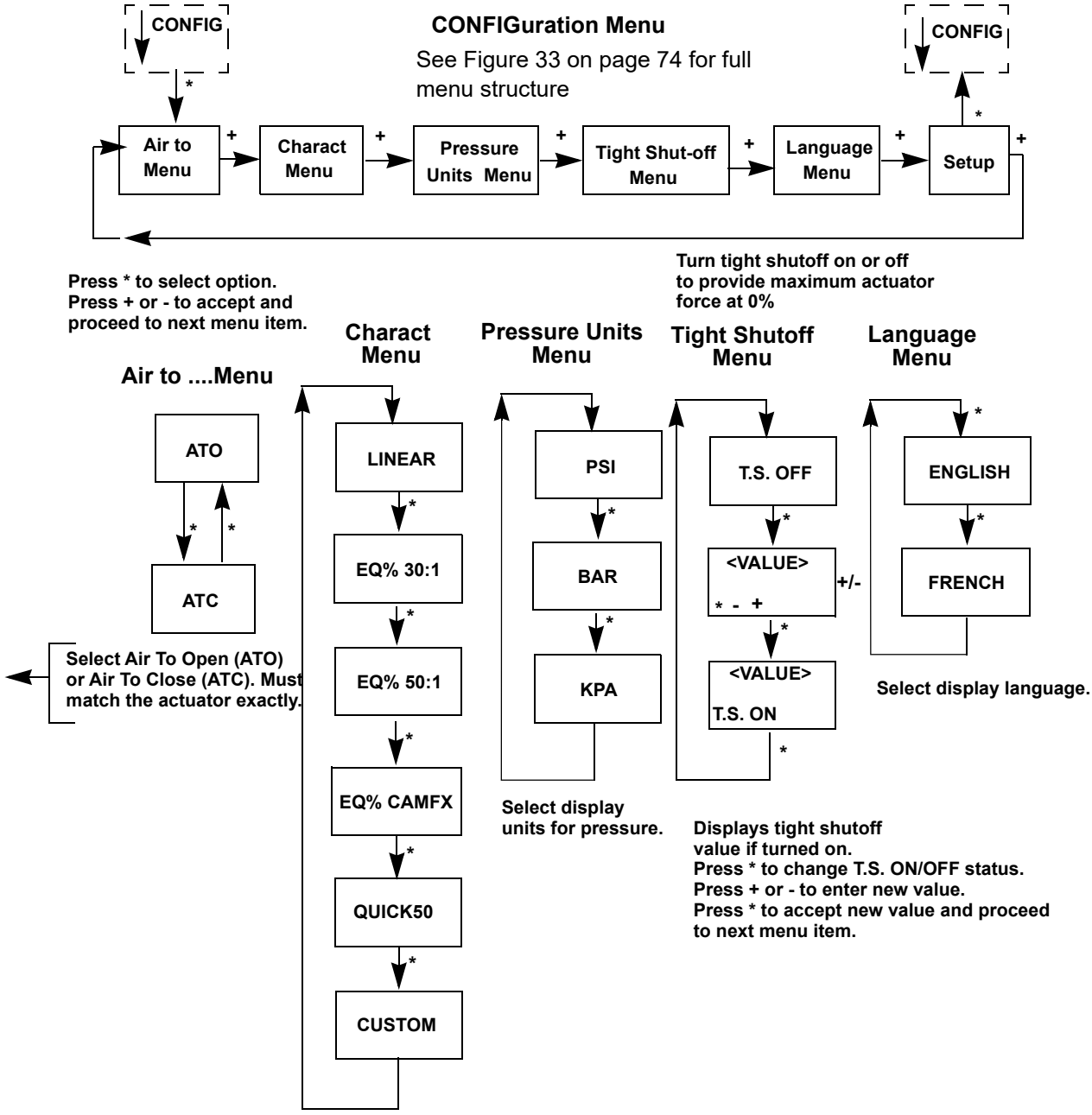


Figure 39 Configuration Pushbutton Guide

Calibration

NOTE

Always perform configuration before running calibration functions.

CAUTION

Pilot Trim Valve Applications require the use of the Manual Stop calibration procedure. Do not run Find Stops or the ValVue Setup Wizard on valves with Pilot Trim or damage to the valve will occur.

Calibrating the SVI II AP Unit Using Pushbuttons

To calibrate the SVI II AP (see Figure 40 on page 100):

1. Observe the display following power-up. The SVI II AP powers up in the previously active mode either MANUAL or NORMAL (operating) mode:
   - √ If in NORMAL mode, the display alternates between *POS* and *SIGNAL* indicating Normal mode.
   - √ If in MANUAL, the display alternates between *POS –M* and *SIG* indicating MANUAL mode.
2. With *MANUAL* mode displayed, press ***** to select the *MANUAL* mode.
3. Press any key to enter *MANUAL* menu.
4. Press **+** to display *SETUP*.
5. Press * to enter *SETUP* mode.
6. In *SETUP* mode press ***** again; ↓*CONFIG* appears. Pressing **+** again brings ↓*CALI*B.
7. Select *CALIB* by pressing *****. *STOPS* appears.
8. Press ***** to perform *FIND STOPS.*
   The valve moves full open and back to full closed.
9. Observe all warnings.
10. Press ***** and the valve strokes and automatically calibrates valve travel.
11. After the STOPS procedure finishes, press **+** twice until TUNE appears.

Calibration using Auto Tune

To auto tune the SVI II AP:

1. Press ***** to begin the Autotune procedure. This takes 3 to 10 minutes and strokes the valve in large and small steps to set the PID parameters for best positioning response.

   When Autotune proceeds, numerical messages display, indicating the procedure is working.

   When Autotune is complete, TUNE appears.
2. Press **+** repeatedly until ↑*SETUP* appears.
3. Press ***** to return to *SETUP* menu ↓*CALIB* appears.

WARNING

DO NOT perform STOPS while the valve is controlling the process.
DO NOT perform Auto Tune while the valve is controlling the process.

Correct for Over Travel

WARNING

During Calibration and Configuration the valve moves. Keep hands clear. Isolate the valve from the process. Calibration functions stroke the valve over its full range of travel.

On some valves the full travel is larger than the nominal travel of the valve and it may be desirable to have the reported 100% position correspond to the nominal travel rather than the full stroke. The STOP OP option allows this correction. Use this procedure to make a correction.

1. From CALIB press ***** to display *Stops*.
2. Press **+** to display *STOP OP*.
3. Press * to move valve to the 100% position.
4. Use the **+** and **-** buttons to position the valve to the nominal full open position.
5. Press ***** to accept this position as the new 100% position.

Adjust Input Signal Range

SIG LO displays the input signal that corresponds to the full closed (ATO) or full open (ATC) position of the valve.

1. If the displayed value is:
   - √ Correct, press **+** to advance to the next item.
   - √ Not correct, press ***** to display value of SIG LO.
2. Use **+** and **–** buttons to change the value.
3. Press ***** to return to menu and move to next item. SIG LO must be between 3.8 and 14.0 mA.

   SIG HI displays the input signal that corresponds to the full open, ATO, or full closed, ATC position.
4. If the displayed value is:
   - √ Correct, press **+** to advance to the next item.
   - √ Not correct, press ***** to display value of *SIG HI*.
5. Use **+** and **–** buttons to change the value.
6. Press ***** to return to menu and move to next item. *SIG HI* must be between 10.0 and 20.2 mA. SIG HI must be larger than SIG LO by at least 5 mA.

   Calibration of the positioner is now complete.
7. At -› *MAN*, press ***** to return to the *MANUAL* mode. *MAN POS* appears.

NOTE

SIG HI and SIG LO allow adjustment of the input current range that corresponds to full valve travel. Normally they are set to 4 and 20 mA. Adjustment is normally required only for split range applications and provides flexibility for unusual applications. A separate ValVue calibration procedure enables adjustment of the current sensing circuit to a precision current reference standard.

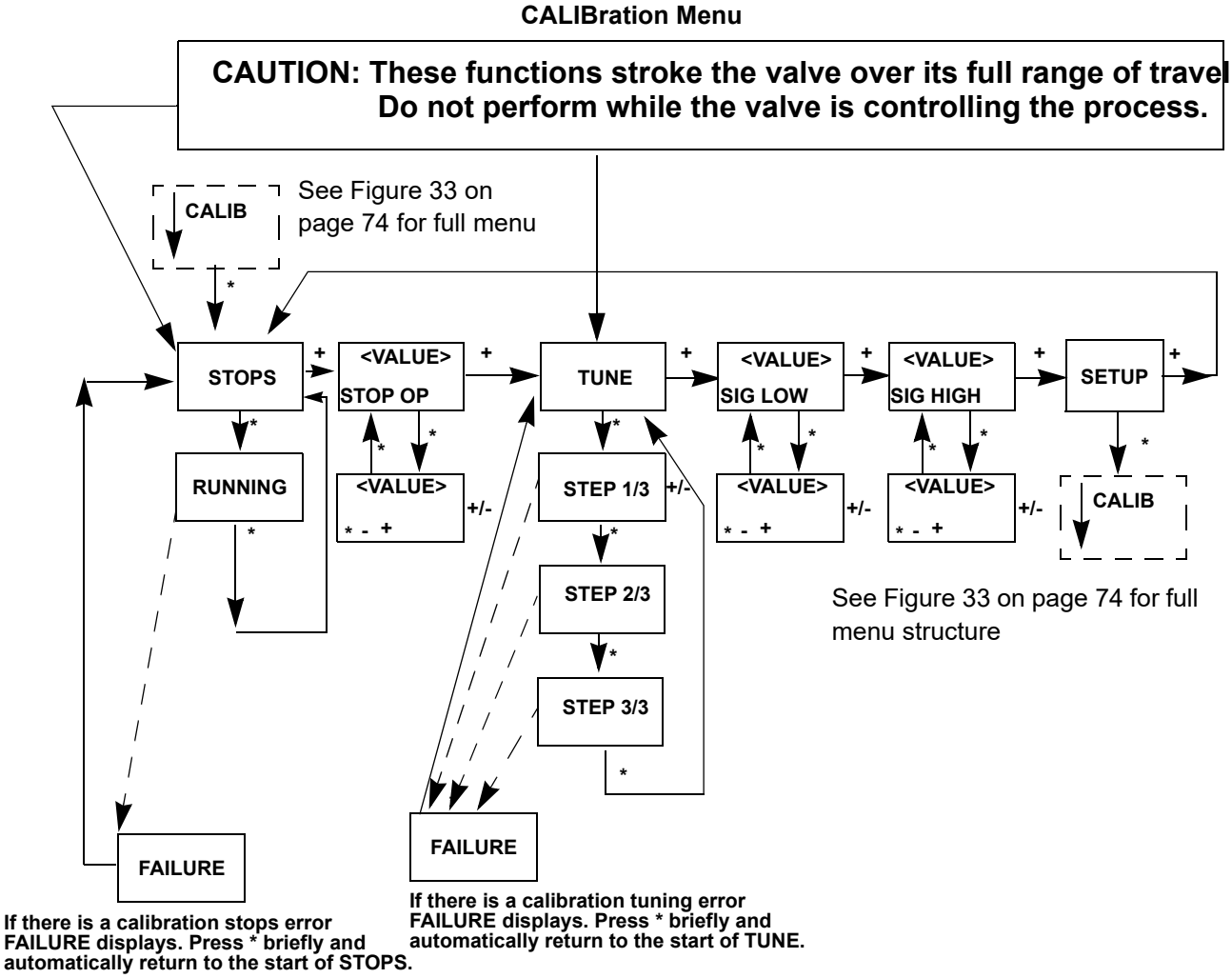


Figure 40 Calibration Pushbutton Guide

Check-out with a HART® Handheld Communicator

This section covers a subset of the functions available with HART®. For a complete description refer to Chapter 4 *Using the Digital Interfaces*. If the SVI II AP is not equipped with optional pushbuttons and local display the checkout and configuration is performed using the standard HART® communications interface. In addition to the functions performed with the local pushbuttons additional functions are performed with HART®. For example, the instrument tag descriptor is written and stored in non-volatile memory and used for point to point wiring checkout.

Connect the HART® Handheld Communicator to the SVI II AP as shown in Figure 41. Refer to the product manual for the HART® Communicator included with the GE DPI620 or other HART® communication devices.

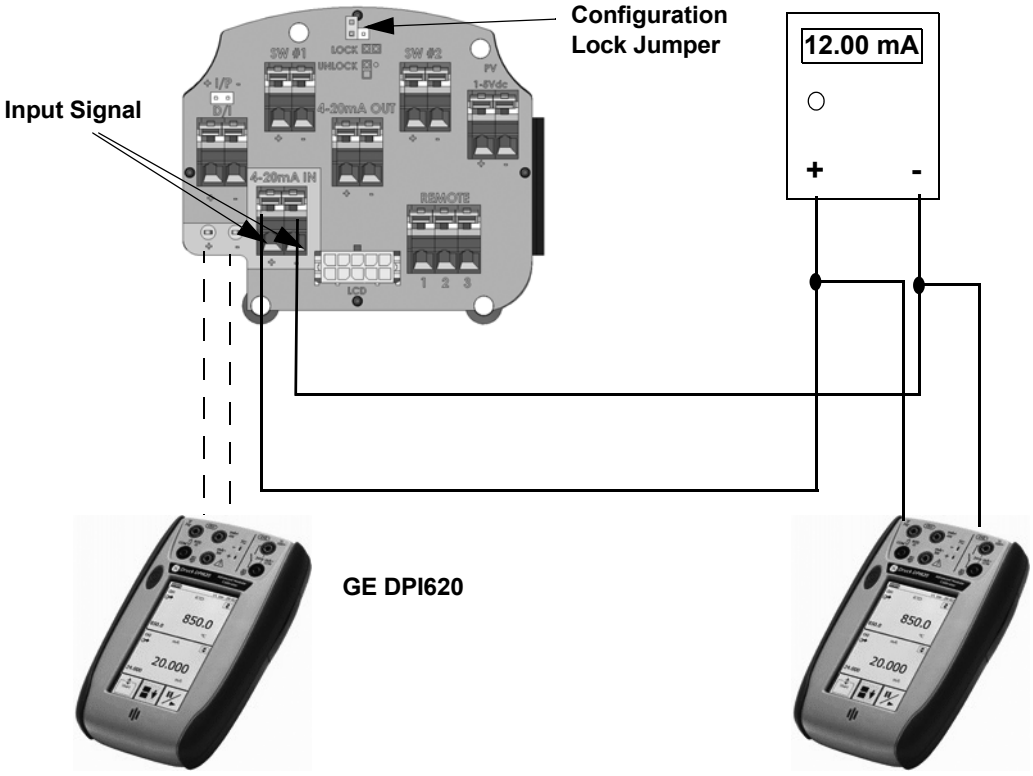


Figure 41 SVI II AP HART® Communicator Connections

Be sure that the configuration lock jumper is in the unlock position. When the jumper is in the lock position (shorting the two-pin header) the handheld is not permitted to make any changes. However, parameters are readable. If fault messages appear, they must be handled before proceeding with HART® communications. Before communications proceed all error messages must be cleared. For example, the following message is displayed if the instrument has been serviced and the air is not connected.

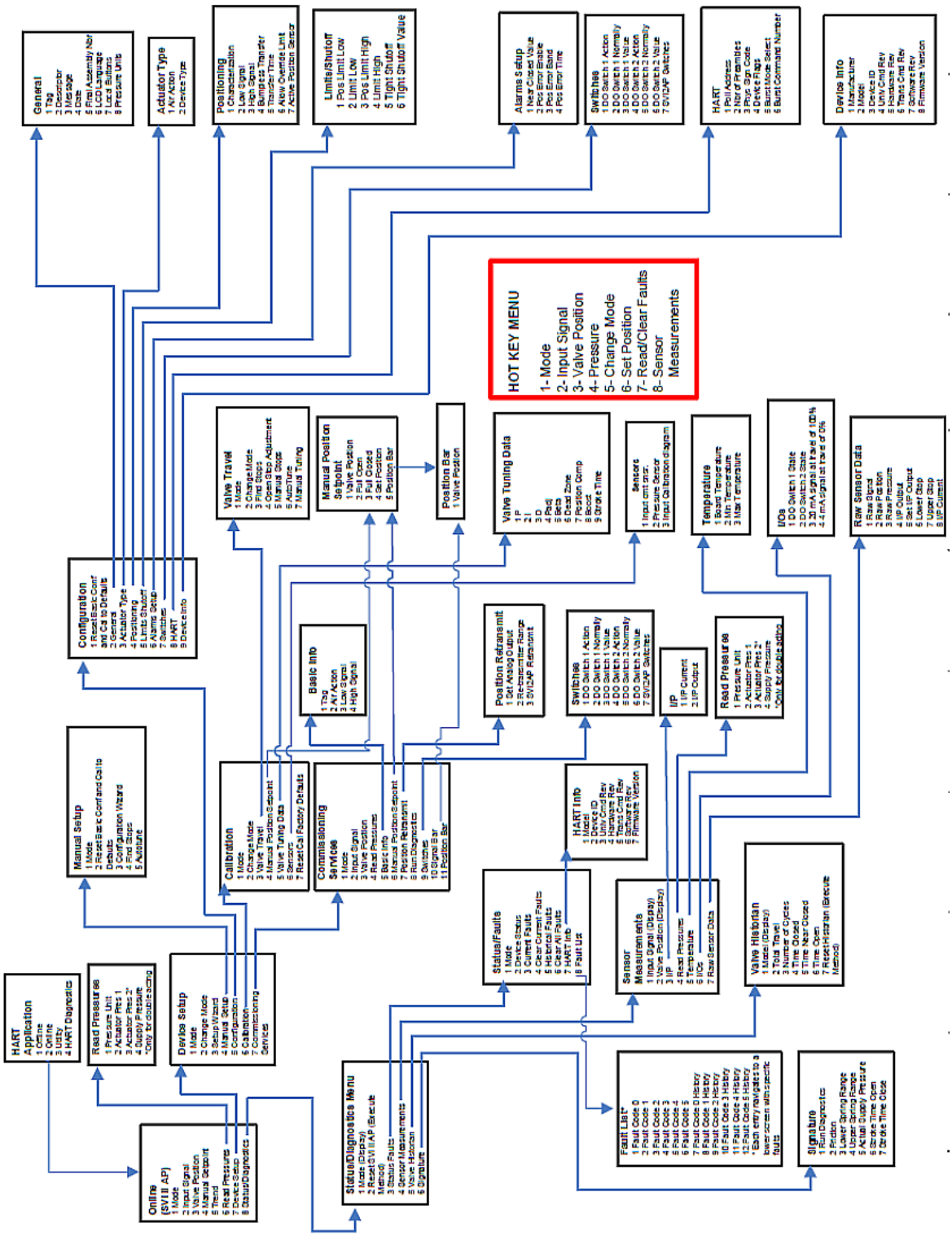
"Process applied to the non-primary variable is outside the operating limits of the field device"

Proceed with the following steps:

1. Press **NEXT.**
2. Field device has more status available.
3. Press **NEXT.**
4. **Ignore next 50 occurrences** of status?
5. Press **YES.**
6. Change to **MANual** mode.
7. Scroll to line **6 EXAMINE**, press **->**.
8. Scroll down to **5 read status**.
9. Read message.
10. Press **OK.**
11. Repeat **OK** to read all messages until the display returns to *read status*.
12. Scroll down to **6 clear status,** press **->.**
13. If *clear fault codes not completed* appears, press **OK** and read the message (*Position Error***,** for example).
14. Correct the problem (Is the air supply on?), and then go to clear status until *Clear Fault codes Completed* appears.
15. Press **OK**.

Emerson 475 Handheld Menu Structure

The menu structure shown below starts in the upper left hand corner of the card (Firmware 3.2.3 HART 5®, 4.1.1 (HART® 6).



Run Auto Tune

1. Open *HART* screen and tap **Online**.
2. Tap **Device Setup**.
3. Tap **Manual Setup**.
4. Tap **Change Mode** and change mode to *Setup*.
5. Tap back arrow.
6. Tap **Auto Tune**. You are led through a series of screens run the process.
7. Tap **Change Mode** and change back to desired mode.

Run Find Stops

1. Open *HART* screen and tap **Online**.
2. Tap **Device Setup**.
3. Tap **Manual Setup**.
4. Tap **Change Mode** and change mode to *Setup*.
5. Tap back arrow.
6. Tap **Find Stops**. You are led through a series of screens run the process.
7. Tap **Change Mode** and change back to desired mode.

Run Open Stop Adjustment

1. Open *HART* screen and tap **Online**.
2. Tap **Device Setup**.
3. Tap **Calibration**.
4. Tap **Valve Travel**.
5. Tap **Change Mode** and change mode to *Setup*.
6. Tap back arrow.
7. Tap **Open Stop Adjustment**. You are led through a series of screens run the process.
8. Tap **Change Mode** and change back to desired mode.

Run Diagnostics

1. Open *HART* screen and tap **Online**.
2. Tap **Status/Diagnostics**.
3. Tap **Signature**.
4. Tap **Run Diagnostics**. You are led through a series of screens run the process.

View and Clear Faults

1. Open *HART* screen and tap **Online**.
2. Tap **Status/Diagnostics**.
3. Tap **Status/Faults**.

   On this screen you can tap:

   √ **Current Faults** to view only active faults.

   √ **Clear Current Faults** to clear the faults. The faults will reoccur if the cause is not fixed.

   √ **Historical Faults** to view all faults current and past.

   √ **Clear All Faults** to clear current and historical faults.
4. Tap **Fault List** to view the full fault code list.

Configuring and Calibrating with ValVue

ValVue is the most complete and easiest to use configuration tool. ValVue is downloaded from the website (*valves.bakerhughes.com/resource-center*) and provides an interface for configuring and calibrating SVI II AP. Use of these tools is recommended. See the ValVue Instruction Manual included with the SVI II AP download.

In this section, we recommend a few ValVue steps to checkout and configure a pre-installed SVI II AP on a control valve.

- √ Read and Set Configuration Parameters
- √ Change to MANUAL mode
- √ Run Find Stops
- √ Run AutoTUNE
- √ View Calibration Parameters
- √ View Diagnostics
- √ Read and Clear Status
- √ Return to NORMAL mode

NOTE

Setting the input current span is unnecessary except for applications such as split range. Calibration of the input current sensor requires the use of high accuracy current standards. The factory settings should only be changed if a calibration laboratory detects errors.

Never connect ValVue to an SVI II AP that is in Configuration or Calibration using pushbuttons.

Troubleshooting Autotune

Autotune, whether using ValVue, pushbuttons, a DD or a handheld, is the best way to tune the valve. If it does not work:

Step One

Autotune again using recommended tuning parameters for the valve is use. The SVI II AP DTM help offers you instructions in how to enter these parameters in the Autotune procedure. Alternately, Try starting tuning from the 50% position.

This often helps with slow moving valves. In manual mode on the Masoneilan DTM Trend screen or in Set up mode on Trend screen or the Manual Position Setpoint tab and change the Set point to 50% before attempting to Autotune.

Table 14 outlines some effects of parameter changes.

Table 14 Rough Guide to Effect s of Changing PID Values

Parameter	Rise Time		Overshoot		Settling Time	
	Increase Value	Decrease Value	Increase Value	Decrease Value	Increase Value	Decrease Value
P	Decrease	Increase	Increase	Decrease	Small Effect	Small Effect
I	Small Effect	Small Effect	Decrease	Increase	Decrease	Increase
D	Small Effect	Small Effect	Decrease	Increase	Decrease	Increase

Step Two

Run autotune again after ensuring the:

- √ Air supply is sufficient and there are no air leaks.
- √ Linkage is not loose or in an improper position.
- √ Alarms are cleared.
- √ Boosters are not too aggressive.
- √ Is the booster by-pass valve closed? Open by-pass valve ½ turn from closed and Auto-tune again
- √ Valve does not have excessive friction. Add some *Dead Zone* (0.25).
- √ Mounting is installed correctly.
- √ Magnet is not out of position.
- √ Solenoid in supply line should have a C_V that is .25 or higher (Std Capacity SVI II AP).

Other Issues That Affect Autotune

Valve oscillating fast:

- √ *P* term too high: reduce *P* by ½ and try again
- √ Booster too hot (aggressive) open by-pass on booster and try again

Valve oscillation slow - friction:

- √ Increase *I* term by 20-25%
- √ Add *Dead Zone* – try 0.25%

Valve moves too slowly:

- √ *P* term too low, try increasing by 25%
- √ Stroking time set to non-zero value.

If Actuator is very large:

Enter a typical value for P in the PID parameter in ValVue. SVI II AP factory value for P is 100; if it is a large valve this may need to be higher to start. In Setup mode enter larger value for P and run Autotune again (See Table 14).

Installation of Cover

The cover of the SVI II AP is a critical component for safety in Hazardous Areas. To ensure safe operation the flat surfaces of the cover and the housing must be clean and absolutely free of particles or dents. The O-ring must be securely located in its groove. Install the cover and tighten all four screws. There must be no gap between the housing and cover.

7. Wiring an SVI II AP

Overview

The SVI II AP is used as a current loop device drawing power and analog input signal from a precision current source. This section describes wiring configurations using HART® digital communications operating in the 4 - 20 mA current mode.

System Connections

All system connections must comply with the HART® Communications Protocol Specifications. For complete technical information refer to the Field Comm® Group Document Number HCF-SPEC-11 and the references. The SVI II AP 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.

When installing the SVI II AP 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 bring 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 on 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 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 with 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 129.

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

Wiring Guidelines

Guidelines for a successful implementation of DC current signal, DC power, and HART® communication to the SVI II AP:

- √ Compliance voltage at the SVI II AP is approximately 9 V at 20 mA, 11 V @ 4 mA. See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 209.
- √ Signal to the SVI II AP 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.
- √ In the frequency range of the HART® tones, the controller 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 SVI II AP. The current source must be a true high impedance current limiting device. A proper current source explicitly enables adjustment of the current, not the voltage.
- √ When wiring a position retransmit:
  - Use the same gauge wires as the 4-20 mA control loop.
  - Ensure that the position retransmit signal is connected to the control system’s analog input card.
  - Ensure the control loop is powered while making make measurements with a meter.

SVI II AP Setups

Control Systems using Explosion Proof or Conventional I/O Systems must have a compliance voltage greater than 9 V at 20 mA including wiring losses. See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 209.

Typical Control Systems using Intrinsic Safety methods must have a compliance voltage greater than 17.64 V.

Typical system setups are shown in Figure 42 on page 113, for General Purpose and Explosion Proof (EEx d) Installation Schematic and Figure 43 on page 114, for Intrinsically Safe Installation Schematic. The SVI II AP digital valve positioner can be located in a general-purpose or hazardous area protected by Explosion Proof (EEx d) methods. Wiring diagrams are generalized, actual wiring must adhere to Electrical Installation section of manual and local electrical codes. The use of a handheld communicator or a HART® modem is not permitted in the Hazardous Area protected by Explosion Proof (EEx d) methods. In Figure 43 on page 114 the SVI II AP digital valve positioner is located in a hazardous area that is protected by Intrinsically Safe wiring practices.

The SVI II AP requires an electrical input from a 4 - 20 mA current source. The SVI II AP input signal can carry a HART® communication protocol signal from ValVue software and a HART® modem, or from a HART® hand held communicator. 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 SVI II AP. If the SVI II AP is located in a hazardous area with Intrinsically Safe protection a barrier is not required for a flameproof installation. Alternatively the system can be installed as Explosion Proof/flameproof.

The SVI II AP can communicate with a remote PC running ValVue software via a modem connected to the PC's serial port. 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.

The SVI II AP can be operated, calibrated, configured, and interrogated either by using local pushbutton and display, or by using a remote PC running ValVue software or with the HART® handheld communicator. The SVI II AP is polarity sensitive so the positive lead must be connected to the positive (+) terminal and the negative lead to the negative (-) terminal. Reversal of input will not cause damage but the unit will not function.

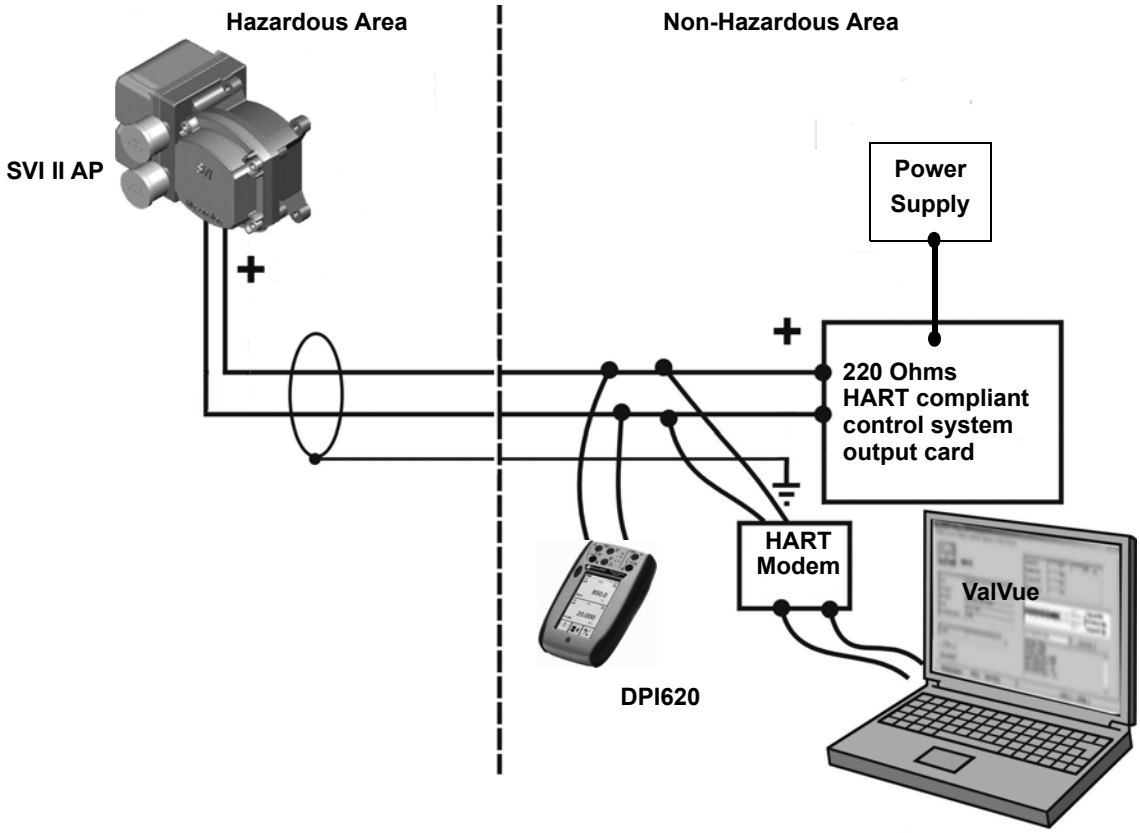


Figure 42 General Purpose and Explosion Proof Installation

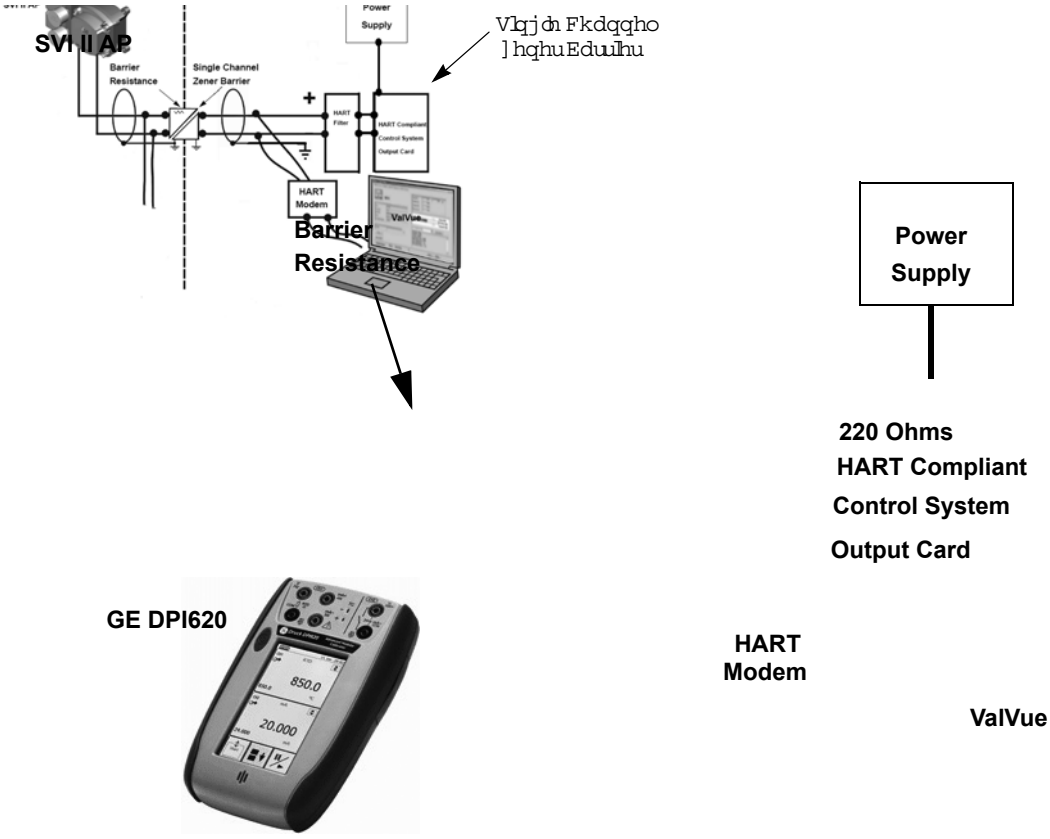


Figure 43 Intrinsically Safe Installation

Grounding Practices

There must never be more than one ground point for the shield of the signal wiring. 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 at the lower right of the display cover and inside the cover. The case is isolated from all circuitry and can be grounded locally in accordance with applicable codes.

If noise or instability is present set the positioner to MANUAL mode of operation and manually position the valve over its entire range. If the valve is stable in MANUAL mode then the problem can be noise in the control system. Recheck all wiring connections and ground points.

Compliance Voltage in Single Drop Current Mode

The SVI II AP requires 9.0 V at 20 mA and 11.0 V 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 SVI II AP is noteworthy in that it requires LESS Voltage at higher current that complements the characteristic of the source requiring only *9 V at 20 mA.* See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 209.

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 15 through Table 17 on page 7116 provide examples of several SVI II AP installations and calculating the compliance voltage necessary to supply 9 V at 20 mA.

Table 15 Compliance Voltage for Single Channel Zener with 22 AWG Cable

Voltage at SVI II AP 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’ long (30 Ohms per 1000’)	1.8 V
Drop in passive HART® Filter	0.0 V
Voltage required at controller	17.64 V

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

Table 16 Compliance Voltage for Galvanic Isolator with 22 AWG Cable

Voltage at SVI II AP at 20 mA	9.0 V
Drop in 22 AWG cable, 3000’ long (30 Ohms per 1000’)	1.8 V
Required voltage at Isolator	10.8 V
Voltage available from Isolator rated to drive 22 mA into 700 Ohm[1]	13.2 V
Voltage required at controller	Not applicable - Isolator supplies the power

[1] For example MTL products.

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

Table 17 Compliance Voltage for No Barrier with HART® Filter and Resistor and 18 AWG Cable

Voltage at SVI II AP at 20 mA	9.0 V
Drop in 220 Ohm resistor	4.4 V
Drop in 18 AWG cable, 6000’ long (12 Ohms per 1000’)	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 V; 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 31 on page 64. The terminals accept wire sizes up to AWG 14. The SVI II AP 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 SVI II AP from the modem or handheld a HART® compliant barrier must be used.

HART® Physical Layer Compliance of the Control System

Communications to a SVI II AP 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 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. It is customary to ground at the controller or intrinsic safety barrier. The SVI II AP 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 SVI II AP 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 Field Comm® Group 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 SVI II AP 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 HART® filters, such as 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 129. of this manual for more information.

Split Range Applications

The SVI II AP is designed to operate in split range configurations supporting up to three control valves connected to a single controller output. Minimum input current span for each SVI II AP is 5 mA. For each positioner the upper range value is between 8 and 20 mA and the lower range value is between 4 and 14 mA. For example, three devices might be configured with input current ranges of 4 - 9 mA; 9 - 14 mA, and 14 - 20 mA. Split range operation with SVI II AP requires special consideration of the compliance voltage. The SVI II AP requires at least 9.0 V. Two SVI II AP in series requires at least 18.0 V in addition to the voltage drops in wiring and other series devices. Typical controller output current sources rarely deliver 24 V, so the system can become voltage starved. It is possible to boost the compliance voltage of the DCS using a series wired voltage source power supply, as shown in Figure 45 on page 124. The total loop voltage must not exceed the rating for the controller output current source. Contact the DCS vendor to validate this approach.

See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 209.

NOTE

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

Multiple Output Circuit Control System

ValVue supports HART® devices including, the SVI II AP with non-zero polling addresses and supports for multiple SVI II AP on the same loop, for split ranging. To enable this support:

1. Select **Enabled** from the *Loop Current Mode* pulldown.
2. Enter the *Polling Address* on the **Advanced Setup** > **Positioner Identification** tab.

DCS systems offer multiple independent analog outputs driven by the same control signal to solve the voltage problem with split ranged positioners. Use of such systems is recommended for split range applications. The HART® address of each SVI II AP are *0*.

For more information on this and how to setup Field Networks, including setting up for HART® and FF communications, see the ValVue help *Field Networks*.

Isolators

Another solution is to use an Intrinsic Safety Isolator for each loop as shown in Figure 44 on page 122. A number of manufacturers make suitable isolators designed for use with HART® output circuits. Using an IS Isolator allows up to three SVI II AP to be operated from a single 4 - 20 mA DCS output. Each isolator has a low compliance voltage input requirement and a high voltage output capacity.

Up to three isolators can be connected in series to a single controller output and each of them can drive a positioner. Isolators are used to provide compliance voltage and isolation even in installations not requiring intrinsic safety. Consult the manufacturer for detailed installation instructions.

The HART® loop address of each device must be set to 1, 2, and 3 (or other non-zero values) to allow a HART® master to recognize each SVI II AP when connected to all three devices on the safe area side of the multiple isolators. Do not use *0* for any of the positioners. A *0* causes HART® masters to stop searching for additional positioners.

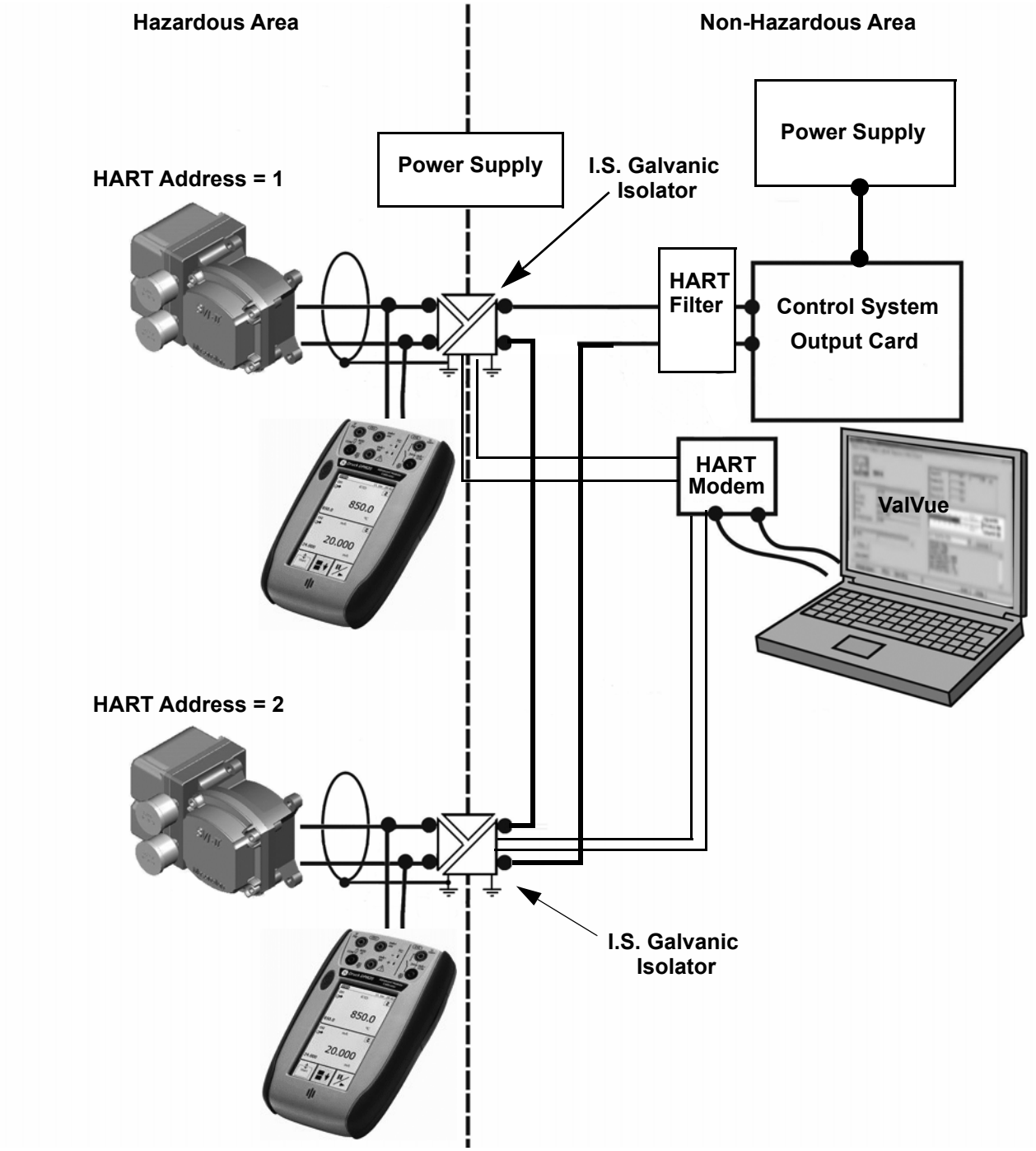


Figure 44 Split Range with Isolator

Supplemental Power Supply

Another approach is to boost the compliance voltage of the DCS using a supplemental power supply (see Figure 45 on page 124) with the split ranged SVI II AP connected in series with the supply. It is not practical to use supplemental supplies when Intrinsic Safety is required. The barriers do not permit adequate voltage. Contact the DCS vendor to verify that the output circuit is compatible with the added voltage. The supplemental voltage must equal 9.0 V for each additional SVI II AP. Exceeding the values in Table 18 will cause damage if the signal wires are short-circuited.

Table 18 Supplemental Voltage for Split Range

Number of SVI II APs on a Current Loop	Maximum Allowable Supplemental Voltage
1	0
2	9.0 VDC
3	18.0 VDC

Verify Wiring and Connections

For split range installations there are additional constraints on the split range system: the minimum span must be 5 mA; the upper range value must be 8 mA to 20 mA; the lower range values must be 4 mA to 14 mA.

Use the following procedure to ensure that the SVI II AP split range system is properly powered:

- √ Connect a DC voltmeter across the input terminals.
- √ For an input current value between 4 and 20 mA the voltage varies between 11 V and 9 V respective. See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 209.
- √ Current is read from the local display or with a milliampmeter installed in series the SVI II AP.
- √ 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.
- √ Connect a milliampmeter in series with the current signal. Verify that source can supply 20 mA to SVI II AP input.
- √ If 20 mA is not attainable, troubleshoot the source and set up.

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.

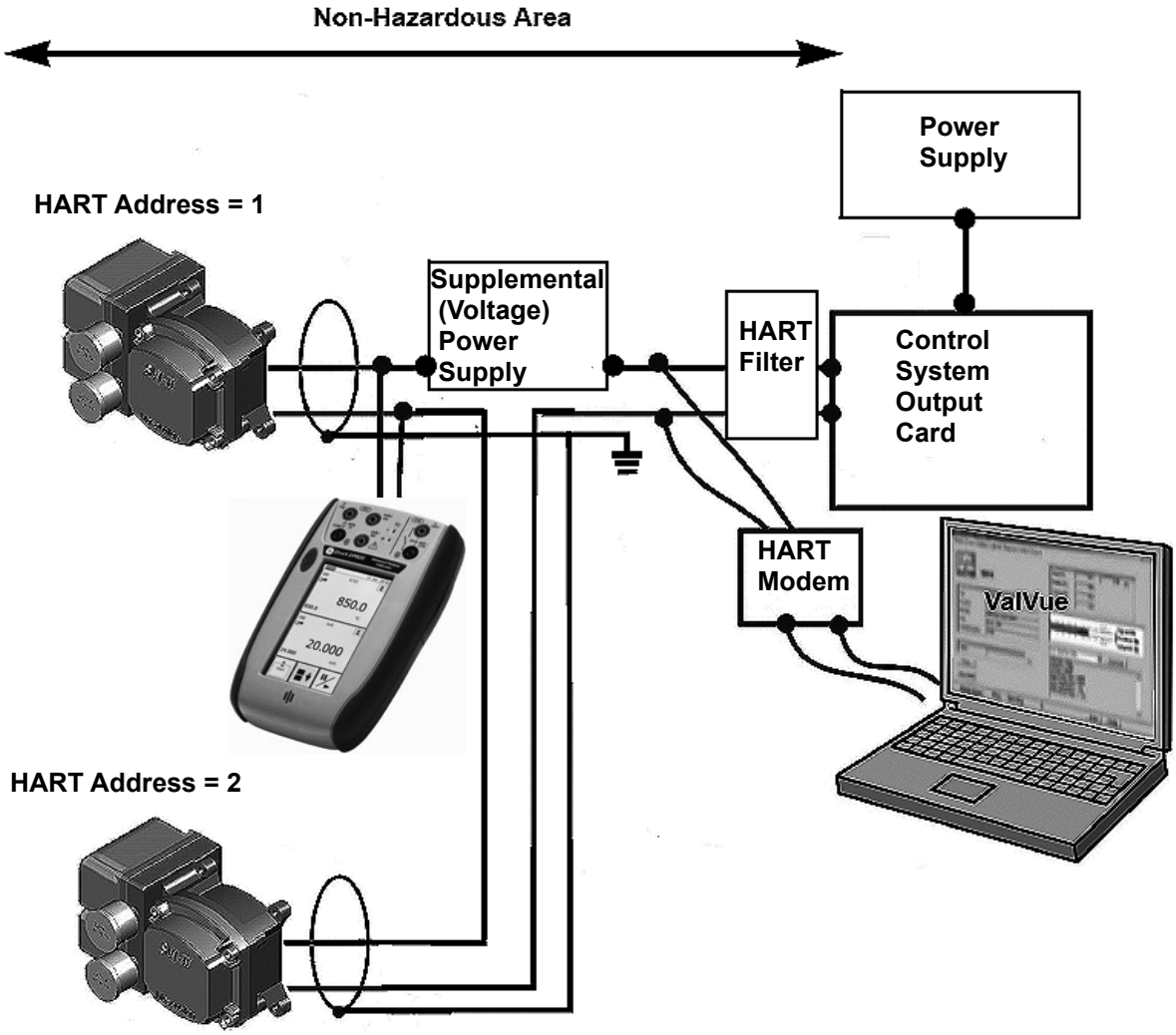


Figure 45 Split Range with Supplemental Power Supply - Non-Hazardous

Required Practices for Explosion Proof Installations

The SVI II AP is provided with two threaded conduit entries. All wiring must be installed with approved conduit and approved seals or with approved cable and cable glands according to local codes. The unused conduit entry is plugged with a ½ NPT pipe plug. Thread engagement must comply with local electrical codes. The cover must always be secured before application of power.

Do not connect a HART® communication device in the hazardous area. Use of the SVI II AP local display with pushbuttons is recommended when Explosion Proof methods are in effect.

Clarification of Terminology

In Factory Mutual Research and Canadian Standards Association codes, *Explosion Proof* means use of approved enclosures and conduit enclosed cables, but in ATEX countries, this method is called *Flameproof*. In ATEX countries, *Explosion Proof* means both Flameproof and Intrinsically Safe.

Recommended Practice for Severe or Humid Environments

The circuitry of SVI II AP is encapsulated for protection from corrosive atmospheres. To prevent moisture from damaging the electronics of the SVI II AP use a sealed junction box in high humidity or tropical environments. The wiring from the junction box to the SVI II AP is sealed by flexible cable with a cable gland or with a potted nipple and pigtail, where applicable codes permit.

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8. HART® Communications with Intrinsic Safety

Overview

When an SVI II AP is installed in a hazardous area in accordance with the applicable codes and standards for Intrinsic Safety there are wiring considerations for successful operation in addition to the requirements for safety. The choice and application of intrinsic safety barriers requires special training. For additional information, consult MTL Instruments PLC Measurement Technology Limited: www.mtl-inst.com or R.Stahl, Inc. www.rstahl.com.

All installations must comply with plant standards and local and international electrical codes.

There are three basic barrier types:

- √ Single channel Zener diode barriers
- √ Dual channel Zener diode barriers
- √ Active galvanic isolators

To determine if the installation will perform successfully with HART® communications you must consider HART® filter requirements and HART® barrier compliance.

HART® Barrier Compliance

The intrinsic safety barrier must be designed to transmit the HART® signals in both directions. Both passive Zener diode barriers and active galvanic isolators are offered with HART® compliance. Consult the manufacturer or refer to the documents listed at the end of this instruction manual.

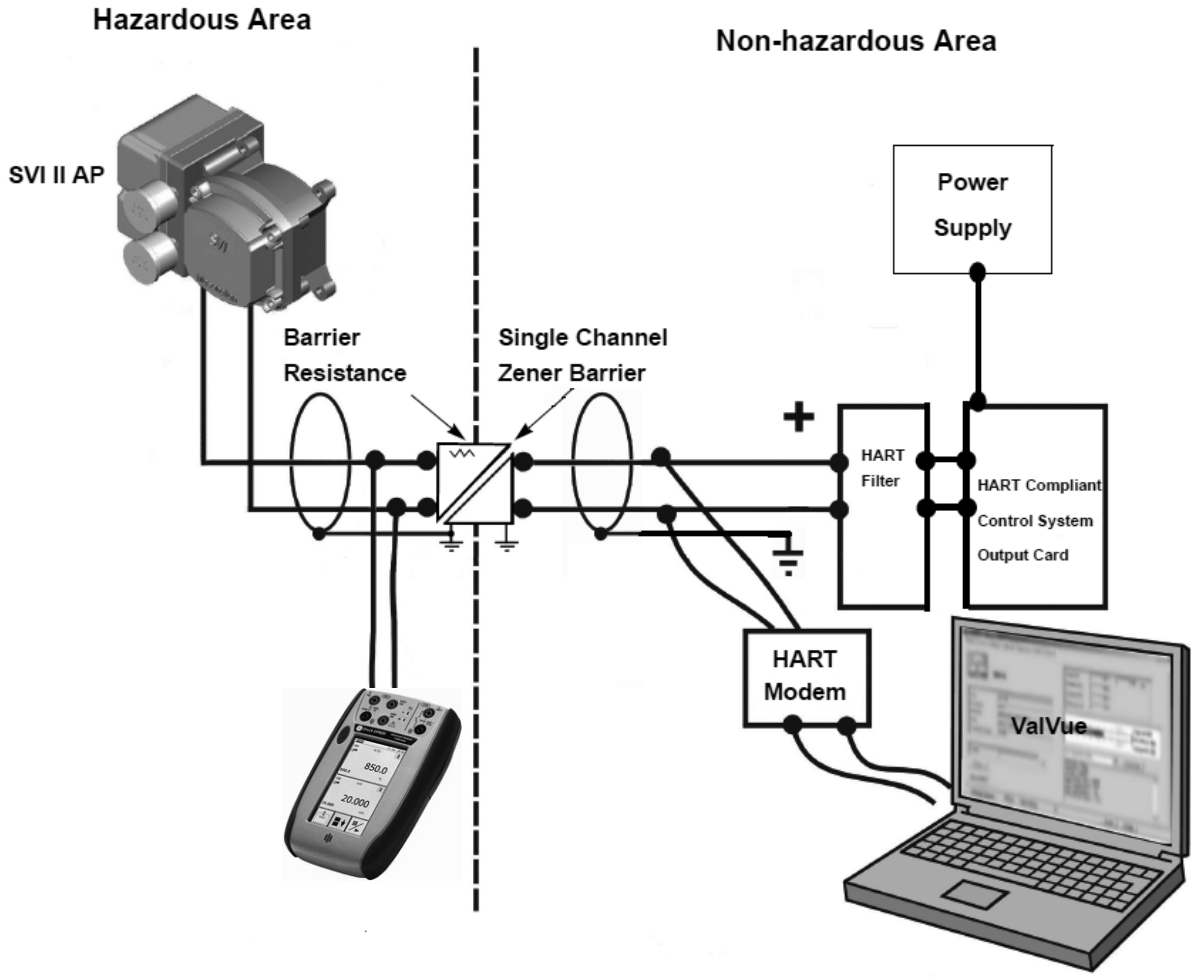

Figure 46 Intrinsically Safe Installation with Zener Barrier and HART® Filter

Output Channel Isolation

The designer of the signaling circuit where the SVI II AP is to be installed must consider the 8 design rules in Wiring Guidelines (see “Wiring Guidelines” on page 111 of this manual). In particular, the control system output interface has analog output channels that are galvanically isolated and share a common ground or are separated from ground by the current control transistor or sense resistor.

- √ If the outputs are isolated a single channel Zener diode barrier can be used.
- √ If the outputs share a common ground a single channel Zener diode barrier can be used.
- √ If the outputs are separated from ground a dual channel Zener barrier is required.

Controller outputs are separated internally from ground by a current sense resistor or a control transistor. Dual channel barriers apply excessive loop resistance and cause compliance voltage problems. An Intrinsically Safe galvanic isolator operates with all three types of output channels, isolated, grounded or separated from ground, and provides sufficient compliance voltage. The galvanic isolator must be certified by the manufacturer to be HART® compliant if the HART® connections are supported on the safe area side of the isolator. See Figure 46 on page 128. Consult barrier and isolator manufacturer for devices rated for use with the SVI II AP I.S. entity parameters in Hazardous Area Approvals.

HART® Filter Requirements

The control system output interface must allow the HART® frequencies to coexist with the precision 4 - 20 mA DC signal. Circuits that are not designed for HART® may need a HART® filter. Consult the controller or DCS manufacturer for interfacing to a particular system. The HART® communications can cause a non-HART® compliant output circuit to malfunction, in some cases. In other cases the HART® communications tones are disabled by the control circuit.

The SVI II AP can be used with non-HART® compliant output circuits but remote communications functionality are not enabled.

Use pushbuttons for all operation and maintenance. If remote maintenance is desired always isolate the control valve from the process and disconnect the non-compliant controller before connecting a current source for power and a HART® master device.

If a HART® filter is required, then its voltage drop must be considered in calculating the compliance voltage.

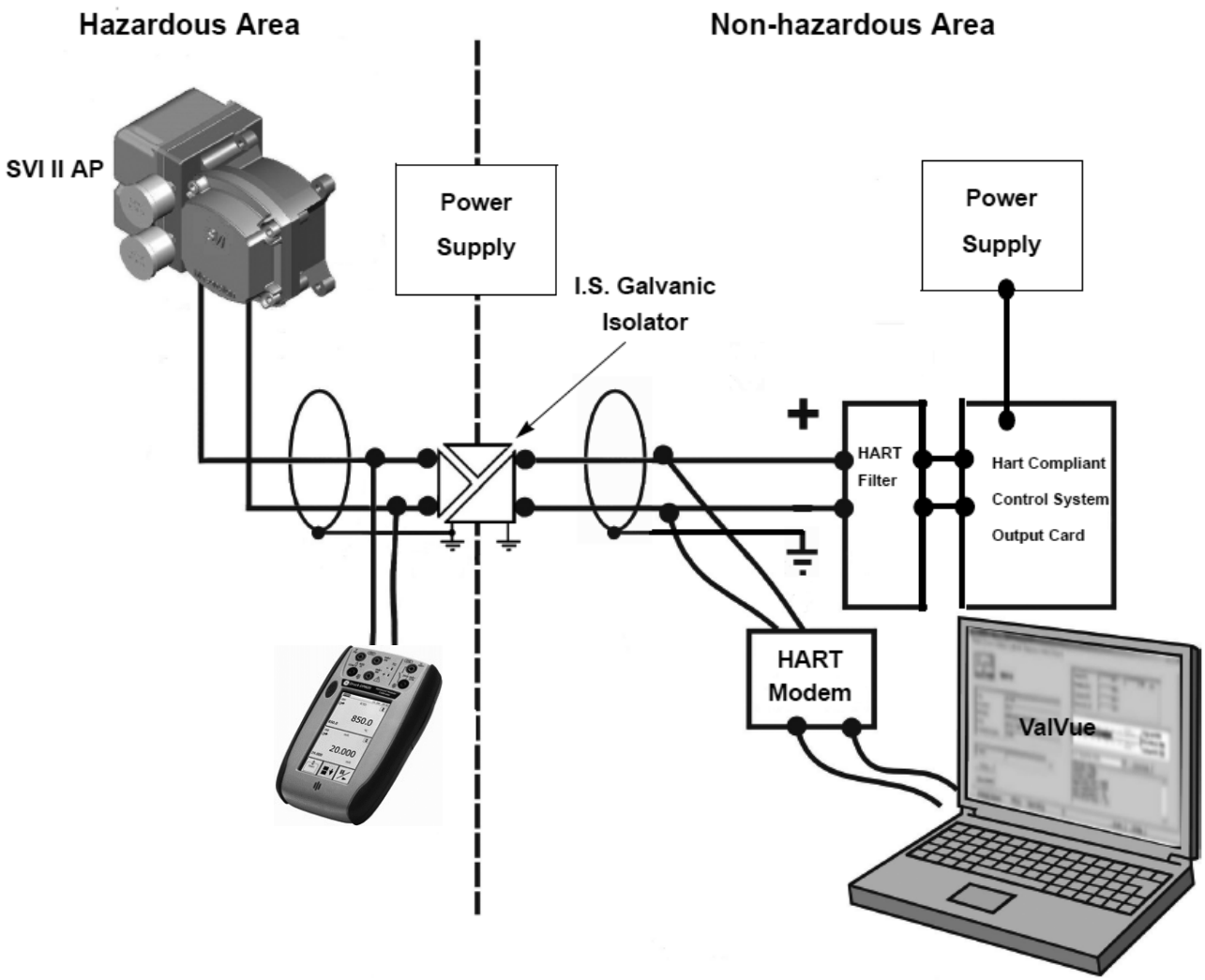

Figure 47 Intrinsically Safe Installation with Galvanic Isolator

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.

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 Required for Certain Controls System Output Circuits.

Modem and Computer Use in Intrinsically Safe Circuits

Many HART® modems that are in use today are not approved for connections to Intrinsically Safe control circuits. Most portable computers are NOT approved for use in hazardous areas. Modems can be safely connected to the safe area side of barriers, and isolators. Observe requirements for the HART® filter.

MACTek® Intrinsically Safe modem

The VIATOR RS232 HART® Interface [Eex ia] IIC complies with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres. Requirements given in Annex II of the Directive 94/9/EC (ATEX Directive) of the European Parliament and the Council of 23 March 1994. Consult MACTek® Corporation, http://www.mactekcorp.com/company.html for detailed requirements for safe use.

MACTek® Warning

"This product has not been tested by any certification agency such as Factory Mutual with jurisdiction outside the European Union for intrinsic safety. The product can be used outside the European Union (e.g. in the USA) on the sole authority of the buyer. MACTek® makes no claims of suitability and offers no warranties regarding the use of this product for connection of PCs to circuits extending into hazardous areas in countries outside the European Union."

Do not connect a PC or HART® modem to an intrinsically safe circuit except on the safe area side of a barrier. Do not operate a PC in a hazardous area without compliance with local and plant regulations.

Use of Handheld Communicators In Intrinsically Safe Circuits

WARNING

Ensure that any handheld communicator in use is approved for use in hazardous areas that use explosion proof safety practices. Do not use unapproved handheld communicators unless the area has been declared safe (Hot Work Permit).

If a HART® communicator is approved to communicate with intrinsically safe control circuits in hazardous areas. Read the product manual before use and observe all warnings. The intrinsic safety entity parameters must be added to the SVI II AP entity parameters to determine suitability for use in any intrinsically safe circuit. Observe the labels on the handheld communicator or consult the manufacturer.

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9. Operation and Maintenance

Principle of Operation

The SVI II AP Electro Pneumatic Digital 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.

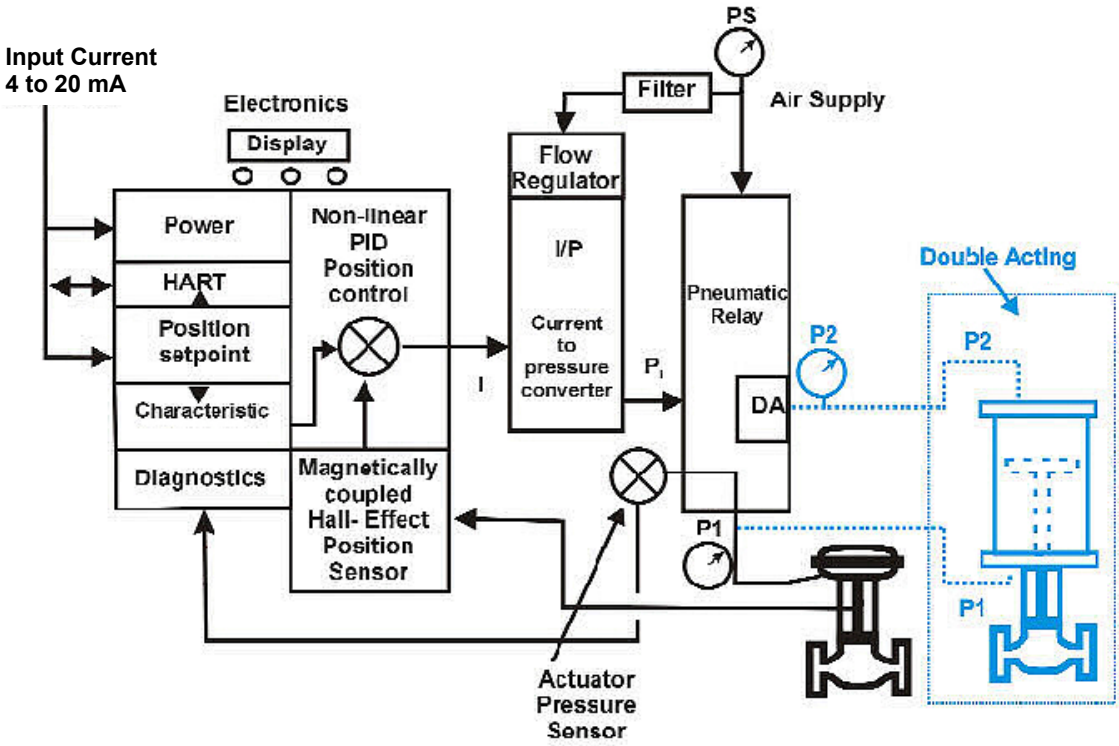


Figure 48 Block Diagram with I/P Converter and Pressure Sensor

Physical and Operational Description

The SVI II AP is housed in an industrial, tough, weatherproof, corrosion resistant aluminum housing that has been designed for operation in hazardous areas as listed in 10 “Specifications and References” and 8 “HART® Communications with Intrinsic Safety”. 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 SVI II AP digital valve 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 connectors for the addition of the optional local display with pushbuttons. Using the internal programmed positioner algorithm, the CPU computes the required output based on information received from the measurement sensors. The base module has no user repairable components.

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 14 on page 45). 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.

The 4-20 retransmit is galvanically isolated from the 4-20 input on the main board.

Pressure Sensor

The pressure sensor located in the Electronics Module measures the output of the single acting relay. The pressure measurement is displayed on the local display 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 SVI II AP supports two identical contact outputs, SW #1 and SW #2 (Digital Output switches), that can be logically linked to status bits.

The switches are polarity sensitive and must be connected only to a DC circuit. The switch (+) 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, regardless of switch state.

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 can be damaged.

Without a load, when the switch is on (closed) the external voltage would be dropped across the switch. **This damages the switch** (Figure 49).

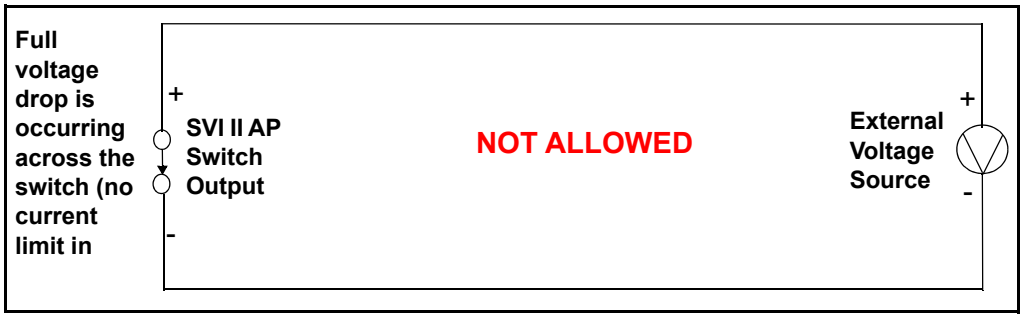


Figure 49 Switch Installation Drawing without Load: Configuration Not Allowed

General Configuration Notes

This section discusses the necessary precautions when configuring a system.

	Switch OFF	Switch ON
V_{SWITCH}	30 VDC max.	≤ 1 V (Switch saturation voltage)
I_{SWITCH}	≤ 0.200 mA (Switch leakage current)	1 A max.

CAUTION

Incorrect polarity connection results in an effectively closed connection.

CAUTION

Consult with qualified personnel to ensure that electrical requirements for the switch are met.

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.

The switch maximum current rating is 1 A. When the switch is ON, the typical switch voltage is ≤1V.

When the switch is on (closed) the external voltage must be dropped across the load (Figure 50).

CAUTION

The load must be designed such that the current in the circuit is ≤1 A at all times. Some 3rd party devices, such as incandescent lamps or solenoids, require surge and back EMF protection to prevent voltage spikes.

Inductive Load, Solenoid, Incandescent Lamp Configuration

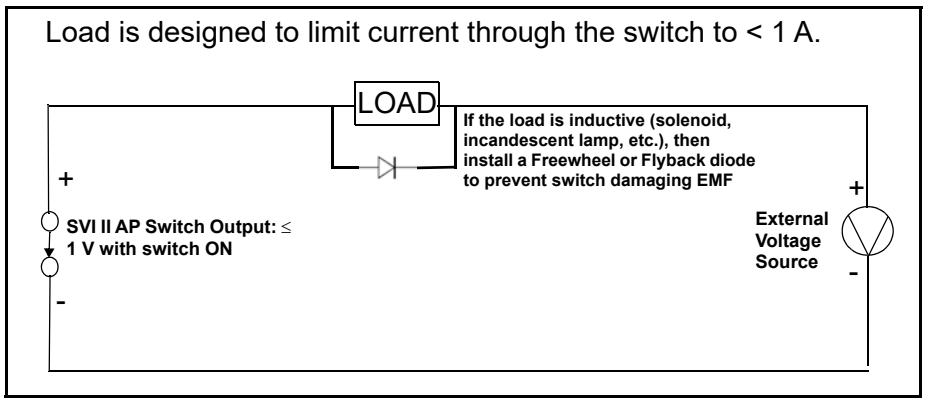


Figure 50 Switch Installation Drawing: Correct Configuration with Load

Distributed Control Systems Configurations

This section gives guidance for configuration in a DCS application. Figure 51 gives two generalized drawings that cover DCS applications to ensure switch safety.

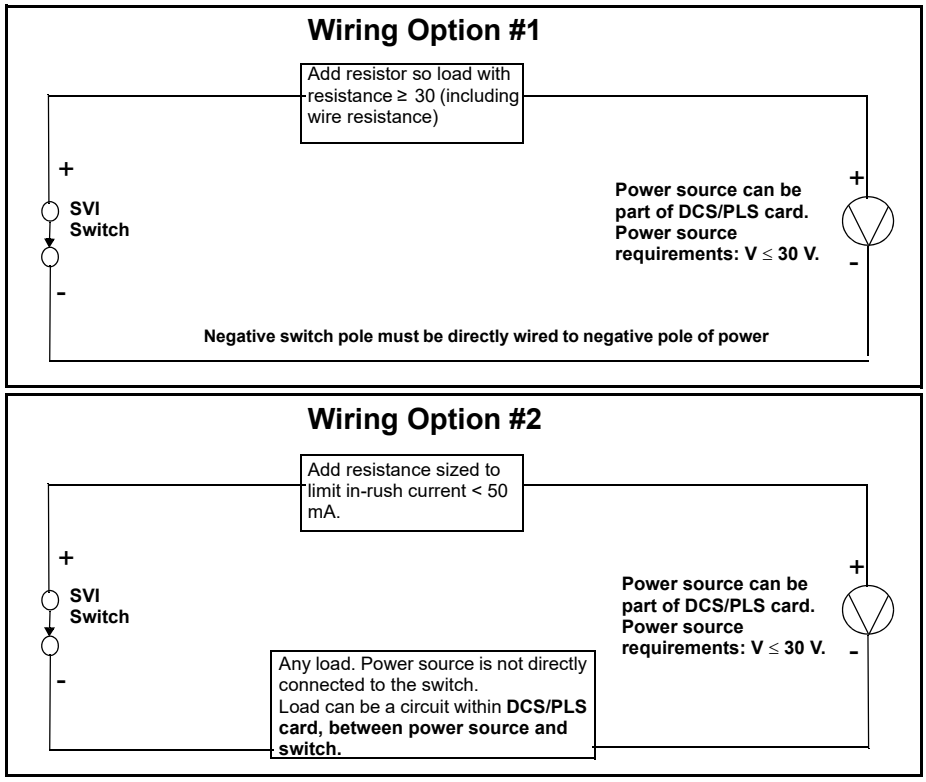


Figure 51 DCS Switches Wiring Options

Configuration Considerations

- √ A typical value for 24 AWG cable about 0.025 Ohm/ft (see Wiring Option #1)).
- √ If IS barrier is a combination of fuse, resistor and Zener diode then the connection is shown in Option #2. The barrier must have adequate resistance to limit inrush current, as the fuse cannot limit inrush current (see Wiring Option #2).

Switch Settings

The two digital output switches can be opened/closed in response to these conditions:

0. *Always Normal Position* - the switch remains in its default position. The two digital output switches can be opened or closed in response to detected conditions. The default configuration setting is *Always Normal Position,* where normal is closed, which means that the switch will not switch for any valve travel. To activate the switch at a given valve position, configure the switch *Position Low Limit* or *Position High Limit*.

1. *Failsafe* - the switch is activated when the SVI II AP is in failsafe mode.

2. *Reset* - the switch is activated whenever a reset has occurred and the switch remains activated until the SVI II AP 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). For ATO the SVI II AP, may not close the valve completely, The Tight shut-off function must be employed to ensure tight shut-off.

5. *Position Low Limit* - the switch is activated whenever the valve position is less than the position setting of this switch control.

CAUTION

*If both Position Low Limit and Tight Shut Off are used, the Position Low Limit **must** be above the Tight Shut Off.*

6. *Position Upper Limit* - the switch is activated whenever the valve position is greater than the position setting of this switch control.

CAUTION

*If both Position High Limit and Full Open Above are used, the Position High Limit **must** be below the Full Open Above.*

7. *Manual Mode* - the switch is activated whenever the SVI II AP is in Manual mode.

NOTE

The contacts are OPEN when the SVI II AP is unpowered and may be configured (via the DTM or DD) 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. A fixed coil creates a magnetic field proportional to the applied current. The field magnetically pulls a flexure towards a nozzle to increase pressure on the flexure. 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

SVI II AP

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).

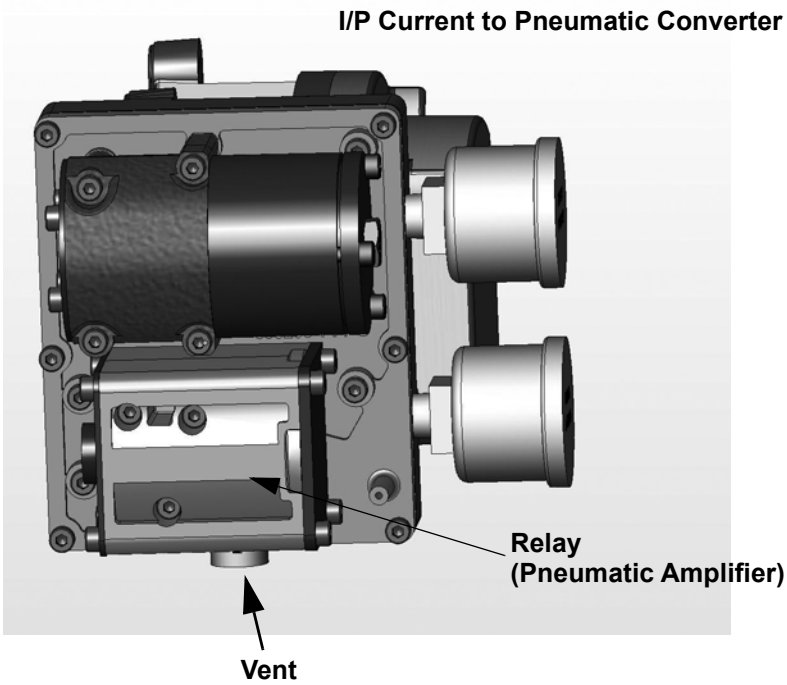


Figure 52 SVI II AP Pneumatic Module with Single Acting Relay

SVI II AP High Flow

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).

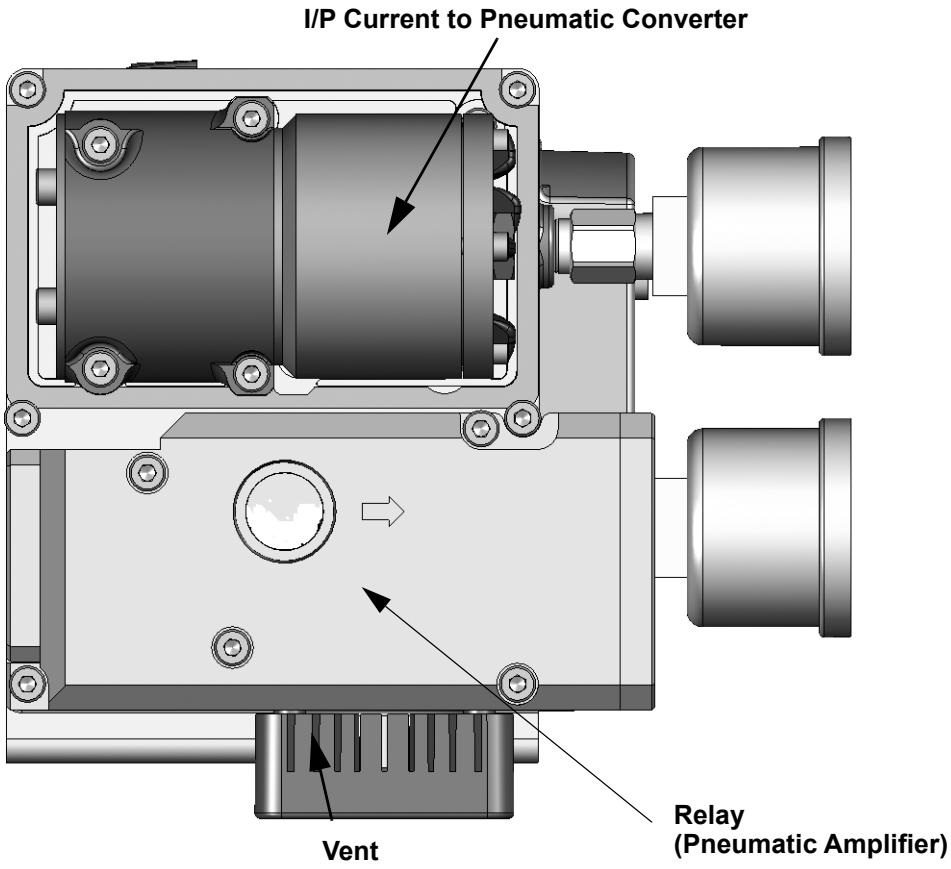


Figure 53 SVI II AP High Flow Pneumatic Module with Single Acting Relay

Double Acting Pneumatic Relay

The double acting pneumatic relay amplifies the pressure from the I/P and provides a pair of high flow output signals for operating a double acting cylinder actuator. The double 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 150 psi (10.35 bar, 1035 kPa). The two output pressures may be balanced by means of an adjustable seat assembly. The average of the two pressures is adjusted to equal 70% of the supply pressure. The double acting relay is rated for supply pressure to 150 psi (10.35 bar, 1035 kPa).

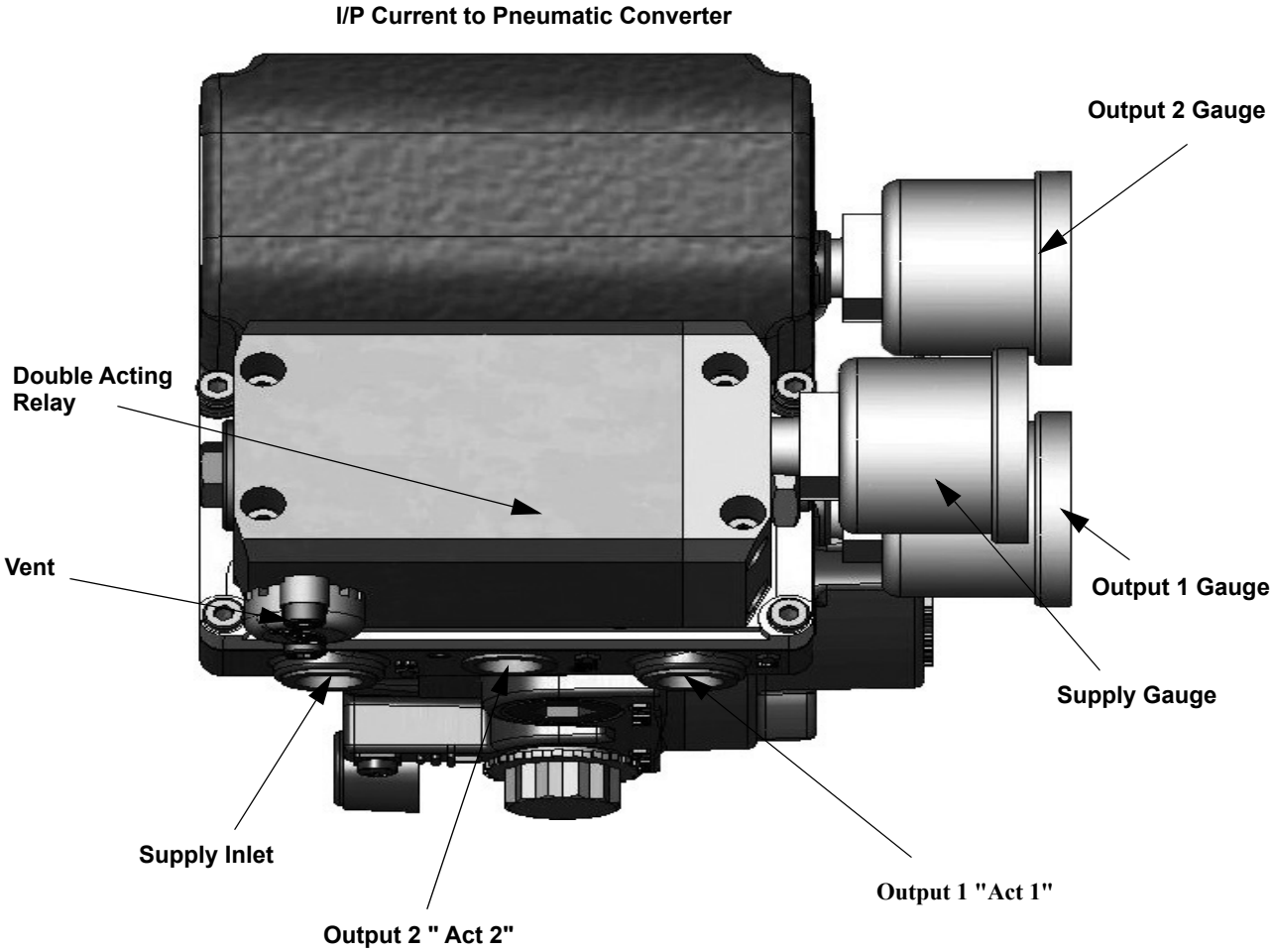


Figure 54 Double Acting Pneumatic Relay

Double Acting Supply Pressure Balance

After installation on the actuator, set supply pressure in accordance with actuator specifications. Do not exceed the maximum pressure rating of the actuator. The double acting relay is adjusted at the factory and set to 70% of supply pressure. If adjustment is required consult the factory.

SVI II AP D/A Bleed Slots

This section shows the bleed slots where you would normally expect to see exhaust from the unit. The slots are red boxed on the routing plate in Figure 55 with the relay, I/P, and all other parts removed. Figure 56 relates the red box callouts in Figure 55 to a complete unit.

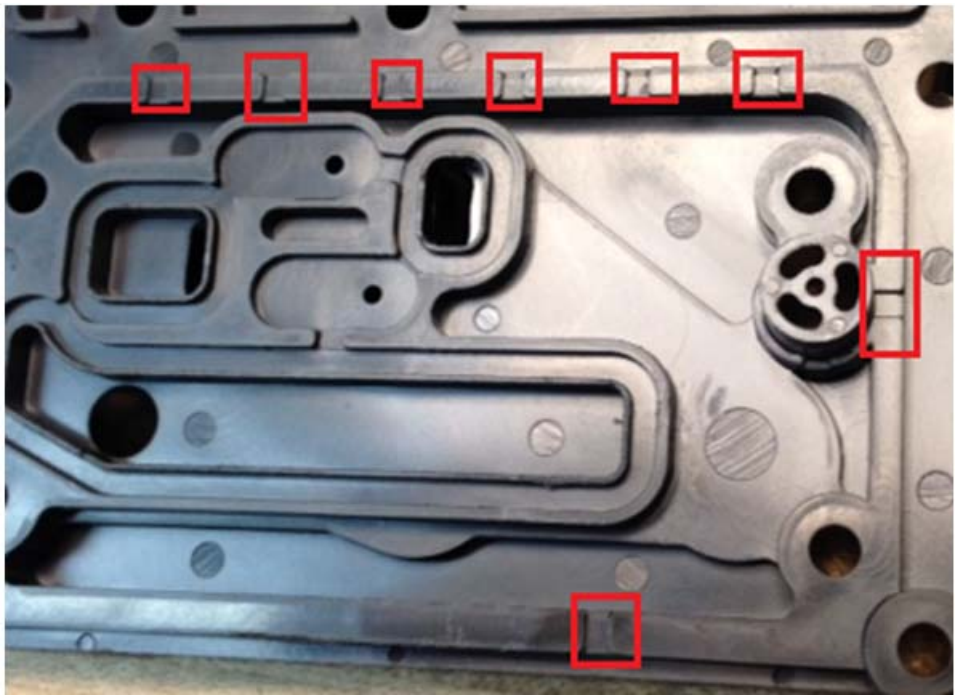


Figure 55 Bleed Slots On Air Routing Plate

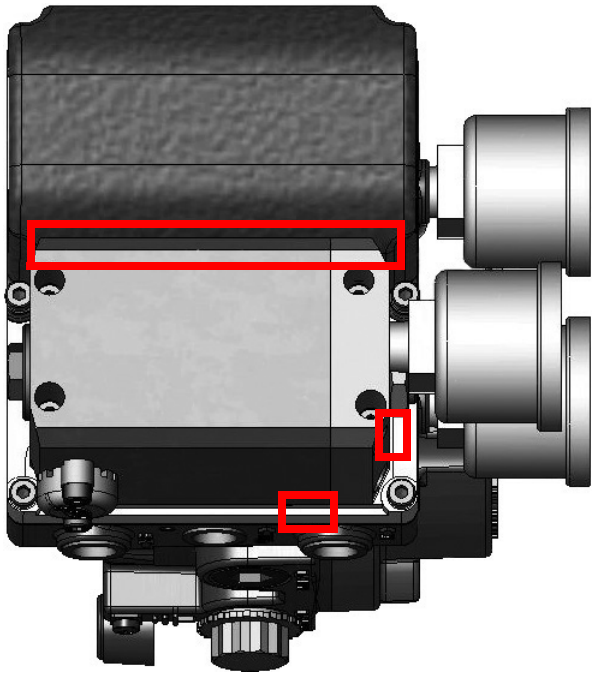


Figure 56 Bleed Slots on Complete Unit

Optional Display and Pushbuttons

The optional display and buttons are mounted on the SVI II AP cover plate. The three pushbutton switches operating in conjunction with the display permit reading and modification of the instrument operating parameters without a PC or HART® hand-held communicator. These switches perform generic functions - Increase, Decrease, and Accept by movement through a conventional menu structure, see “Using the Digital Interfaces” on page 69. The switches are operated in a hazardous environment without compromising the flameproof enclosure.

SVI II AP Maintenance and Repair

The SVI II AP was designed based on a modular concept. All components are interchangeable allowing for easy, quick component swapping.

The only maintenance procedures recommended for the SVI II AP are:

- √ Remove and install the cover, for upgrade to display
- √ Remove and install the I/P module
- √ Remove and install the Pneumatic Relay

WARNING *Do not remove the instrument cover or connect to an electrical circuit in a Hazardous Area unless the power is disconnected.*

Repair

Replacement of the Pneumatic Relay, I/P and cover (with or without display) are the only field repairs permitted.

Only qualified service personnel are permitted to make repairs.

Only parts supplied by the factory are permitted. This includes not only the major assemblies but also mounting screws and O-rings. No substitutions with non-Masoneilan parts are permitted.

Tools Needed

- √ 5 mm hex key
- √ 3 mm hex key

Display Cover Removal and Installation

The display cover (shown in Figure 57) is provided as an option for the SVI II AP. If you have an SVI II AP with a solid cover and would like to replace the solid cover with a display cover follow the instructions below for removal and installation.

Removing the SVI II AP Display Cover

To remove the SVI II AP display cover:

1. Using a 5 mm Hex key unscrew the four screws around the perimeter of the SVI II AP cover.
2. Lift the cover off the positioner.

Figure 57 SVI II AP Display and Pneumatic Covers

Installing the SVI II AP Display Cover

NOTE

After replacing the SVI II AP Display Cover you must power up the unit (see “Powering Up the SVI II AP” on page 66 of this guide).

The replacement display cover is shipped with a lanyard to prevent the cable (that connects from the display to the Terminal Board) from breaking. The lanyard must be inserted under the screw in the lower left corner, that attaches the terminal board to the SVI II AP housing.

To install the cover:

1. Install the lanyard and tighten the screw to 5 in-lbs (.565 N-m).
2. Using the 3mm hex key, remove the screw from the lower left corner, connecting the terminal board to the SVI II AP housing.
3. Connect the cable from the display into the LCD connector on the terminal board.
4. Ensure that the gasket is in its groove in the housing.
5. Place the cover over the screw mounts.
6. Tighten the four screws with the 5 mm hex key.
7. After installing the new display power up the unit (refer to “Powering Up the SVI II AP” on page 66).

NOTE

The cover of the SVI II AP is a critical component for safety in Hazardous Areas. To ensure safe operation the flat surfaces of the cover and the housing must be clean and absolutely free of particles or dents. There must be no gap between the housing and cover; torque spec is 50 in-lbs (5.65 N-m).

Ensure that:

- √ The gasket is seated in the groove in the housing flange.
- √ No wires or retaining cable can be trapped under the cover flange.
- √ The flange area is not corroded and the surface is not scarred.
- √ The four cover bolts are securely tightened to 50 in-lbs (5.65 N-m).

I/P Module Removal and Installation

Prior to removing the pneumatic components it is necessary to remove the electronics module cover (see “Removing the SVI II AP Display Cover” on page 146) and the pneumatic cover first.

Do not remove the I/P module in a hazardous area unless the power is disconnected. Application of more than 1.6 mA to the I/P motor can permanently damage it.

The I/P is rigidly assembled to a wire way sleeve that is a critical component for explosion proof service. Use care to slide the sleeve from the pneumatic module without applying a strain to it.

Pneumatic Cover Removal: AP and High Flow

To remove the AP pneumatic cover:

1. Using a 3 mm hex key, remove the six screws from around the perimeter of the cover.
2. Lift the cover off and put aside for re-installation.

To remove the AP High Flow pneumatic cover:

1. Using a 3 mm hex key, remove the four screws from around the perimeter of the cover (Figure 58 or Figure 59).

Figure 58 Pneumatic Cover Screws: High Flow

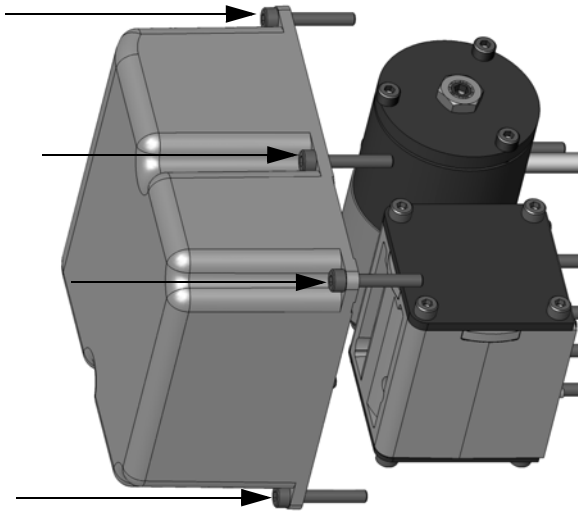


Figure 59 Pneumatic Cover Screws: AP (Four Shown)

2. Lift the cover off and put aside for installation.

I/P Module Removal

To remove I/P module:

1. Disconnect the I/P wire from the terminal board.
2. Using a 3 mm hex key, remove the four screws from around the perimeter of the I/P module.

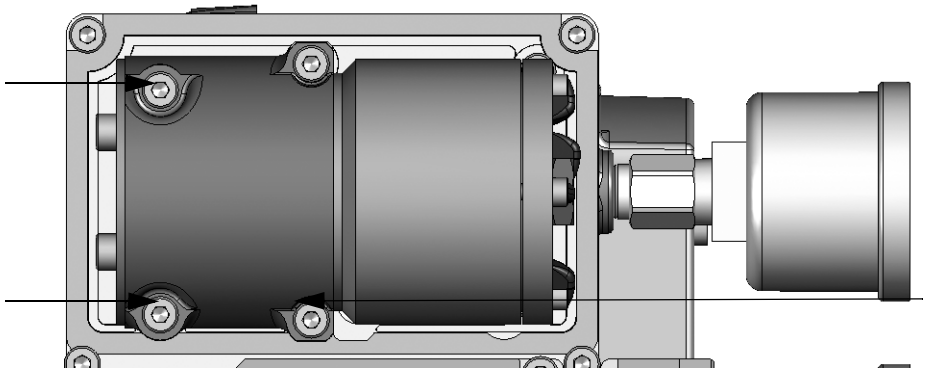


Figure 60 SVI II AP High Flow Pneumatic Module with Single Acting Relay

3. Lift the module off the positioner.

I/P Module Installation

To install I/P module:

1. Place the module in the designated area on the positioner.
2. Using a 3 mm hex key, install the four screws around the perimeter of the I/P module.
3. Replace the I/P wire connector on the terminal board.
4. Replace the Display Cover (see “Installing the SVI II AP Display Cover” on page 147).

Ensure that:

- √ The wire is not damaged when feeding it through the housing.
- √ A single O-ring is in place on the wire-sleeve and is not damaged.
- √ The four retaining screws are tight and torque to 15 in-lb (1.7 N-m).
- √ Inserting the wire sleeve through the housing does not require force.

Pneumatic Cover Installation

To install the pneumatic cover:

1. Place the cover over the pneumatic module.
2. Using a 3 mm hex key, install the six screws around the perimeter of the cover and torque to 8 in-lb (.9 N-m).

Relay Removal and Installation

To remove the pneumatic relay:

1. Using a 3 mm hex key, remove the three screws from around the perimeter of the relay.
2. Lift the relay off the positioner.

Relay Installation

1. Place the relay in the designated area on the positioner.
2. Using a 3 mm hex key, install the three screws around the perimeter of the relay.

Ensure that:

1. The five O-rings are seated in the base of the relay and are not damaged.
2. The three mounting screws are tight and torque to 15 in-lb (1.7 N-m).

NOTE

When you have completed maintenance on the pneumatic relay it is necessary to reinstall the pneumatic cover. Refer to on “Pneumatic Cover Installation” on page 150.

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 representative.

Connecting Components to the Electronics Module

If it is necessary to remove and install any SVI II AP component you may need to reconnect the component to the SVI II AP Electronics Module via the SVI II AP Terminal Board. Refer to “Making Connections to the Terminal Board” on page 65 of this manual for instructions.

Repair by Replacement

Using ValVue and repair-by-replacement is the fastest method to service an SVI II AP. 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 SVI II AP 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 SVI II AP into FAILSAFE mode if the errors continue for a preset time. When the SVI II AP goes into FAILSAFE, the valve is driven to its Failsafe position. It remains in that position until a technician clears the cause of the error and resets the instrument. Reset is performed in two ways:

√ Connect a HART® modem and ValVue, and then click the **RESET** button.

or

√ Turn the power off and on.

To prevent the valve from moving after reset, put the controller in manual, and set the valve position setpoint to the failsafe position 0% if ATO, 100% if ATC. You can set a special case of FAILSAFE. You can set a Position Error Band and a Position Error Time 2 that forces the valve to its failsafe position if the position error exceeds the band for a time longer than time 2. This can be used on critical loops to force the process to trip if the positioner is unable to control the valve.

Upgrading Firmware

The SVI II AP 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 SVI II AP. Firmware improvements for the SVI II AP can be obtained by contacting the factory.

Figure 61 shows the label on the bottom of the unit with the firmware revision (red box).

Figure 61 Body Sticker

Firmware versions can be viewed using the:

- √ SVI II AP DTM on the *Device Info* tab. The firmware revision is: *Hardware Rev. Trans Cmd Rev.Software Rev.*
- √ Handheld by selecting **Online** > **Device Setup** > **Configuration** > **Device Info.**

Certain firmware versions allow the device to operate in multiple HART® versions as follows:

- √ Firmware 3.2.3/4.1.1 – HART® 5 (3.2.3) and HART® 6 (4.1.1) capable
- √ Firmware 3.2.5/5.1.1 – HART® 5 (3.2.5) and HART® 7 (5.1.1) capable
- √ Firmware 3.2.7/5.1.3 – HART® 5 (3.2.7) and HART® 7 (5.1.3) capable
- √ Firmware 3.2.8/5.1.4 - HART® 5 (3.2.8) and HART® 7 (5.1.4) capable

Tools Required

- √ HART ®modem
- √ PC/laptop with Windows® 7 or later, 4 GB RAM
- √ SMARTs Assistant Ver. 3.x

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 using SMARTs Assistant.

When maintenance is complete reinstall the positioner and perform the checkout procedure detailed in “Installation and Set Up” on page 31. Consult the factory for firmware upgrade services. ValVue is the recommended tool for complete re-configuration. See “Configuration and Calibration Using Pushbuttons” on page 93.

Preparing to Contact Customer Support or Product Return

Fill out the two page form below before contacting support or before return shipment.

Baker Hughes

Masoneilan Products

Digital Products
Material Return Authorization

Technical Support	**Phone Number** +1 888-784-5463 **Email Address** svisupport@bakerhughes.com

MRA Guidelines	☐ **Complete the following Material Return Authorization Questionnaire.** ☐ **Email the form to the SVI Help Desk Representative for an MRA Number.** ☐ **Decontaminate the unit and provide an MSDS (Material Safety Data Sheet).**

FIRT #:_____ / MRA #:_____

	Warranty Claimed			**YES**	☐	**NO**	☐
1	Date:	Authorized By:				Original Sales Order:	
2	Plant of Origin	Jacksonville	☐	Deer Park	☐	Other	☐
3	Product	Other:_____	☐	FVP	☐	SVI II AP	☐
		SVi1000	☐	SVI II ESD	☐	SVI FF	☐
4	Part Number:			Serial Number:			
5	With Display		☐	Remotely Mounted			☐
6	Dates in Service:			Date of Field Issue:			
7	Actuator	Masoneilan	☐	Model Size			
		Other _____	☐				
8	Spring Range:			Air Supply - Pressure / Dew point: /			

9	**Sales Representative Information**		**End User Information**	
	Sales Rep. Name		Company Name	
	Address		Address	
	Contact		Contact	
	Phone		Phone	

10	**Field Issues**			
	Troubleshooting Guide Complete	☐	Find Stops Failed	☐
	No Communication Go to page 2:	☐	Auto Tune Failed & Manual Tuning Failed	☐
	No Communication using a Handheld	☐	Unstable Output (Cycling)	☐
	No Pneumatic Output	☐	Output Saturated to Supply	☐
	SVI Display Functional	☐	Unit in Failsafe Mode	☐
	Erratic Valve Positioning	☐	Failsafe Fault _____	
11	**Additional Information:**			
12	**Warranty Authorized By:**		**Estimated Warranty Cost:**	
	Authorized By:		**Date:**	

Baker Hughes

Masoneilan Products

Details of Field Issue: No Communication

Did not communicate with what?
Handheld
PC running software? What software
DCS running what software? DCS type: _____ Software: _____
Please send picture of wiring used for communication

FF details:
SVFI FF bus address in physical SVI FF: _____ Bus Address for SVI FF in DTM or DCS:_____

For Handheld, what type handheld? What is DD version in handheld: _____

Was SVI sold on a new control valve built at GE factory? [ ] Yes [ ] No. If Yes:
Name of factory: _____
Valve ship date:_____
Valve serial number: _____ Valve Tag Number: _____
Sales Order for control valve:_____
Please provide spec sheet for control valve
End user Information on page 1:

Was positioner shipped from GE un-mounted: [ ] Yes Name of GE location that shipped positioner:_____

Did rep mount positioner on control valve and ship control valve with SVI II AP? Provide control valve details as well as date of first use for SVI II AP. SVI II AP date of first use is date when selected from rep stock and mounted on control valve at rep.
Also provide date when control valve was put into service by customer.

Include:

- Positioner configuration report from ValVue software.
- ValVue 2-way 25% step test diagnostic report.
- Installation ambient min/max temperatures when field issue occurred.
- Photographs of installation (show entire control valve).
- ValSpeQ file for new control valve or ValKeep record for repaired valve.

If SVI is standard diagnostic version, also run manual step test and fill out below "Tested Positioner" table:

Expected - Good Positioner		
mA signal	**Valve Position**	**P1**
0	open	0
4	open	0
8	25% closed	10
12	50% closed	12
16	75% closed	15
20	100% closed	20
16	75%	15
12	50%	12
8	25% closed	10
4	100% open	0

Tested positioner s/n _____		
mA signal	**Valve Position**	**P1**
0		
4		
8		
12		
16		
20		
16		
12		
8		
4		

10. Specifications and References

Physical and Operational Specifications

This section provides the physical and operational specifications for the SVI II AP. Specifications are subject to change without notice

Table 19 Environmental Specifications

Operating Temperature Limits	-58° F to 185° F (-50° 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 unit (.73% per bar unit)
Relative Humidity	10 to 90% non-condensing
Humidity Effect	Less than 0.2% after 2 days at 104° F (40° C), 95% relative humidity.
Insulation Resistance	Greater than 10 G Ohms at 50% RH.
MTBF	49 years based on MIL handbook calculation for electronic parts and field data on mechanical parts
Electromagnetic Compatibility Electrostatic	Electrostatic discharge — No effect with contact discharge level of 4 kV and air discharge level of 8 kV (IEC 1000-4-2) Radio frequency interference — Less than 0.2% at 10 V per meter (EN 50140)
Fast Transient Burst	No effect at 2 kV (Coupling clamp IEC 1000-4-4).
Vibration Influence Measured at SVI II AP 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 30 A/m (EN61000-4-8) CE MARK certified to EN50081-2 and EN50082-2

Table 20 Operational Specifications

Accuracy	+/- 0.5% (typical +/-0. 10% 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“ (6 mm - 64 mm) Note**:** Above 2.5” (64 mm) consult factory for mounting instructions.
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 Tight Shut Off (0 -20% of input)
Auto Tune SVI II AP performs automatic determination of the optimal valve positioner 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, you can further adjust the positioner tuning parameters to more conservative or to more responsive values.	Proportional gain: 0 to 5, displayed as 0 to 5000 Integral time: 0 to 100 seconds - displayed as 0 to 1000 (1/10s) Derivative time: 0 to 200 milliseconds Dead Zone: 0 to +/-5% (0 to 10% deadband) Padj: +/- 3000 (depends on P) Beta (non-linear gain factor: -9 to +9 Stroking Time: 0 to 250 seconds Position compensation coefficient: 1 to 20 Boost: 0 to 20
Full open position adjustment	60 to 100% of actual stop
Start Up Time (from no power)	Less than 200 ms
Minimum current to maintain HART®	3.0 mA
HART® Command #3 Mapping	HART® 4-20 mA input signal PV = Valve Position, 0-100% SV = Actuator Pressure (P1-P2) (N/A for standard diagnostic version; units sends zero) TV = Supply Pressure QV = P2 for double acting units (N/A for standard diagnostic version; units sends zero)

Table 21 Input Signal, Power, and Display Specifications

Power Supply	Loop powered from 4 - 20 mA control signal
Valve Setpoint	4 - 20 mA. 450 Ohms input resistance
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
Impedance Range	Low: 450 Ohms; High: 2750 0hms
Minimum Input Span for Split Range Operation	5 mA
Upper Range Value for Split Range Operation	Between 8 and 20 mA
Lower Range Value for Split Range Operation	Between 4 and 14 mA
Wire Size	14/28 AWG
Strip Length	0.22 in / 6 mm
Digital Communication	HART® Communication protocol revision 5, 6 or 7
Local Display Liquid Crystal (optional)	LCD, explosion proof, two lines of nine alphanumeric characters. Display becomes unreadable between 0 °C and -10 °C. Display is shutdown at -15 °C.
Push Buttons	External, Three Explosion Proof / Flameproof push buttons.

Table 22 Construction Material Specifications

Housing and Cover	Aluminum ASTM B85 SG100A standard Stainless Steel optional
Weight	Standard Flow Model: √ Aluminum - 7.4 lbs./ 3.3 kg √ Stainless Steel - 16 lbs/ 7.3 kg High Flow Model: √ With Display: 9.4 lbs./ 4.2 kg √ Without Display: 8.9 lbs./ 4.0 kg
Relay and Manifold	Standard Flow Model: √ Single Acting - PPS, 300 Series Stainless Steel, nitrile diaphragms √ Double Acting - 300 Series Stainless Steel, Ryton; Aluminum 6061 T6, Ryton High Flow Model: √ 300 Series Stainless Steel, Ryton; Aluminum 6061 T6, Ryton
I/P Motor	430 stainless steel, PPS, 300 series stainless steel
Mounting Bracket	300 series stainless steel
Magnet Holder	Corrosion Protected Anodized Aluminum 6061 T6
Pole Ring	416 stainless steel

Table 22 Construction Material Specifications (Continued)

Levers	300 Series stainless steel

Table 23 System Connectivity

HART® Physical Device Type	Actuator Device Type: Rev 1: HART®5: CA (202); HART®6: 65CE (206), HART®7: 65EE (238) Rev 2: HART®5: CA (202)
DD Registered with Field Comm® Group	Yes, available through Field Comm® Group
Integration with HART® Host software	ValVue AMS SNAP-ON application available, plug-in application for Yokagawa® PRM, ValVue for Honeywell® FDM®, Device type Manager (DTM) for FDT Host
Diagnostics	Options include: Valve signature, positioner signature, extended actuator signature, friction, stroking speed, step response, cumulative travel, cumulative cycles, and time of operation in near-closed position. Some diagnostics require pressure sensor and ValVue software. See“Model and Features Comparison” on page 26.

Table 24 Pneumatics Single Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered air (See ISA S7.3)
Action	Direct Acting
Supply Pressure	20 -100 psi max. (1.4 - 6.9 bar) Regulate 5 - 10 psi (.345 bar - .69 bar) above actuator spring range. Do not exceed actuator rating.
Air Delivery - Single Acting Relay	10.0 scf/min. (283 L/min.) at 30 psi (2.1 bar) supply 16.6 scf/min. (470 L/min.) at 60 psi (4.2 bar) supply 23.3 scf/min. (660 L/min.) at 90 psi (6.2 bar) supply
Air Capacity (flow coefficient)	Loading C_v = 0.57 Venting C_v = 0.53
Air Consumption	0.2 scf/min. (5.7 L/min.) at 30 psi (2.1 bar) supply 0.26 scf/min. (7.4 L/min.) at 45 psi (3.1bar) supply
Air Supply Failure	Single Acting Relay On supply failure the actuator output drops. Some overshoot may occur when air pressure returns after a period without air supply pressure. Always set control set point to 0%, and put the process control system in manual, for smooth recovery from air supply failure.
Loss of Input Signal	Output drops to low pressure.
Output Pressure	0-150 psi (10.3 bar) max

Table 24 Pneumatics Single Acting Standard Flow (Continued)

Air Supply	Dry, oil-free, 5 micron filtered air (See ISA S7.3)
Sweet Natural Gas	H_2S content not more than 20 ppm

Table 25 High Flow Pneumatics Single Acting High Flow

Air Supply	Dry, oil-free, 5 micron filtered air (See ISA S7.3)
Action	Direct Acting
Supply Pressure	20 -100 psi max. (1.4 - 6.9 bar) Regulate 5 - 10 psi (.345 bar - .69 bar) above actuator spring range. Do not exceed actuator rating.
Air Delivery - Single Acting Relay	39.0 scf/min. (1100 L/min.) at 30 psi (2.1 bar) supply 70.6 scf/min. (2000 L/min.) at 60 psi (4.2 bar) supply 102.0 scf/min. (2900 L/min.) at 90 psi (6.2 bar) supply
Air Capacity (flow coefficient)	Loading C_V = 2.2 Venting C_V = 2.8
Air Consumption	0.28 scf/min. (8.0 L/min.) at 30 psi (2.1 bar) supply 0.35 scf/min. (10 L/min.) at 45 psi (3.1bar) supply
Air Supply Failure	Single Acting Relay On supply failure the actuator output drops. Some overshoot may occur when air pressure returns after a period without air supply pressure. Always set control set point to 0%, and put the process control system in manual, for smooth recovery from air supply failure.
Loss of Input Signal	Output drops to low pressure.
Output Pressure	0-150 psi (10.3 bar) max
Sweet Natural Gas	H_2S content not more than 20 ppm

Table 26 Pneumatics Double Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered air see ISA S7.3
Action	Output 1 increases with increasing Output 2 decreases with increasing
Supply Pressure for Double Acting	25 - 150 psi max. (1.73 to 10.3 bar) Do not exceed actuator rating.
Air Delivery for Double Acting	7.2 scf/min. (203 L/min.) at 30 psi (2.1 bar) supply 12.8 scf/min. (362 L/min.) at 60 psi (4.2 bar) supply 18.3 scf/min. (518 L/min.) at 90 psi (6.3 bar) supply 23.8 scf/min. (674 L/min.) at 120 psi (8.4 bar) supply

Table 26 Pneumatics Double Acting Standard Flow (Continued)

Air Supply	Dry, oil-free, 5 micron filtered air see ISA S7.3
Air Capacity (flow coefficient)	Loading C_v = 0.39 Venting C_v = 0.33
Air Consumption for Double Acting	0.4 scf/min. (11.3 L/min.) at 30 psi (2.1 bar) supply 0.85 scf/min. (22.6 L/min.) at 80 psi (5.52 bar) supply
Air Supply Failure	Positioner cannot control the failure position of an actuator without a spring. The actuator can, under different conditions, fail in place, fail open, or fail close. In cases where the valve must fail to a required position additional control equipment is required. Some overshoot can occur when air pressure returns after a period without air supply pressure. Always set control set point to 0%, and put the process control system in manual, for smooth recovery from air supply failure.
Loss of Input Signal	Output 1 drops to low pressure. Output 2 rises to supply pressure.
Sweet Natural Gas	H_2S content not more than 20 ppm.

Table 27 HART® Device Information

Item	Definition[1]
Model Name	SVI2 AP
Device Type Code	238 or 0xEE (firmware 5.x.x) 206 or 0xCE (firmware 4.1.1) 202 or 0xCA (firmware 3.x.x and below)
Device Revision	1 if firmware 5.1.x, 4.1.1, or 3.1.x 2 if firmware 3.2.x
HART® Protocol Revision	Firmware 3.2.8/5.1.4 (HART® 5 /HART® 7 switchable) Firmware 3.2.7/5.1.3 (HART® 5 /HART® 7 switchable) Firmware 3.2.5/5.1.1 (HART® 5/HART® 7 switchable) Firmware 3.2.3/4.1.1 (HART® 5/HART® 6 switchable) Firmware 3.2.1, 3.1.2, 3.1.1 (HART® 5)
Number of Device Variables	20 (in HART® 7 for firmware 5.x.x 15 (in HART® 6 for firmware 4.x.x
Physical Layers Supported	FSK
Physical Device Category	Digital Advanced Valve Positioner, Non-DC-isolated Bus Device

[1]Devices carrying firmware 3.2.8/5.1.4 can switch between HART® versions to operate the device in HART® 5 or HART® 7. Similarly, firmware 3.2.3/4.1.1 can operate in HART® 5 (3.2.3) or HART® 6 (4.1.1).

Table 28 variables are returned from HART® command 9.

Table 28 Device Variables

Variable Code	Variable Name	Description	Unit	Availability by Firmware Revision
0	Position	Valve position	Percent	Available for both firmware 4.1.1 (in HART® 6) and 5.1.X (in HART® 7);
1	P1-P2	Actuator pressure (if single acting) Differential pressure (if double acting)	psi	"
2	Supply Pressure	Supply pressure	psi	"
3	P2	Pressure on port 2 (for double-acting)	psi	"
4	Setpoint	Valve setpoint	Percent	"
5	Signal	Analog Input current signal	mA	"
6	SW1	Switch 1 (DO1)	Percent (0% = off, 100% = on)	"
7	SW2	Switch 2 (DO2)	Percent (0% = off, 100% = on)	"
8	DI	Digital Input	Percent (0% = off, 100% = on)	"
9	Temperature	Board temperature	Celsius	"
10	Reserved	Reserved	Reserved	"
11	Raw Position	Raw valve position	Counts	"
12	Strokes	Total valve travel odometer (An accumulated value of 100% travel = 1 stroke. The travel does not need to occur in one movement.)	Counts	"
13	Cycles	Number of direction reversals in valve travel	Counts	"
14	Position Retransmit	Position retransmit via Analog Output	Counts	"
15	I/P Current	Current to pressure transducer current	mA	Available for firmware 5.1.X (in HART® 7 only).
16	Friction	Static valve friction	psi	"

Table 28 Device Variables (Continued)

Variable Code	Variable Name	Description	Unit	Availability by Firmware Revision
17	Position Error Band	Allowed position deviation range from set-point; position deviation range from setpoint greater than this value results in position error.	Percent	"
18	Open Stop Adjustment	Upper limit for valve travel	Percent	"
19	Percent of Range	Analog Input current signal in percentage	Percent	"

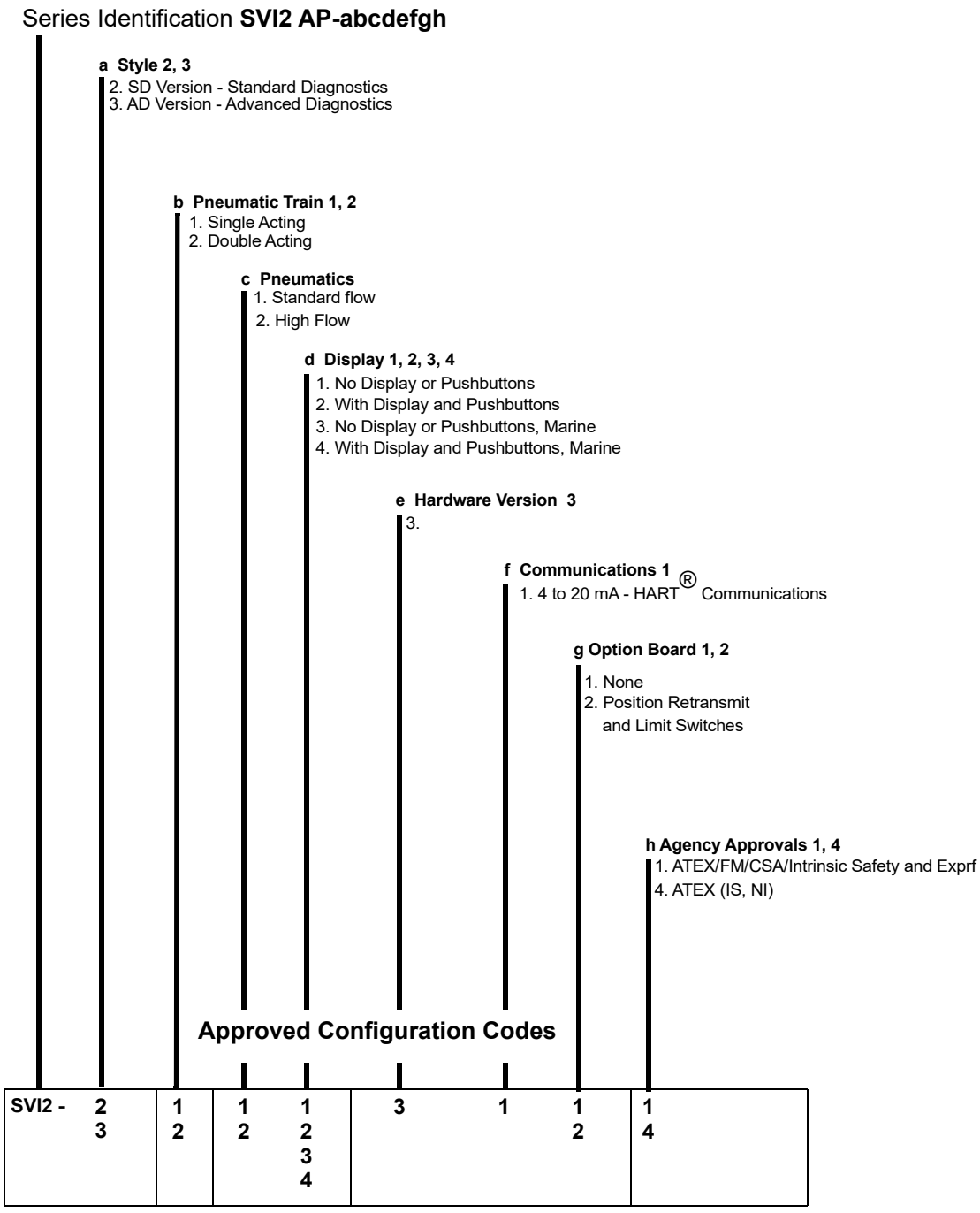


Figure 62 SVI2 AP Model Numbering

Spare Parts

Marketing Release

Circuit Board Kits (Standard and Offshore, Non-JIS)

SVI II **AP-2**,	Position Tx. & Switches **Off**	011531862-999-0000
SVI II **AP-2**	Position Tx. & Switches **On**	011531863-999-0000
SVI II **AP-3**	Position Tx. & Switches **Off**	011531864-999-0000
SVI II **AP-3**	Position Tx. & Switches **On**	011531865-999-0000
SVI II **AP-2 Double-Act.**	Position Tx. & Switches **Off**	011531866-999-0000
SVI II **AP-2 Double-Act**	Position Tx. & Switches **On**	011531867-999-0000
SVI II **AP-3 Double-Act.**	Position Tx. & Switches **Off**	**720081578**-999-0000
SVI II **AP-3 Double-Act**	Position Tx. & Switches **On**	**720081579**-999-0000

Push Button/Display Cover Spare Part Kit

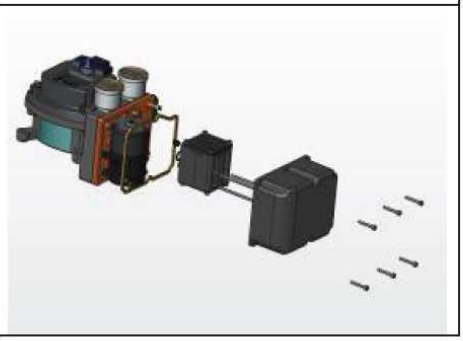
Standard Construction, SVI II AP-**2 720003884-999-0000**
Offshore Construction, SVI II AP-**2 720003885-999-0000**

Item No.	Description	Quantity
1	ASSY, COVER WINDOW	1
2	Gasket, Cover, Electronics	1
3	Instructions	1

Relay Spare Part Kit, **Standard** and **Offshore** Construction

720003880-999-0000

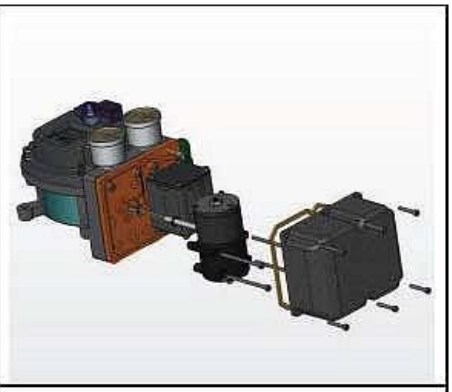
Item No.	Description	Quantity
1	RELAY, Single Acting	1
2	M4 X 0.7 X 60 SHCS	3
3	Pneumatics Cover	1
4	Pneumatics Cover Gasket	1
5	M4 X 0.7 X 25 SHCS	6
6	Instructions	1



I/P Spare Part Kit, **Single-Acting** (Standard and Offshore)

720003878-999-0000

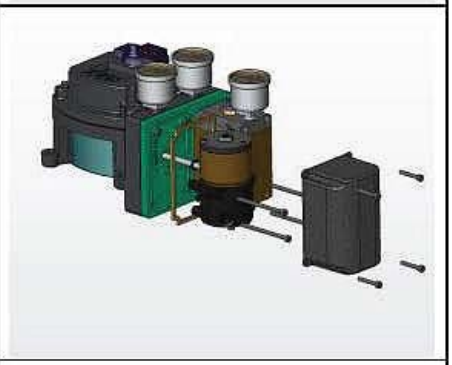
Item No.	Description	Quantity
1	**I/P Assembly**	**1**
2	O-Ring, I/P Stem	2
3	M4 X 0.7 X 60 SHCS	4
4	Pneumatics Cover	1
5	Pneumatics Cover Gasket	1
6	M4 X 0.7 X 25 SHCS	6
7	Instructions	1



I/P Spare Part Kit, **Double-Acting** (Standard and Offshore)

720003879-999-0000

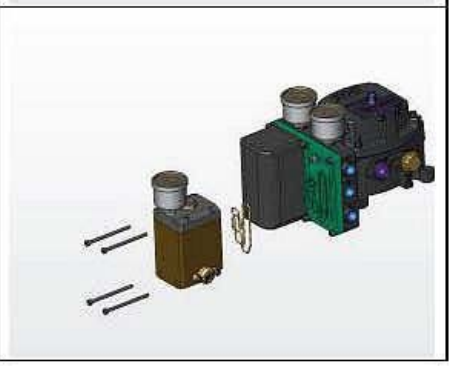
Item No.	Description	Quantity
1	I/P Assembly	1
2	O-Ring, I/P Stem	2
3	M4 X 0.7 X 60 SHCS	4
4	Pneumatics Cover	1
5	Pneumatics Cover Gasket	1
6	M4 X 0.7 X 25 SHCS	6
7	Instructions	1



Relay Spare Part Kit , **Double-Acting**,

Standard Construction **720003881-999-0000**
Offshore Construction **720003882-999-0000**

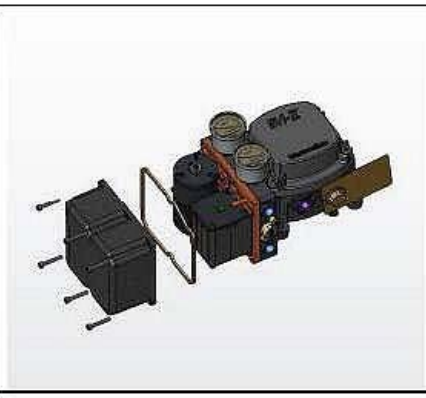
Item No.	Description	Quantity
1	Relay Double-Acting	1
2	O-RING, CONTOURED, DA 12:1 RELAY	1
3	M4 X 0.7 X 60 SHCS	4
4	Instructions	1



Pneumatic Cover Kit, **Single Acting**

720002450-999-0000

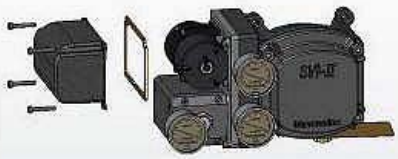
Item No.	Description	Quantity
1	LOCTITE 222MS, 0.5mL LOW STRENGTH	1
2	SCREW M4 X 0.7 X 25 SOCKET HEAD CAP	6
3	GASKET MANIFOLD S/A	1
4	PNEUMATICS COVER S/A SVI2AP	1
5	MINIVALVE 064.001 SILICONE	1



Pneumatic Cover Kit, **Double-Acting**

720002451-999-0000

Item No.	Description	Quantity
1	LOCTITE 222MS, 0.5mL LOW STRENGTH	1
2	SCREW M4 X 0.7 X 25 SOCKET HEAD CAP	4
3	GASKET I/P COVER D/A SVI2AP	1
4	COVER PNEUMATICS DA	1
5	MINIVALVE 064.001 SILICONE	1



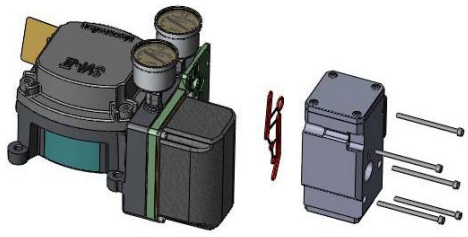
Pushbutton Door, Kit

720002448-999-0000

Item No.	Description	Quantity
1	SCREW CAPTIVE PANEL	1
2	PIVOT PIN PUSH BUTTON COVER SVI II	1
3	CIRCLIP SHAFT PUSH B	2
4	COVER PUSHBUTTON SVI2AP	1
5	GASKET COVER PUSHBUTTON SVI2	1

Relay Spare Part Kit, Standard Construction, High Flow,
Single Acting SVI2 AP-2

720014541-999-0000



Item No.	Part Number	Description	Quantity
1	720017771-265-0000	SCR HEX SHCS M4 X 0.7 X 60 MICROSPHERES 593 PATCH	5
2	971886015-681-0000	O-RING ID 9.19 [0.362] WIDTH 2.62 [0.103] REF NO 2-110	3
3	971886124-681-0000	O-RING ID 29.87 [1.176] WIDTH 1.78 [0.0703] REF NO 2-025	1
4	720020224-681-0000	O-RING ID 9.137.82 [1.498] WIDTH 1.78 [0.0703] REF NO 2-029	1
5	720014540-779-0000	Instructions	1
6	720000638-999-0000	RELAY SA HCP	1

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11. Air to Open and Air to Close Actuators

Actuator Action

It is important to correctly assign the sign + or - of each control variable throughout a control system. Even the control valve subsystem can be complex. Figure 63 and Figure 64 show the action of air to open, ATO, and air to close, ATC, valves when used with SVI II AP. 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 that 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 mA. The graph shows the valve movement and actuator pressure when the Tight Shut-off, T.S., option is set at about 5%, in this example. 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.

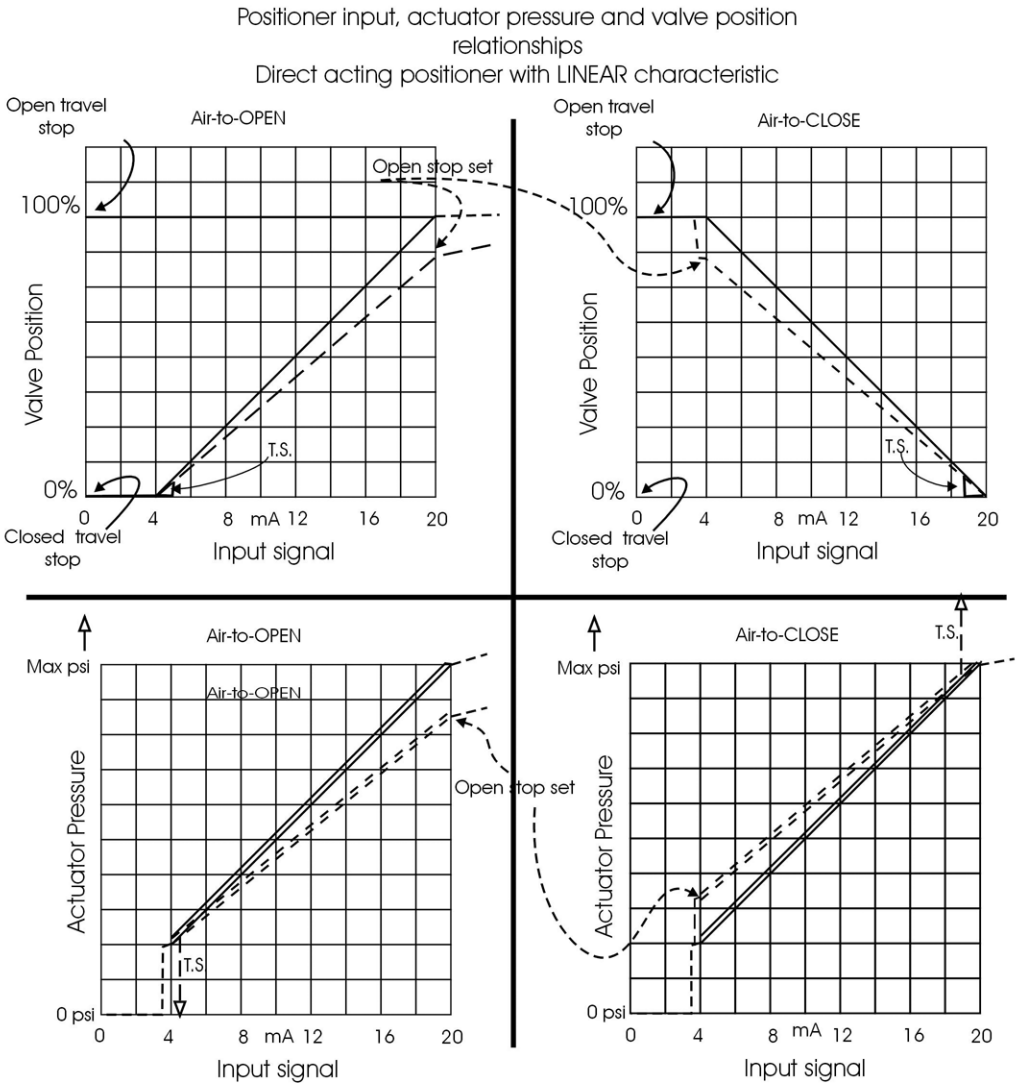

Figure 63 ATO and ATC Action with Linear Positioner Characteristics

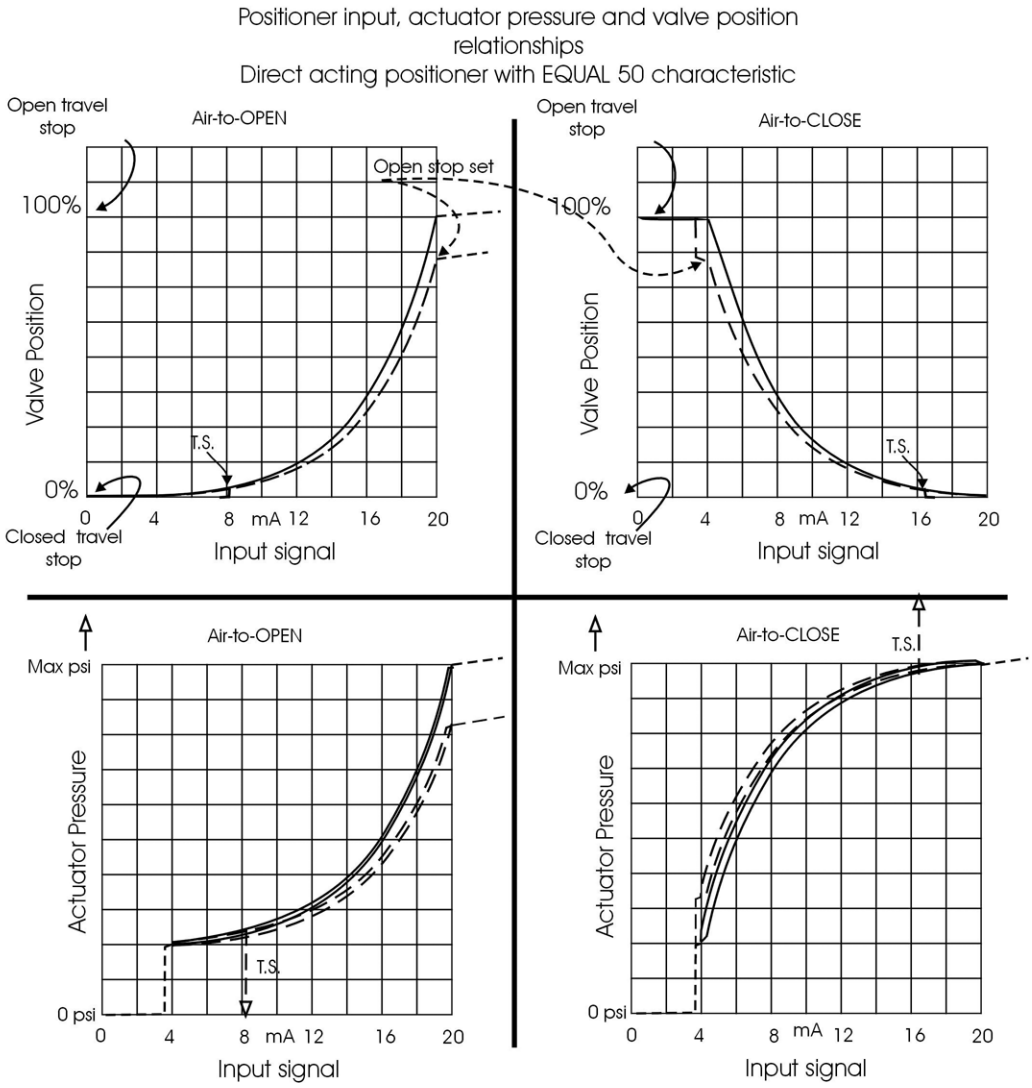

Figure 64 ATO and ATC Action in Percentage of Positioner Characteristics

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12. Installing an SVI II AP in a Natural Gas Environment

WARNING

The interior of the SVI II AP is positively pressured with the supply medium. Appropriate safety measures must be taken to handle pressurized natural gas that may enter the electrical conduit or cable system.

WARNING: EXPLOSION HAZARD- A missing or improperly installed conduit seal, cable seal or cable gland could leak natural gas into the area around the SVI II AP install area or into any area where the conduit is present.

Ensure natural gas that is vented from the SVI II AP dissipates quickly. The pneumatic control system constantly bleeds a small amount of the natural gas into the area around the SVII I AP from the positive pressure vent(s) (see images for bleed vent locations). Also, during an actuator vent cycle (actuator pressure relief), natural gas from the actuator is released into the area around the actuator vent port (see images for actuator vent locations) unless the unit is connected to remote vent gas piping (see "Remote Gas Piping"). Both sources of natural gas (positive pressure bleeding and actuator venting) must be considered when evaluating the Hazardous Classification for the area.

WARNING: EXPLOSION HAZARD - Positive pressure venting and actuator venting leak natural gas into the SVI II AP install area.

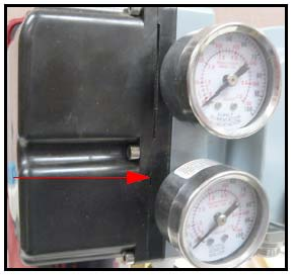
Do not attempt to collect the gas from the positive pressure bleed vent. Attempting to collect the gas from the positive pressure bleed vent may increase the internal pressure, which could affect performance and compromise the flameproof/explosion proof protection.

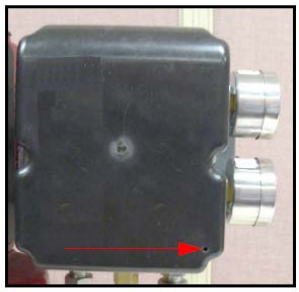
Ensure all covers and other pressure containing components are correctly installed before putting or returning unit to service.

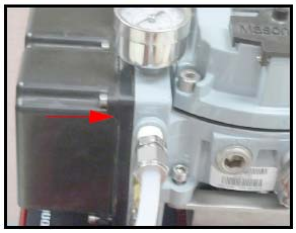
WARNING: EXPLOSION HAZARD- An improperly installed cover or pressure containing component could leak natural gas into the SVI II AP install area.

Approximately 0.2 ft^3/min @ 30 psi (6 sLp/min) of natural gas exhausts from the I/P and is vented. For indoor applications, tak this into consideration and provide circulation and venting.
The exhaust points are shown below using red arrows (→):

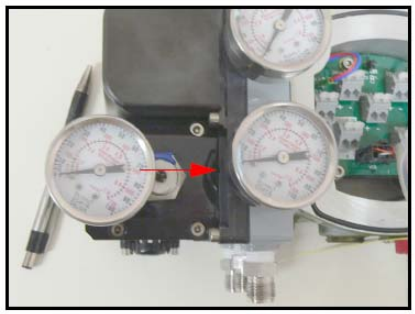
Single Acting



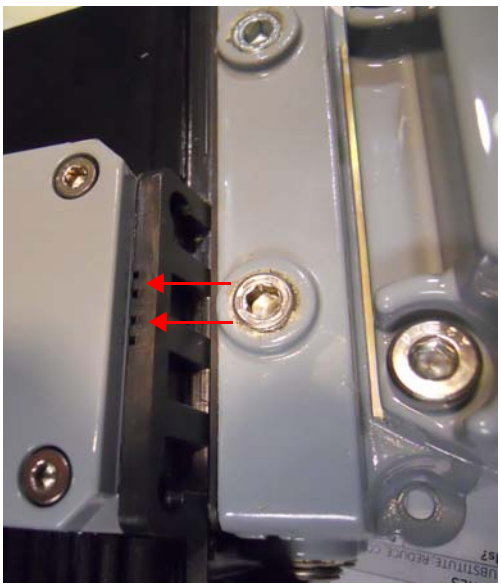




Double Acting



High Flow



Remote Actuator Vent Gas Connection

Remote Gas Piping

Remote vent gas piping must be free flowing to minimize pressure buildup during actuator venting. Pressure buildup inside the vent gas piping can affect performance of the control valve actuation. (Excessive pressure buildup can significantly affect the performance).

Pressure buildup inside the vent gas piping can be minimized by keeping the overall vent gas piping length as short as possible while limiting the number of fittings, elbows, and short radius turns. Keep the vent gas piping diameter large with a minimum (tubing) diameter of 12.7 mm (1/2”) for SVI II AP Single Acting and Double Acting or 19 mm (3/4”) for SVI II AP High Flow.

In addition to remote vent gas piping, ensure that all components and covers are correctly installed.

Single and Double Acting Installation

Tools required:

√ 9/16 and 1" wrenches √ M3 and M5 Hex Key

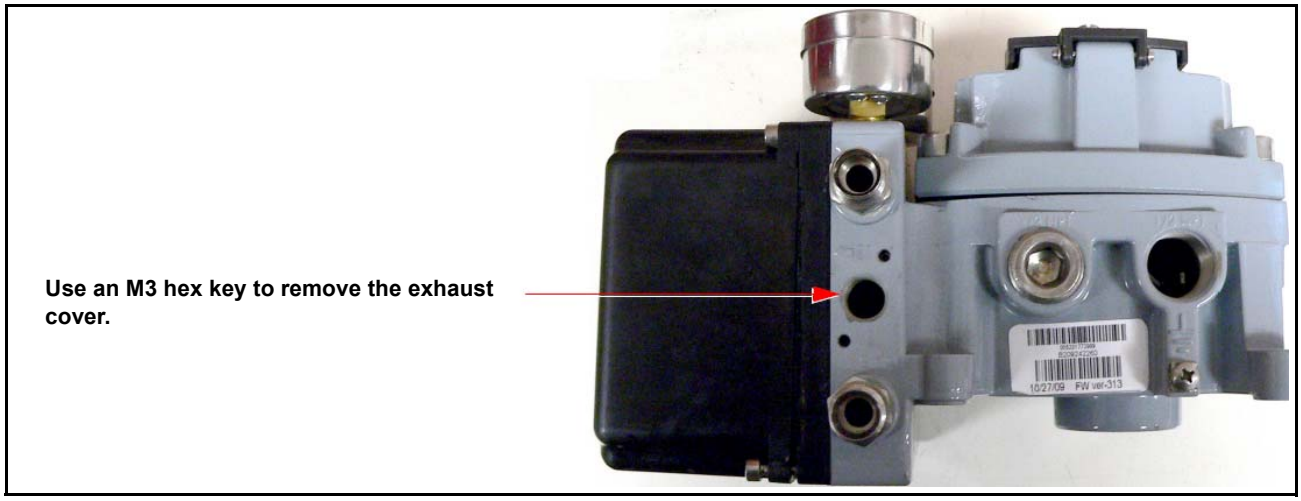
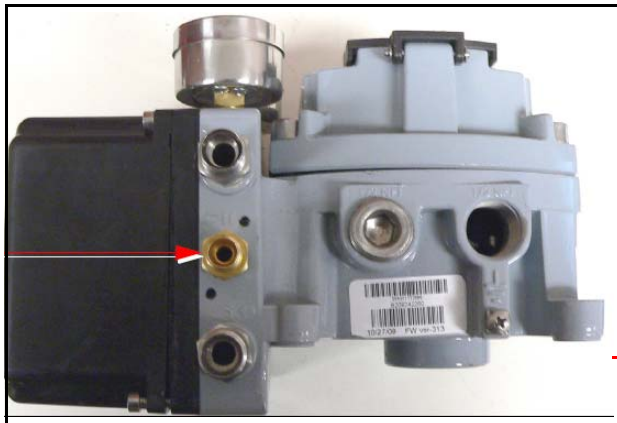
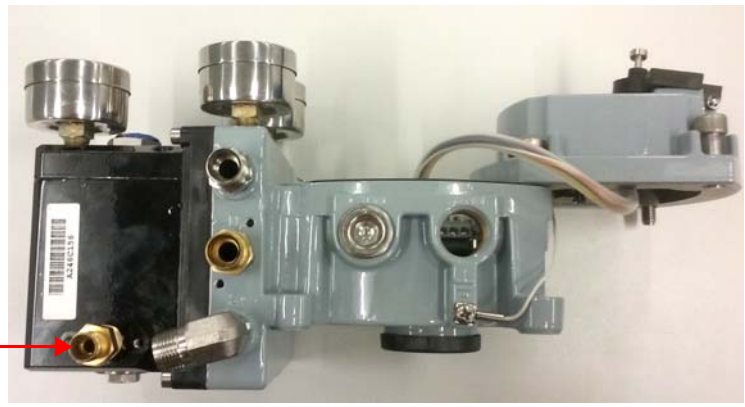


Figure 65 Step 1 Remove the Exhaust Cover





Single Acting **Double Acting**

Use a 9/16 wrench to install a 1/2" X 1/4" fitting into the exhaust port.

Figure 66 Step 2 Install a 1/2” x 1/4” Fitting

CAUTION

The tubing installed in this step will not capture all gases. Heed the Warnings from the first page.

1. Mount the SVI II AP to the mounting plate.

2. Connect 1/4" tubing to the gas supply (S←).

3.Pipe the output from the output pressure:

√ **Port (←I), for single acting, to the actuator.**

√ **Ports (←I) and (←II), for double acting to the actuator.**

4. Connect a 1/2” tube to the exhaust and route it to:

√ **The atmosphere if outside.**

√ **An outside area, if inside. Do not create back-pressure on the relay. The relay will not function properly with an exhaust pressure higher than atmospheric. Consider the following:**

a. Minimize the exhaust tubing length and sharp bends (90°) in the tubing.
b. Maximize the tubing size; consider stroking speeds if specified.

5. Inspect the electrical conduit connection to ensure a proper seal (conduit gland) is installed.

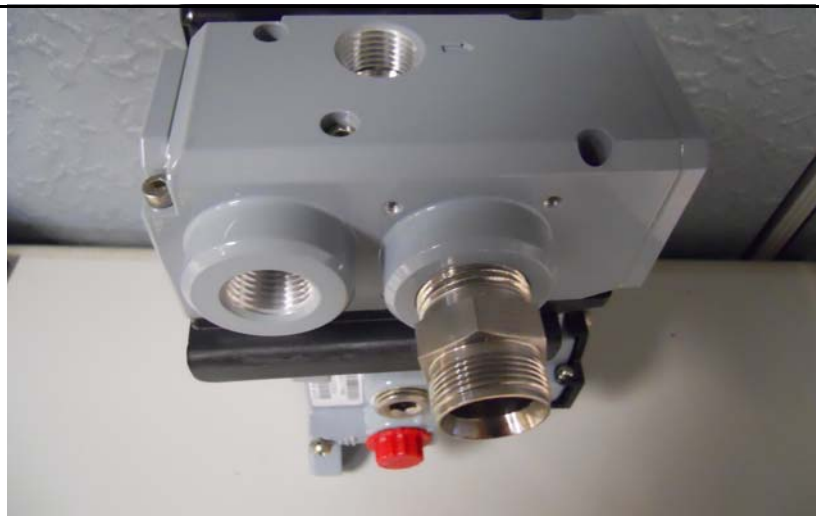
6. Ensure the covers and other pressure containing components are correctly installed before putting the unit into

Figure 67 Step 4 Connect Gas Supply and Exhaust

High Flow Installation

Tools required:

√ 3/4 and 1-1/6” wrenches √ M3 and M5 Hex Key



Use a 1-1/16 wrench to install a 3/4"X 3/4" male/male fitting

Figure 68 Step 1 Install a 3/4” x 3/4” Fitting

CAUTION

The tubing installed in this step will not capture all gases. Heed the Warnings from the first page.

1. Mount the SVI II AP to the mounting plate.

2. Connect 1/2” tubing to the gas supply (←).

3.Pipe the output from the output pressure to the actuator.

4. Connect a 3/4” tube to the exhaust and route it to:

√ **The atmosphere if outside.**

√ **An outside area, if inside. Do not create back-pressure on the relay. The relay will not function properly with an exhaust pressure higher than atmospheric. Consider the following:**

a. Minimize the exhaust tubing length and sharp bends (90°) in the tubing.

b. Maximize the tubing size; consider stroking speeds if specified.

5.Inspect the electrical conduit connection to ensure a proper seal (conduit gland) is installed.

6. Ensure the covers and other pressure containing components are

Figure 69 Step 2 Connect Gas Supply and Exhaust

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13. Air Supply Requirements

Air Supply Requirements

A high quality air supply greatly improves the quality of control and reduce maintenance costs of pneumatic equipment. See ANI/ISA-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 failure of the air supply. SVI II AP 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.

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14. Adjusting Speed of Response

Adjusting Speed of Response

The SVI II AP 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 speed of response of the control valve by adjusting parameters in SVI II AP. Tuning parameters are adjusted by ValVue, the preferred method, or by the handheld.

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15. Advanced Usage

Technology to Maximize Savings and Process Performance

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

Tight Shutoff Application to Protect from Seat Erosion

The Tight shutoff feature can be programmed 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, Tight Shutoff can be adjusted to move the valve from the seat to begin throttling at the minimum operable C_v level. Using the tight shut-off feature in SVI II AP prevents valve seat damage that can occur when throttling at clearance flows. See recommended Tight Shutoff settings in the following table. Tight shutoff can be adjusted with pushbuttons or with ValVue or a HART® communicator.

Table 29 Tight Shutoff Parameters for High Pressure Liquid Letdown Trim

Masoneilan 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

Using ValVue Diagnostics

SVI II AP advanced features are simple to use with ValVue software. The following examples illustrate some uses.

Continuous Diagnostics

SVI II AP continuously gathers critical information that can be used to predict maintenance intervals for control valves. These are:

- √ Total Travel
- √ Number of cycles
- √ Time open
- √ Time closed
- √ Time near closed

Monitoring a Valve Bellows Seal

The SVI II AP automatically stores the accumulated valve stroke reversals, as Number of cycles. ValVue can be used to periodically retrieve the values and to track the remaining life of a bellows seal or packing. Total travel can also be used to estimate the remaining life of packings and seals.

Critical Service, Cavitation Control Trim

The time near closed, of a valve with severe service when near the seat, can be monitored by ValVue and saved to permanent files to monitor and predict maintenance needs. You can use ValVue to specify the criterion for time-spent-near-closed (a valve position such as 4%, for example). See also Tight shutoff- Application to High Pressure Liquid Letdown Valve Trim.

Diagnostic Valve Tests

The standard diagnostic test performs a full stroke test, and determines stroking speed. The Step Response test moves the valve between several points selected by you and graphically presents the dynamic response for each step. The Positioner Signature test strokes the valve over a travel specified by you and records a signature for comparison with the as-built and with future tests to predict maintenance intervals. The full version of ValVue is required for diagnostic tests.

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16. Glossary

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 SVI II AP operation. The SVI II AP has a position control algorithm that is a modified PID. Other algorithms embedded in SVI II AP 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.
CALIBrate	A mode of the positioner in which you can change the calibration of stroke, input signal, and tuning parameters.
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 C_v 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. SVI II AP offers an eleven point custom characteristic option that can be created and edited in ValVue. Local display can be used to select the custom characteristic, but cannot adjust the points.

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 SVI II AP 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 Field Comm® Group 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. SVI II AP and ValVue offer a suite of diagnostic tools to implement condition monitoring.
CONFIGure	A mode of the positioner where you can change permanent parameters required for position control or for communications.
Custom	The custom characteristic in the SVI II AP has ten points to define the (*See Characteristic*) relationship between the setpoint and the valve position. The pushbuttons allow 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 handheld to allow it to communicate and display the custom parameters available in a field device.

Diagnostics	The suite of software, and hardware tools that allow an SVI II AP to monitors its own internal condition and to monitor the performance of the control valve and actuator system. Depending on options purchased the diagnostics can evaluate number of valve strokes, total accumulated valve stem travel, step response times with graphs, input to position relationships. Often system performance signatures are obtained and retained to compare as-built with future performance to predict remaining useful service life.
Double Acting	An actuator is double acting when it has pressure applied to both sides of the piston. A positioner is factory assembled and calibrated as a double acting that has two pressure outputs one that increases and one that decreases with increasing position setpoint. The SVI II AP positioner can be single acting or double acting.
EEPROM	An Electrically Erasable Programmable Read Only Memory. SVI II AP 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 the local display.
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 RESET returns the positioner to the mode prior to the error.
Fatal Error	In error which the SVI II AP program treats as non-recoverable. Service is required.
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 Field Comm® Group is an independent, nonprofit 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.
High Flow	The SVI II AP High Flow Positioner improves the dynamic performance of medium to large volume actuators without the need of a volume booster.
Hot Swappable	The SVI II AP 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 SVI II AP sends an analog current signal to the I/P which produces a controlled pressure to the pneumatic amplifying relay.
ISA	The International Society of Automation. 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 SVI II AP 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 SVI II AP.
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	A personal computer or laptop running Windows®.

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. SVI II AP 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	The response of the valve is different when the valve is nearly closed *Coefficient* 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 (Boost)	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 SVI II AP configuration, the input current setting at which the valve is fully open (ATO) or fully closed (ATC).
Sig Lo	In the SVI II AP 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. (see double acting).
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 SVI II AP 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 (An accumulated value of 100% travel = 1 stroke. The travel does not need to occur in one movement.). 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	Masoneilan full featured software for diagnostics, calibration, and configuration of SVI II AP.
VDE/VDI 3845	A standard common in Europe for mounting positioners and accessories on rotary valve actuators.
VIEW DATA	A mode of the positioner in which the configuration and calibration parameters can been examined, either remotely or with the local display.
VIEW ERR	A mode of the positioner in which the error status or error messages can be examined.

17. Burst Mode Operations

The Burst mode is when the HART® device continuously sends out data for a device not capable of being polled by a Master. Use this mode only for devices that are passive (i.e. not a HART® master), such as a HART® to Analog converter (SPA from Moore Industries, Tri-Loop by Rosemount). Turning on Burst mode affects the overall communication bandwidth. Burst mode is not available for SVI II AP in HART® 7.

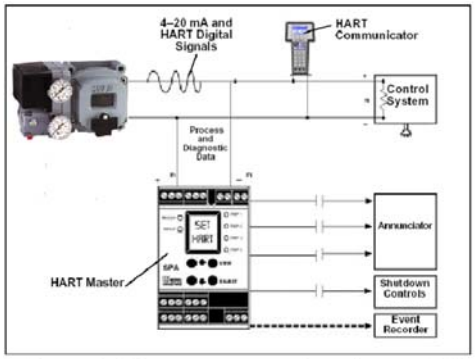
In a DCS-controlled environment, if you are using a:

- √ Tri-Loop configuration: Here the DCS does not have an analog-capable card. The SVI must be in BURST mode when using Tri-Loop.
- √ DCS with a mix of analog output cards: Some without HART and some with HART. SVIs connected to cards without HART need to use HART to analog converter. The SVI also must be set to use Burst mode so it sends the response as requested.

To see how the Burst mode is configured see the ValVue or SVI II AP DTM online help. The Burst mode can send the following commands:

- √ *Cmd1*: PV
- √ *Cmd2*: %range/current
- √ *Cmd3*: Dyn vars/current
- √ *Cmd9*: Device vars w/status
- √ *Cmd33*: Device variables

Choose the Burst command variables to be returned by referring to list of device variables in Table 28 on page 10163.



- must be set as as a secondary master if the SPA is in polling mode to be able to connect

- PV = Position
- SV = Actuator Pressure
- TV = Supply Pressure
- QV = Pressure 2

The on/off contacts can be triggered from the status bits sent with every message. The module must be configured to let it know which bit will trigger the contact.

Figure 70 Burst Mode Configuration: SPA with SVI II AP

Sample Tri-Loop Configuration

Figure 71 shows a simplified schematic showing the connection between the SVI II AP a Tri-Loop and a control system. Some considerations:

- √ The input channel from the control system must have an impedance of at least 250 Ohms or else the HART signal will be attenuated.
- √ Channel one must be enabled and set for Primary Variable with a range of 0-100%. Other vendors may have the Tri-Loop set to function on another channel.
- √ You can enable channel 2 and 3 even if you don't connect them.

CAUTION

Consult the instruction manual of the TRI-LOOP for wring diagrams. Masoneilan is not responsible for improperly wiring the TRI-LOOP. A resistor might be required on the positive leg of Channel 1 to limit the current to the TRI-LOOP.

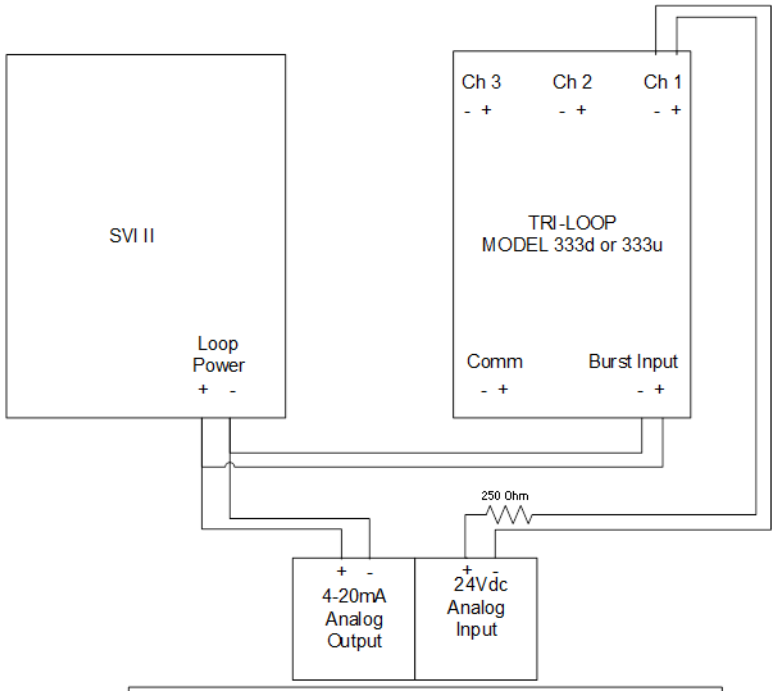


Figure 71 Sample Tri-Loop Configuration

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18. Device Status Diagnostics

Table 30 list the faults, types, possible causes and possible resolutions.

Table 30 Device Status Diagnostics

Status Byte	Status Bit	CMD 48 Strings	NAMUR NE107 Alert Category	Cause	Recommended Action
0	0	Reset	N/A Information Only	Any reset except caused by RAM checksum error or stack overflow (firmware 3.1.1); or per trap configuration (later firmware).	None
0	1	LowPower	Check Function	Input current < 3.15 mA.	Increase input current > 3.25 mA.
0	2	ActuatorError	Maintenance	Unable to position the valve normally.	1. Check for sufficient air pressure (upper spring range + 10 psi or required opening or closing force for double acting). 2. Check for blockage of valve, hand wheel, etc. 3. Check for linkage problems. 4. Check for air leakage in the positioner actuator system.
0	3	AirSupplyLow	Maintenance	Air supply is not turned on or is set below 10 psig (single acting) or 15 psig (double acting).	1. Single Acting: Increase air supply above spring final value + 10 psig. 2. Double Acting: Increase air supply above 15-20 psig.

Table 30 Device Status Diagnostics (Continued)

0	4	PositionError	Maintenance	Position does not match signal.	1. Check for sufficient air pressure (upper spring range + 10 psi or required opening or closing force for double acting). 2. Check for blockage of valve, hand wheel, etc. 3. Check for linkage problems. 4. Check for air leakage in the positioner actuator system.
0	6	KeypadFault	Maintenance	LCD defective.	1. Check LCD cable is plugged in and undamaged. 2. Check inside housing for moisture on LCD cable, ensure electronics are clean and dry and cover was closed properly to prevent water ingress. 3. Replace LCD with known good LCD.
0	7	MarginalPower	Check Function	Input current is between 3.75 mA and 3.15 mA.	1. Increase input current > 3.85 mA. Compare signal to LCD display.
1	0	CalibrationFailed	Maintenance	Check calibration of the mA input signal sensor or pressure sensors was outside the acceptable range when attempting to calibrate.	Double check that you are calibrating the correct channel, either 4-20ma INPUT or Pressure Sensor. Double check difference between calibrated value and actual.
1	1	FindStopsFailed	Maintenance	Zero and span not set.	1. When calibrating stops (Zero / Span) the travel sensor moved outside the acceptable limits. Check for correct magnet orientation and linkages. 2. Timeout occurred due to large actuator with insufficient boosters. 3. Valve position could not stabilize when de-energizing or when energizing the actuator.

Table 30 Device Status Diagnostics (Continued)

1	2	AutoTuneFailed	Check Function	Device could not tune automatically, need to manually tune system.	1. Increase air supply above spring final value + 10 psig. 2. Check for air leaks and sufficient current applied to 4-20ma input. 3. Using ValVue or HART® Host, Autotune with an aggressiveness level of -9. 4. Manual tune the parameters according to the instruction manual ensure accessories (boosters, etc) are set properly.
1	3	StdDiagnostics-Failed	N/A Information Only	When running a Standard Actuator Signature, the SVI did not move the valve between 10% to 90%.	1. Selected speed is too slow. Increase speed for the test by 1. 2. Insufficient air supply, increase air supply. 3. Check for limits (tight shut-off, etc).
1	4	ExtDiagnostics-Failed	N/A Information Only	When running a Extended Actuator Signature, SVI did not move the valve between the configured travel parameters (i.e. 5 to 95%).	1. Selected speed is too slow. Increase speed for the test by 1. 2. Insufficient air supply, increase air supply. 3. Check for limits (tight shut-off, etc).
1	5	OperatingSys-temFault	Failure	An internal condition from which the device recovered automatically.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.

Table 30 Device Status Diagnostics (Continued)

2	0	BiasOutofRange	Maintenance	I/P drive current at outside of expected range (10k to 35k counts).	1. Check for sufficient air pressure (upper spring range + 10psi or required opening or closing force for double acting). 2. Check for blockage of valve, hand wheel, etc. 3. Check for linkage problems. 4. Check for air leakage in the positioner actuator system.
2	1	I_POutofRange	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
3	0	NVMChecksumError	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
3	1	RAMChecksumError	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
3	2	FlashChecksumError	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.

Table 30 Device Status Diagnostics (Continued)

3	3	StackError	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
3	4	FactoryMode-Fault		Mode allowed only for flashing firmware upgrade.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
3	5	NVMTestError	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
4	0	RefVoltageFault	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.

Table 30 Device Status Diagnostics (Continued)

4	1	PositionSensor-Fault	Failure	Positioner sensor not reading proper values.	1. Use Smart Assistant to confirm selection of proper travel sensor. 2. Ensure that the mounting kit magnets are moving only +/-65 degrees (sensor should read between -10k to 10k counts w/ no jumps i.e. while traveling in one direction reading -8000 counts, -9900 counts then reading +10,000 counts). 3. If using remote verify that it is powered and wiper is connected, verify wiper voltage between 0 and 1.25 V. 4. If correct sensor selected, replace electronics module and report the problem at svi-support@BakerHughes.com.
4	2	CurrentLoopSen-sorFault	Failure	4-20mA input sensor failure detected.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
4	3	TemperatureSen-sorFault	Failure	Temperature Sensor failure detected.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
4	5	ActuatorPres-sure1Fault	Maintenance	Output Pressure Sensor Fault (Single-acting) or Output 2 Pressure Sensor Fault (double-acting).	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.

Table 30 Device Status Diagnostics (Continued)

4	6	ActuatorPressure2Fault	Maintenance	Supply Pressure Sensor Fault (Single acting) or Output 1 Pressure Sensor Fault (double acting).	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
4	7	SupplyPressureSensorFault	Maintenance	Supply Pressure Sensor Fault (double-acting only).	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
5	0	I_PPressureSensorFault	Failure	I/P pressure sensor failure detected.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
5	1	AtmosphericPressureSensorFault	Maintenance	Atm pressure sensor failure detected.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
5	3	NVMWriteFault	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using ValVue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.

Table 30 Device Status Diagnostics (Continued)

5	4	IRQFault	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using Val-Vue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
5	5	SelfCheckError	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using Val-Vue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.
5	6	SoftwareError	Failure	Hardware failure.	1. Remove power to the device for two minutes and restart the device. 2. Clear the alarm using Val-Vue or HART® Host. 3. If the failure persists, replace the complete device or electronics module.

19. Determining an SVI Positioner Compliance Voltage in a Control System

This discussion explains how to determine compliance voltage for an SVI positioner. It applies to the SVI II AP, SVI II ESD, SVI II APN and SVi1000.

A definition of compliance voltage is: The voltage that must be available at the control system output in order to drive the control current through the SVI II AP and all the resistive devices in series with it.

Measuring the voltage across the SVI II AP terminals doesn't give the true available system compliance voltage as the positioner self-regulates voltage as current flows through it. Additionally, it also doesn't confirm what system voltage is available under load conditions. *Therefore, if compliance testing needs to be done, it is best done before installation.*

Use a 1K potentiometer as this is the maximum for most analog output cards and as at 20 mA this equals 20 VDC, which is a sufficient maximum.

Compliance Test Setup

1. Configure a test setup as in Figure 72.

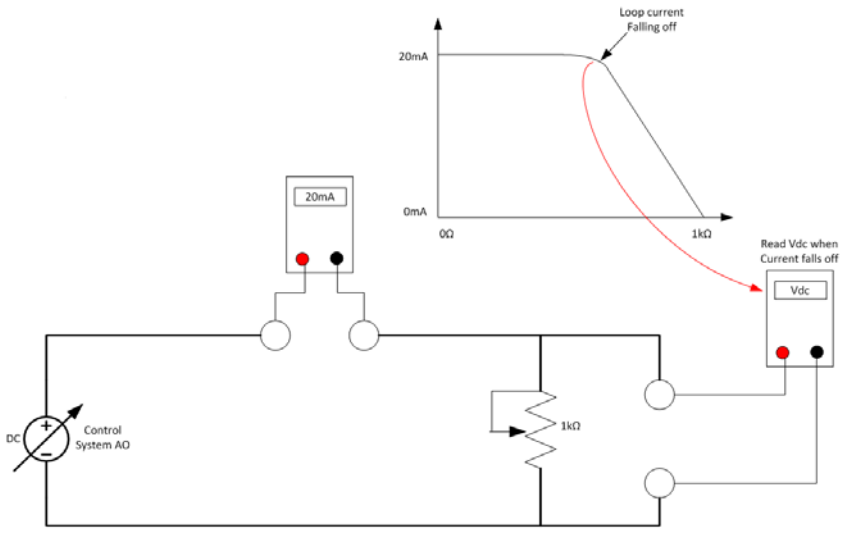


Figure 72 Compliance Voltage Test Setup

2. Send 4 mA to the test setup.
3. Increase the potentiometer value until the loop current reaches 3.95.
4. Read the voltage across the potentiometer, which should be > 11 VDC. This is the available system voltage at the minimum output.
5. Send 20 mA to the test setup.
6. Increase the potentiometer value until the loop current reaches 19.95 mA.
7. Read the voltage across the potentiometer, which should be > 9 VDC. This is the available system voltage at the maximum output.

Table 31 lists some compliance voltage readings at positioner terminals at several currents.

Table 31 Expected Voltage Range at Positioner Terminals

Current	Compliance Voltage Requirement at Positioner Terminals	Expected Voltage Measured at Positioner Terminals
4 mA	11 V	10 to 11 V
8 mA	10.5 V	9.5 to 10.5 V
12 mA	10 V	9 to 10 V
16 mA	9.5 V	8.5 to 9.5 V
20 mA	9 V	8 to 9 V

20. SVI Physical Characteristic Identification

This guide is designed to help the user to quickly identify the different SVI product versions: SVI I2 AP, SVi1000, SVI2-1, SVI2 or SVI 1.

Body Styles

Recognizable Feature: *SVI* shown on Display Cover (Only change is SVI lettering on cover)

Figure 73 SVI2 AP: Cover Phase In Started 2015

Recognizable Feature: *SVI-II* (with dash) shown on Display Cover

Figure 74 SVI2 AP: Cover Phase Out Started 2015

Figure 75 SVi1000: Started Shipping 2011

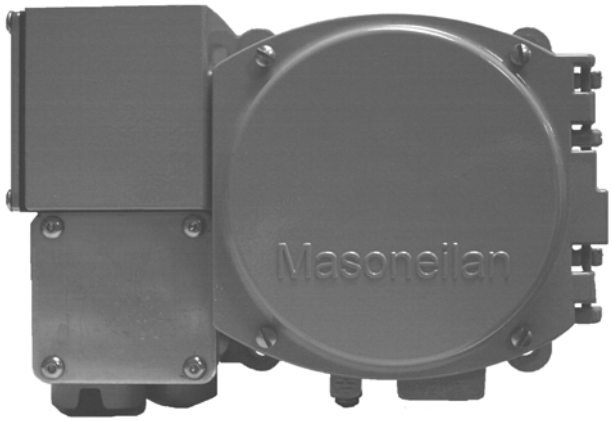
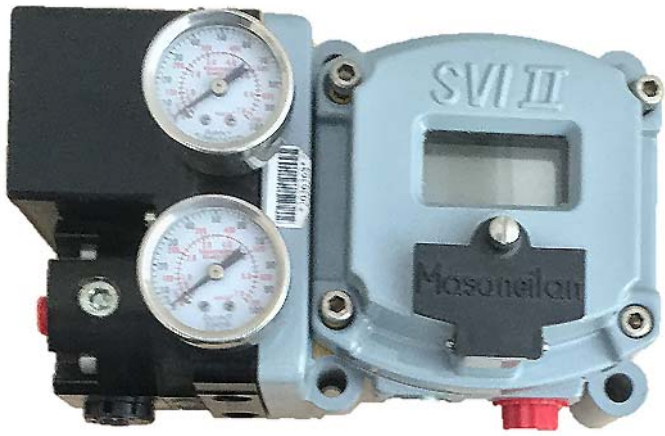
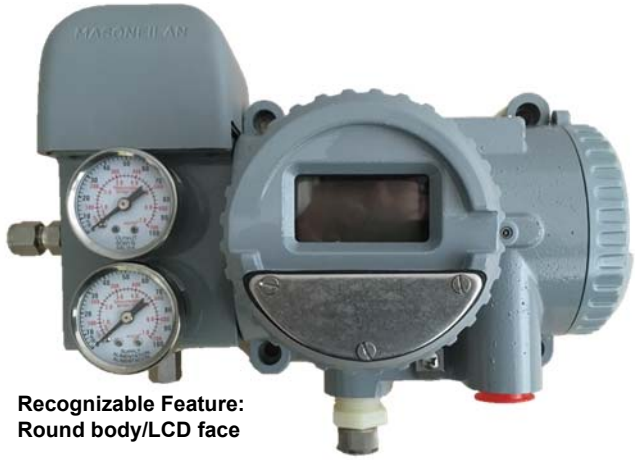


Figure 76 SVI2 -1: Obsolete



Recognizable Feature:
***SVI II* shown on Display Cover**

Figure 77 SVI2: Obsolete



Recognizable Feature:
Round body/LCD face

Figure 78 SVI I: Obsolete

Additional Differences Between SVI II AP and SVI II

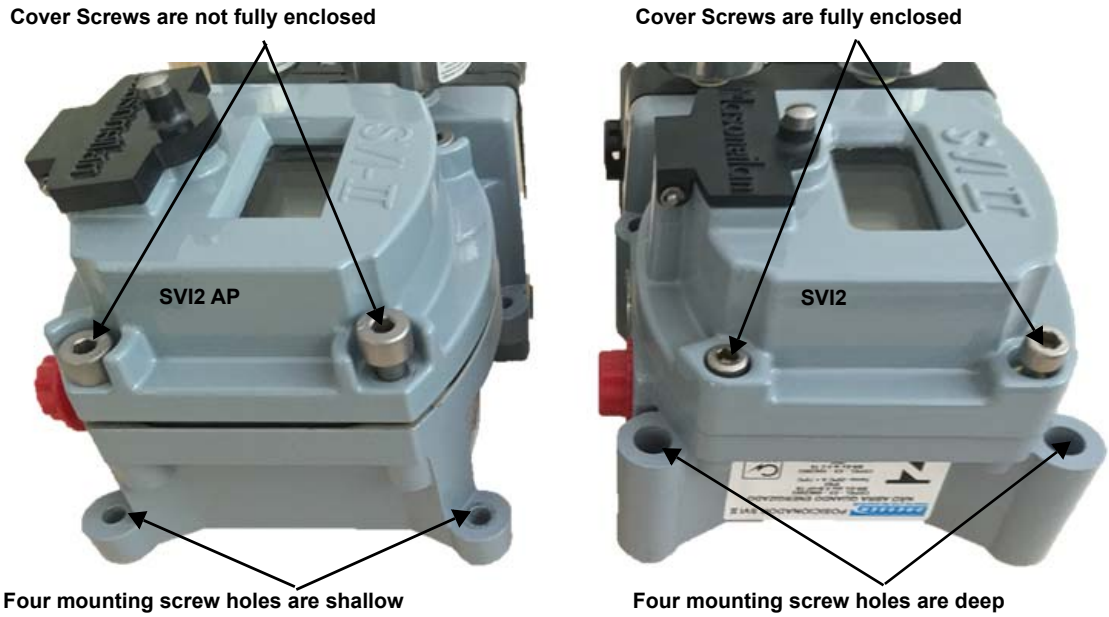


Figure 79 Cover and Mounting Screw Configuration

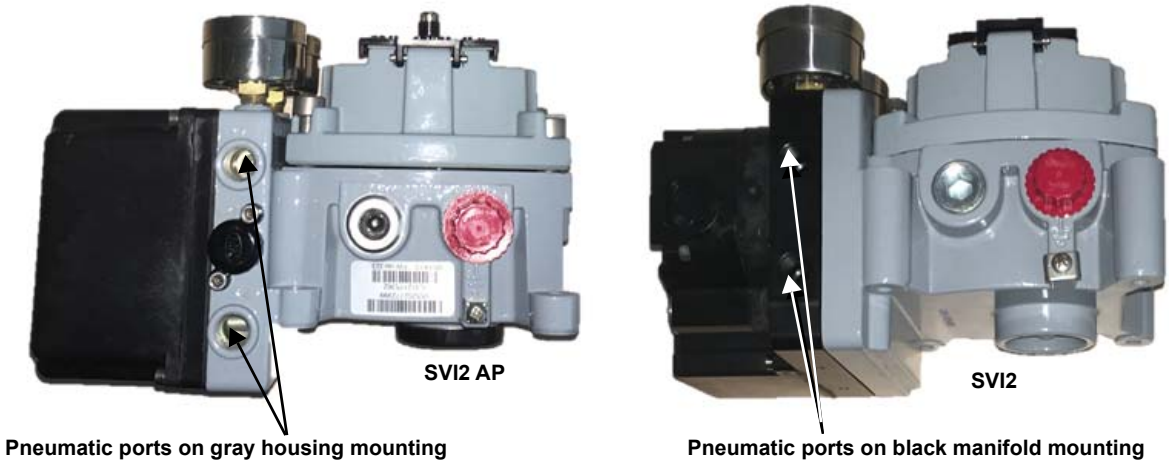


Figure 80 Pneumatic Ports

SVI2 AP Blind Cover (New) **SVI2 AP Blind Cover (Original)**

Figure 81 SVI2 AP Cover Differences

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21. How Do I Interface with the SVI II AP DTM?

The lists below give you an idea of what tasks you need to accomplish using the SVI II AP DTM. The tasks are split into *Getting Started Tasks* that are necessary at least the first time you configure and *Common Tasks* for tasks performed at anytime. All tasks are listed using the title by which you can find them in the SVI II AP DTM help or the help pdf version (GEA31429 Masoneilan Products SVI II AP DTM Software Manual).

Getting Started Tasks

- √ *Registration Process* leads you through the entire registration process.
- √ *HART® Screen* explains the operations of the screen where you view process information, change mode and change the setpoint.
- √ *Calibration Autotune Screen*: to run autotune.
- √ AP DTM Work Environment gives an overview of functionality.
- √ *Setup Wizard* explains how to use the wizard to do the initial setup.

Common Tasks

- √ *Audit Trail* explains how to generate a report of positioner events.
- √ *Registration* leads you through the entire registration process.
- √ *Report* explains how to create/print a report on the SVI II AP device configuration.
- √ *ValVue™ 3 Installation and Logon*.
- √ *Installing SVI II AP Advanced DTM Software*.
- √ *Calibration Screen*: to restore the factory calibration data for all sensors.
- √ *Calibration Range Screen*: to perform valve tuning, including manual and automatic manual stops and open stop adjustment.
- √ *Calibration Autotune Screen*: to run autotune.
- √ *Calibration Manual Tune Screen*: to enter manual tuning parameters and view the results of those parameters on the *Trend* display.
- √ *Calibration Calibration Screen*: to calibrate pressure and input signals.

- √ *AP DTM Work Environment* gives an overview of functionality.
- √ *HART® Screen* explains the operations of the screen where you view process information, change mode and change the setpoint.
- √ *Setup Wizard* explains how to use the wizard to do the initial setup.
- √ *Configuration General Screen*: Use this screen to configure Tag Information, display language and set LCD button control.
- √ *Configuration Position Screen*: to set all position-based limits.
- √ *Configuration Actuator Screen*: to select the *Air Action* type.
- √ *Configuration I/O Configuration Screen*: to configure switch states, activate/deactivate digital input, configure the input signal range and valve retransmit range
- √ *Configuration Options Screen*: to configure the parameters related to valve characterization, pressure units and bumpless transfer.
- √ *Diagnostics Signature Analysis Screen*: to see the diagnostic results for the performance of the valve.
- √ *Diagnostics Status Screen*: to see the SVI II AP operating and internal status.
- √ *Diagnostics Health Screen*: to view the status of signals, pressure, temperatures and I/Os.
- √ *Commissioning Services Screen*: to monitor all pressures on one screen.
- √ *Commissioning Services Configuration Screen*: to set the Tag and Low and High signals.
- √ *Commissioning Services Manual Position Setpoint Screen*: to fully open the valve, fully close the valve or use the *Manual Setpoint* feature to input a setpoint in percentage of valve position or in signal range (mA).
- √ *Commissioning Services Set Analog Output Screen*: to set a fixed analog output for the position retransmitter for a loop wire check.
- √ *Commissioning Services Re-transmitter Range Screen*: to change the relationship valve position transmitter output and the valve opening.
- √ *Commissioning Services Switches Screen*: to set the default operating position for the switches.
- √ *Diagnostics Screen*: to perform a device reboot of the SVI II AP.
- √ *Diagnostics Continuous Data*: to view data about valve operations at closing and opening, which useful in valve operation analysis..
- √ *Diagnostics Signature Screen*: to perform diagnostic tests, and displays test results in the *Trend* window.
- √ *Diagnostics Raw Data Screen*: to view the raw counts of status of signals, pressure, temperatures and I/Os. Additionally, you can set the I/O Output.

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