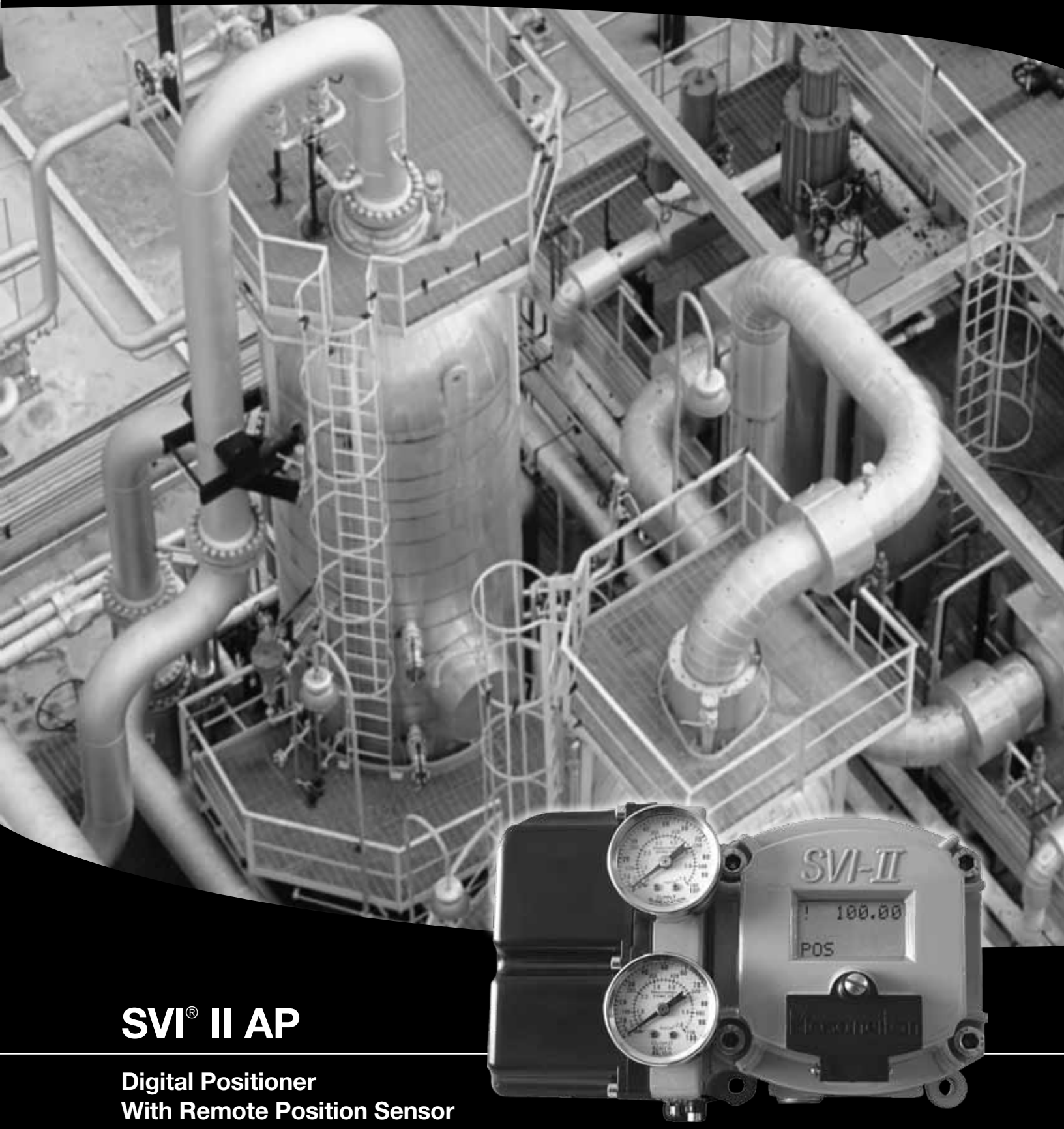
DRESSER Masoneilan

Putting You In Control

Instruction Manual
EW2002-AP
06/10 Rev D



SVI® II AP

Digital Positioner
With Remote Position Sensor

Warranty

Items sold by Dresser,® Inc. are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment provided said items are used according to Dresser recommended usages. Dresser, Inc. reserves the right to discontinue manufacture of any product or change product materials, design or specifications without notice.

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

The SVI II AP series positioners are warranted for use only with interface software approved by Dresser, Inc. Consult Masoneilan Dresser factory locations for approved software listing.

About this Guide

This Instruction Manual applies to the following instruments and approved software:

- SVI II AP -2 through SVI II AP -3
  - - with Firmware version 3.1.1, 3.1.2 or 3.2.1
  - - with ValVue® version 2.4 or greater
  - - with AMS® ValVue® SNAP-ON® version 2.4 or greater
  - with ValVue PRM Pug-in
  - - with Model HH375 HART® Communicator with DD published for SVI II AP

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

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

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

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

Copyright

PN 055201-241 Rev. D

Safety Information

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

Important - Please Read Before Installation!

Safety Symbols

SVI II AP instructions contain **WARNINGS**, **CAUTIONS** labels and **Notes**, where necessary, to alert you to safety related or other important information. Read the instructions carefully before installing and maintaining your instrument. **WARNING** hazards are related to personal injury. **CAUTION** hazards involve equipment, property or data damage. Operation of damaged equipment can, under certain operational conditions, result in degraded process system performance that can lead to injury or death. 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 damage.

NOTE Indicates important facts and conditions.

SVI II AP Product Safety

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

NOTE

Installations using natural gas are Zone 0 or Div 1 installations.

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.

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.

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

WARNING

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.

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

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

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Introduction

1

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.

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

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.

ValVue Lite

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

System Requirements

ValVue Lite runs on IBM compatible computers. Minimum requirements for all versions of ValVue software are Windows 2000, XP, 64 MB RAM, serial or USB port connected to a HART® modem, and a CD-ROM drive.

ValVue Trial Version

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

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

ValVue functionality includes:

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

- Display comparative test results (full version only)
- Perform diagnostic test procedures (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 Masoneilan or your local Masoneilan representative to obtain licensing information.

Contact Masoneilan

For the most recent software visit our SVI II AP web site at: www.masoneilan.com

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 Positioner (see Figure 1 on page -1) 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 Compatible
- HART Remote Operation Calibration Configuration Diagnostics Using ValVue software or a HART Handheld Communicator, HH375 and any HART Compatible Host
- Single or Double Acting

Available Options

Some of the options available for the SVI II AP are listed below:

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

About This Manual

The SVI II AP Instruction Manual is intended to help a Field Engineer install, setup, and calibrate an SVI II AP in the most efficient manner possible. 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 Masoneilan or your local Masoneilan 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.

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Installation and Set Up

2

Overview

The SVI II AP (Smart Valve Interface - see Figure 2 on page 8) 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 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 iii at the beginning of this manual.

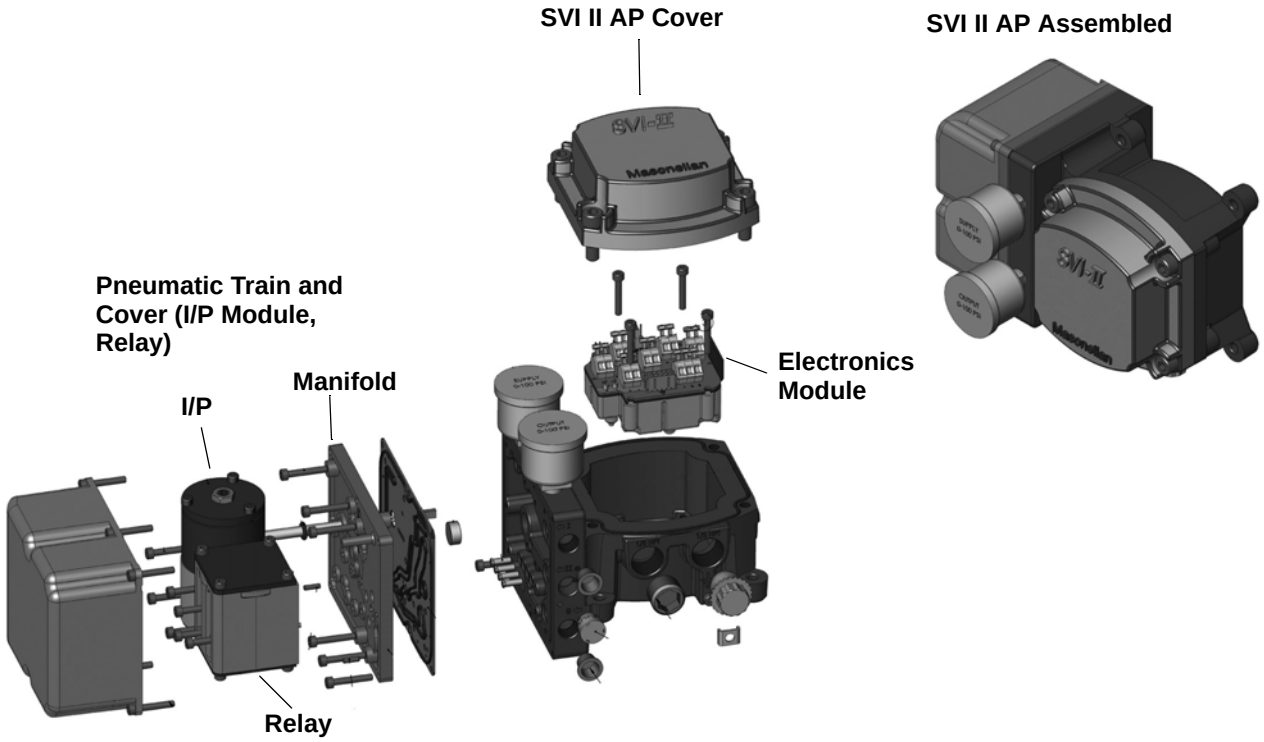


Figure 2 SVI II AP Components

SVI II AP Dimensions and Weights

Figure 3 illustrates the dimensions and weight of the SVI II AP.

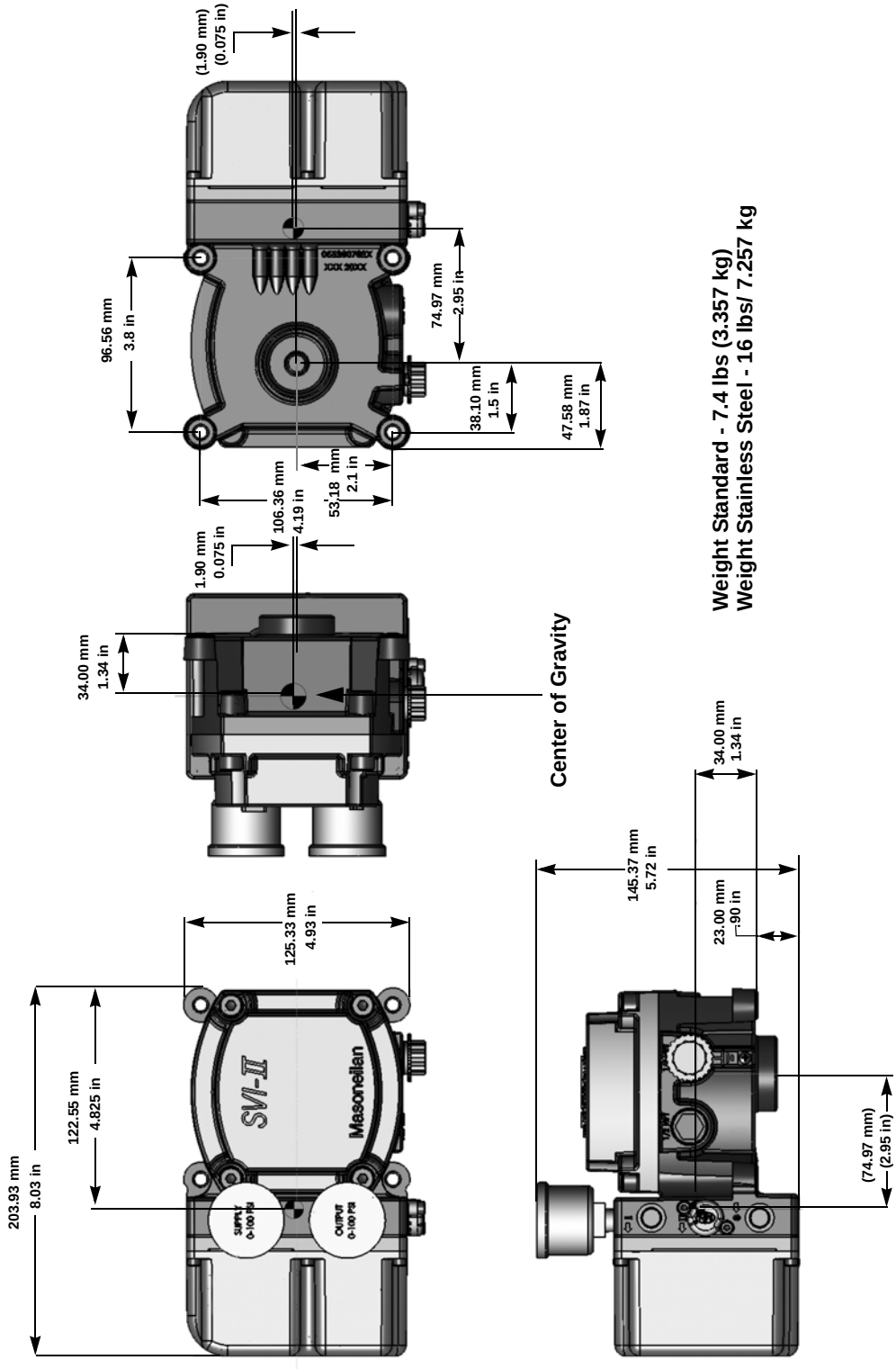


Figure 3 SVI II AP Dimensions

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. The SVI II AP container includes a CD-ROM with ValVue Lite, ValVue Trial Version, and manuals.

Installation Steps

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

The steps necessary to complete the SVI II AP installation and software setup are outlined in Table 1.

Table 1 SVI II AP Installation Steps

Step No.	Procedure	Reference
1	Attach mounting bracket to the actuator.	See page 13 for rotary valve and page 17 for reciprocating valve instructions.
2	Install the SVI II AP magnetic assembly (rotary valves only).	See page 17 for instructions.
3	Assemble the SVI II AP on the bracket that is mounted to the valve actuator.	See page 13 for rotary valve and page 17 for reciprocating valve instructions.
4	Install the Remote Position Sensor, if necessary.	See page 23 for instructions.
5	Connect the pneumatic tubing to the SVI II AP.	See page 29 for instructions.
6	Connect the air supply to the SVI II AP.	See page 32 for instructions.

Table 1 SVI II AP Installation Steps (Continued)

Step No.	Procedure	Reference
7	Connect the positioner to the HART Control Loop segment by installing the SVI II AP wiring.	See page 33 for instructions.
8	Configure/Calibrate using LCD Pushbutton display	See page 67 for instructions
	Configure/Calibrate using a Hart Hand Held Communicator.	See page 75 for instructions
	Configure/Calibrate using ValVue	See page 77 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 Masoneilan.
- 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 Section "Specifications and References".

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 the following:

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

NOTE

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 manufacturers 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 16

Required Tools

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

- 3⁄16" Hex Key with tee handle
- 5⁄32" Hex Key
- 3 mm, 4mm, 5mm 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 5 on page 15, ATO or in Figure 6 on page 15, 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 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 5 and Figure 6.
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.

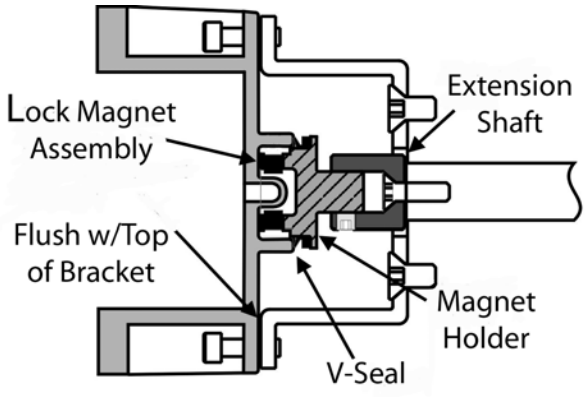


Figure 4 Camflex with Mounting Bracket (Side View)

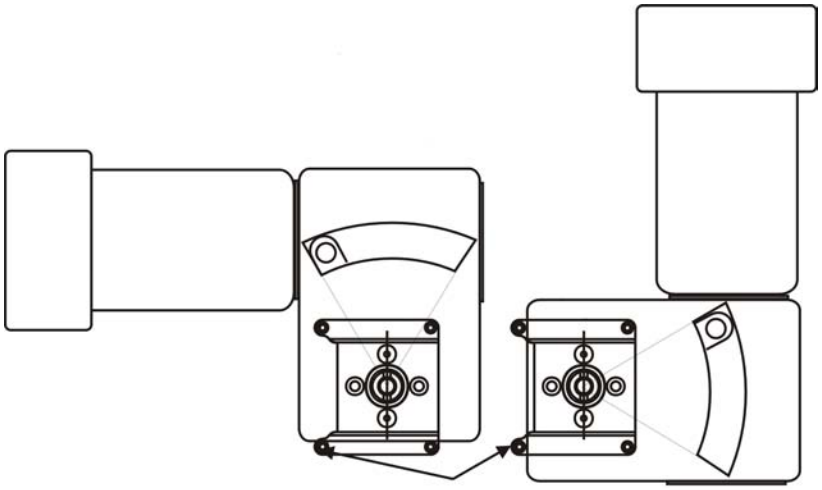


Figure 5 Camflex ATO Mounting (Front View)

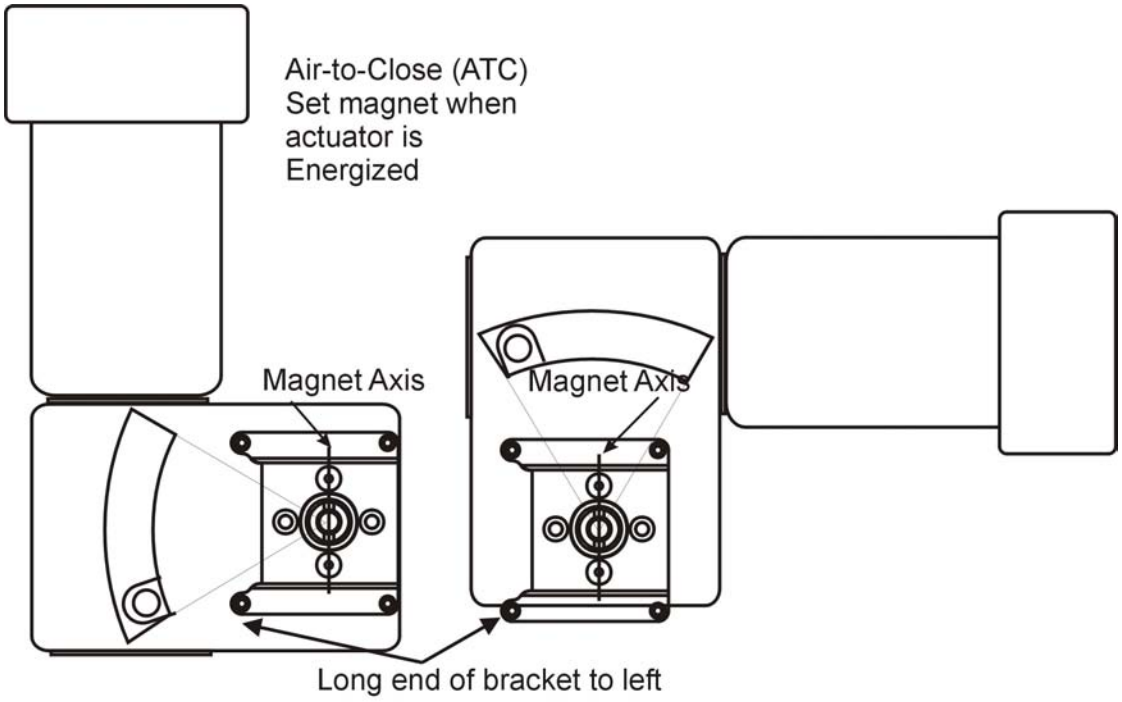


Figure 6 Mounting Bracket on Air-to-Close Actuator

Table 2 Magnet Orientation on Rotary Actuators

Rotary Actuator Type	Magnet Setting - ATO	Magnet Setting - ATC
Camflex Actuator is energized	—	Magnet Axis is Vertical Figure 6
Camflex Actuator is de-energized	Magnet Axis is Vertical Figure 5	—
Varimax® Actuator is energized	—	Magnet Axis is Vertical
Varimax Actuator is de-energized	Magnet Axis is Vertical	—
Model 33 in clockwise to open valve Actuator is de-energized (36000 Series Control Ball, 37000 MiniTork®)	Magnet axis 45° to right of vertical position in Figure 7	Magnet axis 45° to right of vertical
Double acting cylinders at mid-travel	Magnet Axis Vertical	Magnet Axis Vertical

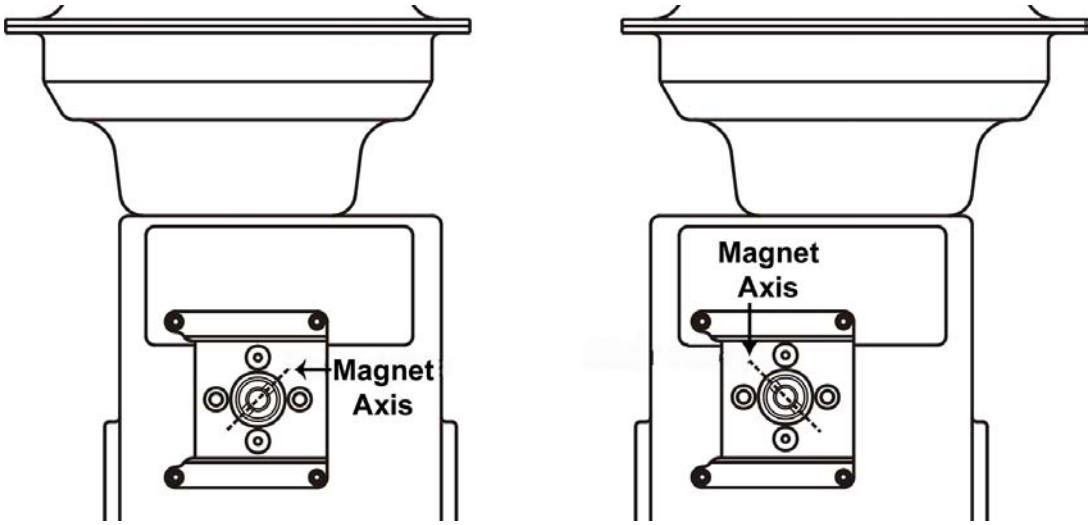


Figure 7 Model 33 Actuator

Rotary - 90°

For actuators with 60 to 120° rotation, follow the instructions in “Mounting the SVI II AP on Rotary Valves” on page 13 except mount the magnet at plus or minus 45° while the actuator de-energized as shown in Figure 7 on page 16.

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. Note 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 positioner from a rotary valve perform Steps 1 - 8 on page page 10 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
- 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 9 on page 19 and Figure 3 on page 19.

3. Select mounting hole A, B, C or D for the stroke of the valve. For example, hole B is shown in Figure 10 on page 19 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. Thread the take-off rod to the actuator stem connector. Refer to Figure 11 on page 20. Ensure that the travel pointer located on the coupling is correctly positioned.
5. 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 10 on page 19 and the Reciprocating Valve Linkage Selection, Table 3 on page 19.
6. Thread the right hand lock nut and turnbuckle onto the right hand rod end approximately two turns. Turnbuckle length is a function of actuator size. (Refer to Table 3 on page 19.)
7. Secure the magnet housing assembly, including the lever and right hand rod end, to the bracket using four M5 X 10 mm flat head screws.
8. Attach the left hand threaded rod end to the take-off rod with 1⁄4 - 20 UNC nut and thread the left hand lock nut onto the rod end.
9. Move the valve to its closed position. For air to 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.
10. Thread the turnbuckle onto the left hand threaded rod end. Refer to Figure 11 on page 20.
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 9 on page 19.)
12. Mount the SVI II AP to the bracket and secure with four M6 socket head cap screws.

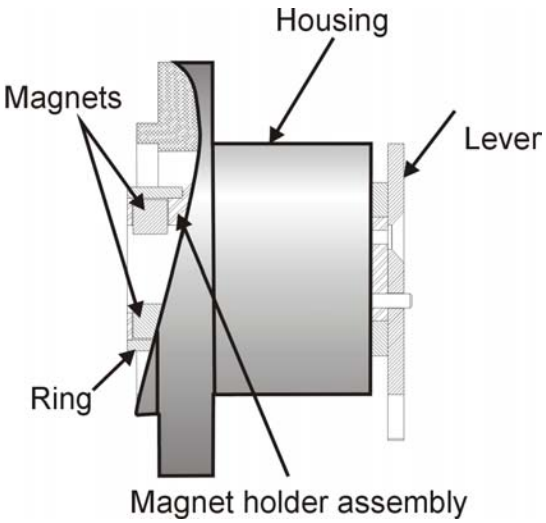


Figure 8 Magnet Holder for Reciprocating Valves

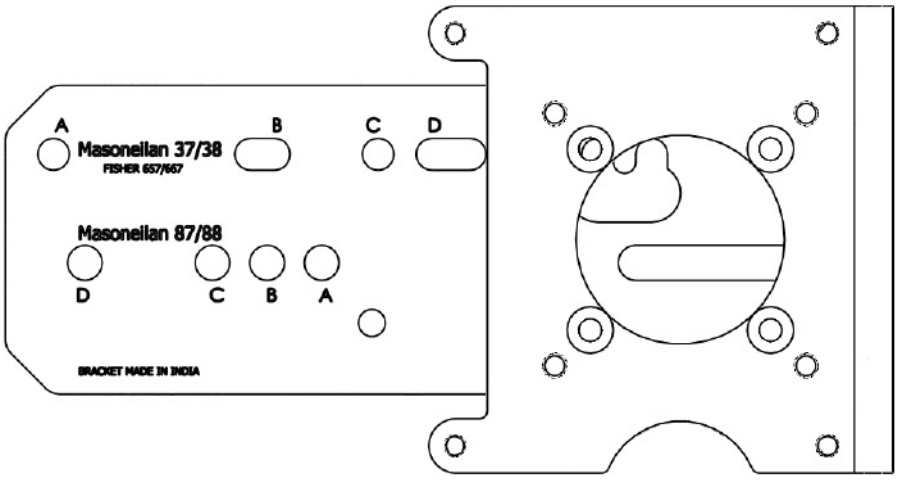


Figure 9 Reciprocating Valve Mounting Bracket

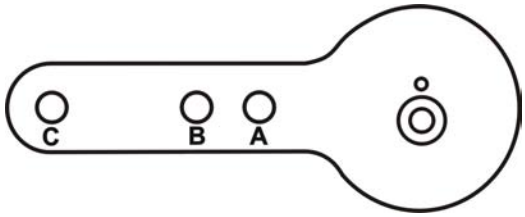


Figure 10 Lever for Model 87/88 Multispring Actuator

Table 3 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 - 41.5 mm)	B	B	1.25" (31.75 mm)
16	0.5 - 0.8" (12.7 - 20.32 mm)	B	A	2.90" (73.66 mm)
16	>0.8 – 1.5" (20.32 - 41.5 mm)	C	B	2.90" (73.66 mm)
16	>1.5 – 2.5" (41.5 - 63.5 mm)	D	C	2.90" (73.66 mm)

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

Actuator Size Masoneilan	Stroke	Mounting Hole	Lever Hole	Turnbuckle Length
23	0.5 - 0.8" (12.7 - 20.32 mm)	B	A	5.25" (133.35 mm)
23	>0.8 – 1.5" (20.32 - 41.5 mm)	C	B	5.25" (133.35 mm)
23	>1.5 – 2.5" (41.5 - 63.5 mm)	D	C	5.25" (133.35 mm)

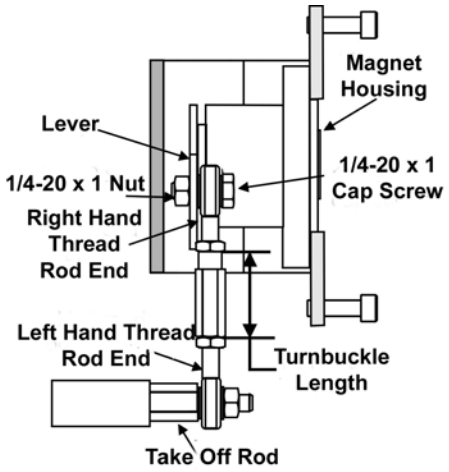


Figure 11 Reciprocating Linkage

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 positioner from a reciprocating valve perform Steps 1 - 12 on pages page 13 - page 14 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. Mount the kit mount assembly to the yoke (Figure 12) using helical spring washer 5/16, flat washer 5/16 and hex screw 5/16-18x44.5 [1.75] LG.

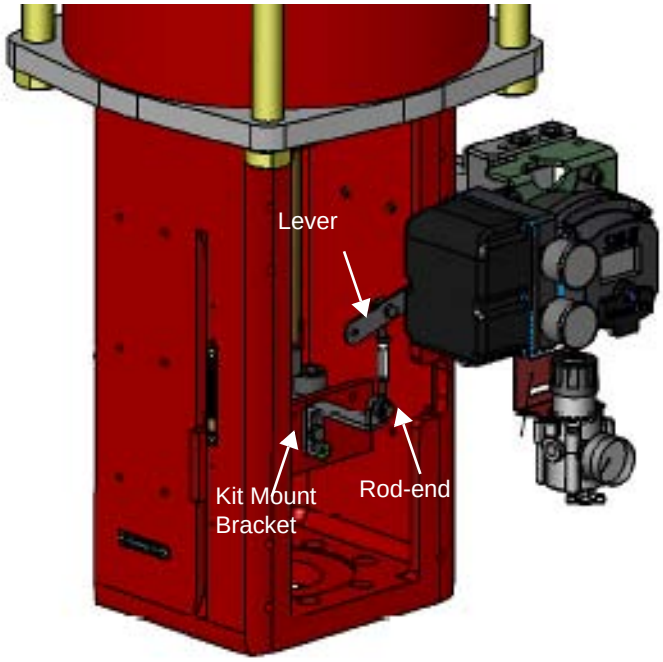


Figure 12 84/85/86 Valve

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 13.

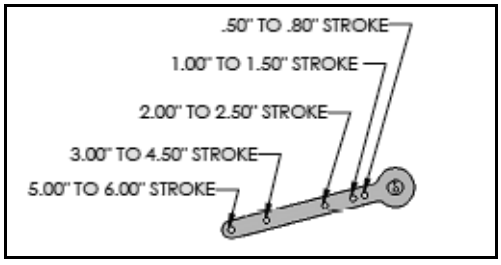


Figure 13 Stroke Settings

4. Mount take-off bracket to stem block at angle which keeps turnbuckle assembly parallel to stem (Figure 14) 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.

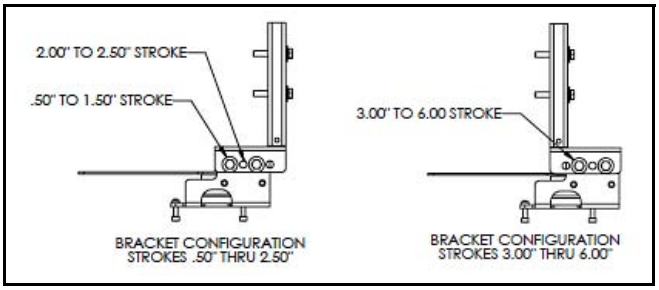


Figure 14 Bracket Configuration Strokes .5 - 2.50” and 3-6”

5. Ensure the turnbuckle assembly is parallel to the stem and the magnets are in the valve closed position (Figure 15) and connect to take-off bracket.

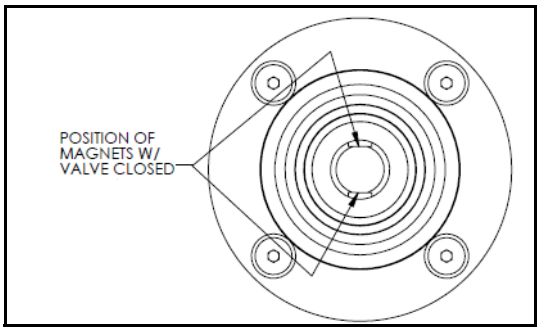


Figure 15 Magnet Position with Valve Closed

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

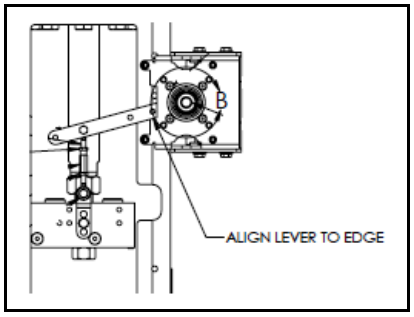


Figure 16 Lever Alignment

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.

Installing the SVI II AP Remote Position Sensor

An option that is available for the SVI II AP is the Remote Position Sensor. The Remote Position Sensor is a remotely mounted position-sensing device, that is connected electrically to an SVI II AP valve positioner. It is used as position feedback in applications where direct mounting of an SVI II AP to a valve actuator is not practical due, typically but not limited to, extreme vibration, heat or radiation.

The Remote Position Sensor is a potentiometer located in an enclosure which can be mounted on a valve or damper to indicate stem position when connected to a suitable receiver. There is a three wire connection provided on a screw terminal block to interconnect to the receiving device.

The SVI II AP Remote Position Sensor is suitable for installation indoors and outdoors in an industrial environment. Mounting kits are provided to permit mounting on a variety of valves.

Table 4 Remote Position Sensor Specifications

Operating Temperature Range	-55°C to 125°C (-67°F to 257°F)
Vibration Limits	Vibration resistant according to ISA 75.13
Maximum Distance to SVI II AP	30 M (100 Ft.) maximum recommended, for setups with distances of more than 30 M consult the factory
Recommended Wiring	Shielded Cable up to 14 AWG

WARNING

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

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.*

Remote Position Sensor Mounting Instructions

Tools Needed:

- 7/16" open end wrench
- 6 mm hex wrench
- 2.5 mm hex wrench
- Blade screwdriver

NOTE

The instructions below cover mounting the Remote Mount Sensor to both reciprocating and rotary actuators. The two mounting kits share only one part; the ¼-20 hex head cap screws. Although the assembly steps are similar, differences are noted. Refer to Figure 17 on page 25 when reading these instructions for proper orientation.

1. Fasten the mounting bracket to the actuator yoke
   a. For *reciprocating* actuators, use the (2) 5/16-18 hex head bolts supplied.
   b. For *rotary* actuators, use the (2) 5/16-18 hex socket countersunk screws supplied.
2. Connect the Remote Mount Sensor (RMS) to the mounting bracket using (4) ¼-20 hex head cap screws. Orient the RMS as shown in Figure 17, such that the conduit opening faces the ground.
3. Attach the feedback lever to the RMS output shaft.
   a. For reciprocating mounting; Slip the feedback lever onto the RMS output shaft, and thread the M5 set screw into the hole. Be sure to align the setscrew hole of the feedback lever with the flat of the RMS output shaft such that the setscrew contacts the flat. Next, connect the take-off rod to the split clamp of the actuator stem. Finally, connect one end of the turnbuckle to the feedback lever, and the other end to the take-off rod. (Refer to Table 5 on page 25 for turnbuckle length.)
   b. For rotary mounting; First connect the feedback lever (with the pin) to the actuator shaft (protruding from the actuator yoke) using the supplied hardware. This hardware includes a spacer, a spring washer and a ¼-28 hex head cap screw. Next, attach the second feedback lever (with the slot) to the RMS output shaft and at the same time, insert the pin of the first feedback lever into the slot. It may be necessary to loosen some of the parts in order to get everything to align properly. Finally, thread the M4 socket head cap screw into the setscrew hole of the second feedback lever making sure it contacts the flat of the RMS output shaft.

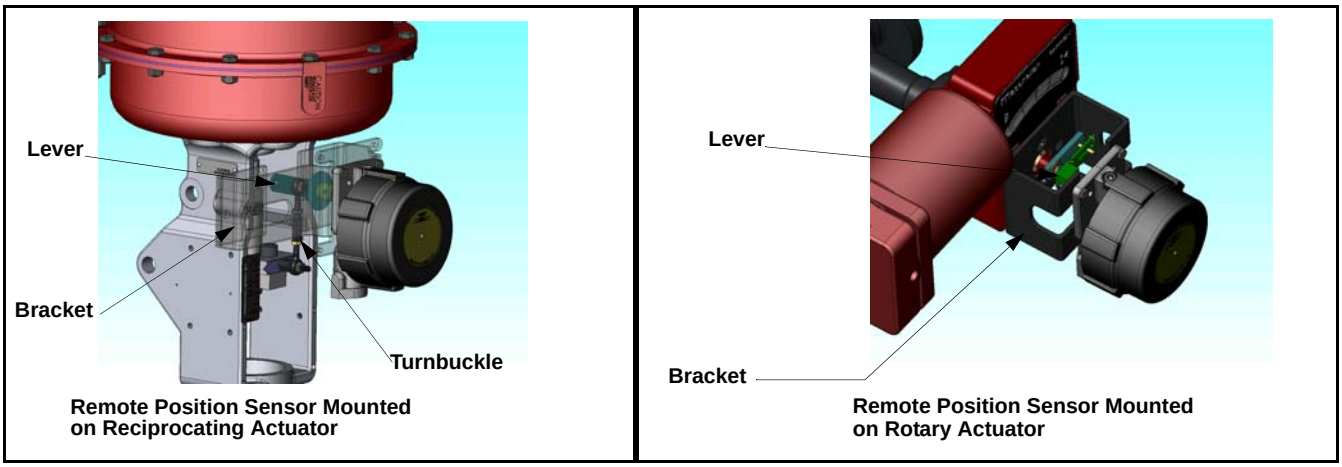


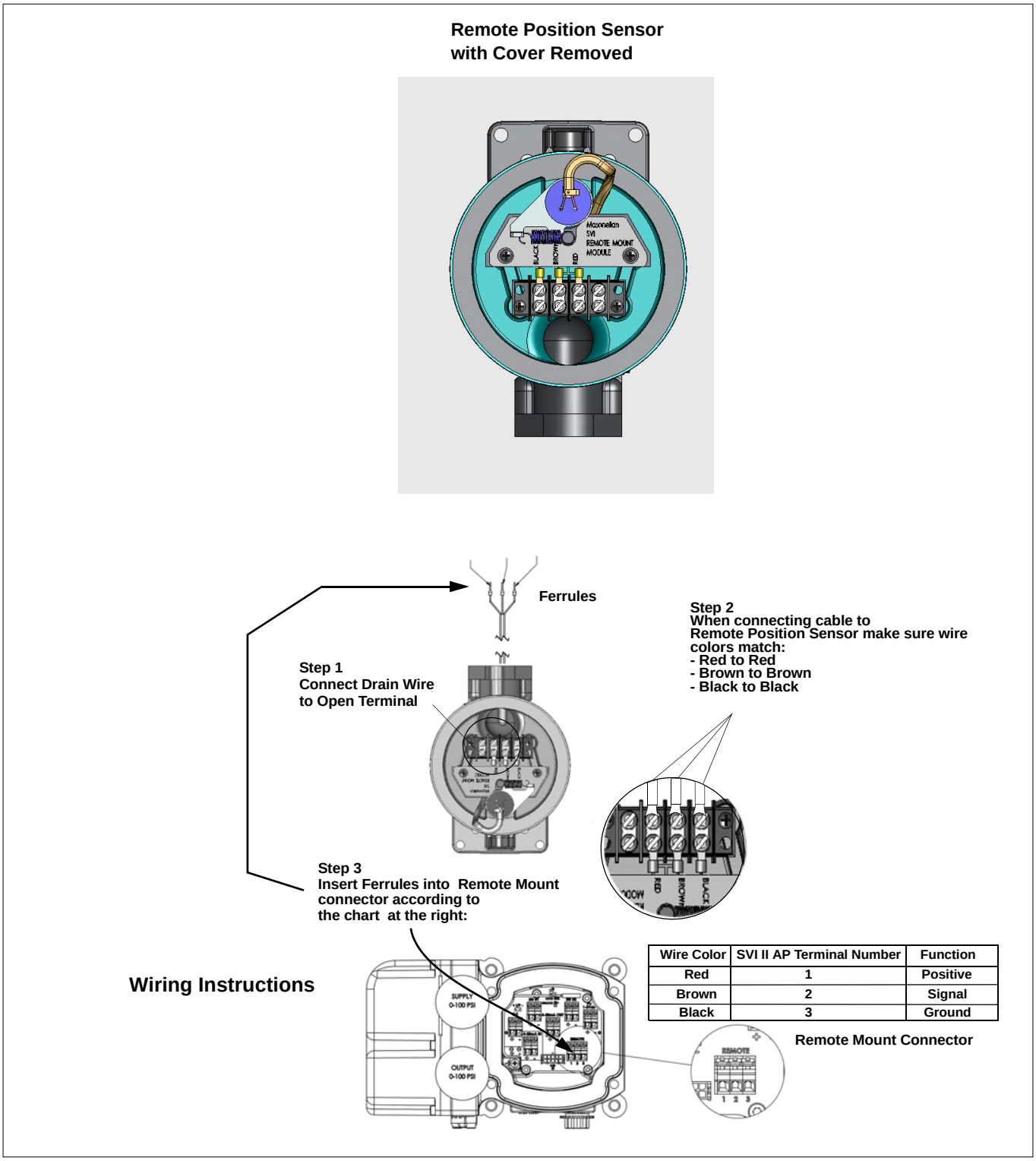
Figure 17 Remote Position Sensor Mounting

Table 5 Remote Position Sensor Turnbuckle Length

Actuator Size	Stroke	Turnbuckle Length
6 and 10	0.5 - 0.8" (12.7 - 20.32 mm)	1.25" (31.75 mm)
10	0.5 - 0.8" (12.7 - 20.32 mm)	1.25" (31.75 mm)
10	>0.8 – 1.5" (20.32 - 41.5 mm)	1.25" (31.75 mm)
16	0.5 - 0.8" (12.7 - 20.32 mm)	2.90" (73.66 mm)
16	>0.8 – 1.5" (20.32 - 41.5 mm)	2.90" (73.66 mm)
16	>1.5 – 2.5" (41.5 - 63.5 mm)	2.90" (73.66 mm)
23	0.5 - 0.8" (12.7 - 20.32 mm)	5.25" (133.35 mm)
23	>0.8 – 1.5" (20.32 - 41.5 mm)	5.25" (133.35 mm)
23	>1.5 – 2.5" (41.5 - 63.5 mm)	5.25" (133.35 mm)

4. Remove the M8 cover-retention screw of the RMS and unscrew the cover to gain access to the terminal strip.
5. Route the cable from the SVI II AP to the RMS and thread the cable through the conduit at the bottom of the housing.
6. Using a blade screwdriver, loosen the screws on the terminal strip and connect the wires; black-to-black, brown-to-brown and red-to-red. Then retighten the screws. Refer to Figure 18 on page 26 for Remote Position Sensor Wiring.
7. Connect the cable's shielding drain wire to the unlabeled terminal.
8. Screw on the RMS cover and replace the M8 cover-retention screw.

9. At the other end of the cable, insert the ferrules into the terminal labeled *REMOTE*; black-to-black, brown-to-brown and red-to-red. When performing this step, be careful not to side-load the terminal levers.



Wire Color	SVI II AP Terminal Number	Function
Red	1	Positive
Brown	2	Signal
Black	3	Ground

Figure 18 Remote Position Sensor (Cover Removed) and Wiring

Configuring the SVI II AP for Remote Position Sensing

After the Remote Position Sensor is installed and cabled to the SVI II AP, the SVI II AP needs to be configured so that valve position is sensed by Remote Position Sensor. A digital communication software tool is provided on the CD shipped with the SVI II AP for this purpose. First you must install the software tool, SMARTS Assistant, from the CD and then using the tool, configure the SVI II AP. (You can also download SMARTS Assistant from the Masoneilan web site, www.masoneilan.com, downloads.)

To install SMARTS Assistant (see Figure 19):

1. From the CD click on **Install Software**.
   The CD displays other available software tools.
2. Click on **Install SMARTS Assistant Standard Edition 2.00.0**. The program automatically installs.

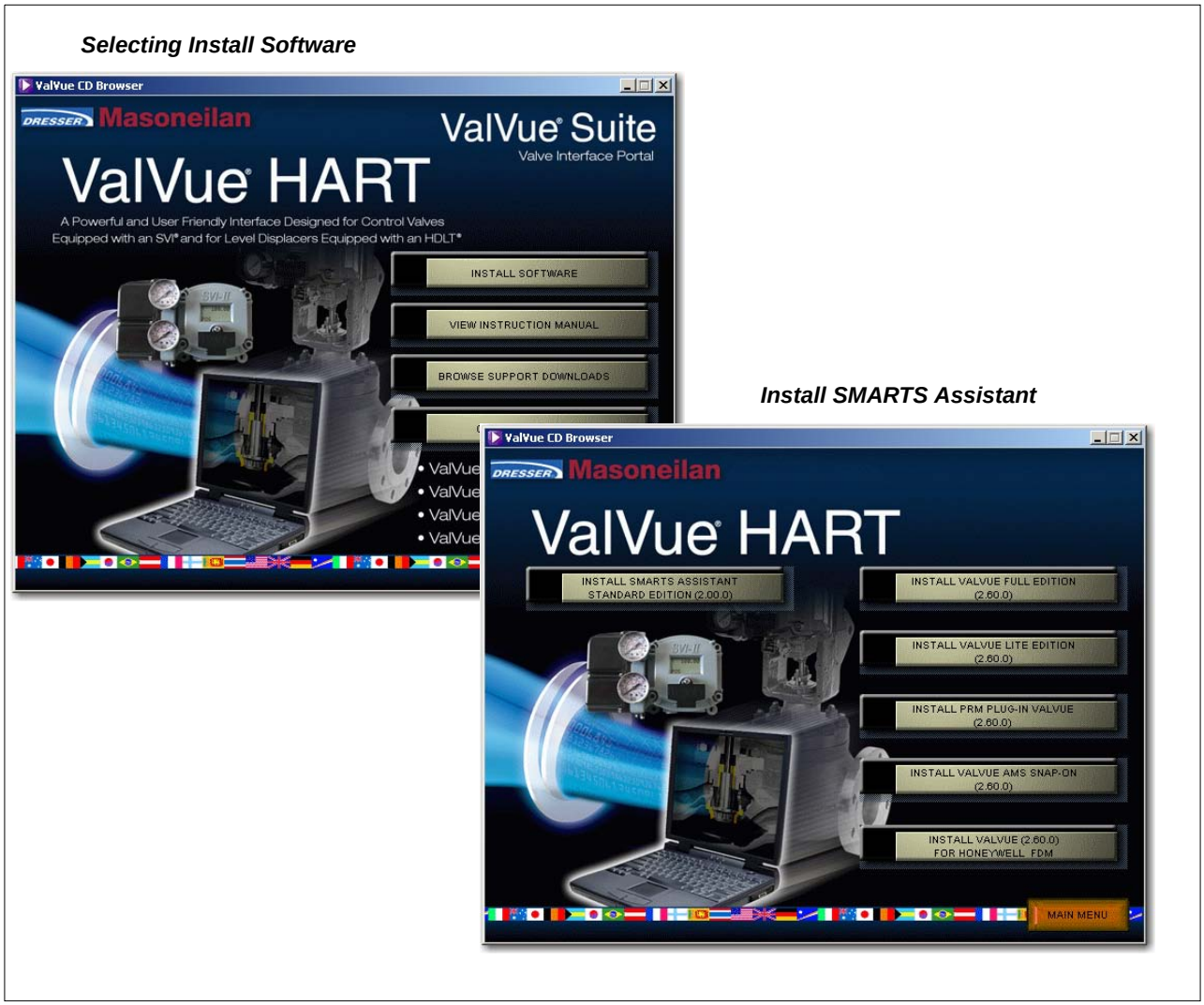


Figure 19 Installing SMARTS Assistant from CD

Configuring the SVI II AP Using SMARTS Assistant

To configure the SVI II AP:

1. Start SMARTS Assistant Standard by clicking the desktop icon or by selecting the program through the Start menu.
   The *Connection* screen appears.
2. Click on **Connection** (Figure 20).
   SMARTS Assistant searches for the SVI II AP to which the Remote Position Sensor is connected, connects the device to the software and device information appears (Figure 20).
3. Select the **Options** tab and the screen appears (Figure 20).
4. Select the **Remote PO** checkbox.
5. Activate the Remote Position Sensor by clicking **Change Options**.
   SMARTS Assistant changes control to the Remote Position Sensor and the message appears.
6. Click **OK** to continue.

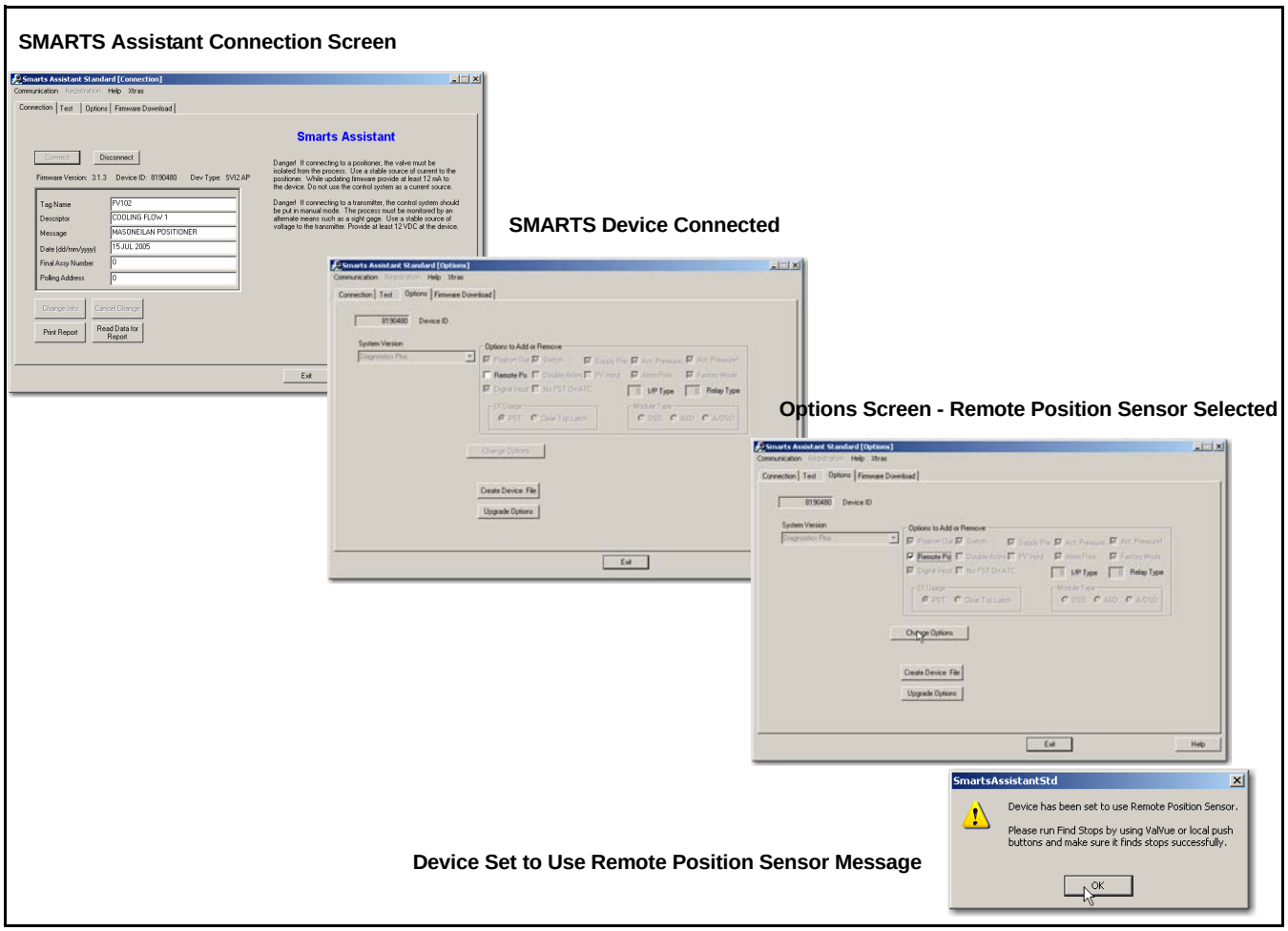


Figure 20 SMARTS Assistant - Commissioning the Remote Position Sensor

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**←).
2. For a single acting actuator - pipe the outbound air from the output pressure port (←**I**) to the actuator.
3. For a double acting actuator - pipe output pressure port one (←**I**) for one side of the actuator and output pressure port two (←**II**) for the other side of the actuator.
4. Air supply:
   - q Supply pressure for single acting SVI II AP: 20 -100 psi (1.4 - 6.9 bar) (138 - 690 kPa)
   - q Supply pressure for double acting SVI II AP: 25 - 150 psi (1.73 - 10.4 bar) (0 - 1035 kPa)
   - q Minimum tubing diameter 1⁄4" (6mmx4mm)

NOTE

The SVI II AP Digital 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 SVI II AP-2 through SVI II AP-3).

Table 6 Air Supply Requirements

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

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 lower of actuator maximum rated supply pressure 100 psi (6.9 bar, 689.7 kPa) for single acting or 150 psi (10.4 bar, 1035 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, 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.

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)** to the valve actuator.
2. Connect air supply and actuator outputs (1⁄4" NPT). Supply pressure is 20 -100 psi (1.4 - 6.9 bar) (138 - 690 kPa). Minimum tubing diameter 1⁄4" (6mmx4mm).

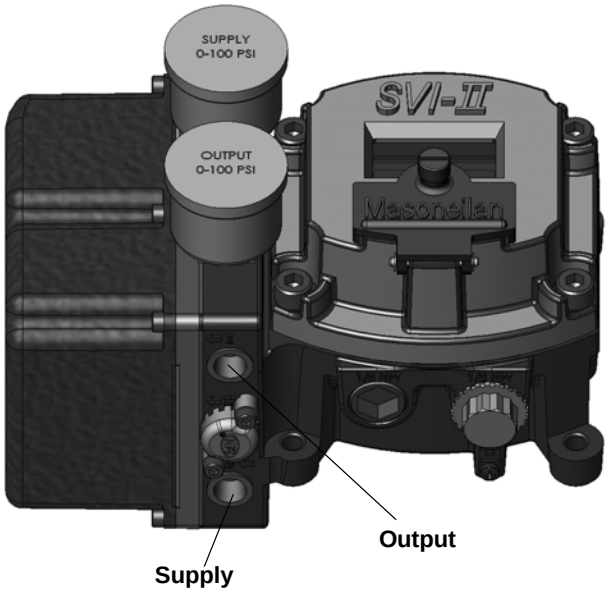


Figure 21 Air Ports on Single Acting Positioner

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.

1. Connect Output 1, labeled ***(←I)*** to the inlet port of the actuator and Output 2 labeled ***(←II)*** to the opposing actuator port (see Figure 22).
2. Connect air supply and actuator outputs (1⁄4" NPT). Supply pressure is 25 - 150 psi (1.4 - 10.4 bar) (138 - 1035 kPa). Minimum tubing diameter 1⁄4" (6mmx4mm)

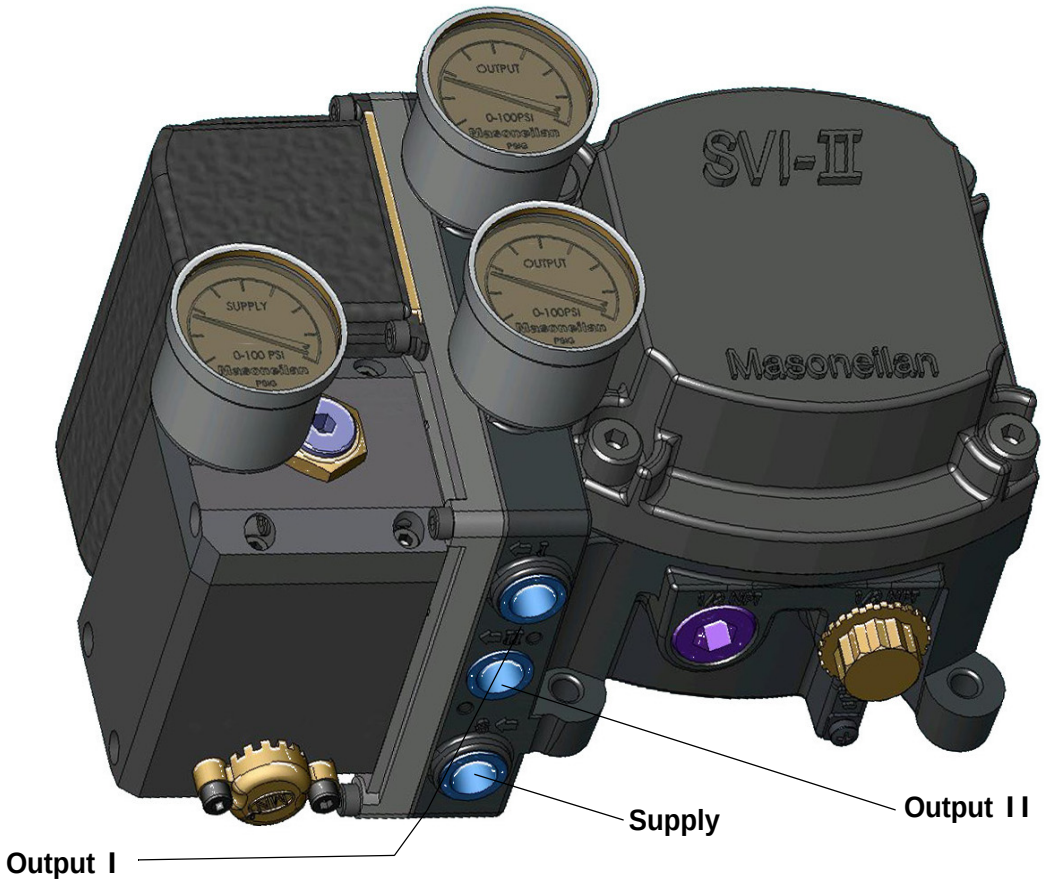


Figure 22 Air Ports on Double Acting Positioner

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, labelled *ACT 1* to the inlet port of the actuator in accordance with Table 7. Output 2 labelled *ACT 2* connects to the opposing actuator port.

Table 7 Double Acting Positioner ATO/ATC Settings for Reciprocating Valves

Actuator Style	Required Position on Loss of Input Current	Connection to Output 1	Action of Positioner	Notes
Piston without spring	Closed	To retract	ATO	Requires backup air supply or reserve tank to failsafe the valve
Piston without spring	Open	To extend	ATC	Requires backup air supply or reserve tank to failsafe the valve
Piston with spring to extend (ATO)	Closed	To retract	ATO	
Piston with spring to retract ATC)	Open	To extend	ATC	

* Assumes that valve closes, down seating, when the actuator extends. The terminology is reversed for an up-seating valve.

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 locale conditions for potentially explosive atmosphere permit the safe opening of the cover.*

Connecting to the Control Loop

The SVI II AP 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 HART® Communication Foundation. 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.

Verify Wiring and Connections

NOTE

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 is properly powered:

1. Connect a DC voltmeter across the input terminals.
2. For an input current between 4 and 20 mA, the voltage varies between 11 V and 9 V respective.
3. Current is read from the local display or with a milliammeter installed in series with the SVI II AP.
4. When voltage exceeds 11 V check that the polarity is correct.

5. If voltage is less than 9 V and polarity is correct, voltage compliance of current source is inadequate.
6. Connect a milliammeter in series with the current signal. Verify that the source can supply 20 mA to SVI II AP input.
7. If 20 mA is not attainable, see troubleshooting.

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.

Wiring Considerations

For a detailed description of wiring guidelines refer to “Wiring Guidelines” on page 80 of this manual.

Check Out and Power Up

3

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 are listed below:

- 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

Physical Inspection

SVI II AP checkout consists of physical and operational checkout procedures. The physical checkout procedures are listed below:

- 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
- Valve Mounting
- The Air Supply

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
2. Air to Close (ATC)
3. Actuator pressure rating
4. Actuator bench range
5. 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 23 on page 37.

For rotary valves, or for actuators with rotations greater than 60°, the magnet assembly must be aligned as shown in Figure 24 on page 38.

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 26 on page 39 for details).

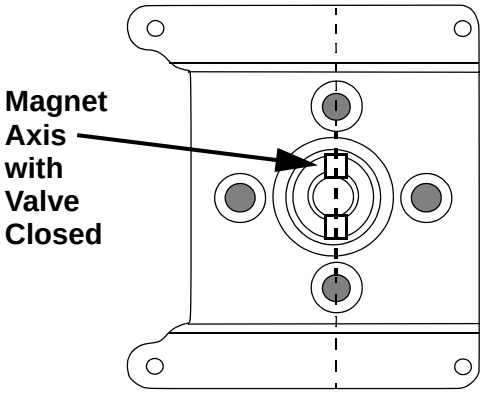


Figure 23 Magnet Orientation for Rotary Valves with Valve Closed

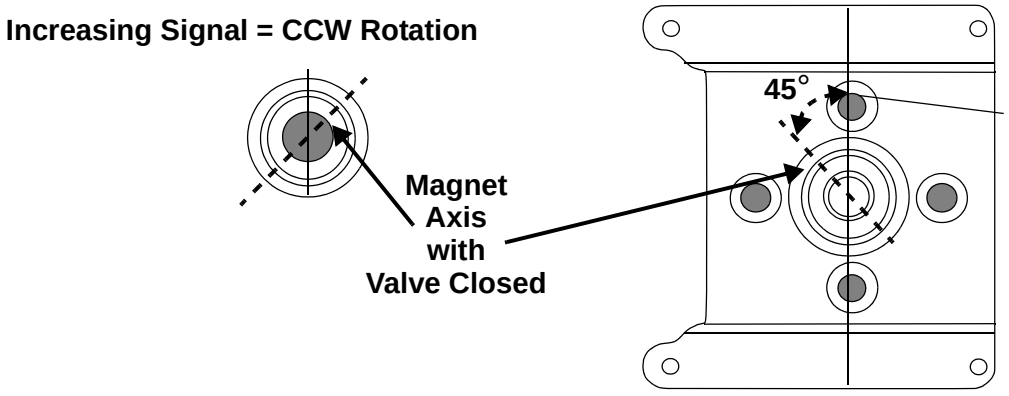


Figure 24 Magnet Orientation for 90° Valve Rotation with De-energized Actuator

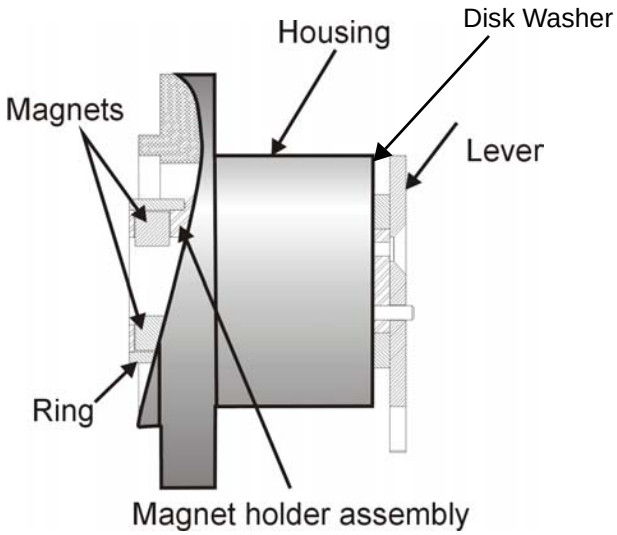


Figure 25 Magnet Holder for Reciprocating Valves

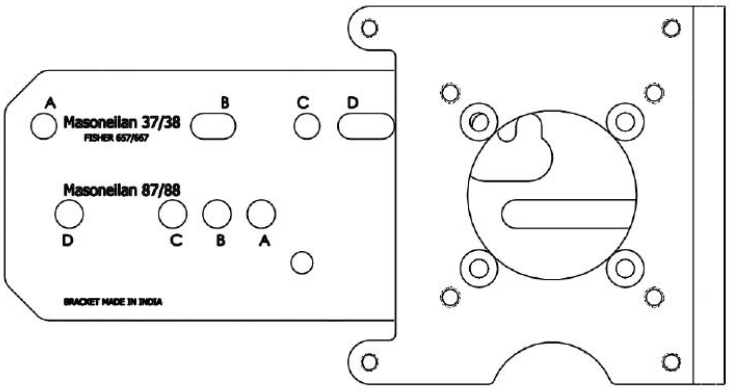


Figure 26 Reciprocating Valve Mounting Bracket

Using ValVue to Check Magnet Position

Use this procedure to check the magnet using ValVue:

1. Connect to the positioner in accordance with the ValVue instructions. For further information refer to the ValVue Instruction Manual.
   a. Run ValVue.
   b. Select the installed positioner from the list of *Connected Devices*.
   c. Select the: **Check** tab to view the current operating conditions of the selected positioner.
2. The Raw Position Value should be between – 1000 and +1000 when a reciprocating or less than 60° rotation rotary valve is closed.
3. The Raw Position Value should be between –1000 and +1000 when a greater than 60° rotation rotary valve is at 45° of rotation (mid stroke for a 90° 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 the 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	
	SVI II AP-2	SVI II AP-3
4 - 20 mA Input Setpoint	√	√
Display/ Pushbuttons	Optional	Optional
Remote Mount Input	√	√
Process Variable 1 - 5 VDC		
SW #1 and #2	Optional	Optional
4 - 20 mA Out Position Tx	Optional	Optional

1. Confirm that all applicable connections to the electronics module connectors are correct.

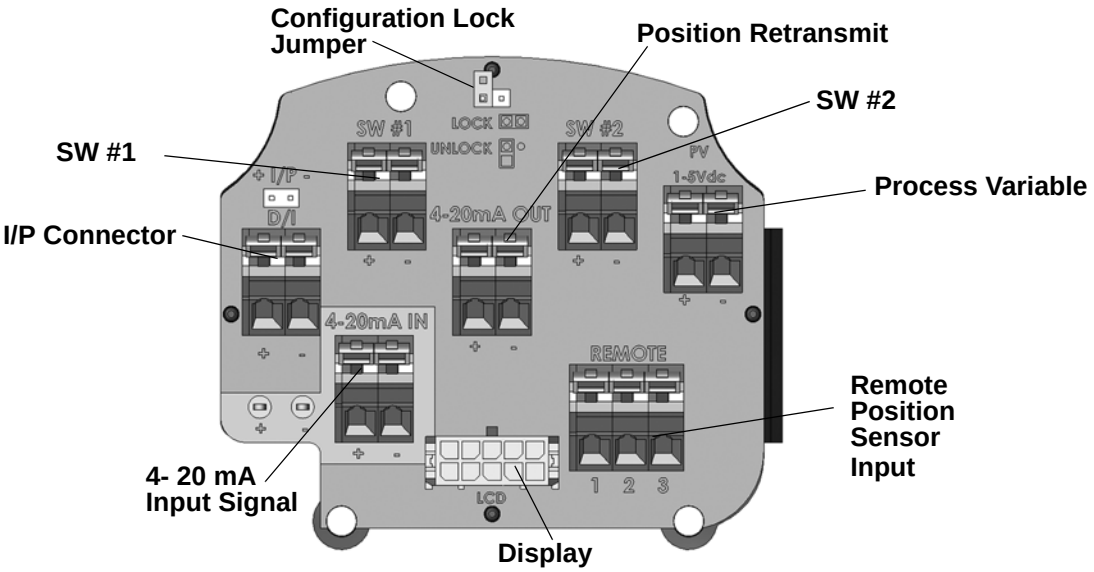


Figure 27 Connections to Electronics Module (via Terminal Board)

NOTE

When an SVI II AP is turned on it is advisable to 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 27 on page 41).
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 Lite 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 the damage the SVI II AP. A proper current source explicitly enables adjustment of the current in mA, not Volts.

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 27 on page 41).

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.*
5. Proceed to Calibration and Configuration.

* 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 Lite. 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 27 on page 41. 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 HHC 375 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.

Using the Digital Interfaces

4

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
- Any HART capable Host loaded with the DD for the SVI II AP

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.

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 HHC 375 is approved for Intrinsically Safe use in Hazardous Areas in accordance with SVI II AP Approvals and in accordance with the HHC approvals. See Appendix C and Chapter Six 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 Lite is provided with all SVI II AP positioners and is recommended for set up, service and maintenance where a PC or laptop is permitted. See "Configuring and Calibrating with ValVue" on page 77 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 Positioner as a local device is controlled through the optional device-mounted pushbuttons and digital display, shown in Figure 28 on page 47. 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

When an! is displayed in the SVI II AP display window, it indicates that there is instrument status available.

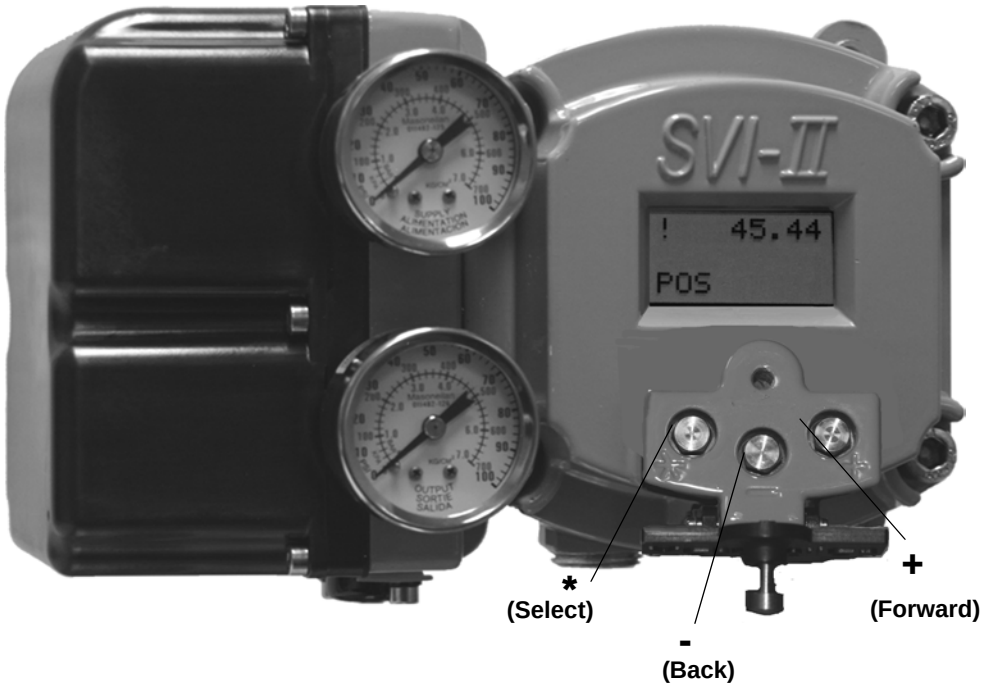


Figure 28 SVI II AP Display

To determine how to display and select a specific parameter value or configuration option, refer to the menu structure diagrams shown in Figure 29 on page 49 through Figure 32 on page 56. 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.

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.

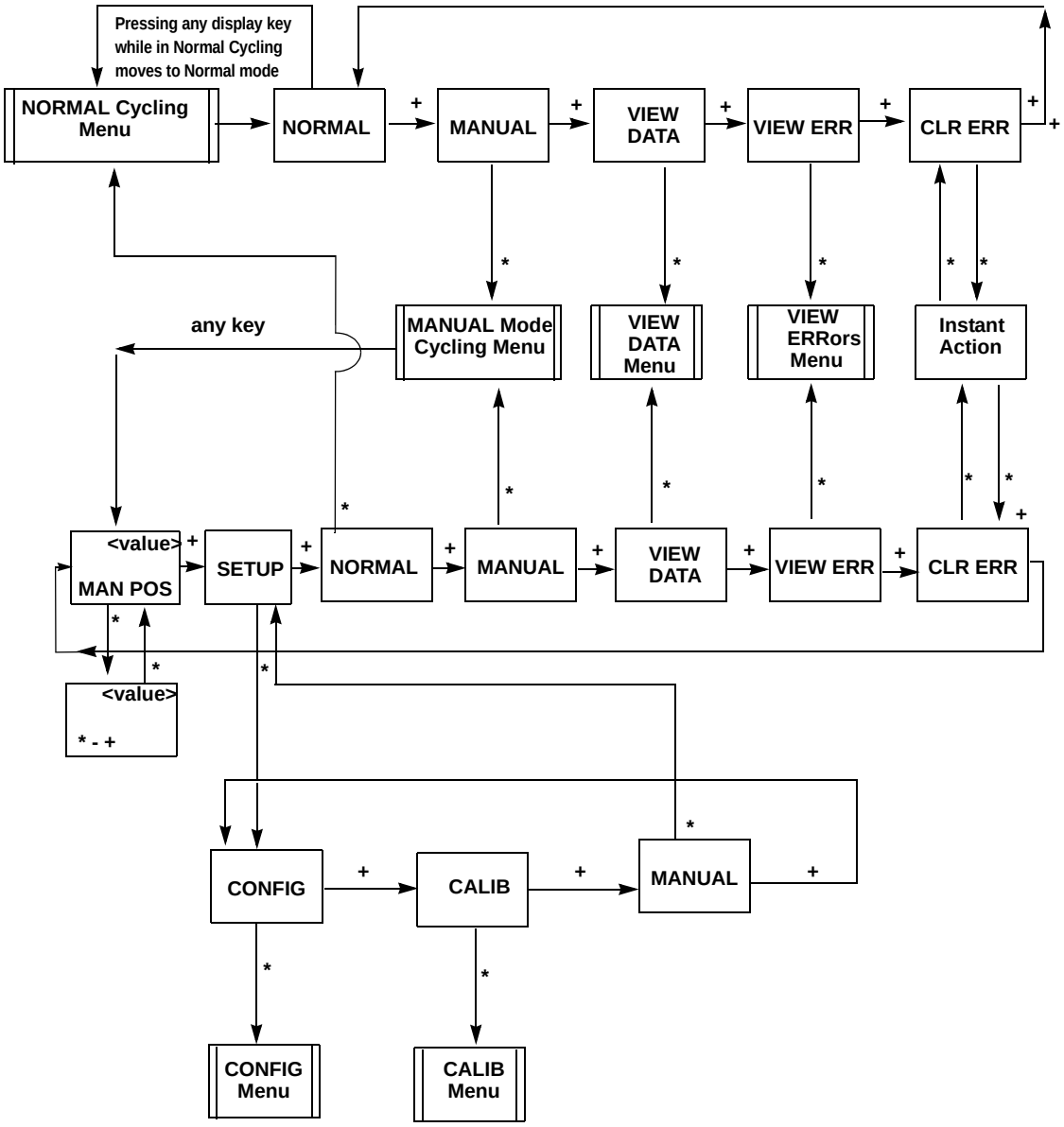


Figure 29 NORMAL Operation and MANUAL Menu Structures

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.

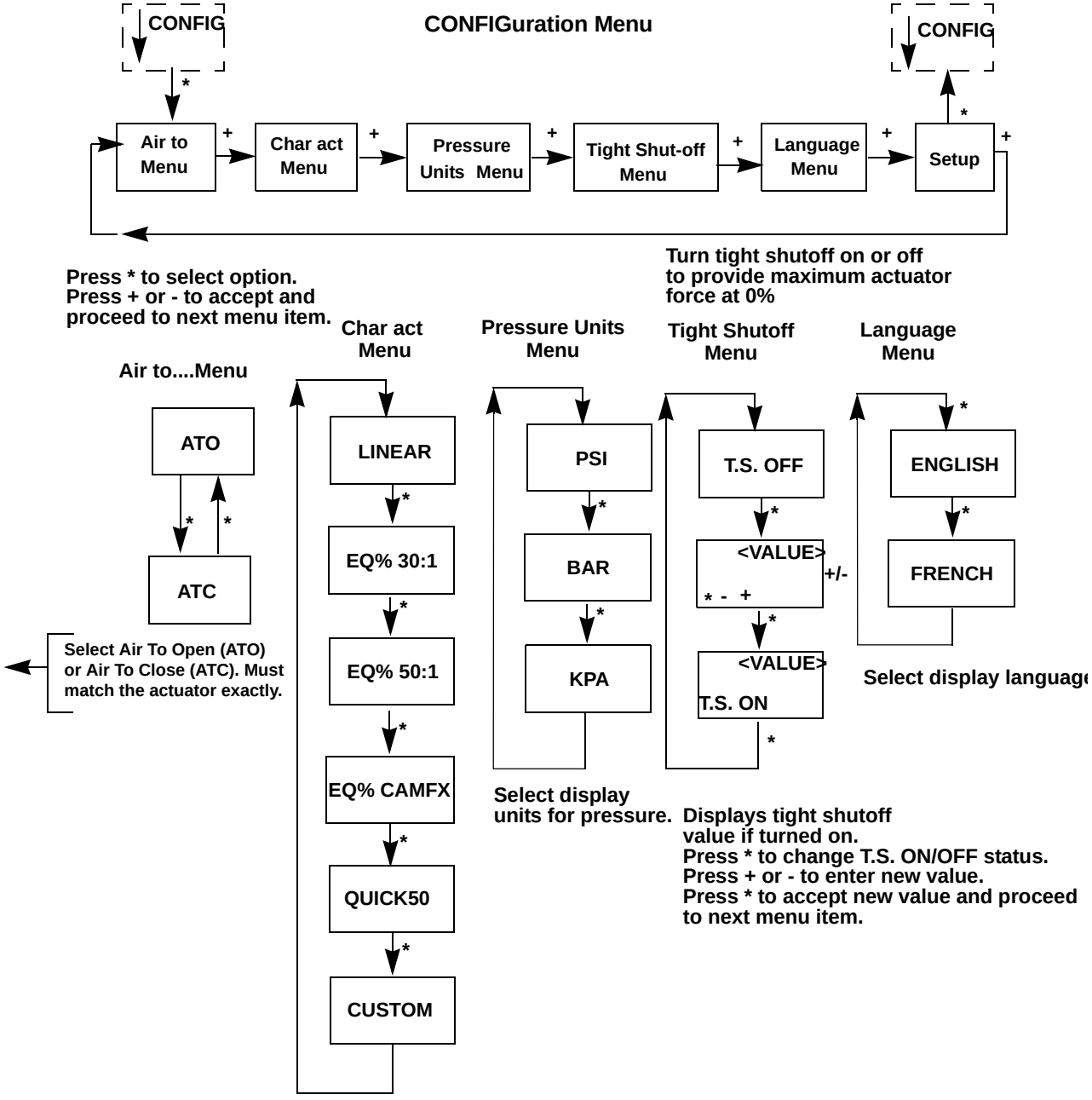


Figure 30 CONFIGure Menu

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 10 on page 52 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 config 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 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 10 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)

Table 10 Guidelines for Characteristic Choice (Continued)

Valve Type and Built In Characteristic	Desired Installed Valve Position Characteristic	Standard Positioner Characteristic Selection
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 31 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.

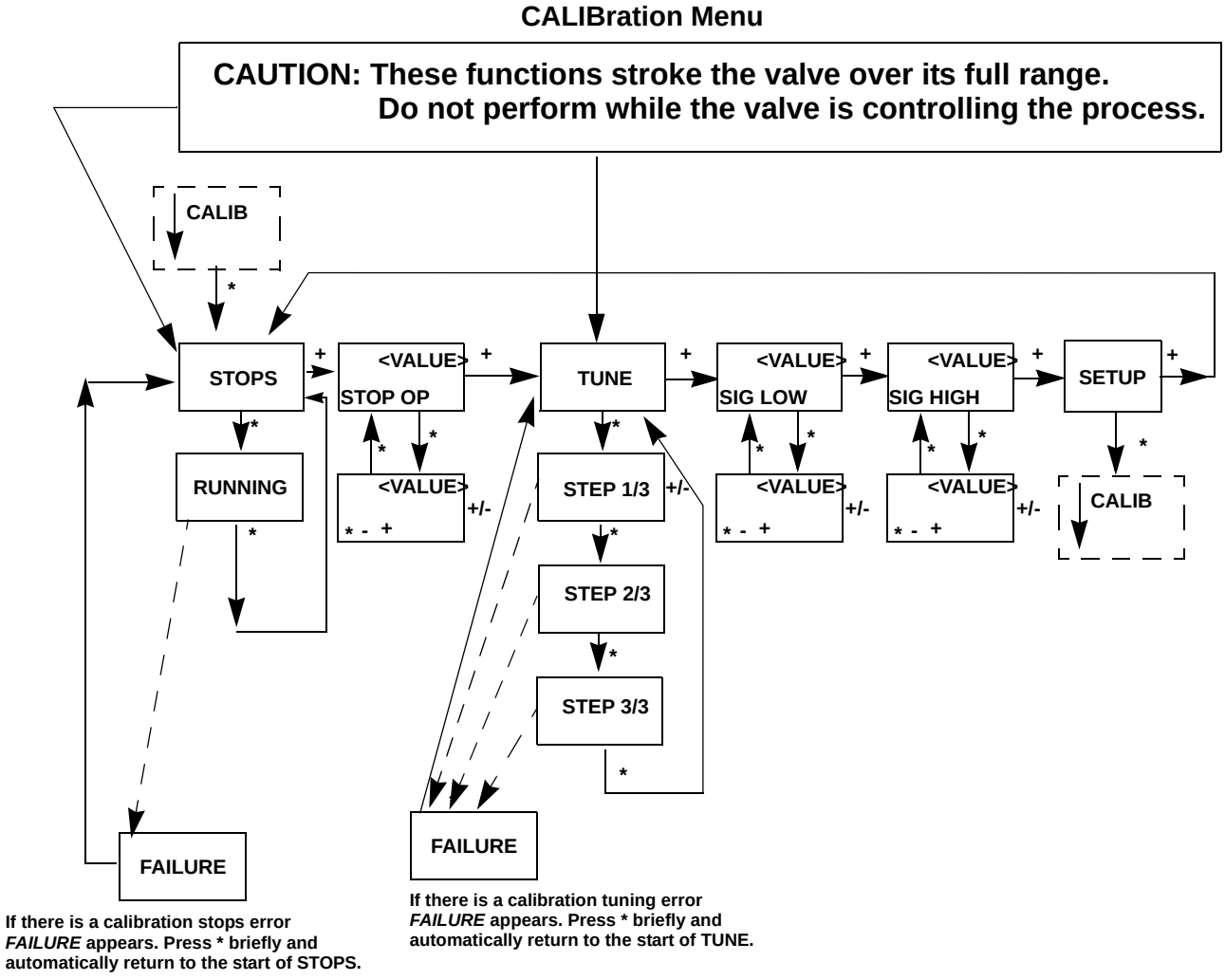


Figure 31 CALIBration Menu

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.

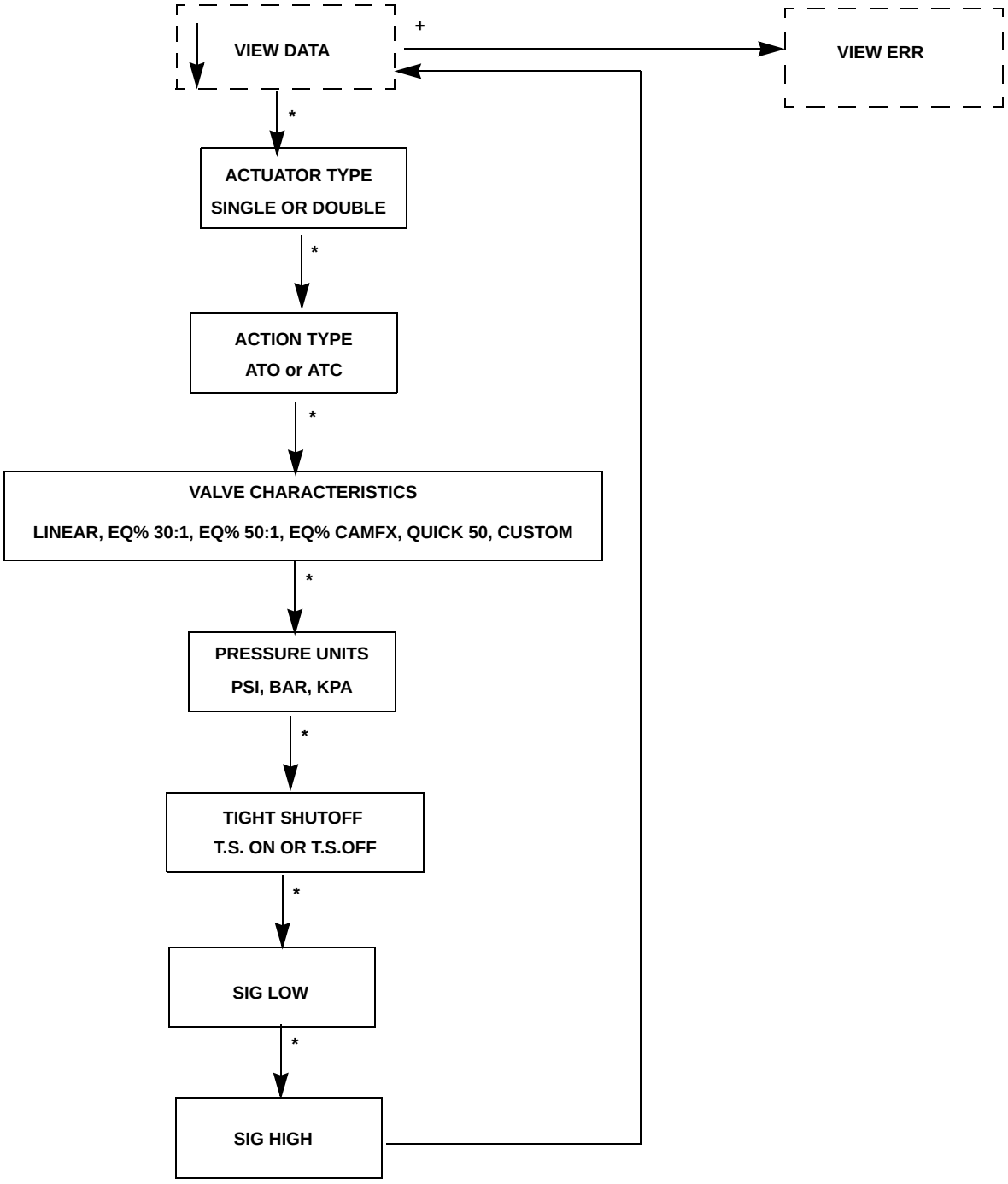


Figure 32 VIEW DATA Menu

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 the fault messages in turn.
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).

FAILSAFE Menu

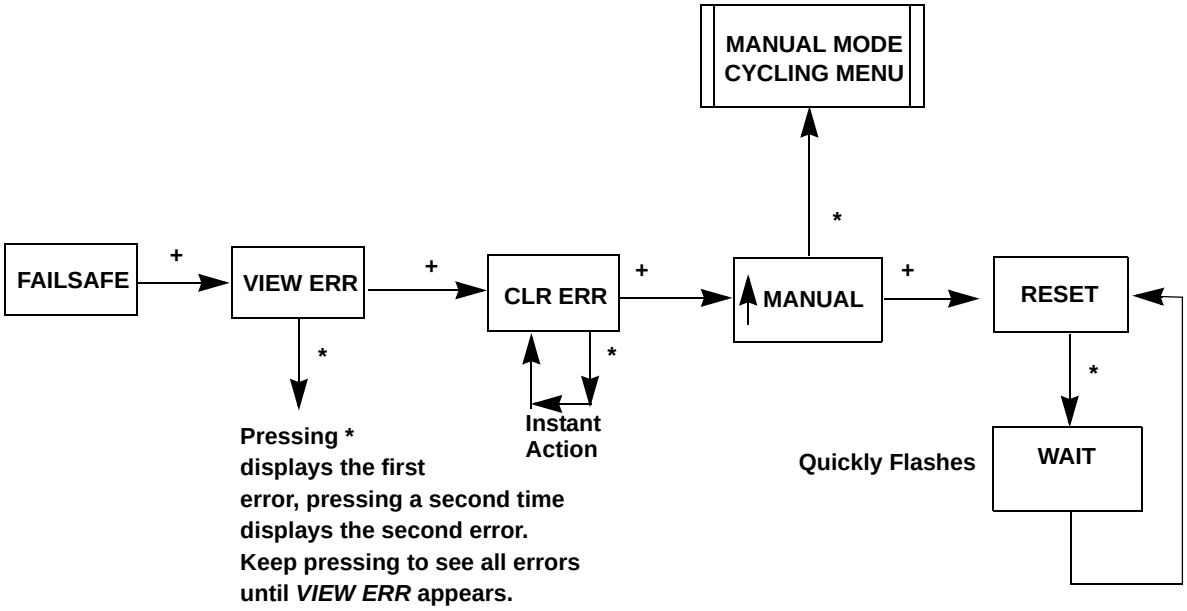


Figure 33 FAILSAFE Menu

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 11 Error Messages

LCD	Description	Action	Cause
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
LOW POWER	Input current < 3.6 mA	Takes the device to low power	
ACT ERR	Positioner unable to position a valve normally	Warning	
AIR LOW	Supply pressure option is configured and supply pressure is < 10 psi (.69 bar, 69 kPa). Otherwise I/P pressure is below 0.8 psi (.05 bar, 5.5 kPa)	Warning	Mechanical or pneumatic problem
POS ERR	The position error exceeds configured limit for more than configured time	Warning after T1 and Failsafe	Pneumatic/ mechanical, configuration, loose magnet
KEYBOARD	LCD/Button Failure	Warning	Damaged buttons or LCD electronics
MARGN PWR	Input signal is insufficient to proceed		
CALIB ERR	Calibrate failed	Warning	Invalid values for current calibration and input range by HART commands
STOP ERR	Calibration error. Find STOPS was unsuccessful.	Warning	Configuration, calibration
TUNE ERR	Auto tune failed	Warning	Mechanical or pneumatic problem causes tuning failure
STD DIAG	A standard diagnostic procedure failed to complete	Warning	Pneumatic / mechanical, configuration

Table 11 Error Messages (Continued)

LCD	Description	Action	Cause
EXT DIAG	An extended diagnostic procedure failed to complete	Warning	Pneumatic / mechanical, configuration
CMD STOP	HART command aborted	Warning	Bad data range or data limitation
BIAS ERR	Position algorithm error in output bias	Warning	Pneumatic/ mechanical
I/P LIMIT	I/P current too high or too low	Warning	Electronic hardware
TEMP ERR	Internal circuit temperature high (>80° C, 176° F) or low (<-40° C, -40° F)	Warning	Environment
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	
RAM ERR	RAM data item had a bad checksum	Warning	
FLASH ERR	Flash memory failed checksum test	Failsafe	Flash memory failed checksum test
STACK ERR	A valid hidden record (in RAM) existing upon reset indicating that a stack overflow had occurred	Warning	
FCTRYMODE	Factory mode failure	Failsafe	
NVM ERR-T	An FRAM record and its copy both have CRC errors	Warning	
REF VOLT	Temperature compensated I/P current is out of range for 5 reads in a row or the raw reading it out of range	Failsafe	
POS SENSR	Internal error in Hall Effect sensor	Warning	Electronic hardware
SIG SENSR	Internal error in sensing of 4 - 20 mA	Warning	Electronic hardware
PRES1 ER	Temperature compensated pressure sensor 1 reading is outside the range	Warning	
PRES2 ER	Temperature compensated pressure sensor 2 reading is outside the range	Warning	

Table 11 Error Messages (Continued)

LCD	Description	Action	Cause
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	
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	
PRES5 ER	Temperature compensated pressure sensor 5 reading is outside the range	Warning	
NVM ERR-W	Writer to FRAM fails or data repairing in FRAM fails	Warning	
IRQ FAULT	Valid hidden record (in RAM) existing upon reset that indicates that an illegal interrupt occurred	Warning	
DATA ERR	Internal software error data overrun	Failsafe	CPU/firmware
MCU ERR 1	Micro-Controller Self Check failed	Failsafe	
SW ERR	Software self check error	Failsafe	CPU/firmware

Display and Clear Error Messages

Use this procedure, VIEW ERR, to view fault codes and messages listed in Table 11 of this manual.

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 11 on page 59 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:
   - q ***** to return to NORMAL operating mode, if *NORMAL* appears.
   - q ***** 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 HART Communication Foundation. When the DD is installed in a host communication device then the host can readily access all the information in the smart field device. The SVI II AP registered DD will be available from HART Communication Foundation when it next publishes the HART DD. The SVI II AP DD can be obtained from Masoneilan or by contacting your local Masoneilan 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.

ValVue

The third digital interface available for the SVI II AP is Masoneilan's ValVue software. ValVue provides a user friendly interface that facilitates set up and operation of the positioner. ValVue is used to configure, calibrate and perform valve diagnostics with the SVI II AP utilizing HART communications protocol.

The SVI II AP is shipped with a free version of ValVue Lite, that is ready to use without registration. Please refer to the ValVue Instruction manual included on the ValVue CD ROM.

Installation of ValVue Software, and Registration

For assistance contact the nearest Masoneilan Dresser Sales Office, your local Masoneilan representative or email svisupport@masoneilan.com.

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

System Requirements

ValVue Lite runs on IBM® compatible computers. Minimum requirements for all versions of ValVue software are:

- Windows® 2000, XP, and Windows Server 2003
- 64 MB RAM
- Hard drive available space 35 MB
- A CD ROM drive
- An available Serial or USB port
- A HART modem and appropriate cables

Install the ValVue software in the PC in accordance with the instructions on the CD-ROM jacket. After installation select ValVue from the program group, and double click to begin. See Figure 34, which shows the screen for setting the ValVue options. Be sure to set the COM port to the serial output connection attached to your PC modem. Checking the Allow Multidrop option (as shown) slows down the search for active devices on single drop current loops. It is recommended only for split range and multiplexor applications.

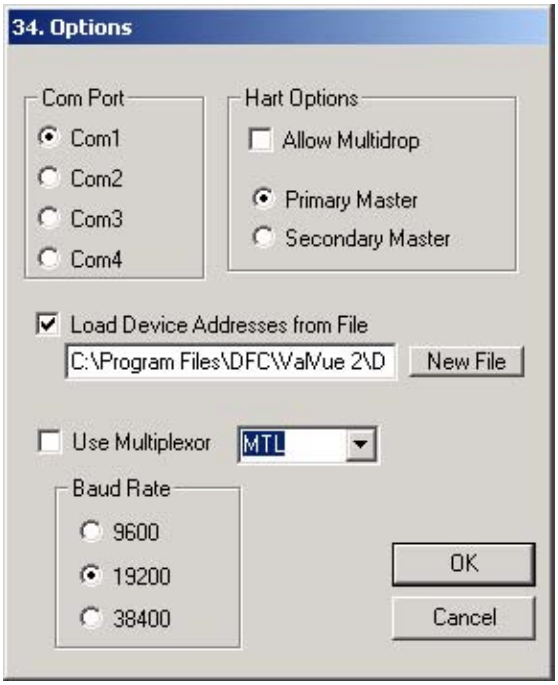


Figure 34 ValVue Options

Configuration and Calibration

5

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.

ValVue Software

The SVI II AP is shipped with a free version of ValVue Lite and a trial version of ValVue.

ValVue Lite

ValVue Lite software is shipped with each SVI II AP for positioner calibration and configuration. ValVue Lite software is offered without registration. It provides sufficient functionality to fully commission, configure, and start up a positioner on a control valve.

System Requirements

ValVue Lite runs on IBM compatible computers. Minimum requirements for all versions of ValVue software are Windows 2000, and XP, 64 MB RAM, a serial port connected to a HART modem, and a CD-ROM drive.

Full Trial Version

The SVI II AP comes with a copy of ValVue Trial Version software that can be used for sixty days without a license. After the 60-day trial period, ValVue does not execute and you must register. ValVue, full version, provides advanced diagnostic, maintenance capabilities and basic calibration and configuration for the SVI II AP. The SVI II AP performs valve diagnostics and in ValVue displays stroking speed, step response, cumulative travel, cycles, and operation in near-closed position. The software stores test results for comparison with future results for predictive maintenance. Password protected access to remote instruments is set up with administration features. The fully licensed ValVue software is available as an upgrade.

Pushbuttons and Local Display for Configuration and Calibration

The pushbuttons and local display are thoroughly described in “Using the Digital Interfaces”, “Pushbuttons and Local Display” on page 46 of this manual.

Pushbuttons Summary

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.

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 Lite. 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 12 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 27 on page 41. 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 HHC 375 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.

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 premounted 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

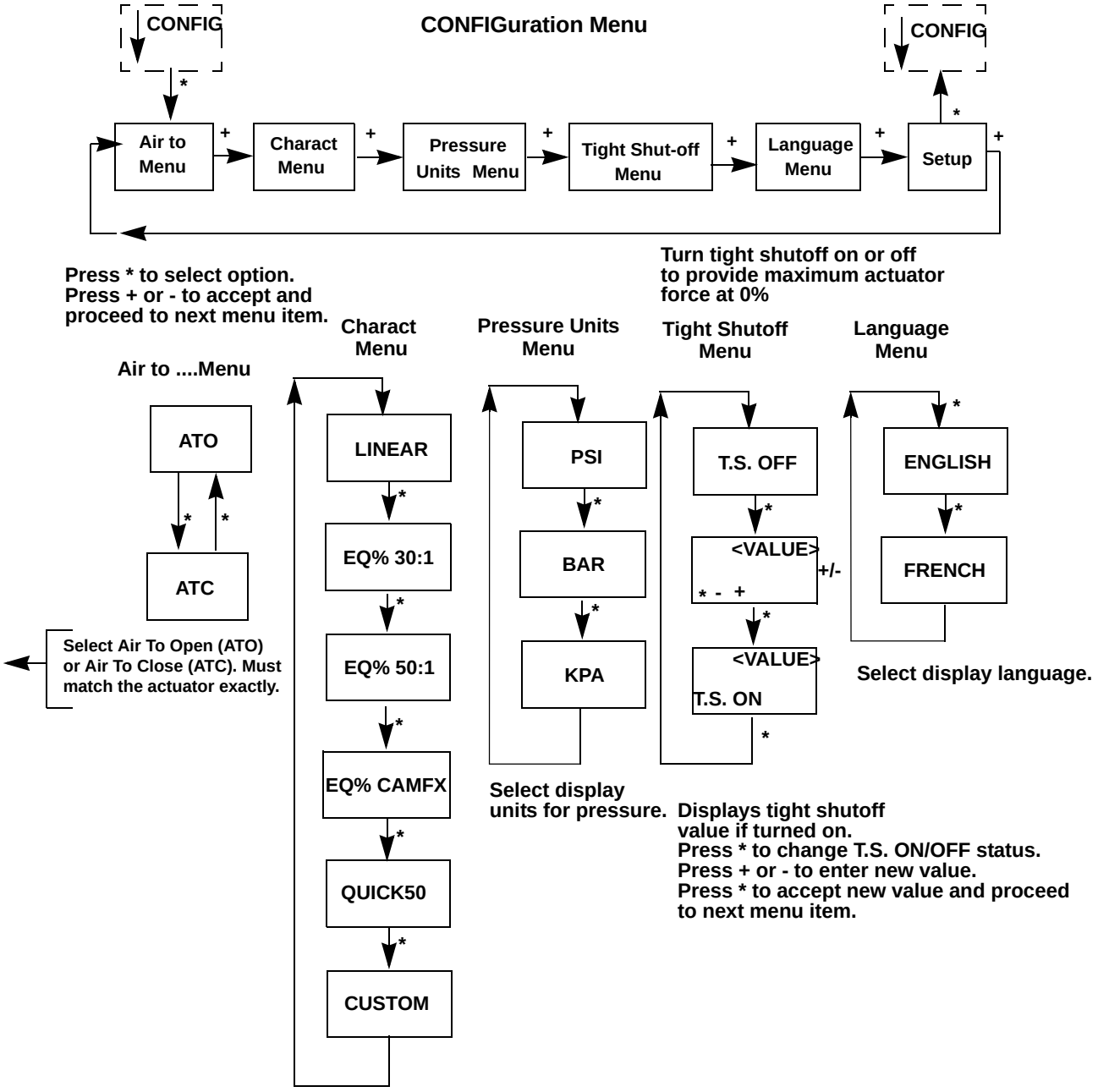


Figure 35 Configuration Pushbutton Guide

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 36 on page 74):

1. Observe the display following power-up. The SVI II AP powers up in the previously active mode either MANUAL or NORMAL (operating) mode:
   - q If in NORMAL mode, the display alternates between *POS* and *SIGNAL* indicating Normal mode.
   - q 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 ***** to cause the valve to stroke and to automatically calibrate 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.

CAUTION

***DO NOT** perform **STOPS** while the valve is controlling the process.*

CAUTION

***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 it's full range.

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:
   - q Correct, press **+** to advance to the next item.
   - q 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:
   - q Correct, press **+** to advance to the next item.
   - q 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.

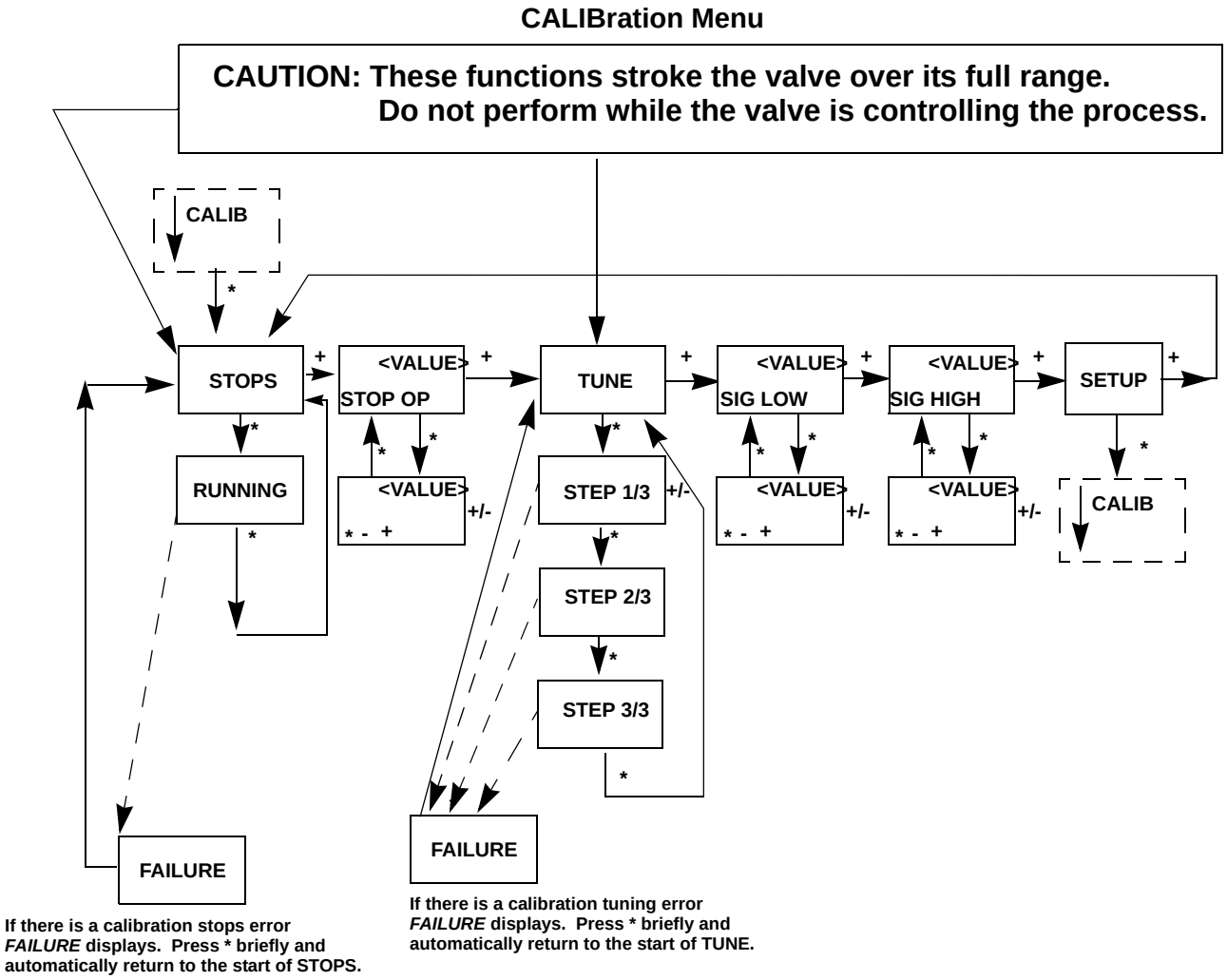


Figure 36 Calibration Pushbutton Guide

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 (HHC) to the SVI II AP as shown in Figure 37. Refer to the Product Manual for the HART Communicator included with the HHC375 or other HART communication devices.

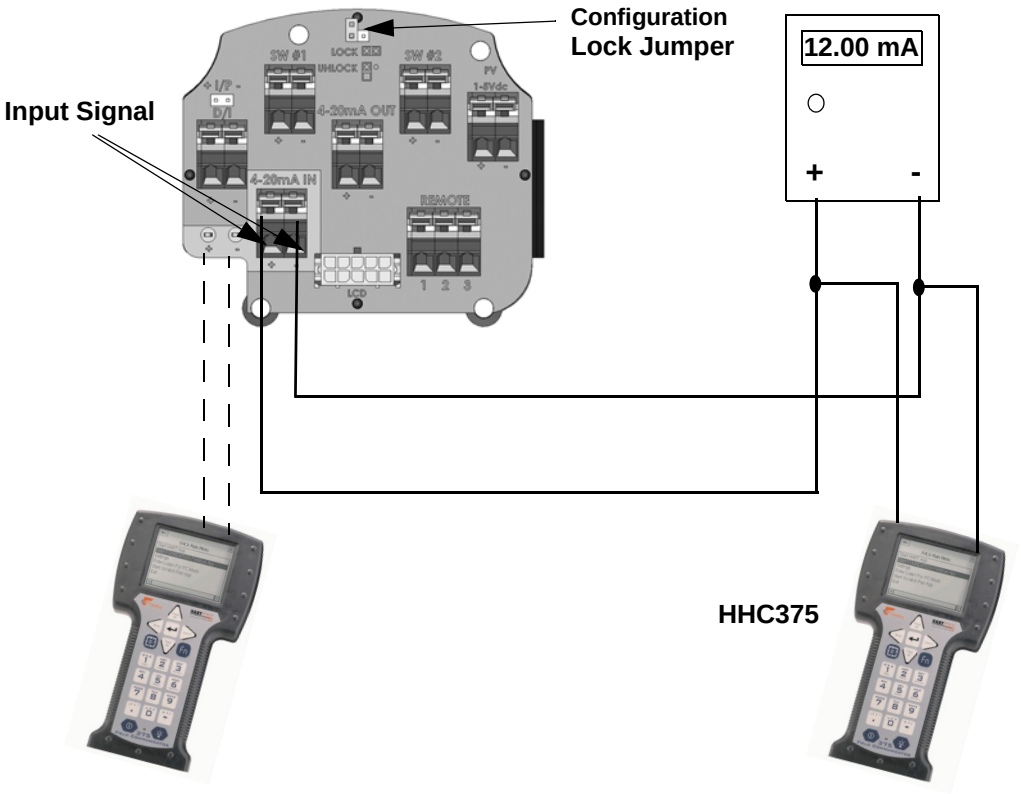


Figure 37 SVI II AP HART Communicator Connections

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 HHC375 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 proceeds 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.

NOTE

"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) or go to the troubleshooting guide.
14. Correct the problem (Is the air supply on?), and then go to clear status until **Clear Fault codes Completed** appears.
15. Press **OK**.

Configuring and Calibrating with ValVue

ValVue Lite is the most complete and easiest to use configuration tool. ValVue Lite is provided with each SVI II AP. ValVue or ValVue Lite provides a personal computer interface for configuring and calibrating SVI II AP. Use of these tools is recommended. See the ValVue Instruction Manual on the CD-ROM included with the SVI II AP.

In this section, we recommend a few ValVue Lite 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.

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.

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Wiring an SVI II AP

6

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 HART Communications Foundations 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 upon the current signal without distorting the current signal, without the tones being affected by the electrical characteristics of the current signaling device. All these conflicting requirements must be met with equipment manufactured by various manufacturers, and work with long cables, in a noisy hostile plant environment. Energy levels are often limited for safe installation in explosive environments. Special engineering may be required to meet the signaling requirements at low energy levels.

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

CAUTION

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

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

Do not connect a PC or HART modem 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 99.*

- *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

This list contains eight 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 must be 9 volts at the maximum current of 20 mA.
- Signal to the SVI II AP must be a well-regulated current in the range 3.8 to 22 mA.
- Controller output circuit must be unaffected by the HART tones which are in the frequency range between 1200 and 2200 Hz.
- Frequency range of the HART tones must have a circuit impedance of more than 220 Ohms, typically 250 Ohms.
- HART tones may be imposed by the positioner and a communication device located anywhere on the signaling circuit.
- Capacitance of the signaling circuit may not exceed about 0.26 microfarads or with high series resistance 0.10 microfarads.

- Cabling must be shielded to prevent electrical noise that would interfere with the HART tones, with the shield grounded at only one location.
- Signal must be properly grounded in only one place.

NOTE

For details and calculation methods for wiring resistance, and capacitance and for calculation of cable characteristics please refer to the HART FSK Physical Layer Specification.

SVI II AP Setups

Control Systems using Explosion Proof or Conventional I/O Systems must have a compliance voltage greater than 9 volts at 20 mA including wiring losses.

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

Typical system setups are shown in Figure 38 on page 82, for General Purpose and Explosion Proof (EEx d) Installation Schematic and Figure 39 on page 83, for Intrinsically Safe Installation Schematic. The SVI II AP 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 39 on page 83 the SVI II AP 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 Hand-held Communicator. The HC375 HART Handheld Communicator is approved for Intrinsically Safe use in accordance with FM, CSA, and ATEX standards. Read and observe all HHC labelling. 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.

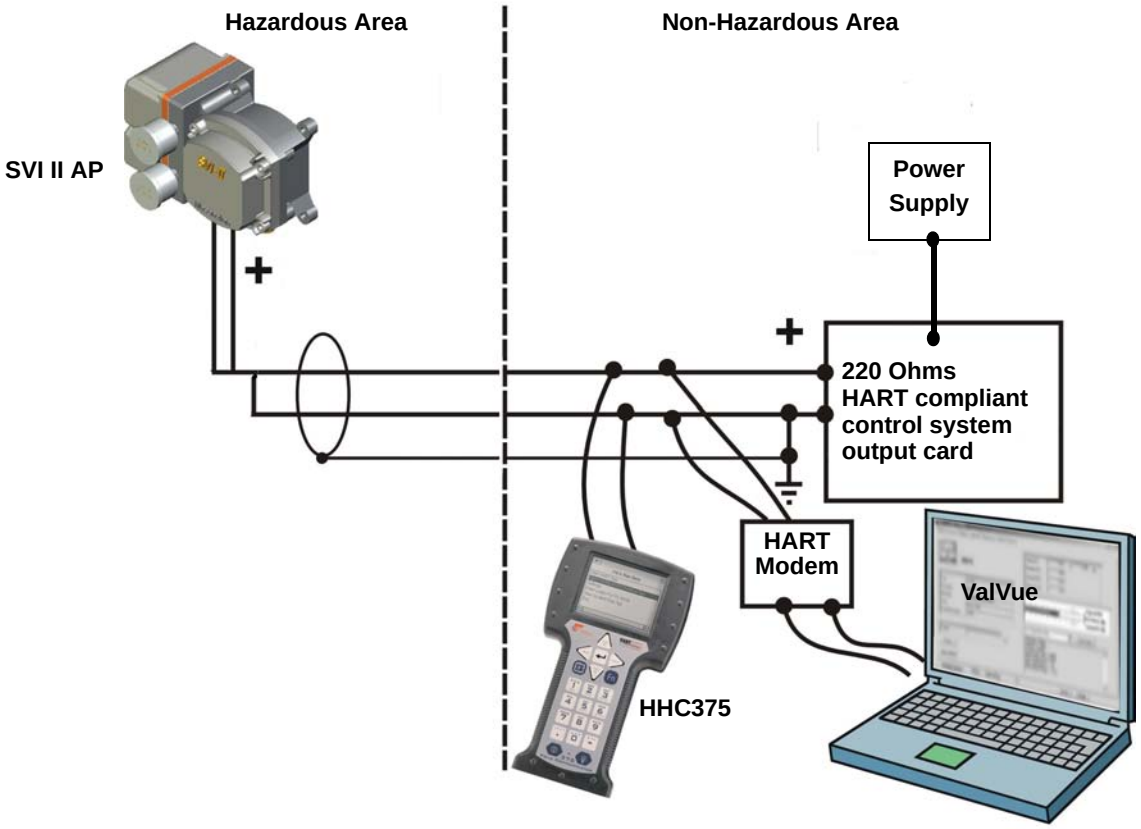

Figure 38 General Purpose and Explosion Proof Installation

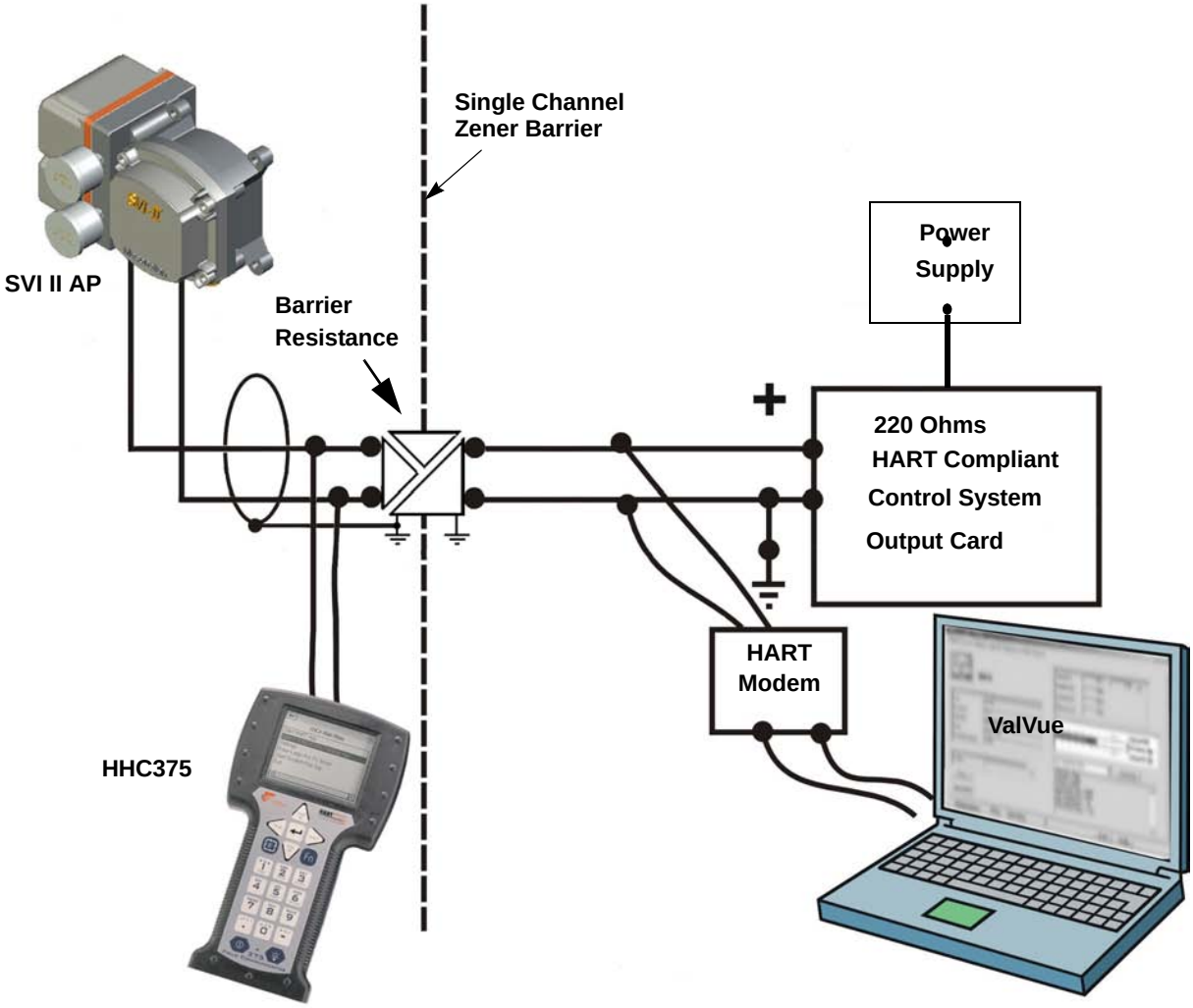

Figure 39 Intrinsically Safe Installation

Grounding Practices

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

The case grounding screws are located on the outside of the case 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 it's 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 Volts at 20 mA and 11.0 Volts at 4 mA. Typical smart devices require MORE Voltage at higher current. The controller supplying the current has LESS Voltage available at higher current. The SVI II AP is unique in that it requires LESS Voltage at higher current which compliments the characteristic of the source requiring only **9 Volts at 20 mA**.

NOTE

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

Table 14 through Table 16 on page 85 provide examples of several SVI II AP installations and calculating the compliance voltage necessary to supply 9 Volts at 20 mA.

Table 14 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 ft. long (30 ohms per 1000 feet)	1.8 V
Drop in passive HART Filter*	0.0 V
Voltage required at controller	17.64 V

* Such as MTL HCU16AO

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

Table 15 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 ft. long (30 ohms per 1000 feet)	1.8 V
Required voltage at Isolator	10.8 V
Voltage available from Isolator rated to drive 22 mA into 700 ohms*	13.2 V
Voltage required at controller	Not applicable - Isolator supplies the power

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

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

Table 16 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 ft. long (12 ohms per 1000 feet)	0.6 V
Drop in passive HART Filter*	2.3 V
Voltage required at controller	16.3 V

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

Wire Size and Conduit

Electrical connections are made to the electronics module terminal board as shown in Figure 27 on page 41. 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 HHC a HART compliant barrier must be used. See Chapter Six for details.

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 and signal loop grounded at only one point, minimizes the effects of noise.

Cabling and Interconnection Requirements

Interconnections are made using shielded twisted pair cables. The shield is connected to ground at one point only. The signal loop is grounded at only one point in accordance with plant electrical standards. It is customary to ground the signal at the controller or intrinsic safety barrier. The 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 HART Communications Foundations specifies cable capacitance requirements to preserve signal strength. Refer to the standards for detailed calculation methods.

CAUTION

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

HART Filter Required for Certain Control System Output Circuits

The 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 the HART filter HCU16AO. It is a 16 channel DIN rail mounted device composed of passive circuitry that introduces negligible voltage drop. For additional information, contact MTL.

NOTE

A control circuit must be HART compatible or have a HART filter installed. Contact the manufacturer of the controller or DCS. See *“HART Filter Requirements” on page 99.* *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 Volts. Two SVI II AP in series requires at least 18.0 Volts in addition to the voltage drops in wiring and other series devices. Typical controller output current sources rarely deliver 24 Volts, 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 43 on page 94. The total loop voltage must not exceed the rating for the controller output current source. Contact the DCS vendor to validate this approach.

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.

Setting Loop Addresses for Split Range Systems

When more than one positioner is installed in a single current loop, the HART loop address of each device must be set to 1, 2, or 3 (or other non-zero values) to allow a HART master to recognize each SVI II AP when connected to all three devices on a single current loop. Do not use *0* for any of the positioners. A *0* may cause HART masters to stop searching for additional positioners.

Both the ValVue software or the HART Communicator 375 can be used to set non-zero addresses. ValVue must be configured to allow *multidrop* mode, by selecting the *Set Options* function in the *Tools* menu on the *Select Device* screen as shown in Figure 40 on page 89. The *Select Device* screen appears on successful logging into ValVue

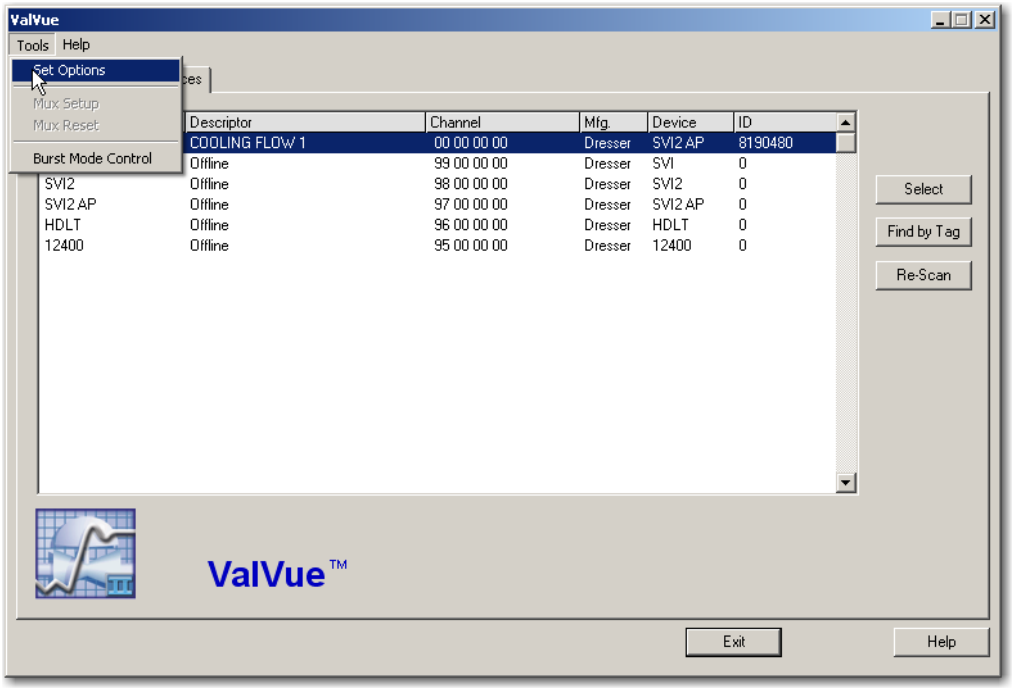

Figure 40 ValVue Activate Set Options on Device Screen

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, check the Multidrop box as shown in Figure 41. If unchecked, ValVue looks for devices only at polling address 0. When in multidrop mode, even if a device is found at polling address 0, other polling addresses are searched.

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*.

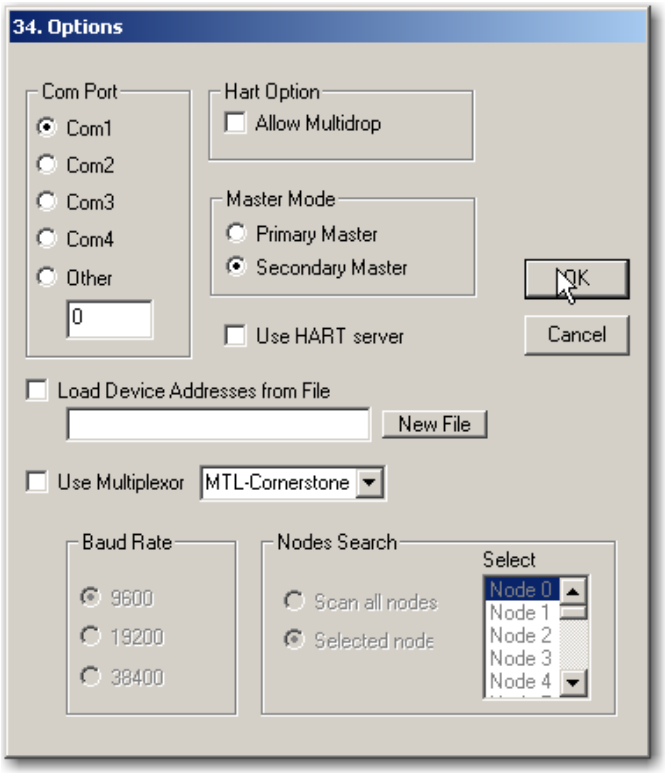

Figure 41 ValVue Setup Options for Multi-Drop

Isolators

Another solution is to use an Intrinsic Safety Isolator for each loop as shown in Figure 42 on page 92. 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. An example of an isolator can be obtained from R. Stahl, (Model 9318/16-22-10). 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.

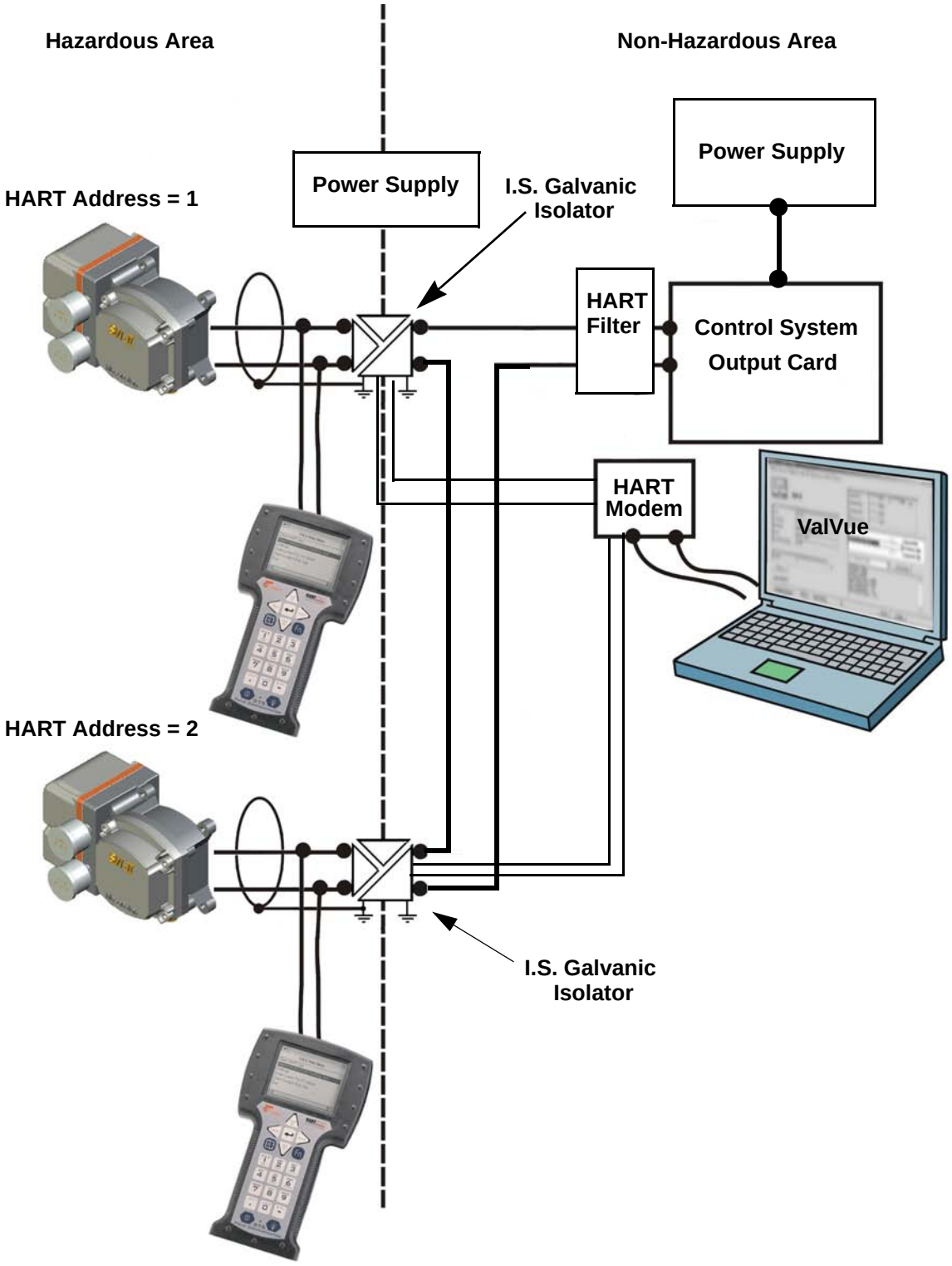

Figure 42 Split Range with Isolator

Supplemental Power Supply

Another approach is to boost the compliance voltage of the DCS using a supplemental power supply (see Figure 43 on page 94) with the split ranged SVI II AP positioners 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 volts for each additional SVI II AP. Exceeding the values in Table 17 will cause damage if the signal wires are short-circuited.

Table 17 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.
- Current is read from the local display or with a milliammeter 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 milliammeter in series with the current signal. Verify that source can supply 20 mA to SVI II AP input.
- If 20 mA is not attainable, see troubleshooting.

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.

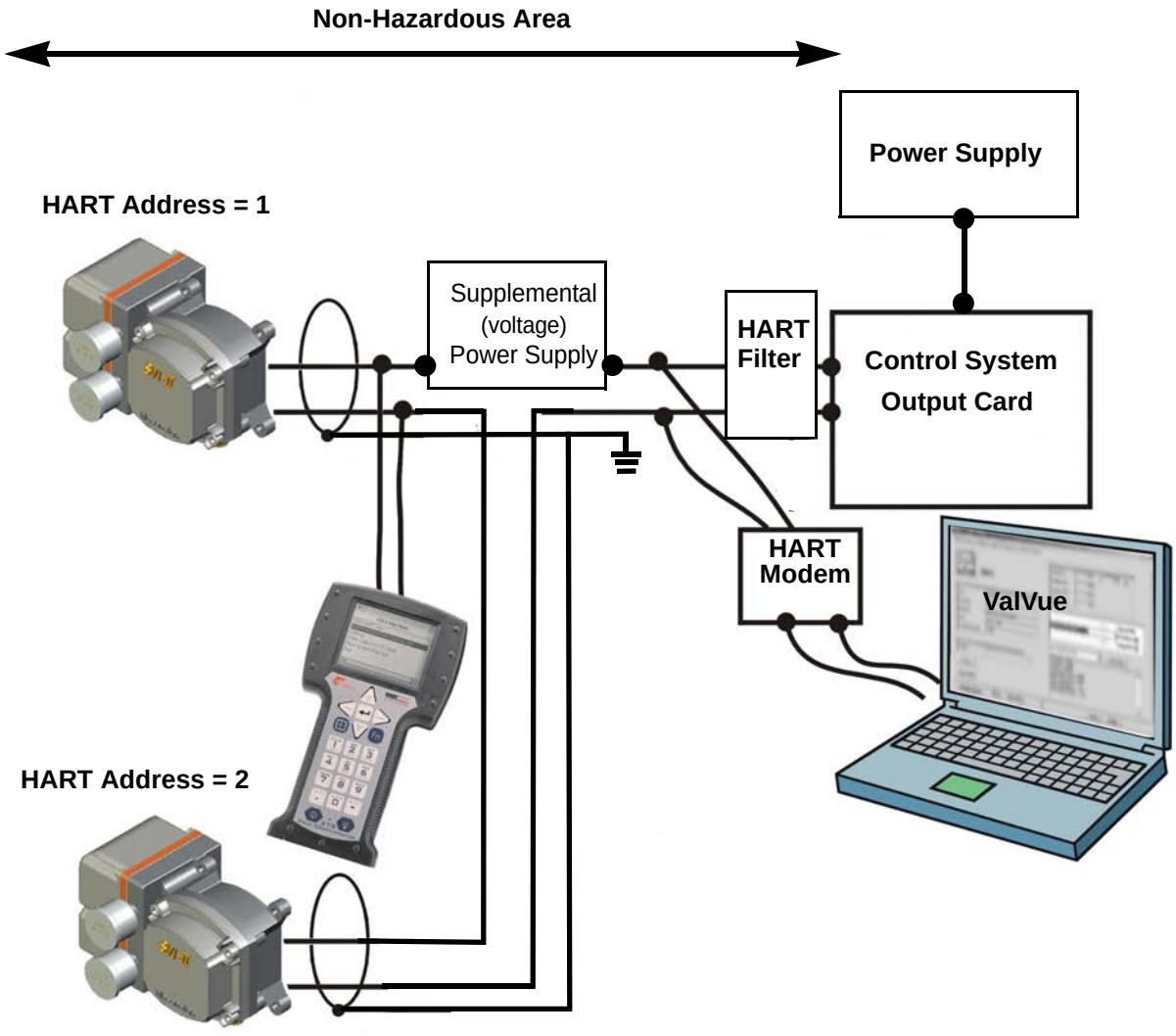

Figure 43 Split Range with Supplemental Power Supply - Non-Hazardous

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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HART Communications with Intrinsic Safety

7

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.

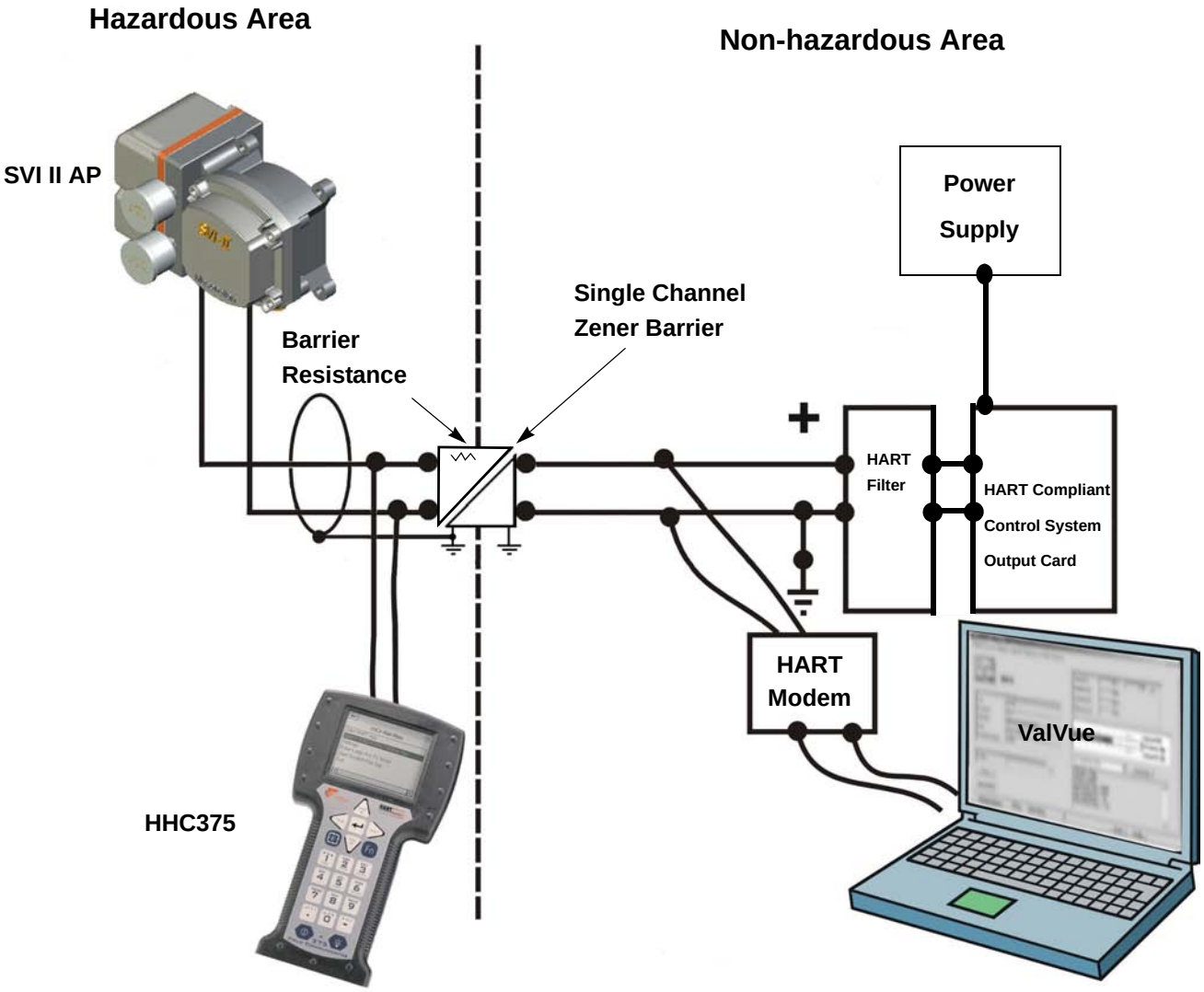

Figure 44 Intrinsically Safe Installation with Zener Barrier and HART Filter

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 80 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 44 on page 98. Consult barrier and isolator manufacturer for devices rated for use with the SVI II AP positioner 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.

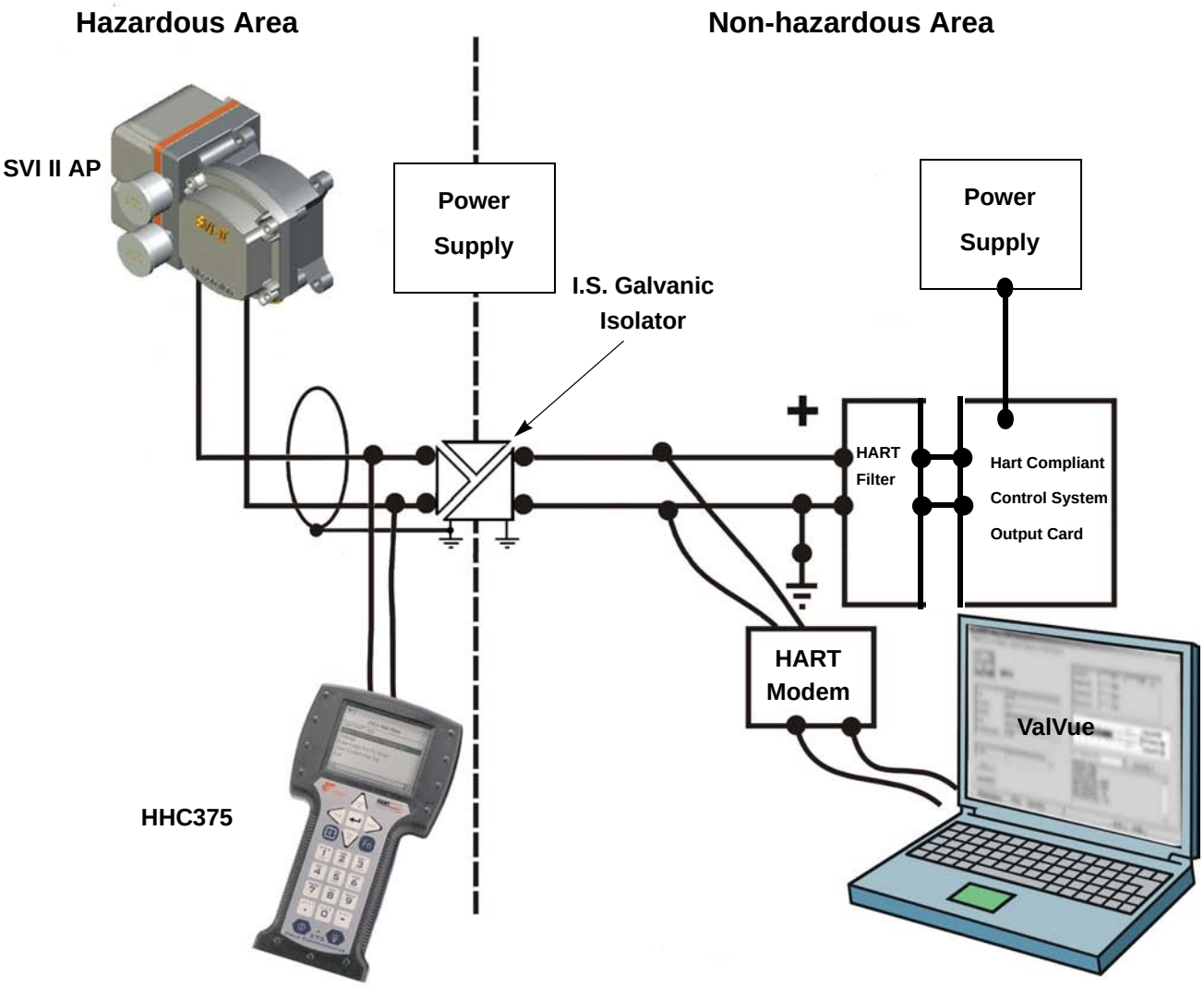

Figure 45 Intrinsically Safe Installation with Galvanic Isolator

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, Model 010005

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

The HC375 is not approved for use in hazardous areas that use explosion proof safety practices. Do not use the HC375 unless the area has been declared safe (Hot Work Permit).

The HART Communicator HC375 is approved to communicate with intrinsically safe control circuits in hazardous areas. Read the product Manual for the HART Communicator. 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 HC375 or consult the manufacturer.

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Operation and Maintenance

8

Principle of Operation

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

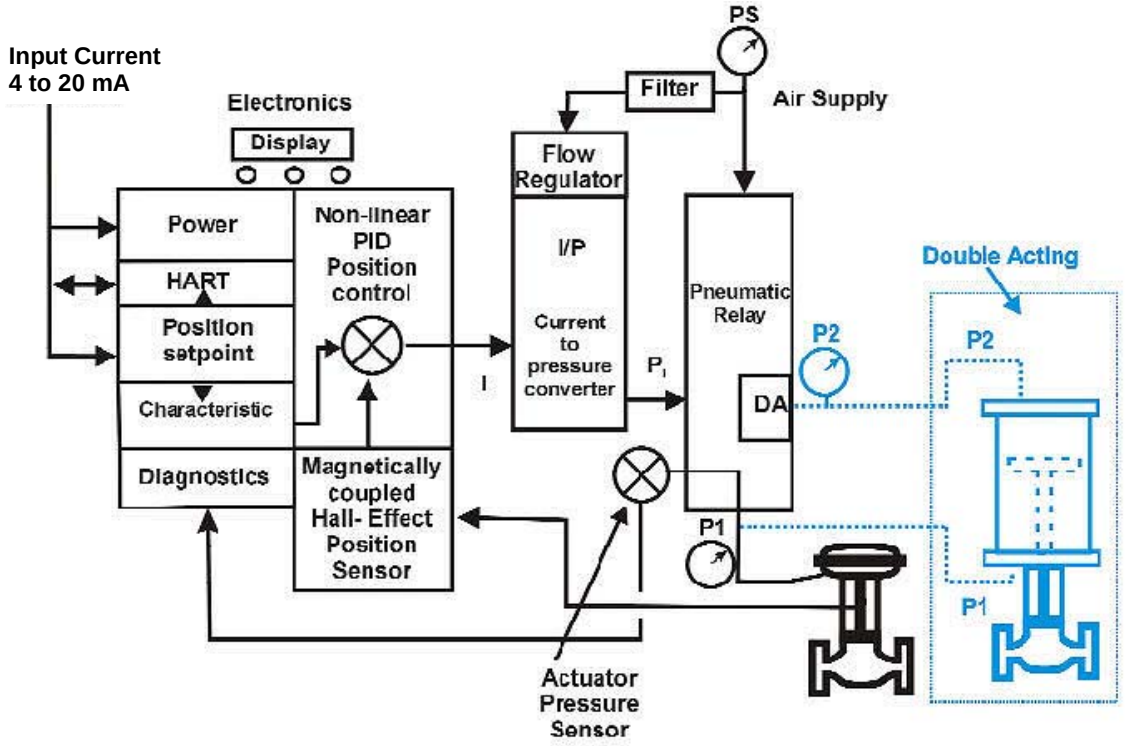

Figure 46 Block Diagram with I/P Converter and Pressure Sensor

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 Appendix B. 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 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 8 on page 18.) The Hall effect sensor has a maximum travel range of up to 140° rotation.

Position Retransmit

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

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

Pressure Sensor

The pressure sensor located in the Electronics Module measures the output of the single acting relay. The pressure measurement is displayed on 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 Digital Output switch terminals are solid state contacts, similar to relay contacts. Each switch requires its own power source and must be connected to the appropriate connector on the Electronics Module Terminal Board.

The switches are polarity sensitive and must be connected only to a DC circuit. When the switch is OPEN the + terminal must be electrically positive with respect to the – terminal. If the + terminal is electrically negative with respect to the – terminal, then the switch will conduct. **Polarity reversal will not damage the switch, but the switch will appear to be always ON.**

There must be a series load in the circuit to prevent damage to the switch. **If the switch is connected directly across the power source the current will be limited only by the capacity of the power source and the switch will be damaged.**

NOTE

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

The switch is rated for 30 Volts open and 1 Amp closed with a resistive load. An incandescent load (such as a lamp) draws a surge current of as much as 20 times the rated current of the lamp as the filament heats up. The switch current capacity is adequate to drive typical incandescent loads (such as annunciator panel lamps) but a 25 Watt lamp may damage the switch. An inductive load such as a solenoid valve or relay discharges the energy stored in the coil when it is on into the switch when the coil is turned off. The switch has adequate capacity to absorb the energy from a typical low power air solenoid or control relay. Using the switch to operate a large capacity motor controller may damage the switch. **With an incandescent or inductive load, limiting the rated load current to 0.1 mA is always safe.**

Switch Settings

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

0. **Always Normal Position** - the switch is not controlled by the SVI II AP and remains in it's default position
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)
5. **Position Low Limit** - the switch is activated whenever the valve position is less than the position setting of this switch control
6. **Position Upper Limit** - the switch is activated whenever the valve position is greater than the position setting of this switch control
7. **Manual Mode** - the switch is activated whenever the SVI II AP is in manual mode, configure mode, calibrate mode, or diagnostic mode.

NOTE

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

Pneumatic Module

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

Current-to-Pressure Converter, I/P

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

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).

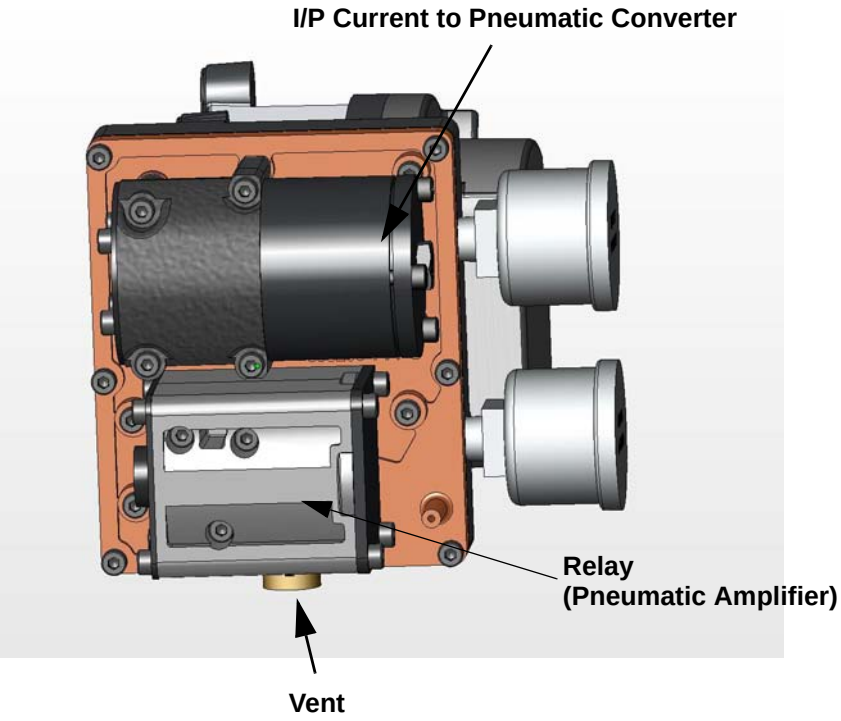

Figure 47 Pneumatic Module with Single Acting Relay

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).

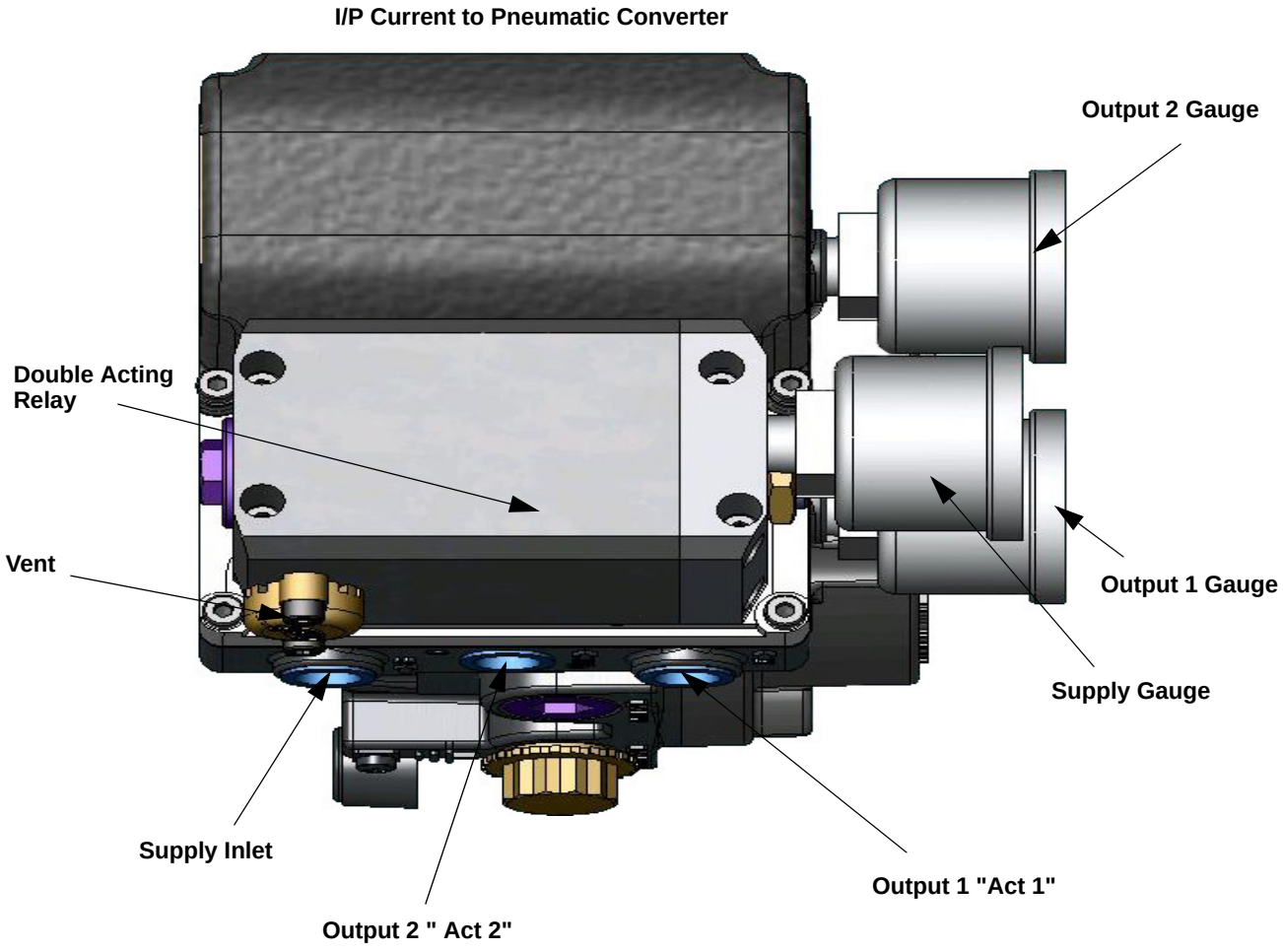

Figure 48 Double Acting Pneumatic Relay

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.

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 45. 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 Masoneilan 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 49) 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 49 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 42 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 42).

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).

Make sure 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 110) 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

To remove the 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 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.
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 111).

Make sure that:

1. The wire is not damaged when feeding it through the housing.
2. A single O-ring is in place on the wire-sleeve and is not damaged.
3. The four retaining screws are tight and torque to 15 in-lb (1.7 N-m).
4. 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

To install pneumatic relay:

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.

Make sure 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 113.

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 Masoneilan 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 41 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 on 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.

Tools Required

- HART modem
- IBM PC with Windows 2000, XP or later, 16 MB RAM
- ValVue (provided with software upgrade on CD-ROM)

Installing Firmware Upgrade

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

To check the firmware version cycle the power off, then on, to perform a cold start. The display shows software version in upper right corner. When maintenance is complete reinstall the positioner and perform the checkout procedure detailed in “Installation and Set Up” on page 7. Consult the factory for firmware upgrade services. ValVue is the recommended tool for complete re-configuration. See “Configuration and Calibration” on page 65.

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Specifications and References

A

Physical and Operational Specifications

This section provides the physical and operational specifications for the SVI II AP.

Table 18 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 volts 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 19 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“(12mm - 64mm) **Note:** Above 2.5” (64mm) 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)
Position Auto Tune SVI II AP performs automatic determination of the optimal valve position control parameters. In addition to P, I, D, the position algorithm uses damping, symmetry for exhaust and fill time constants, dead zone and magnitude characterization parameters. Auto Tune is optimized for 5% step changes with negligible overshoot. After the Auto Tune process is completed, 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
SIL	SIL2 Compliant per IEC61508
HART Command #3 Mapping	PV = Valve Position, 0-100% SV = Actuator Pressure (P1-P2) TV = Supply Pressure QV = P2 for double acting units

* Specifications are subject to change without notice

Table 20 Input Signal, Power, and Display Specifications

Power Supply	Loop powered from 4 - 20 mA control signal
Compliance Voltage Rating	9.0 Volts at 20 mA, 11.0 Volts at 4.0 mA
Minimum Current Signal to Start Up	3.2 mA
Minimum Input Span for Split Range Operation	5 mA
Upper Range Value for Split Range Operation	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
Local Display Liquid Crystal (optional)	LCD, explosion proof with two lines of nine alpha numeric characters
Push Buttons	External, Three Explosion Proof / Flameproof push buttons

Table 21 Construction Material Specifications

Housing and Cover	Aluminum ASTM B85 SC84B standard Stainless Steel optional
Weight	Standard - 7.4 lbs./ 3.357 kg Stainless Steel - 16 lbs/ 7.257 kg
Relay and Manifold	Single Acting - PPS, 300 Series Stainless Steel, nitrile diaphragms Double Acting - 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
Levers	300 Series stainless steel

Table 22 System Connectivity

HART Physical Device Type	Actuator; HART device type 7, Device type 202, 0 , 00CA
DD Registered with HART Communication Foundation	Yes, available through HART Communication Foundation
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.

Table 23 Pneumatics Single Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered air (See ISA S7.3)
Action	Direct Acting
Supply Pressure	20 -150 psi max. (1.4 - 10 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 scfm (280 l/m) at 30 psi (2.1 bar) supply 16.6 scfm (470 l/m) at 60 psi (4.2 bar) supply 23.3 scfm (660 l/m) at 90 psi (6.3 bar) supply
Air Capacity (flow coefficient)	Loading CV = 0.57 Venting CV = 0.53
Air Consumption	0.2 scfm (5.7 sl/m) at 30 psi (2.1 bar) supply 0.26 scfm (7.4 sl/m) 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 bar) max

Table 24 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 scfm (200 l/m) at 30 psi (2.1 bar) supply 12.8 scfm (360 l/m) at 60 psi (4.2 bar) supply 18.3 scfm (520 l/m) at 90 psi (6.3 bar) supply 23.8 scfm (675 l/m) at 120 psi (8.4 bar) supply
Air Consumption for Double Acting	0.4 scfm (11.3 l/m) at 30 psi (2.1 bar) supply 0.85 scfm (22.6 l/m) 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.

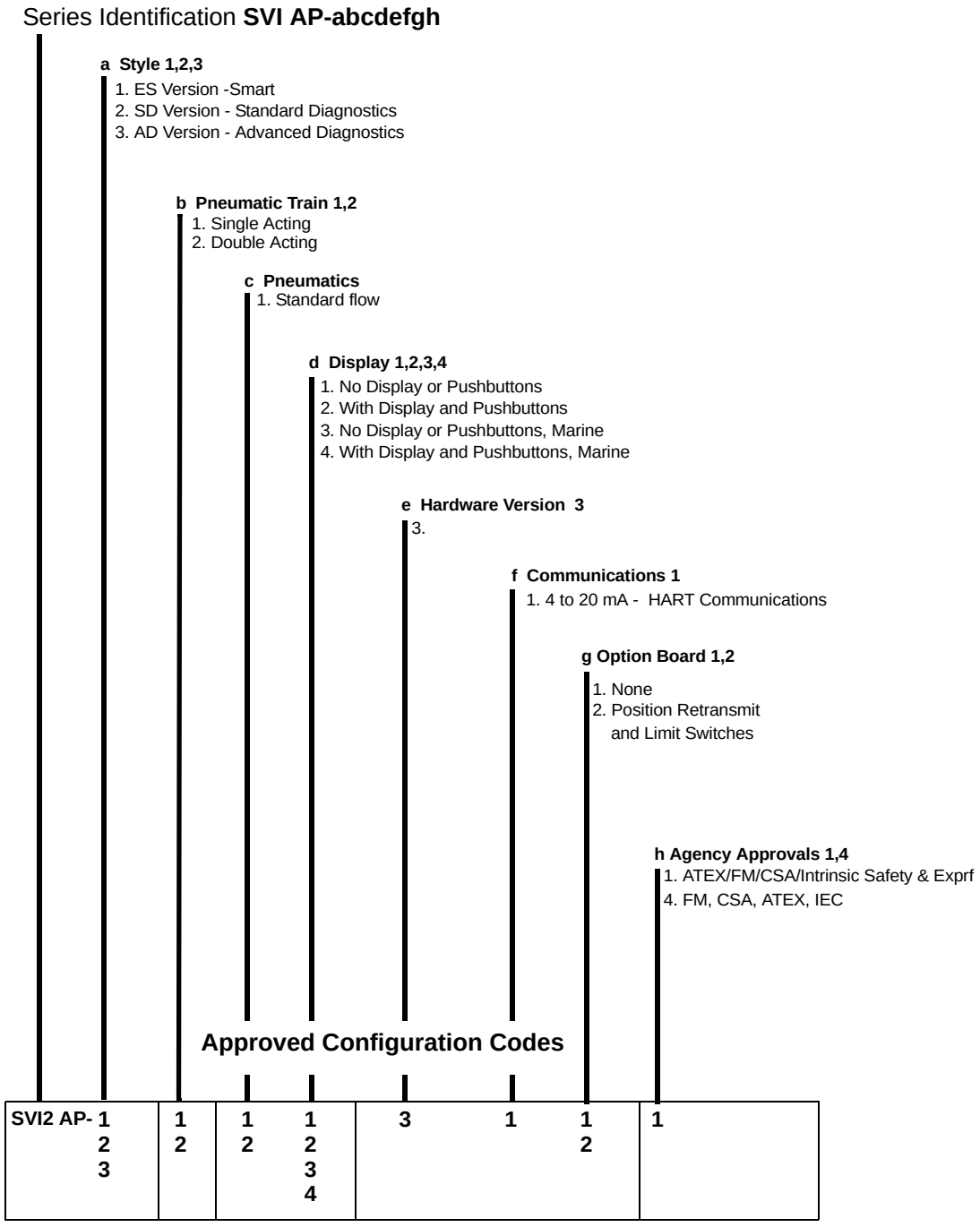


Figure 50 SVI II AP Model Numbering

Spare Parts

DRESSER Masoneilan — 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

Push Button/Display Cover Spare Part Kit

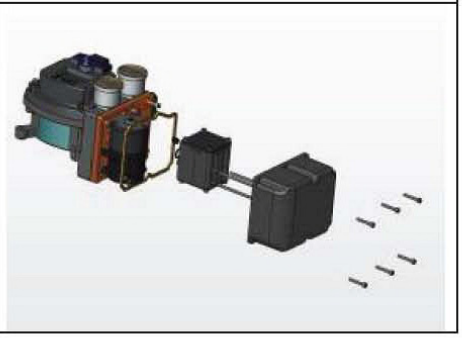
Standard Construction, SVI **II** AP-**2 720003884-999-0000**
Offshore Construction, SVI **II** AP-**2 720003885-999-0000**

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

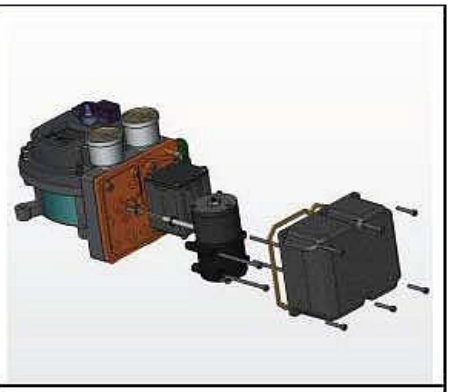
Item No.	Description	Quantity
1	RELAY, Single Acting	1
2	M4 X 0.7 X 60 SHCS	3
3	Pneumatics Cover	1
4	Pneumatics Cover Gasket	1
5	M4 X 0.7 X 25 SHCS	6
6	Instructions	1



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

720003878-999-0000

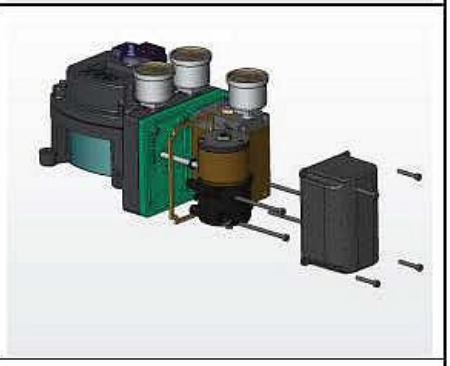
Item No.	Description	Quantity
1	**I/P Assembly**	**1**
2	O-Ring, I/P Stem	2
3	M4 X 0.7 X 60 SHCS	4
4	Pneumatics Cover	1
5	Pneumatics Cover Gasket	1
6	M4 X 0.7 X 25 SHCS	6
7	Instructions	1



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

720003879-999-0000

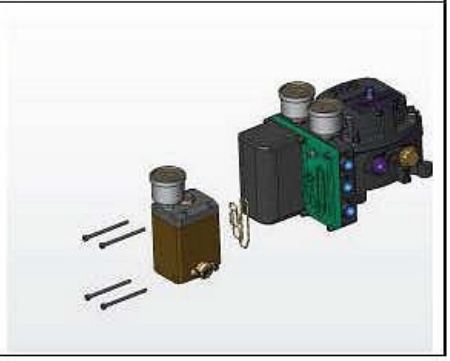
Item No.	Description	Quantity
1	I/P Assembly	1
2	O-Ring, I/P Stem	2
3	M4 X 0.7 X 60 SHCS	4
4	Pneumatics Cover	1
5	Pneumatics Cover Gasket	1
6	M4 X 0.7 X 25 SHCS	6
7	Instructions	1



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

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

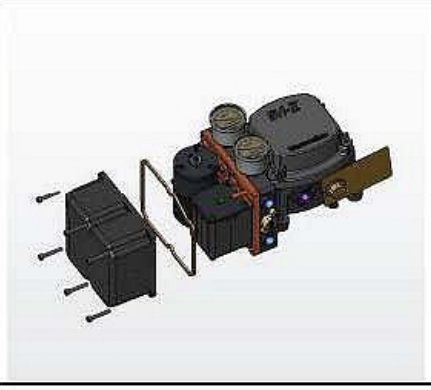
Item No.	Description	Quantity
1	Relay Double-Acting	1
2	Gasket	1
3	M4 X 0.7 X 60 SHCS	4
4	Instructions	1



Pneumatic Cover Kit, **Single Acting**

720002450-999-0000

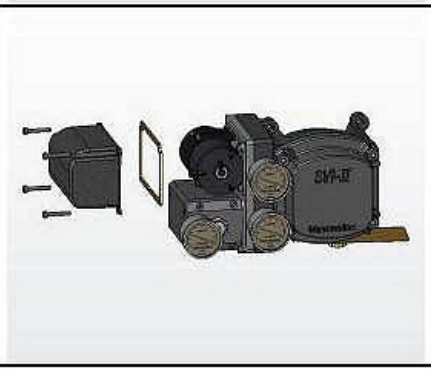
Item No.	Description	Quantity
1	LOCTITE 222MS, 0.5mL LOW STRENGTH	1
2	SCREW M4 X 0.7 X 25 SOCKET HEAD CAP	6
3	GASKET MANIFOLD S/A	1
4	PNEUMATICS COVER S/A SVI2AP	1
5	MINIVALVE 064.001 SILICONE	1



Pneumatic Cover Kit, **Double-Acting**

720002451-999-0000

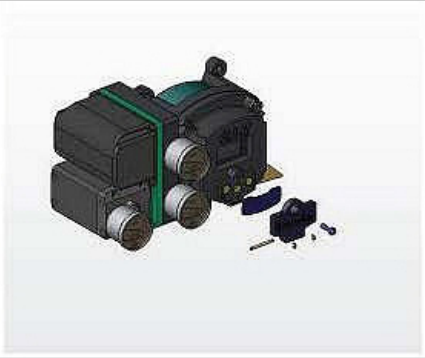
Item No.	Description	Quantity
1	LOCTITE 222MS, 0.5mL LOW STRENGTH	1
2	SCREW M4 X 0.7 X 25 SOCKET HEAD CAP	4
3	GASKET I/P COVER D/A SVI2AP	1
4	COVER PNEUMATICS DA	1
5	MINIVALVE 064.001 SILICONE	1



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



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Air to Open and Air to Close Actuators

B

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 51 and Figure 52 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. 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.

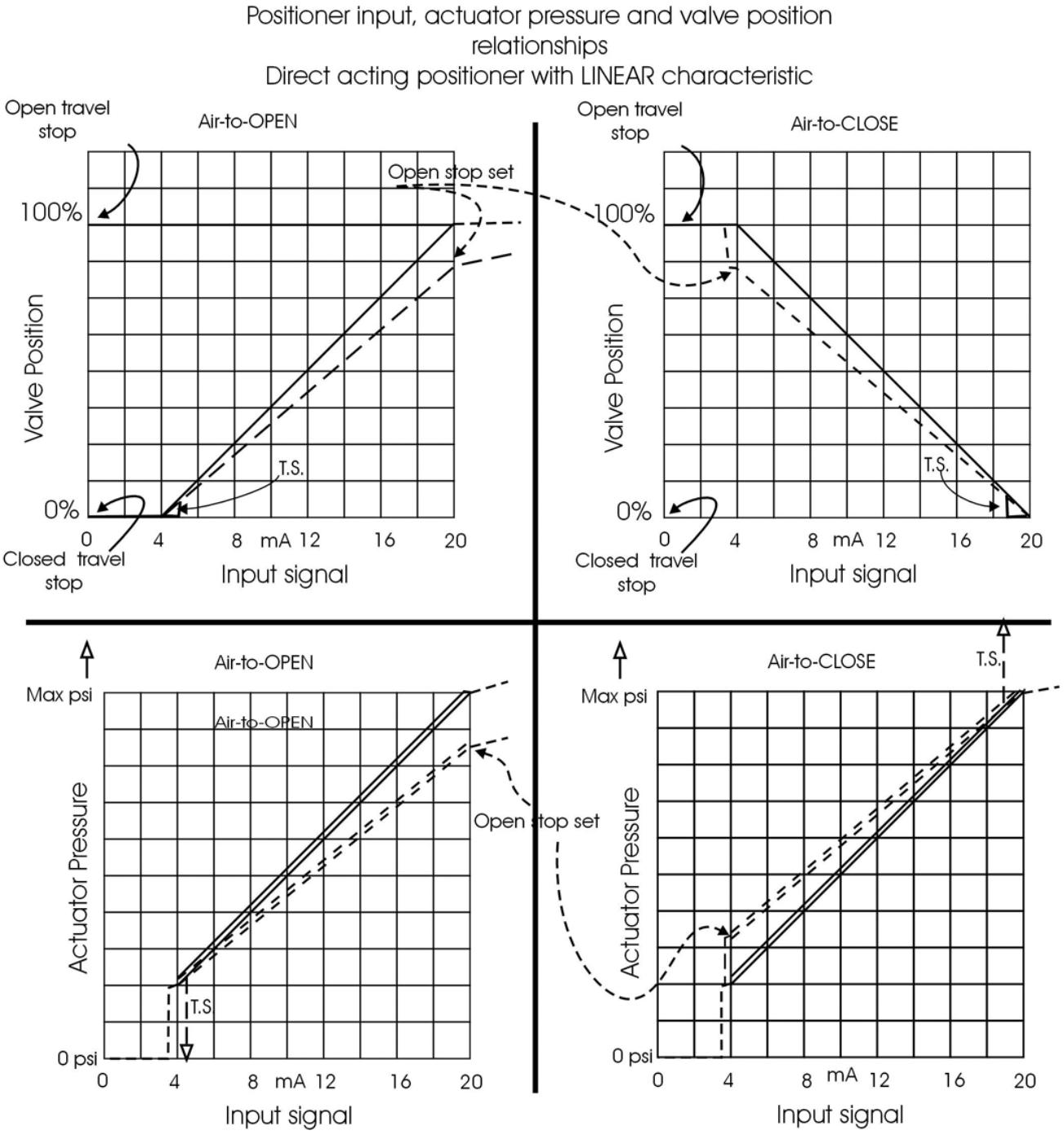

Figure 51 ATO and ATC Action with Linear Positioner Characteristics

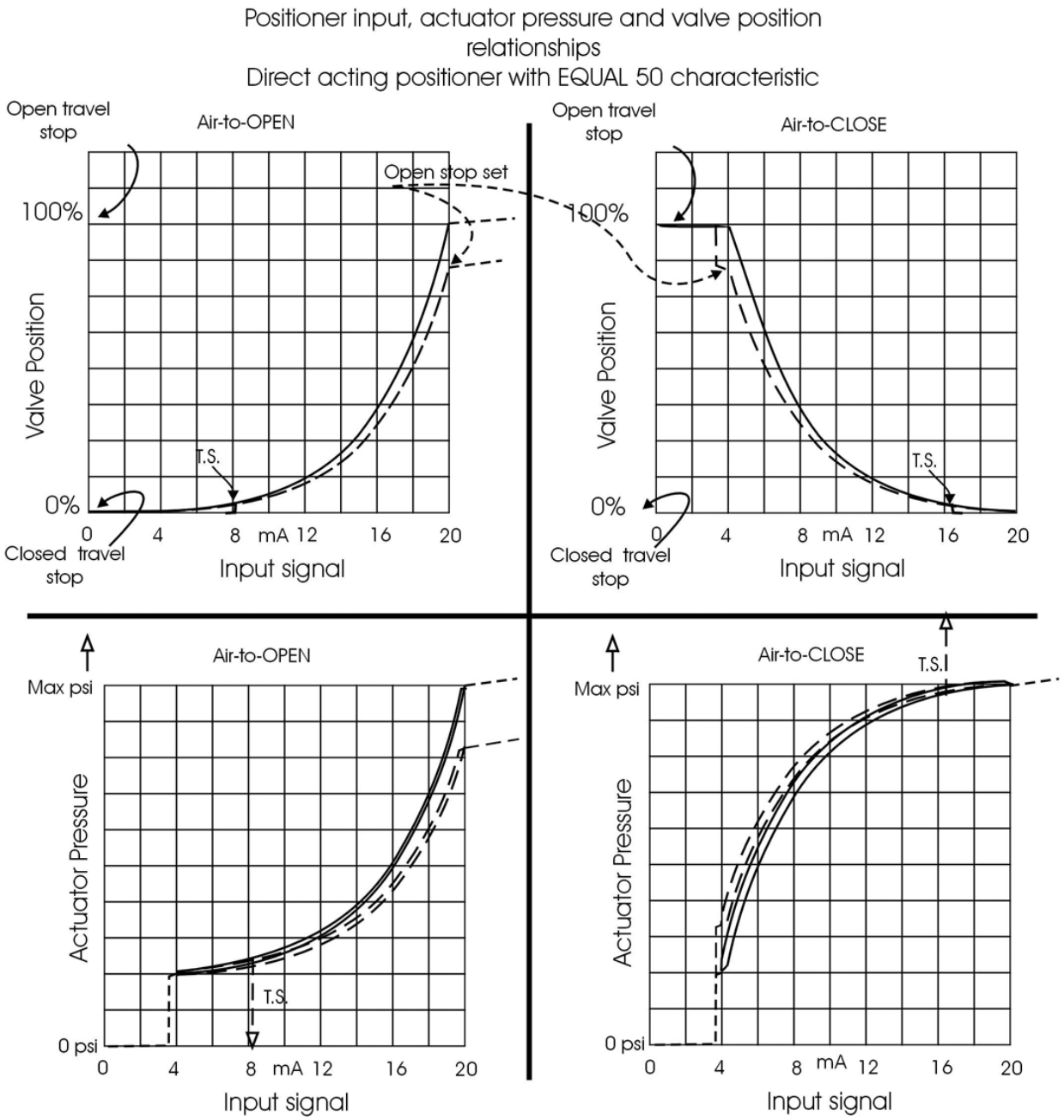

Figure 52 ATO and ATC Action in Percentage of Positioner Characteristics

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Air Supply Requirements

C

Air Supply Requirements

A high quality air supply greatly improves the quality of control and reduce maintenance costs of pneumatic equipment. See ANSИSA-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.

- Keep clear of moving parts. The SVI II AP can cause the valve to move when the air supply returns.

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Adjusting Speed of Response

D

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 HHC 375. See the ValVue Instruction Manual for details.

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Advanced Usage

E

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 CV 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 25 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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Glossary

F

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 Cv is also called valve inherent characteristic. It is often adjusted by design, to equal percentage, for example. The positioner characteristic is applied to modify the setpoint to travel relationship of the actuator. The characteristic of the positioner must be chosen to compliment the valve. If the valve is equal percentage, set the positioner to linear. If a linear valve is installed the positioner can be set to an equal percentage characteristic to improve flow control. 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 HART Communications Foundation standards.

Condition Monitoring A technology for measuring the performance of process equipment and valves over a period of time to predict the need for maintenance. The technology evolved to meet NRC requirements GL 89-10, and has proven valuable to other process industries. 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- 20mA current to the positioner.

Device Description, DD

The software object installed in the HART Handheld Communicator HHC 375 to allow it to communicate and display the custom parameters available in a field device.

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 4-20mA. 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 4-20mA 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 4-20mA signal.

HART Communication The HART Communication Foundation is an independent, non-profit foundation corporation specifically organized to coordinate and support the application of HART technology worldwide. Educating the industry on the capabilities and value of this important technology is a key role.
Operating costs are offset by membership and training/support service fees. Membership is open to all suppliers, end users, and others interested in the use of HART technology.

HART Filter A filter required with certain DCS systems that are not HART compliant. It allows the 4 - 20 mA output signal to pass from control system to positioner, but blocks HART FSK tones from passing from the field wiring to the control system.

HART Master A device, usually a PC which is controlling the communications over a HART protocol network. The HART master sends to a field device a command and requires a response.

HART Slave A device, normally a transmitter or positioner, that communicates over a HART protocol network only in response to a command from a master.

Hazardous Area	The area of the plant where explosion hazards are present, hazards such as propane gas in a refinery, or dust in a flour mill.
HHC 375	The HART Handheld Communicator supplied by Fisher-Rosemount. It supports the DDs for all field devices. The DDs are combined into a single file and loaded into the HHC 375 memory by a manufacturer. Memory is available in several capacities.
Hot Swapable	The 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 Instrument Society of America. ISA develops and publishes international standards for use in process control. See www.isi.org.
Multidrop	A variation of the HART Communications Protocol that allows many smart field devices to draw power from and to communicate over a single pair of wires. Though most suited to multiple measurement devices, it can be used with 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 As used in this manual, a personal computer or laptop running under Windows 2000 or later operating system.

Position With a reciprocating valve, the position is the distance of the plug from its seat, normally measured as a linear motion of the valve or actuator stem. With a rotary valve the position is the angle of rotation of the valve plug measured as angular rotation of the valve shaft.

Position Limit The Actuator can be mechanically set to stop at a predetermined position by setting an adjustment, sometimes with a handwheel or screw stop. 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:	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 of valve travel. Often used as a verb to describe the process of moving the valve.

Tag	The formal designator the control valve used in control loop documentation.
Tight Shutoff (TS)	A positioner property which is selected and adjusted when it is desired to prevent operation of the valve at or near the closed position. The positioner causes all available actuator force to be applied to the valve seat at a position set point equal to or less than the TS adjustable parameter. A dead band is applied to prevent cycling in and out of this behavior.
ValVue® Lite	The Masoneilan software for calibration, and configuration that is provided with every SVI II AP.
ValVue®	The full featured Masoneilan 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

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Dresser Masoneilan, headquartered in Houston, Texas, has been the leading global partner in process control valves and solutions for more than 100 years. A business segment of Dresser, Inc., the company delivers customized products, services and diagnostic solutions for oil and gas, process and power generation applications. www.dresser.com

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