Masoneilan™
SVI™ II APN
Digital Positioner

Quick Start Guide (Rev. M)

Baker Hughes

About this Guide

This Quick Start Guide applies to the following instruments and approved software: SVI II APN

- ☐ Firmware version 3.2.1 or greater
- ☐ *ValVue*™ suite version 2.70.0 or greater (including PRM Plug-In & AMS SNAP-ON) or ValVue 3
- ☐ DTM version 2.00.0 or greater
- ☐ HART® handheld communicator with DD published for SVI II APN

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

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 PN 720010269-888-0000 REV M.

Table of Contents

Document Changes

Version/Date	Changes
A/04-2013	First release
H/08-2013 Note: Revision level went from A to H.	Updated ES-699 to Rev Y. Updated drawing in Load Limits section. Added note that there are no spare parts for the unit.
I/03-2014	Updated ES-699 to Rev Z. Updated Load Limits section.
J/03-2017	Updated ES-699 to Rev AC. Update ValVue references to ValVue 3. Updated Load Limits section. Added note on PV and DI inputs. Added Burst section.
K/12-2017	Update Load Limits section. Updated Intrinsically Safe figures. Added notes for PV and DI to card interface drawing. Updated Wiring Guidelines for Position Retransmit. Change ESS-699 to Rev AD.
L/01-2018	Update Load Limits section.
M/07-2021	ES-699 instructions removed. Re-branded to Baker Hughes format.

Safety Information

This section provides safety information and defines the documentation symbols.

Safety Symbols

WARNING

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

CAUTION

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

NOTE

Indicates important facts and conditions.

SVI II APN Product Safety

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

General installation, maintenance or replacement

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

Intrinsically Safe Installation

Products certified as explosion proof or flame proof equipment or for use in intrinsically safe installations MUST BE:

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

NOTE

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

WARNING

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

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

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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Installation and Set Up

Introduction

The SVI II APN Quick Start Guide is intended to help an experienced field engineer install, setup, and calibrate an SVI II APN in an efficient manner. This document provides basic installation and setup instructions. If you experience problems that are not documented in this guide, call your local representative. Sales offices are listed on the last page of this document.

The SVI II APN provides reliable operations of control valves with setup and commissioning simplicity for the nuclear industry. It is equipped with a non-contact travel sensor allowing for accurate positioning and maintenance free operations. The pneumatic train of the SVI II APN is a dual-stage amplification system with stainless steel wetted parts for durability. Intrinsically Safe, Flameproof and Explosion proof designs are standard. Using Hart eDDL and FDT-DTM technologies, the SVI II APN digital valve positioner provides interoperability with leading control systems.

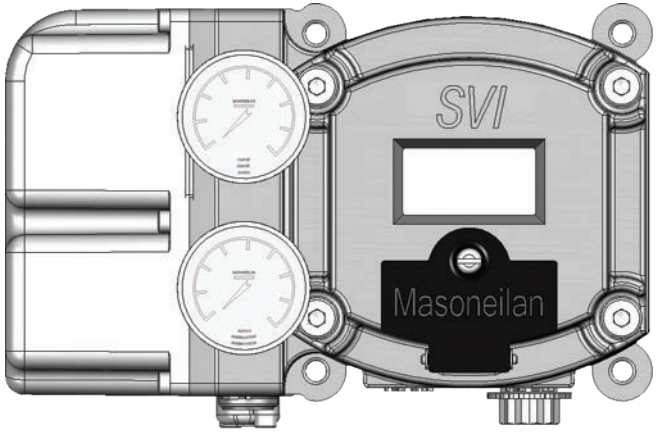


Figure 1 - SVI II APN Digital Positioner

The sticker on the right side of housing (Figure 2) identifies that the product was made according to a nuclear qualified program.

The sticker lists:

Date of Manufacturing

Install By date, which is the manufacturing date plus five years

Figure 2 - Safety Related Nameplate

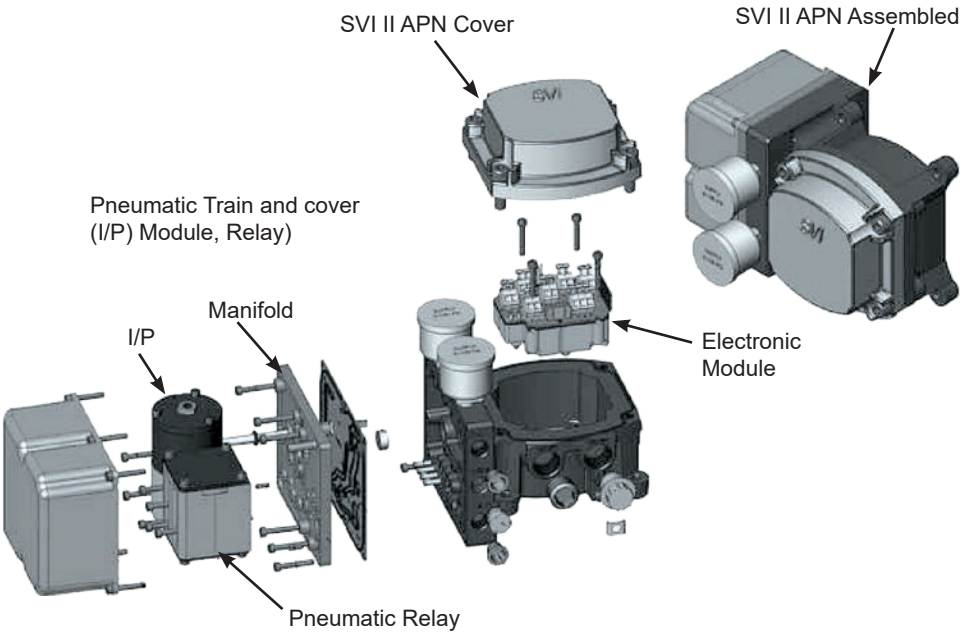


Figure 3 - SVI II APN Components

Single-Acting Positioner

The supply and output connections for the SVI II APN, located on bottom of the pneumatic block, are tapped 1⁄4" NPT. The output port 1 is toward the front while the supply is toward the back. Two pressure gauges, output on top, supply port on bottom, are located on the front of the pneumatic block.

Maximum allowable air supply pressure to the SVI II APN varies according to actuator, valve size, and valve type. Refer to the serial plate of the valve to know the specified supply pressure; it must never be less than the maximum spring pressure +5 psi.

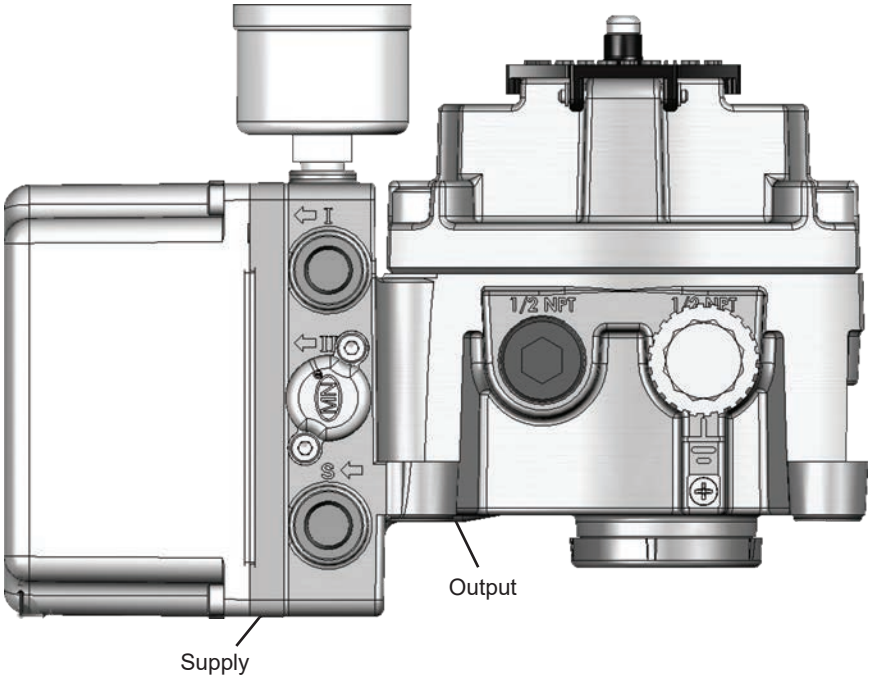


Figure 4 - Air Ports on Single-Acting Positioner

Double-Acting Positioner

Connect Output 1, labeled ←I to the inlet port of the actuator and Output 2, labeled ←II to the opposing actuator port Figure 5).

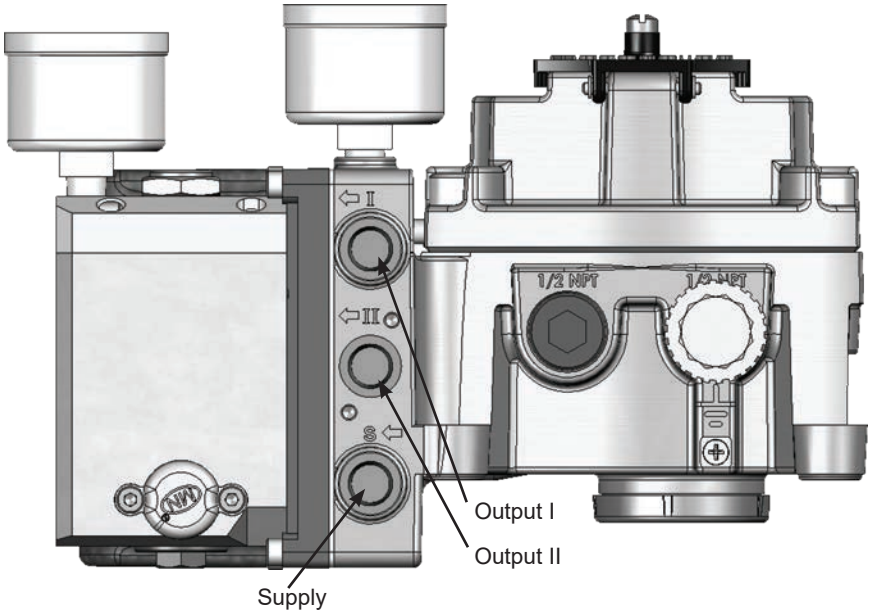


Figure 5 - Air Ports on Double-Acting Positioner

Pushbuttons and Local Display

This section covers the optional local interface consisting of the LCD alphanumeric display and pushbuttons. Operation of the SVI II APN Digital Valve Positioner as a local device is controlled through the optional device-mounted pushbuttons and digital display, shown in Figure 6 on page 14. 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 APN has two operational modes: Normal Operating mode and Manual mode and two setup modes, Configuration and Calibration. The SVI II APN also has two modes for handling of faults and power-up: Reset and Failsafe. When commissioning or checking a control valve with SVI II APN fully installed the following steps are recommended:

Change mode to Manual mode

Enter Calibration mode

Run autoTUNE to set dynamic response

Introduce manual set point changes to verify dynamic performance

Examine and adjust all CONFIGuration items

Run STOPS to automatically calibrate stroke

Examine the device STATUS

Pushbuttons

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

The three pushbuttons perform the following functions:

Left Button - Marked with *, permits you to select or accept the value or parameter option currently displayed.

Middle Button - Marked **–**, permits you to move back through the menu structure to the previous item in the menu or decrement the value currently shown in the digital display. When used to decrease a displayed value, holding the button down causes the value to decrease at a faster rate.

Right Button - Marked **+**, permits you to move forward through the menu structure to the next item in the menu, or to increment the value currently shown in the digital display. When used to increase a displayed value holding this button down causes the value to increase at a faster rate.

NOTE

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

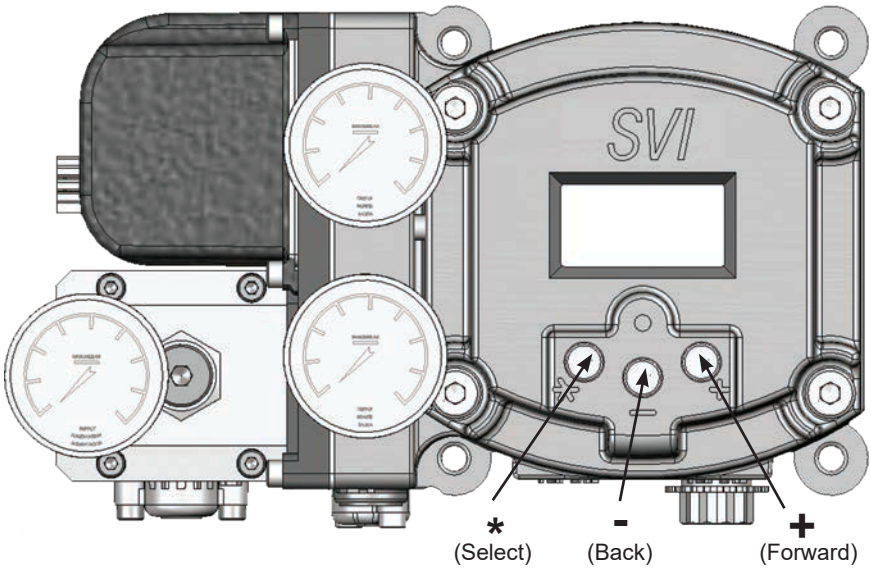


Figure 6 - SVI II APN Display Pushbuttons

ValVue Software

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

System Requirements

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

ValVue and SVI II AP DTM DTM Trial Version

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

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

- Setup Wizard
- Set calibration parameters
- Monitor status/error indicators
- Remote calibration of the SVI II AP
- Remote operation of the SVI II AP
- Trend setpoint, valve position, actuator pressure
- Perform diagnostic test procedures (full version only)
- Remote display of valve position, actuator pressure(s)
- Set configuration parameters
- Input/Output configuration
- Remote configuration of the SVI II AP
- Backup and restore configuration (clone device)
- Display comparative test results (full version only)

Advanced and Online Diagnostics

The SVI II AP offers various levels of control valve diagnostics. Up to five pressure sensors that detect circuit board temperature, loop current, and reference voltage, are available for diagnostics. For more details on the use of ValVue software, refer to the ValVue User's Guide. Contact the factory or your local representative to obtain licensing information.

Masoneilan Software Download

Download and Install ValVue3

1. Go to the Resource Center (https://valves.bakerhughes.com/resource-center) and enter ValVue in the search field (arrow in Figure 7).

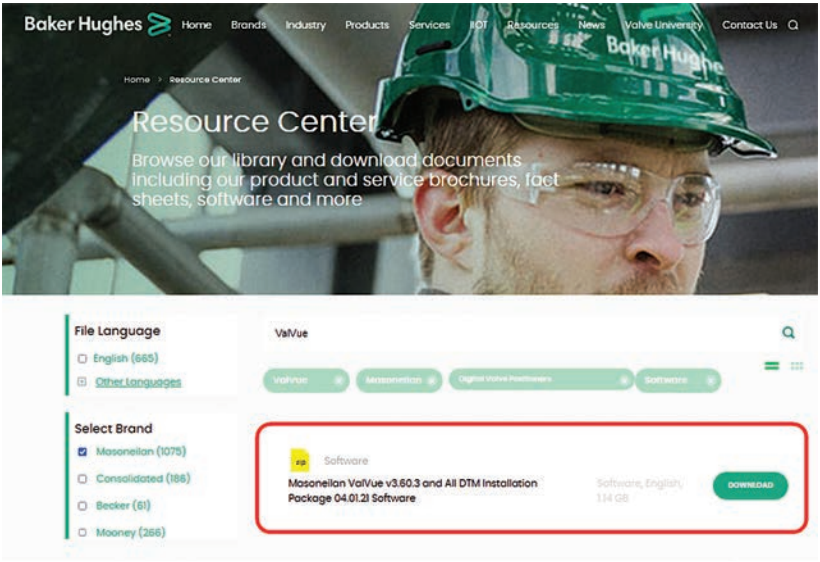


Figure 7 - Download Center: Search for Valvue

2. Use the arrows to move through the selections. Select Download below ValVue V3.30 Installer Download and Figure 8 appears.

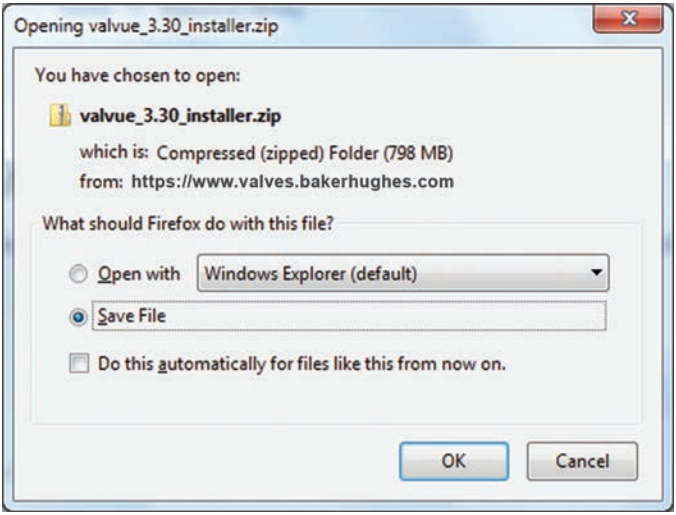


Figure 8 - Opening Dialog

NOTE

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

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

NOTE

For fastest installation, save the download file to your laptop/PC.

Don't install from the website.

4. Open Windows Explorer and click the **Windows Downloads** folder

NOTE

If you have a previous install of ValVue3 you are prompted to uninstall first and then you must run the installer again to finish the upgrade.

NOTE

If you are upgrading from ValVue 2.x you must update the SQL database location to match ValVue 3's.

5. Double-click on the installer and follow the instructions to install.

Download and Install the SVI II AP DTM

1. Go to the Resource Library (https://valves.bakerhughes.com/resource-center) and enter SVI II AP DTM in the search field (red arrow in Figure 9).

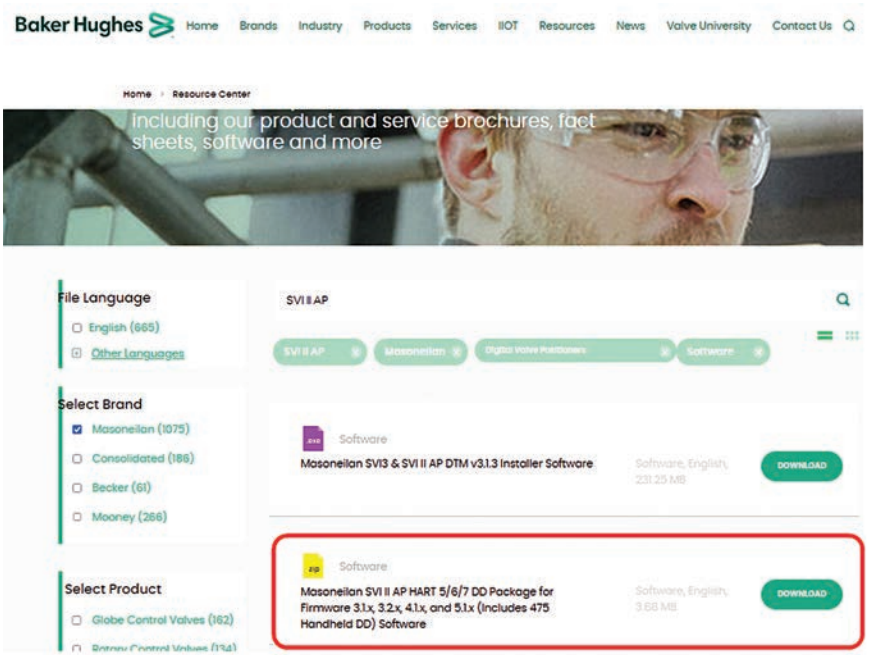


Figure 9 - Download Center: Search for SVI II AP DTM

2. Select Download below SVI II AP DTM and Figure 10 appears.

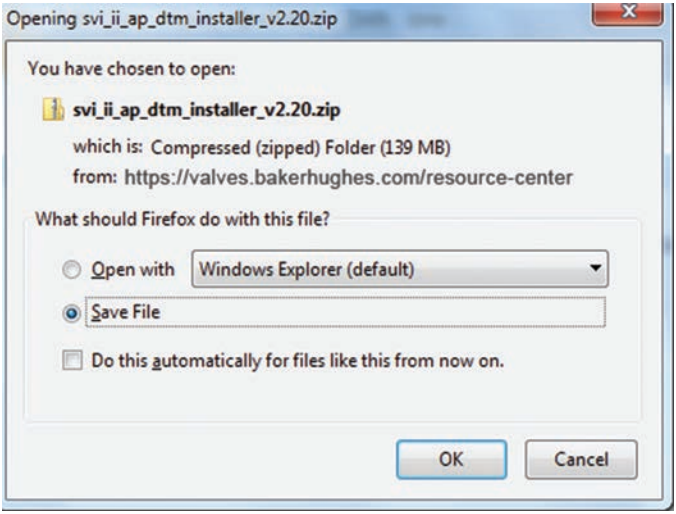


Figure 10 - Opening Dialog

NOTE

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

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

NOTE

For fastest installation, save the download file to your laptop/PC.

Don't install from the website.

4. Open Windows Explorer and click the **Windows Downloads** folder.

NOTE

If you have a previous install of the SVI II AP DTM you are prompted to uninstall first and then you must run the installer again to finish the upgrade

5. Double-click on the installer and follow the instructions to install.

Maintenance

WARNING

field replaceable parts nor any maintenance required or allowed on the SVI II APN. Performing any alterations on the unit can compromise unit operations and may void the SVI II APN warranty. This is not mentioned in ES-699.

Contact the factory with any service requests or concerns.

Installation

Compliance voltage testing is best done before installation. See ***Determining an SVI Positioner Compliance Voltage in a Control System*** on page 68.

This section describes how to mount and wire the SVI II APN, which includes:

Step 1: ***Mounting the SVI II APN on*** page 21.

Mounting the SVI II APN on Rotary Valves on page 22

Mounting the SVI II APN on Reciprocating Valves on page 25

Additionally, there is ***Installing the SVI II APN for Double-Acting Operation*** on page 29

Step 2: ***Connecting the Tubing and Air Supply*** on page 31

Step 3: ***Wiring the SVI II APN*** on page 35

WARNING

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

*Before installing or using this instrument, **READ THE INSTRUCTIONS CAREFULLY**. Refer to **Hazardous Location Installation** on page 60 for detailed instructions.*

Shielded cables must be used for APN installation.

Unpacking: Inspect Actuator, Linkages, or Rotary Adapter

Verify that the mounting has no shipping damage for a pre-mounted SVI II APN, physically inspect the actuator, linkage. Record the following information for the configuration checkout:

- Valve Air to Open (ATO) or Air to Close (ATC)
- Actuator bench range
- Actuator pressure rating
- Control valve Inherent trim characteristic; linear, equal percentage, etc.

NOTE

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

Step 1: Mounting the SVI II APN

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

1. Attach the mounting bracket to the actuator.
2. Install the magnetic assembly.
3. Assemble the SVI II APN on the mounting bracket.

NOTE

Mount the SVI II APN with the conduit connections down in order to facilitate drainage of condensate from the conduit.

Necessary Precautions

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

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

Mounting the SVI II APN on Rotary Valves

This section describes the procedure for mounting the SVI II APN on rotary control valves that have less than 60° rotation, such as the *Camflex*™. Figure 11 shows a side view of a Camflex actuator and the SVI II APN actuator mounting brackets.

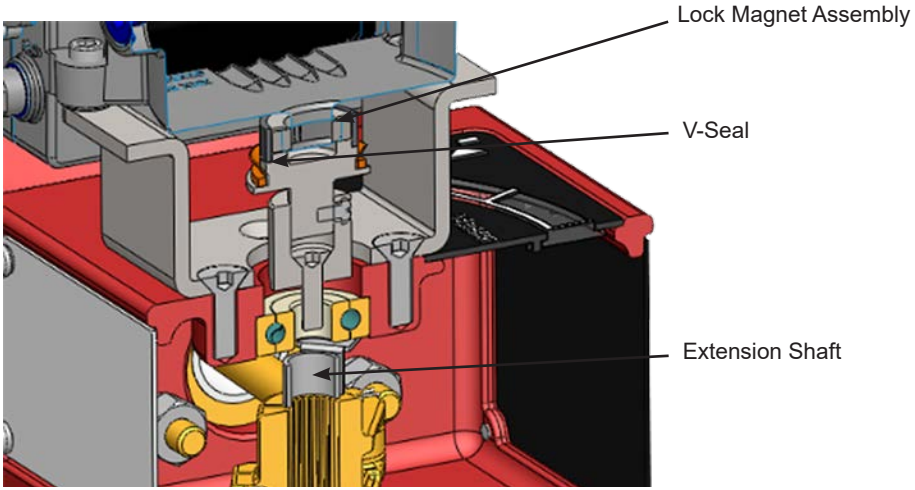


Figure 11 - Camflex with Mounting Bracket (side view)

Tools required:

- ☐ M5 Hex Key
- ☐ M4 Hex Key
- ☐ M3 Hex Key

To mount the SVI II APN:

1. Attach the mounting bracket to actuator (Figure 12).

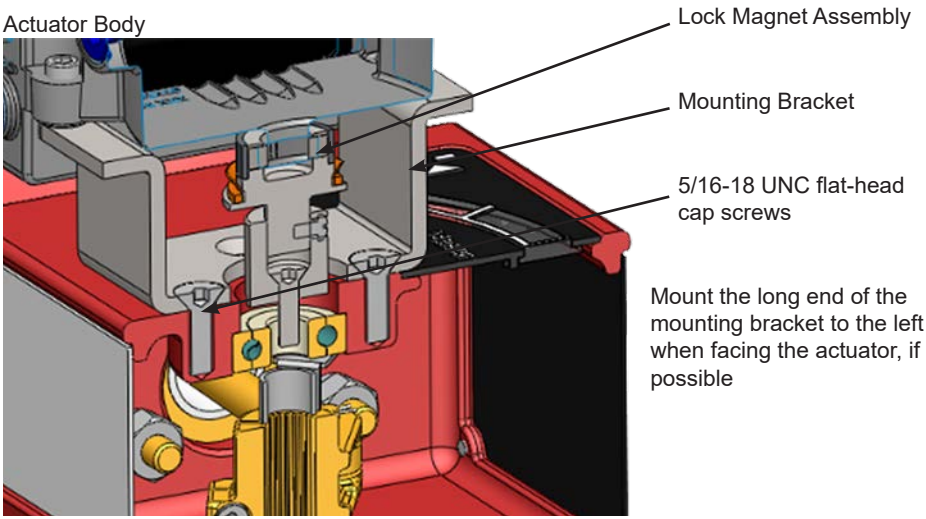


Figure 12 - Rotary Mounting Bracket to Valve actuator

2. Bolt the extension shaft to the valve position take-off shaft (Figure 13).

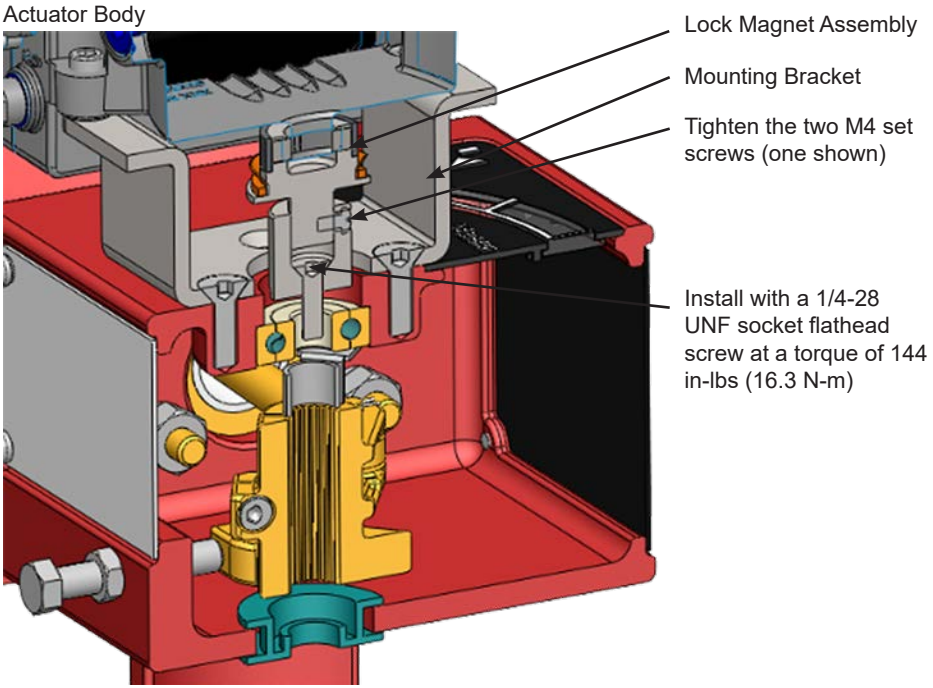


Figure 13 - Extension Shaft to the Valve Position Take-off Shaft

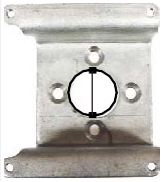
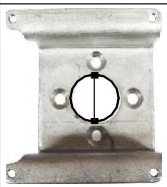
Internal valve pressure	The valve plug shaft is pushed out to the mechanical stops, usually a thrust bearing. On valves where the valve position take-off is mounted directly on the end of the plug shaft, a Camflex for example, the shaft must be bearing on its stop to properly set up the SVI II APN Controller. During hydrostatic testing the shaft is thrust to its stop and a normally tightened packing retains it in that position.
Vacuum service	The valve shaft is drawn into the body by the vacuum acting on the shaft, but the magnetic coupling must be assembled flush with the mounting bracket with the shaft pulled fully out to its thrust bearing. Therefore, before a vacuum is applied, ensure that the endplay from the vacuum position to the fully extended position is less than 0.06" (1.524 mm).

3. Perform magnet install and travel sensor alignment by:

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

    b. Rotating the magnet holder so that the magnet axis is vertical when the valve is in the closed position (Table 1).

Table 1 - Travel Sensor Alignment

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

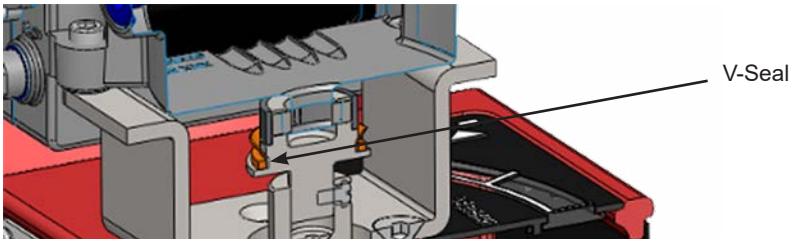
c. Aligning the end of the magnet holder flush with the end of the mounting bracket. Secure the magnet holder with two M5 set screws.

d. Sliding the V-Seal over the magnet holder. You can also check the magnet using ValVue software by reading sensor counts and comparing them to Table 1.

4. Secure the SVI II APN onto the mounting bracket using four M6 x 20 mm Socket Head Cap screws.

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

6. Ensure that the V-Seal makes contact with the skirt around the position sensor protrusion on SVI II APN housing (Figure 14).



Mounting the SVI II APN on Reciprocating Valves

This section describes the procedure for mounting the SVI II APN on Reciprocating Valves, using Masoneilan's 87⁄88 Multi-Spring actuators as an example. Figure 15 shows the standard lever for all size installations.

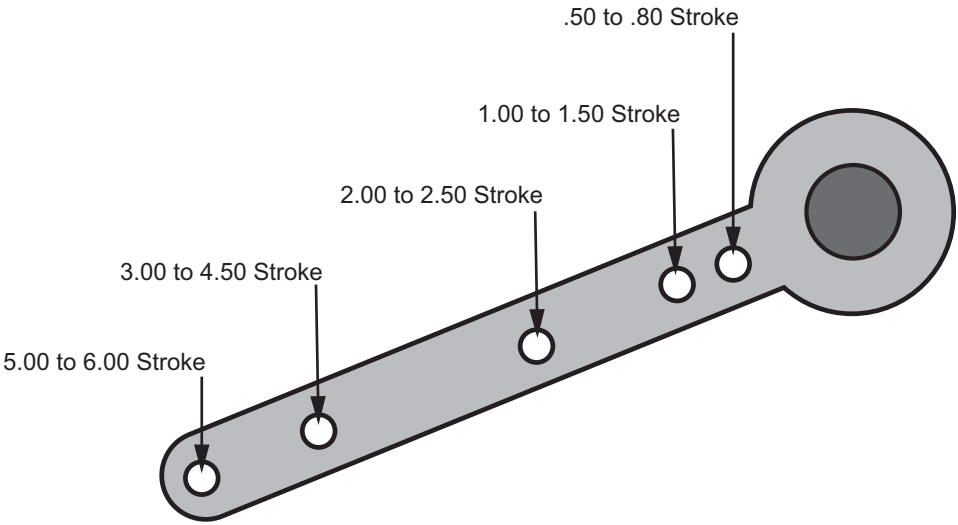


Figure 15 - Standard Lever

Tools required:

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

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

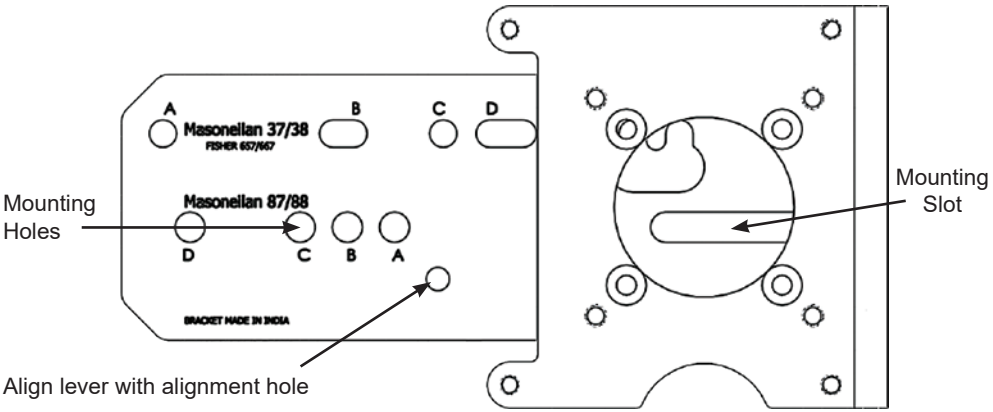


Figure 16 - Reciprocating Valve Mounting Bracket for Standard Lever

2. Ensure that the magnet axis is vertical when the lever is in the valve closed position by pinning the lever is to the magnet assembly and securely tightening using an M5 flat head screw and Loctite 222ms or equivalent (Figure 17).

CAUTION

You must use Loctite 222ms or equivalent during installation. Check that the screw is tight during installation and during regular periodic maintenance.

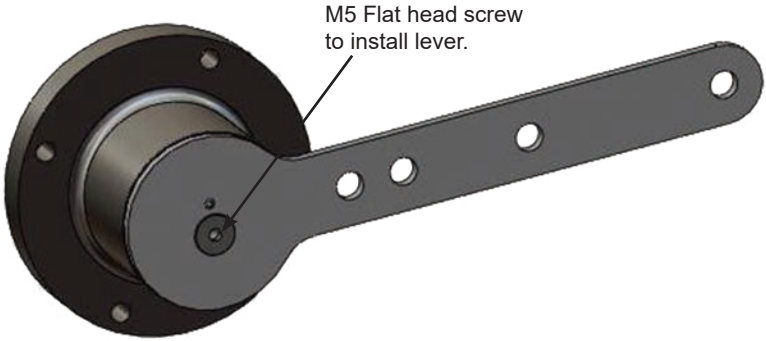


Figure 17 - Magnet Holder and Standard Lever for Reciprocating Valves

3. Select mounting hole for the stroke of the valve. For example, hole B is shown in Figure 18 on page 28 for a size 10 actuator with 1.0” stroke. Unless otherwise specified, the SVI II APN mounting assumes that the actuator is in the normal upright position. The mounting hole in the slotted opening of the mounting bracket must be left when facing the actuator, with the actuator in the upright position.

Table 2 - Reciprocating Valve Mounting Hole and Turnbuckle Length

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

4. Thread the take-off rod to the actuator stem connector (Figure 18).

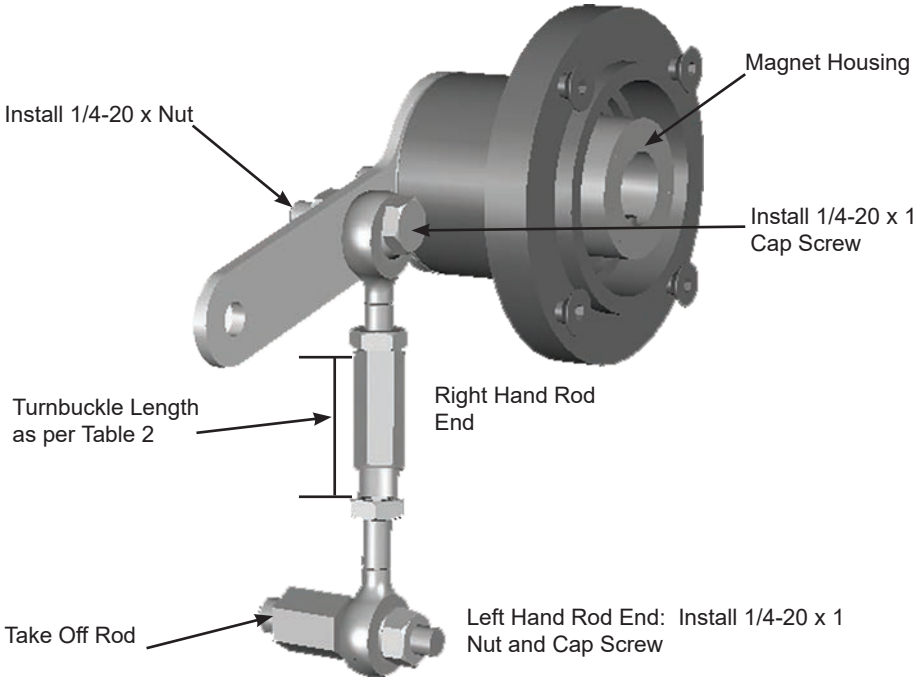


Figure 18 - SVI II APN Take Off Rod Mounting

5. Attach the right hand threaded rod end to the SVI II APN lever using a 1⁄4 - 20 x 1” cap screw and nut (Figure 18).

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 2 on page 27.

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.
    - Retract, actuators vent the actuator of air pressure.

10. Thread the turnbuckle onto the left hand threaded rod end (Figure 18).

11. Adjust the turnbuckle until the hole in the SVI II APN lever is aligned with the indicating hole in the bracket. Tighten both turnbuckle lock nuts (Figure 18).

12. Ensure the adjustable link turnbuckle is parallel to the valve stem. 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 using the proper holes (Figure 16 on page 26).

13. Mount the SVI II APN to the bracket and secure with four M6 socket head cap screws.

Installing the SVI II APN for Double-Acting Operation

This section explains how to mount the SVI II APN 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 19) using helical spring washer 5/16, flat washer 5/16 and hex screw 5/16-18x44.5 [1.75] LG.

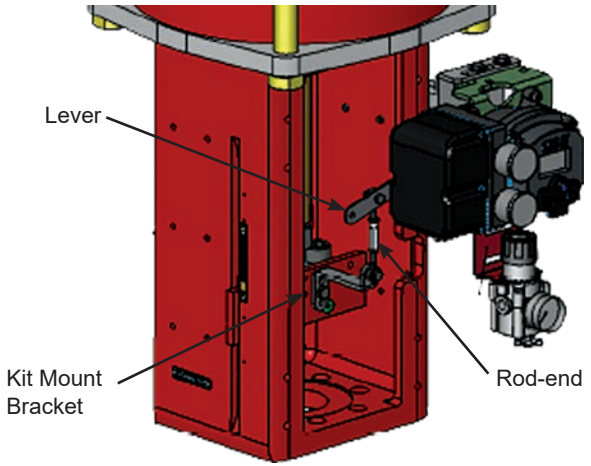


Figure 19 - 84/85/86 Valve

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 15 on page 25.

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

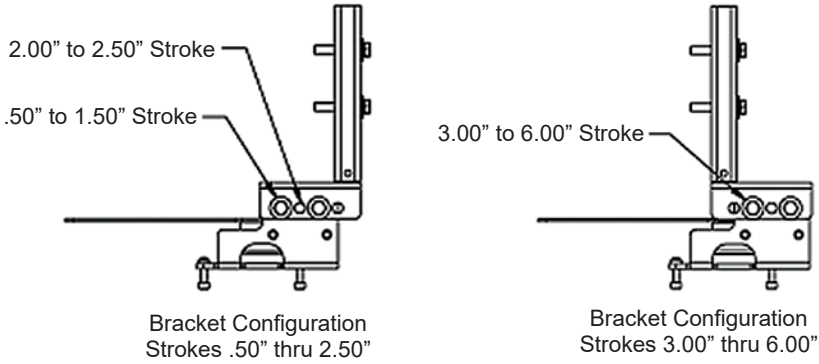


Figure 20 - Bracket Configuration Strokes .50” - 2.50” and 3.00” - 6.00”

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

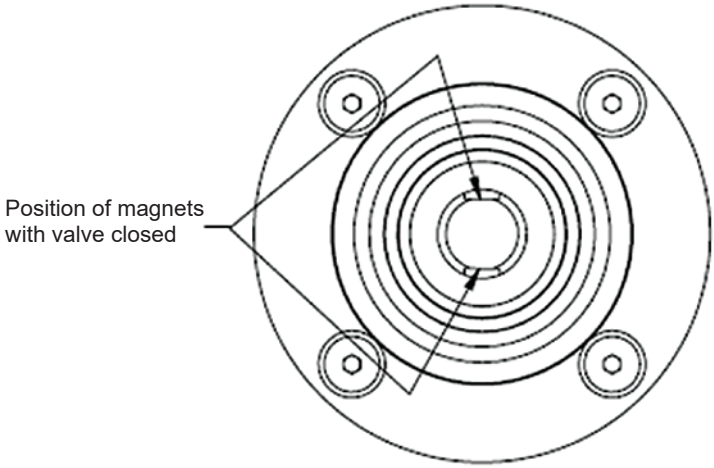


Figure 21 - Magnet Position with Valve Closed

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

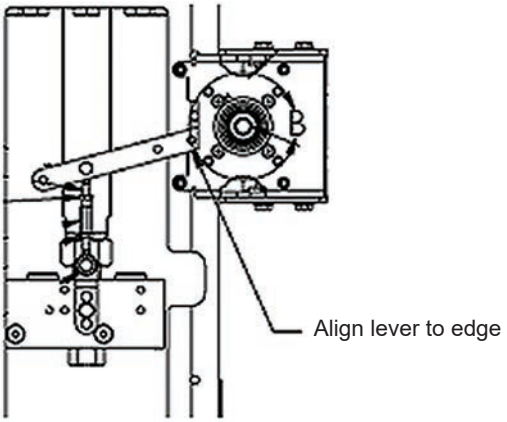


Figure 22 - Lever Alignment

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

Step 2: Connecting the Tubing and Air Supply

To connect the air supply:

1. Install the tubing to the air supply port (S¬). Minimum tubing diameter 1⁄4” (6 mm x 4 mm) (Figure 23).

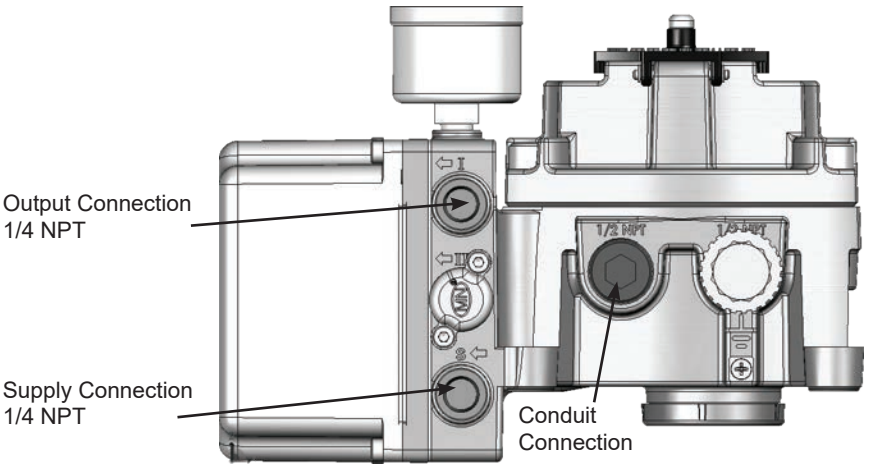


Figure 23 - Single-Acting Air Ports

2. Pipe the output air from the output pressure port (¬**I**) to the actuator.

NOTE

The SVI II APN 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.

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

Table 3: Air Supply Requirements

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

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

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

Connecting the Tubing and Air Supply - Double-Acting

This section describes the process for connecting the tubing and air supply to a 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¬).

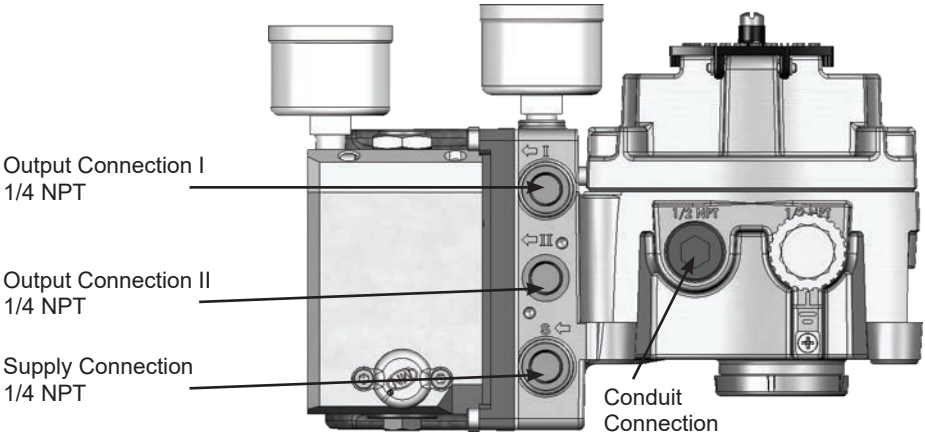


Figure 24 - Double-Acting Air Ports

2. 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.

   Air supply:

   Supply pressure for double-acting SVI II APN:

   25 - 150 psi (1.73 - 10.4 bar) (172 - 1035 kPa)

   Minimum tubing diameter 1⁄4” (6 mm x 4 mm)

NOTE

The SVI II APN 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 APN models SVI II APN/SD through SVI II APN/AD).

Actuator Piping

Connect Output 1, labeled ACT 1 to the inlet port of the actuator in accordance with Figure 25. Output 2 labeled ACT 2 connects to the opposing actuator port.

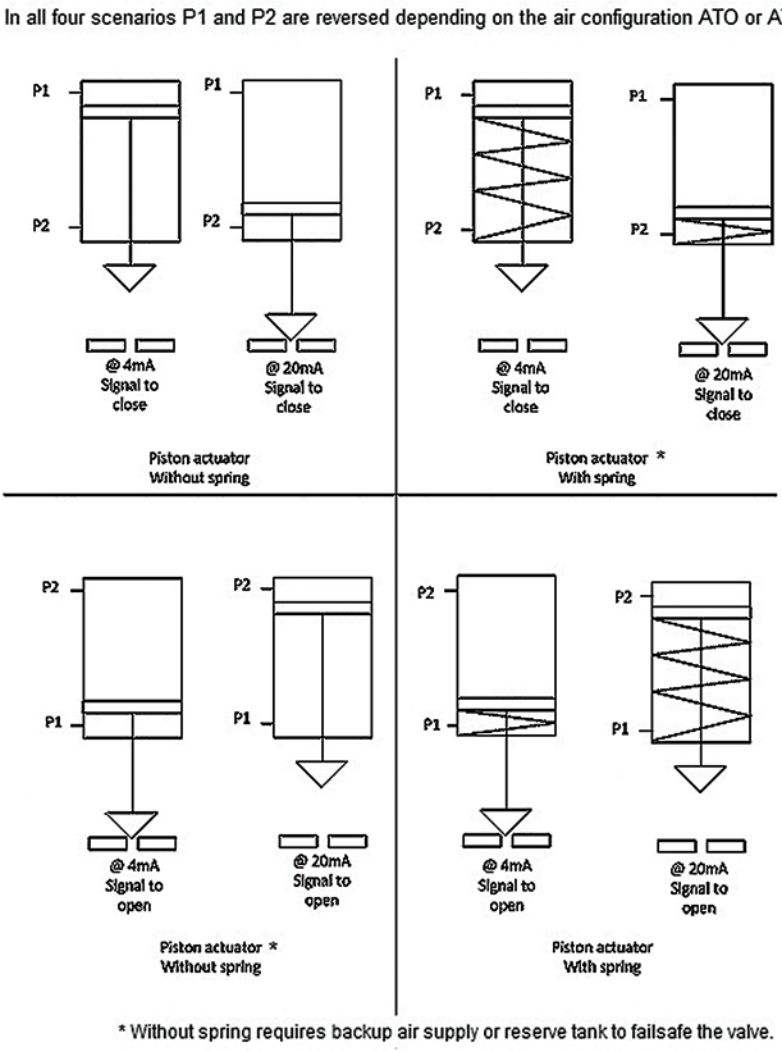


Figure 25- Double-Acting Positioner ATO/ATC Settings for Reciprocating Valves

* Without spring requires backup air supply or reserve tank to failsafe the valve.

Step 3: Wiring the SVI II APN

WARNING

Comply with current national and local regulations for electrical installation work.

Use only shielded cables.

Before carrying out any work on the device, power off the instrument.

CAUTION

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

*Refer to **Optional Switch Load Limits** on page 64 for instructions on safely wiring the switches.*

All connections to electronic module in the SVI II APN are made through the terminal board. The SVI II APN terminal board has a terminal block with cage clamp connectors. Not all options are available for every model. Refer to Table 4 for available functionality.

Table 4: SVI II APN Models and Functionality

Available Functionality	Positioner Model Number	
	SVI II 31123126	SVI II 32123126
4 - 20 mA Input Setpoint	Standard	Standard
Display/ Pushbuttons	Standard	Standard
Solid State Switch #1 and #2	Standard	Standard
4- 20 mA Out Position Tx	Standard	Standard

NOTE

The PV (Process Variable) is not used for the SVI II APN. The Digital Input (DI) is activated using SMARTs Assistant, which is downloaded at https://valves.bakerhughes.com/resource-center.

The DI switch is a dry contact switch. As an example, the switch may be utilized as a mechanical limit switch backup. The most common way to read the switch status is via the DTM or DD. The input to the switch can be automated by sending Device Variable 8 (DI) via CMD 9 or CMD 33 from a DCS.

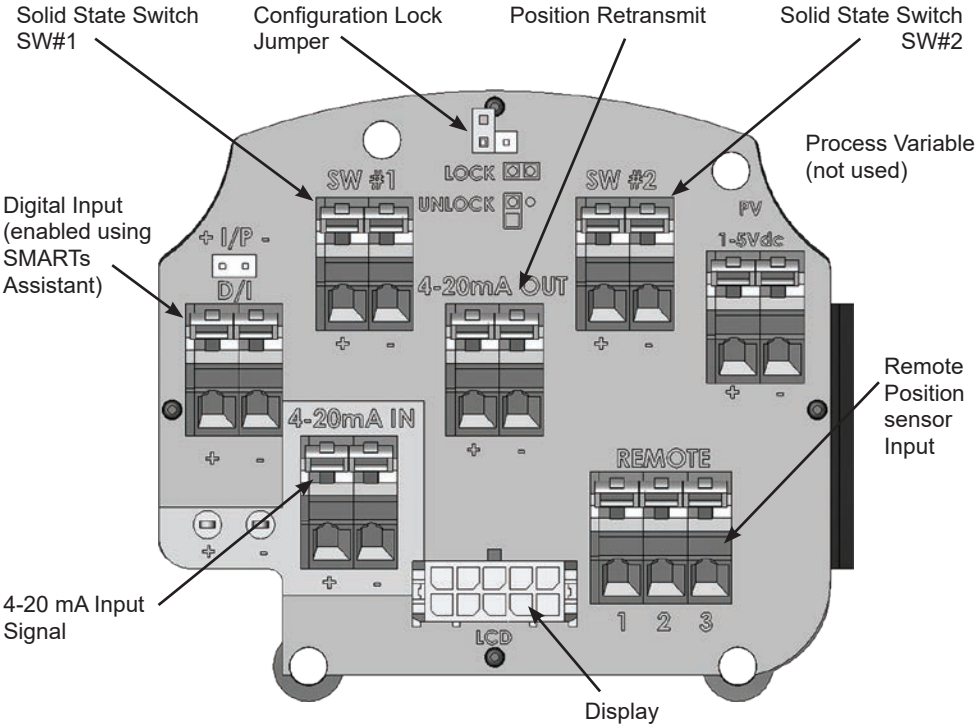


Figure 26 - Connections to Electronics Module (via Terminal Board)

Wiring Guidelines

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

Compliance voltage at the SVI II APN is 9 V at the current of 20 mA. See ***Determining an SVI Positioner Compliance Voltage in a Control System*** on page 68.

Signal to the SVI II APN must be a regulated current in the range 3.2 to 22 mA.

Controller output circuit must be unaffected by the HART tones which are in the frequency range between 1200 and 2200 Hz.

Frequency range of the HART tones must have a circuit impedance of more than 220 Ohms, typically 250 Ohms.

HART tones may be imposed by the positioner and a communication device located anywhere on the signaling circuit.

Cabling **must be shielded** to prevent electrical noise that would interfere with the HART tones.

Shield must be properly grounded in only one place.

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

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

Use of a low impedance voltage source damages the SVI II APN. The current source must be a true high impedance current limiting device. A proper current source explicitly enables adjustment of the current in mA, not Volts.

When wiring a position retransmit:

Use the same gauge wires as the 4-20 mA control loop.

Ensure that the position retransmit signal is connected to the control system's analog input card.

Ensure the control loop is powered while making make measurements with a meter.

CAUTION

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

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.

Wiring a Position Retransmit

CAUTION

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

To connect:

1. Strip the insulation at the end of the wires. Strip approximately 1/4" (6.35 mm) of the insulation at the end of wires (wire size 14 to 28 AWG, 2.5 mm2 to .08 mm2).
2. Connect the +/- terminals from the 4-20 mA Out to the position retransmit input signal: + to + and - to -. See Figure 26 on page 36.

To troubleshoot retransmit connections:

Ensure that the retransmit circuit has a minimum voltage of 10 V (maximum 30 V).

Ensure the minimum AO current is 3.2 mA. If the module loses power and the AO circuit remains powered, the AO signal will be 3.2 mA.

3. Check Out, Configuration and Calibration

Overview

This section provides the calibration procedures to ensure proper valve positioning. Operational checkout, configuration and calibration procedures are described using an SVI II APN that has a display with pushbuttons.

NOTE

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

Check Out Procedures

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

- ☐ ***Verify Mounting and Linkage Adjustment*** on page 38
- ☐ ***Check the Magnet*** on page 38
- ☐ ***Checking the Air Supply*** on page 39

Verify Mounting and Linkage Adjustment

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

Check the Magnet

Use this procedure to check the magnet using ValVue.

1. Run ValVue.
2. Select the installed positioner from the list of Connected Devices.
3. Select the Check tab to view the current operating conditions of the selected positioner.
4. Read Raw Position. When the valve is:
   - ☐ Closed the value should be between – 1000 and +1000 for a reciprocating valve or a 60° rotation rotary valve.
   - ☐ At mid-travel the value should be between –1000 and +1000 for a greater than 60° rotation rotary valve.

Checking the Air Supply

Use this procedure to check the air supply.

1. Turn on the air supply.
2. Adjust the filter regulator.
3. Supply pressure must be a minimum of 10 psi 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.

NOTE

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

Operational Checkout

The operational checkout of the SVI II APN consists of:

- ☐ Checking the pushbutton locks
- ☐ Powering up the SVI II APN

This section describes configuration and calibration with the optional local display and pushbuttons. If the SVI II APN 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 APN is turned on it is advisable to apply the air supply before applying the electrical input signal.

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 is provided in the unlocked mode.

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

Table 5: Pushbutton Lock Security Level

Level	Access
Security Level 3	Allow Local Buttons: Buttons on the SVI II APN 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 notgo 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 calibrateor 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. When set to the secure position, shorting the two-pin header, configuration and calibration are not permitted by the local interface or by remote communications. Pushbuttons, ValVue and a handheld are locked out, except to examine configuration, calibration, and position. This is similar to Security Level 1 shown in Table 5.

Powering Up the SVI II APN

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 APN is turned on, apply the air supply before applying the electrical input signal.

CAUTION

Use of a low impedance voltage source will damage the SVI II APN. The current source must be a true high impedance current limiting device. A proper current source explicitly enables adjustment of the current in mA, not Volts.

To power up the SVI II APN:

1. Adjust current to 12 mA. On initial power up of a newly installed SVI II APN, the positioner runs in NORMAL mode using the default instrument parameters installed at the factory. The positioner cycles through the NORMAL cycle menu and LCD displays the following values:
   - ☐ PRES: Pressure - unit of measurement and value
   - ☐ SIGNAL
   - ☐ POS (Position)
   - ☐ An exclamation point (!) appears in the top left corner of the display window to indicate that there is further instrument status available.
2. Proceed to ***Configuration*** on page 41.

NOTE

If the SVI II APN is specified without local pushbuttons and display, local operation is not available. Configure and calibrate with ValVue and a HART modem.

Configuration

Use the procedures that follow to: calibrate, tune, view configuration data and status messages for the SVI II APN.

WARNING

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

Notes on Aggressiveness

Setting Aggressiveness

While the SVI II AP DTM and the DD allow you to set Aggressiveness, the pushbuttons do not. In all three methods, however, the Aggressiveness value is inherited from any previously performed tuning (Autotune or manual). Once Aggressiveness, and other tuning values are determined, they are stored in NVRAM.

The SVI-IIAP provides a user define Aggressiveness Level for auto-tuning, the allowable range varies from -9 to +9 where 0 (Zero) is consider normal tuning. The Aggressiveness Level influences stroking speed and over-shoot. A negative value will SLOW stroking speed and help minimized over-shoot. A positive value will INCREASE stroking speed and may add some over-shoot. The recommended values for Aggressiveness is 0 for control valves without volume boosters.

In applications with volume boosters and/or quick exhaust valves are used the Aggressiveness Level is not as influential. For Auto-tuning it is usually between 0 and 3. Reduce the volume boosters sensitivity by opening the integral bypass needle valve about 1 to 2 turns. Use caution when adjusting the needle valve so as to not to damage the seat, close gently to seat and then open 1 or 2 turns.

Aggressiveness Dynamic

Lower values of aggressiveness lead to lower PID values and slower response and less overshoot.

Higher values lead to higher PID values and quicker response and more overshoot.

Once you have a preferred aggressiveness and you tune once, all future autotunes automatically use that same value, until user-changed.

Configuration with Pushbuttons

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

Viewing Configuration Data

To view SVI II APN configuration data:

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

Configuration 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.

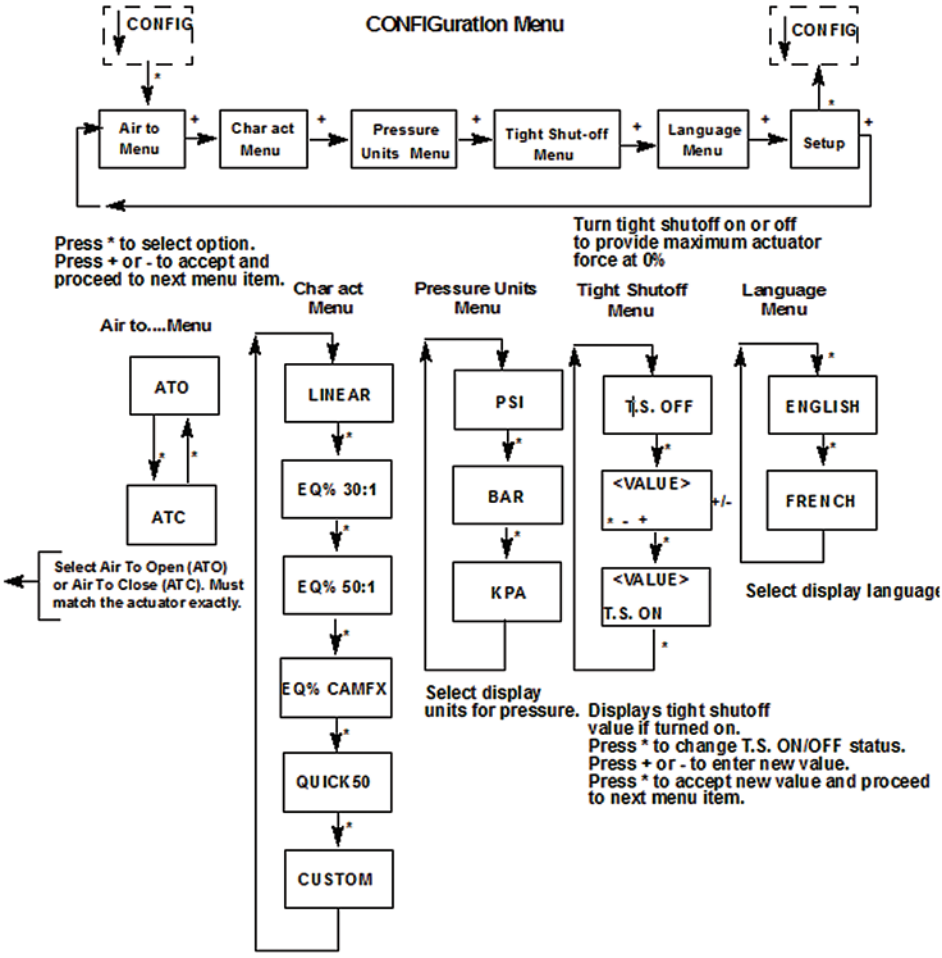


Figure 27 - CONFIGure Menu

Viewing Status Messages

To view SVI II APN status messages:

1. Press + and * to select VIEW ERR.
2. Observe any internal errors. For example, there should be a RESET status caused by powering up. If the positioner was powered without air a Position Error or POSERR can appear.
3. Press + to view all faults.
4. Press * to return to MANual menu.
5. Press + until CLR ERR appears.
6. Press * CLR ERR. WAIT appears for a second or two.

VIEW DATA Settings

Table 6: VIEW DATA Settings

Typical Setting	Optional Setting				
SINGLE	DOUBLE				
ATO	ATC				
LINEAR	EQUAL 30	EQUAL 50	QUICK 50	CUSTOM	CAMFXEQ
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				

Calibration

CAUTION

Use the Manual Stop calibration procedure for Pilot Trim Valve Applications. Do not run Find Stops or the ValVue Setup Wizard on Pilot Trim valves as this damages the valve.

To calibrate the SVI II APN:

1. Observe the display following power-up. The SVI II APN powers up in the previously active mode either MANUAL or NORMAL (operating) mode:
   - ☐ In NORMAL mode, the display alternates between POS and SIGNAL.
   - ☐ In MANUAL, the display alternates between POS –M and SIG.
2. With MANUAL mode displayed, press * to select the **MANUAL** mode.
3. Press + again; ↓CONFIG appears. Pressing + again brings ↓CALIB.
4. Select CALIB by pressing *. STOPS appears. The valve moves full open and back to full closed. Observe all warnings.
5. Press * to cause the valve to stroke and to automatically calibrate valve travel. The STOPS procedure finishes.
6. Press + twice until TUNE appears.

Calibration Menu

The Calibration menu shown in Figure 28 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.

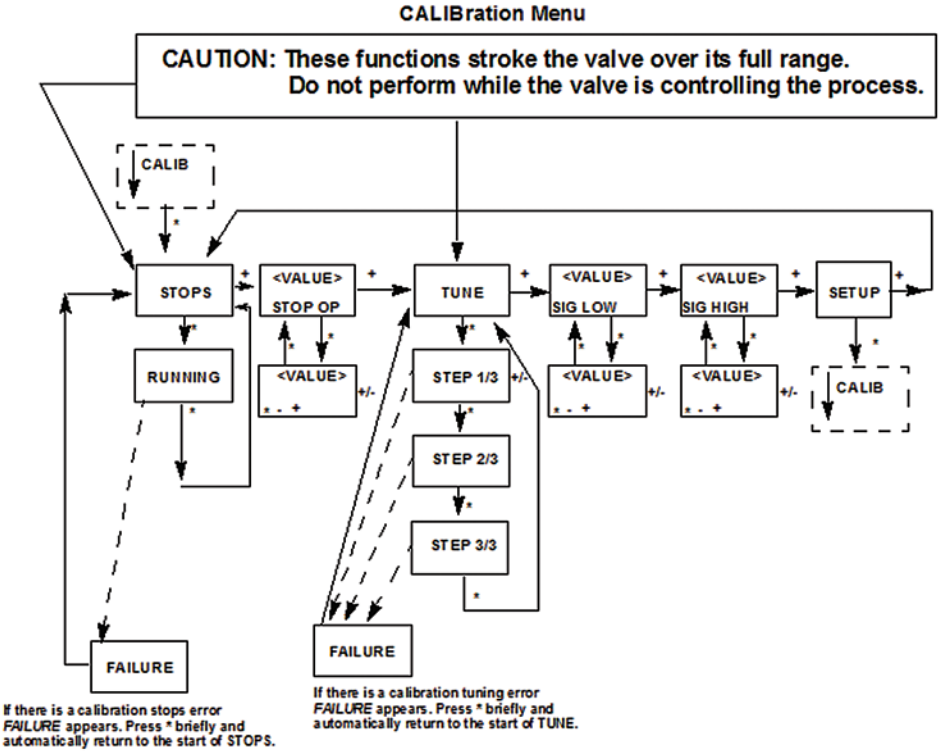


Figure 28 - CALIBration Menu

Auto Tune

This process takes 3 to 10 minutes and strokes the valve in large and small steps to set the PID parameters for best positioning response.

To auto tune the SVI II AP:

1. Press * to begin the autoTUNE procedure.
   As autoTUNE proceeds, numerical messages display, indicating the procedure is working.
   AutoTUNE completes and TUNE appears.
2. Press + repeatedly until ↑ SETUP appears.
3. Press * to return to SETUP menu; ↓CALIB appears.

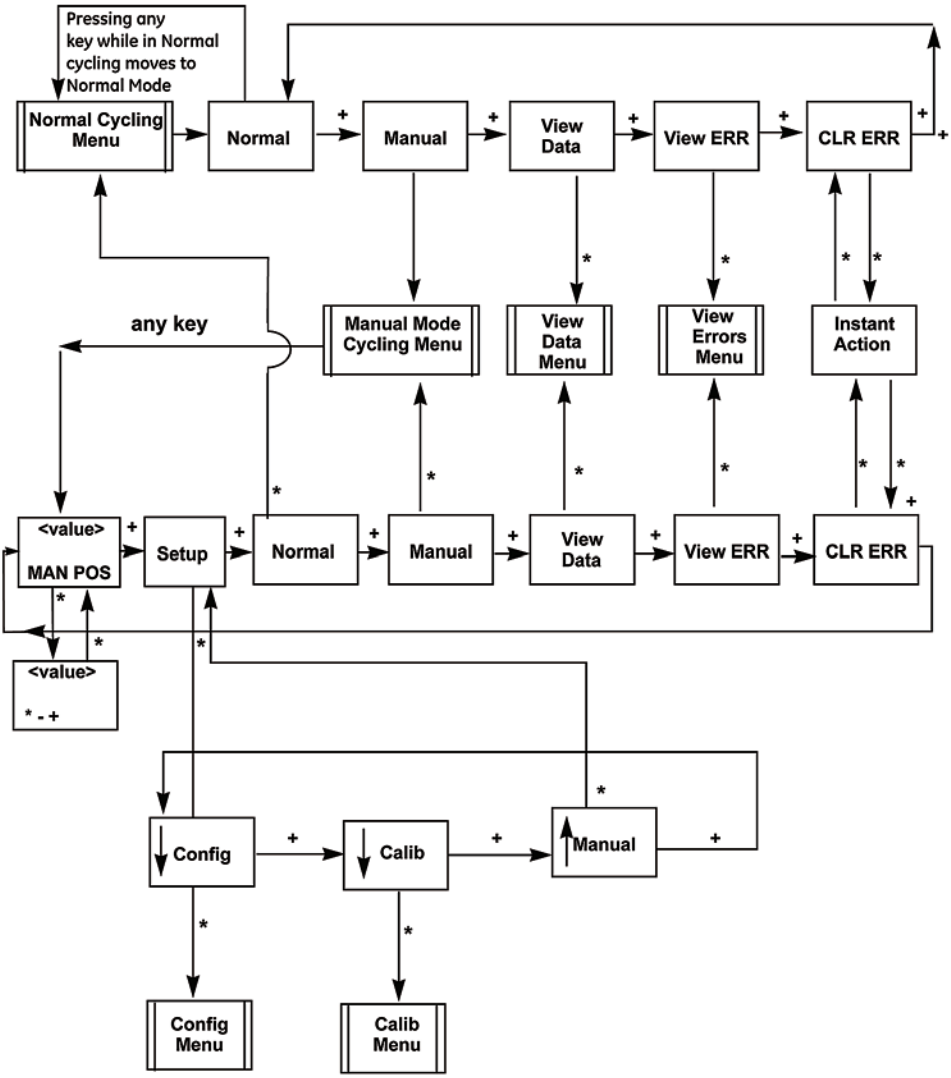


Figure 29 - NORMAL Operation and MANUAL Menu Structures

Check-out with a HART Handheld Communicator

If the SVI II APN is not equipped with optional push buttons and local display the checkout and configuration is performed using the standard HART communications interface.

Connect the HART handheld communicator to the SVI II APN as shown in Figure 30. Refer to the product manual for The HART communicator.

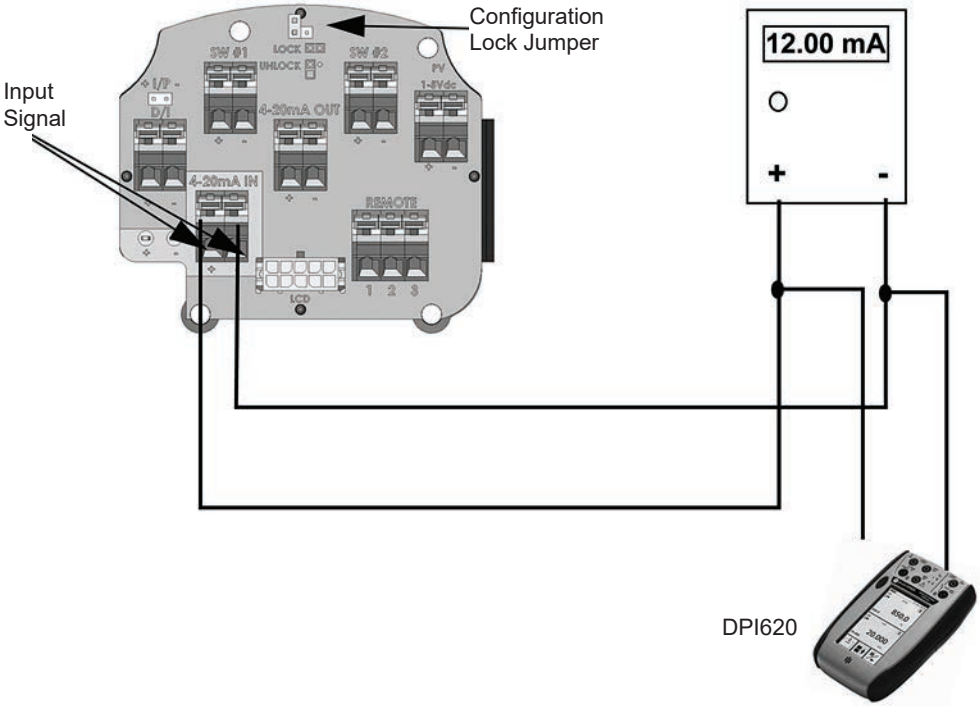


Figure 30 - SVI II APN HART Communicator Connections

Be sure that the configuration lock jumper is in the unlock position. When the jumper is in the lock position (shorting the two-pin header) the handheld is not permitted to make any changes. However, parameters are readable. If fault messages appear, they must be handled before proceeding with HART communications. Before communications 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
1. Press **NEXT. Ignore next 50 occurrences** of status?
1. Press **YES**
1. Change to **MANual** mode
1. Scroll to line **6 EXAMINE**, press →.
1. Scroll down to **5 read status**.
2. Read message.
1. Press **OK**.
1. Repeat **OK** to read all messages until the display returns to read status.
1. Scroll down to **6 clear status**, press →.
1. If **clear fault codes not completed** appears, press **OK** and read the message (**Position Error**, for example) or go to the troubleshooting guide.
1. Correct the problem (Is the air supply on?), and then go to clear status until **Clear Fault codes** Completed appears.
1. Press **OK**.

Appendix A: Specifications and References

Physical and Operational Specifications

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

Table 7: 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 (.73% per bar)
Relative Humidity	10 to 90% non-condensing
Humidity Effect	Less than 0.2% after two 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 (IEC1000-4-2) Radio frequency interference — Less than 0.2% at 10 V/m (EN 50140)
Fast Transient Burst	No effect at 2 kV (Coupling clamp IEC 1000-4-4).
Vibration Influence Measured at SVI II APN 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 8: Operational Specifications

(Specifications are subject to change without notice)

Accuracy	+/- 0.5% (typical +/-0. 10% or less)Full Span
Hysteresis and Deadband	+/- 0.3% Full Span
Repeatability	+/- 0.3% Full Span
Conformity	+/- 0.5% Full Span
Start-Up Drift	Less than 0.02% in first hour
Long Term Drift	Less than 0.003% per month
Position Travel Limits	Rotary: 18 - 140° Reciprocating: 0.25” - 2.5“ (6 mm - 64 mm) Note: Above 2.5” (64 mm) consult factory for mounting instructions.
Flow Characteristics Applied in addition to the control valve’sinherent 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 APN 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 theAuto 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 as0 to 1000 (1/10s) Derivative time: 0 to 200 ms Dead Zone: 0 to +/-5% (0 to 10% deadband)Padj: +/- 3000 (depends on P) Beta (non-linear gain factor): -9 to +9 Stroking Time: 0 to 250 seconds Position compensation coefficient: 1 to 20 Boost: 0 to 20
Full open position adjustment	60 to 100% of actual stop
Start Up Time (from no power)	Less than 200 ms
Minimum current to maintain HART	3.0 mA
HART Command#3 Mapping	HART 4-20 mA input signal PV = Valve Position, 0-100% SV = Actuator Pressure (P1-P2) (N/A for standard diagnostic version; units sends zero) TV = Supply Pressure QV = P2 for double-acting units (N/A for standard diagnostic version; units sends zero)

Table 9: Input Signal, Power, and Display Specifications

Power Supply	Loop powered from 4-20 mA control signal
Compliance Voltage Rating	9.0 V at 20 mA, 11.0 V at 4.0 ma
Minimum Current Signal to Start Up	3.2 mA
Minimum Input Span for Split RangeOperation	5 mA
Upper Range Value for Split RangeOperation	8 mA to 20 mA
Lower Range Value for Split RangeOperation	4 mA to 14 mA
Wire Size	14/28 AWG
Strip Length	0.22' / 5.6 mm
Digital Communication	HART Communication protocol revision 5
Local Display	LCD, Explosion proof with two lines of ninealpha numeric characters. Display becomes unreadable between 0°Cand -10°C. Display is shutdown at -15°C.
Push Buttons	External, Three Explosion Proof /Flameproof push buttons

Table 10: Construction Material Specifications

Housing and Cover	Aluminum ASTM B85 SG100A standard
Weight	Standard - 7.4 lbs./ 3.357 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 11: System Connectivity

HART Physical Device Type	Valve positioner; HART device type 6, Device type 202, 0, 00CA)
DD Registered® with FieldComm® Group	Yes
Integration with HART Hostsoftware	ValVue AMS SNAP-ON application available, Plug-In Application For Yokogawa PRM, ValVue For Honeywell FDM, Device Type Manager (DTM) for FDT Host
Diagnostics	Standard: Alarms, cycle counter, travel accumulator, time open, time close, time near close, Step Test, Positioner Test Advanced: Includes Standard Diagnostics and the following: Low Air Supply alarm, Valve Signature (Friction, spring range, seat profile)

Table 12: Pneumatics Single-Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered air(per ISA S7.3)
Action	Direct-Acting
Supply Pressure	20-100 psi max. (1.4 to 6.9 bar) Regulate 5 to 10 psi above actuator spring range. Do not exceed actuator rating.
Air Delivery - Single-Acting Relay	10.0 scf/min. (283 L/min.) at 30 psi (2.1 bar) supply 16.6 scf/min. (470 L/min.) at 60 psi (4.2 bar) supply 23.3 scf/min. (660 L/min.) at 90 psi (6.1 bar) supply
Air Capacity (flow coefficient)	Loading CV = 0.57 Venting CV = 0.53
Air Consumption	0.2 scf/min. (5.7 sL/min.) at 30 psi (2.1 bar) supply 0.26 scf/min. (7.4 sL/min.) at 45 psi (3.1 bar) supply
Air Supply Failure	Single-Acting Relay On supply failure the actuator output fails to atmosphere. 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	Actuator Output fails to atmosphere
Output Pressure	0-150 psi (10.3 bar) max

Table 13: Pneumatics Double-Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered air see ISA S7.3
Action	Output 1 increases with increasing signal Output 2 decreases with increasing signal
Supply Pressure for Double-Acting	25 - 150 psi max. (1.7 to 10.3 bar) Do not exceed actuator rating.
Air Delivery for Double-Acting	7.2 scf/min. (204 L/min.) at 30 psi (2.1 bar) supply 12.8 scf/min. (362 L/min.) at 60 psi (4.1 bar) supply 18.3 scf/min. (518 L/min.) at 90 psi (6.1 bar) supply 23.8 scf/min. (674 L/min.) at 120 psi (8.3 bar) supply
Air Capacity (flow coefficient)	Loading CV = 0.57 Venting CV = 0.53
Air Consumption for Double-Acting	0.4 scf/min. (11.3 L/min.) at 30 psi (2.1 bar) supply 0.85 scf/min. (24.1 L/min.) at 80 psi (5.52 bar) supply
Air Supply Failure	Positioner cannot control the failure position of an actuator without a spring. The actuator can, under different conditions, fail in place, fail open, or fail close. In cases where the valve must fail to a required position additional accessories are 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 fails to atmosphere Output 2 fails to supply pressure

Table 14: Nuclear Industry Standards and Guidelines

IEEE Std 323-2003	IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Plants
IEEE Std 344-2004	IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Generating Stations
IEEE Std 382-1996	IEEE Standard for Qualification of Actuator for Power Operated ValveAssemblies with Safety-Related Functions for Nuclear Power Plants
Qualtech Documents (Qualification Facility)	• Q1150.0-Rev 2 - Nuclear Environmental and Seismic Test Procedure for Masoneilan SVI2 AP Positioners • Q1150.1-Rev 0 - Test Procedure for Masoneilan SVI2 AP Positioner ValVue Software • Q1150.2-Rev 2 - Electromagnetic Compatibility Test Procedure for Masoneilan SVI2 AP Positioners • Q1150.3-Rev 0 - Nuclear Environmental Test Procedure for Masoneilan SVI2 AP Positioners • NUP.0541-Rev. A - SVI2 AP Qualification Test Specification
US Nuclear Regulatory Commission Documents	• Regulation 10 CFR Part 50 Appendix B “Quality Assurance Criteria for Nuclear power Plants and Fuel Processing Plants” • Regulation 10 CFR Part 21 “Reporting of Defects and Non-Conformances”
EPRI Electric PowerResearch Institute	TR-107330 Rev 3 Guidelines for Electromagnetic Interference Testingof Power Plant Equipment

Table 15: Qualified Life and Vibration Aging

Qualified Thermal Life	• 6 Years • Service Temperature 55°C (131°F) • Aging Tests per IEEE-323 (Version 1983 / 2003)
Radiation	30,000 rads
Cycling	660 full stroke, 33,000 partial
Vibration Aging	.75 G single axis sine wave sweep from 5 to 100 Hz at two octave perminute for 90 minutes in each orthogonal axis. Application to the actuator and positioner combination as follows: • Single-acting design in a valve mounted configuration. • Double-acting design in a valve mounted configuration.
Seismic	• Resonance search • RIM test per IEEE-382-1996, Clause 6.3, Figure 1 SSE level: a. OBE sine sweep at one octave/minute from 2 to 100 to2 Hz form90 minutes in each axis at 2/3 SSE level b. SSE sine beats at 1/3 octave dwell points for 15seconds • RMF test per Qualtech NP SQURTS Table Limits RRS, Masoneilan Specification Figure 2. • RMF test per Masoneilan Specification Figure 3
Humidity Testing	EPR1 TR107330
Test Report	QualTechNP Nuclear Environmental and Seismic Qualification TestReport Q1150.0

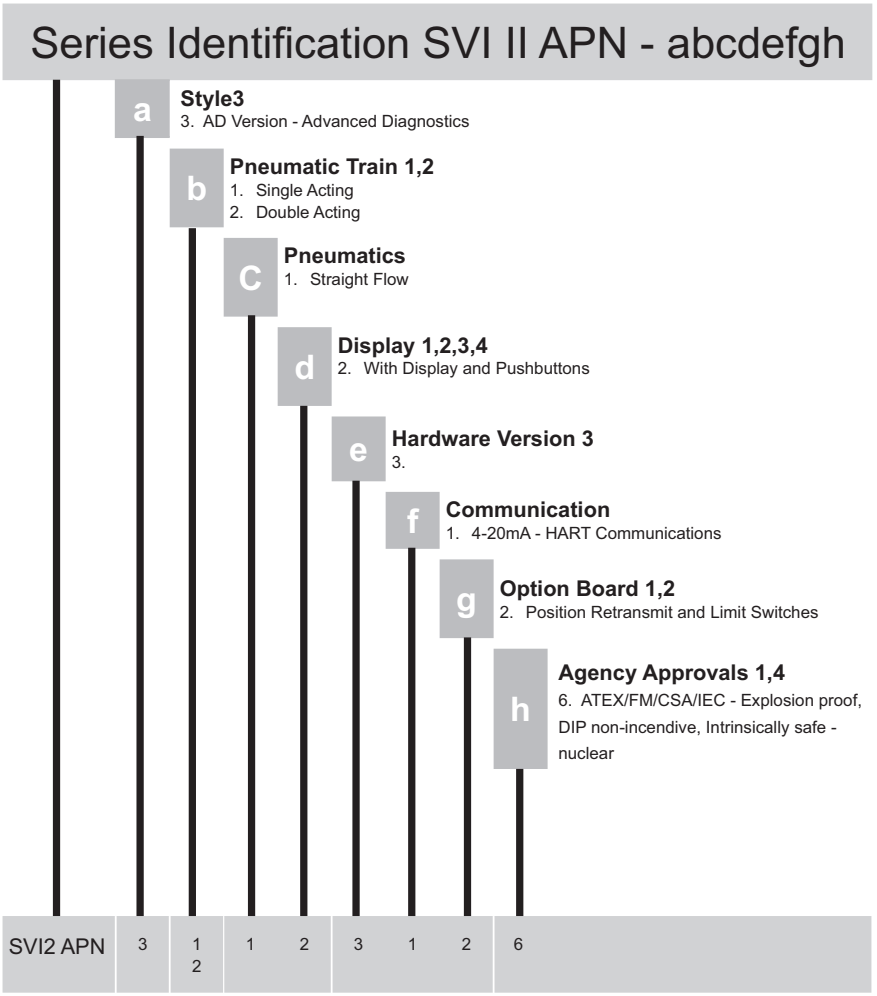


Figure 31 - SVI II APN Model Numbering

Hazardous Location Installation

WARNING

Refer to ES-699 Safe Use Instructions for installing Masoneilan SVI II APN in areas where there is a potential risk for explosive gas atmosphere or inflammable dust.

ES-699 instructions are available in several languages on:

valves.bakerhughes.com/resource-center

Appendix B: Setups

SVI II APN Setups

Control Systems using Explosion Proof or Conventional I/O Systems must have a compliance voltage greater than 9 V at 20 mA including wiring losses. See ***Determining an SVI Positioner Compliance Voltage in a Control System*** on page 68.

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

Typical system setups are shown in Figure 32 on page 62, General Purpose and Explosion Proof (EEx d) Installation Schematic and Figure 33 on page 62, Intrinsically Safe Installation Schematic. The SVI II APN digital valve positioner can be located in a general-purpose or hazardous area protected by Explosion Proof (EEx d) methods. Wiring diagrams are generalized, actual wiring must adhere to Electrical Installation section of manual and local electrical codes. The use of a Handheld Communicator or a HART modem is not permitted in the Hazardous Area protected by Explosion Proof (EEx d) methods. In Figure 33 on page 62 the SVI II APN digital valve positioner is located in a hazardous area that is protected by Intrinsically Safe wiring practices.

The SVI II APN requires an electrical input from a 4-20 mA current source. The SVI II APN 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 APN. If the SVI II APN 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. SVI II APN can communicate with a remote PC running ValVue software via a modem connected to the PC's serial or USB 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 APN can be operated, calibrated, configured, and interrogated either by using local pushbutton and display, or by using a PC running ValVue software, HART Handheld Communicator, or any registered HART Host that supports DDs. The HART Handheld Communicator is approved for Intrinsically Safe use in accordance with FM and ATEX standards. Read and observe all handheld labeling. The SVI II APN is polarity sensitive so the positive lead must be connected to the positive (+) terminal and the negative lead to the negative (-) terminal. Reversing the input will not cause damage but the unit will not function.

Grounding Practices

There must never be more than one ground point for the shield wiring. Normally ground is connected at the controller or at the intrinsic safety barrier.

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

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

Compliance Voltage in Single Drop Current Mode

The SVI II APN requires 9.0 V at 20 mA and 11.0 V at 4 mA. Typical HART devices require MORE voltage at higher current and MORE current source have LESS voltage available at higher current. The SVI II APN is unique in that it requires LESS voltage at higher current which compliments the characteristic of the source requiring only 9 V at 20 mA. See ***Determining an SVI Positioner Compliance Voltage in a Control System*** on page 68.

Verify Wiring and Connections

NOTE

For split range installations the compliance voltage must be capable of the minimum span being 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 APN is properly powered:

1. Connect a DC voltmeter across the input terminals.

   For an input current between 4 and 20 mA the voltage varies between 11 V and 9 V respective. See ***Determining an SVI Positioner Compliance Voltage in a Control System*** on page 68.

   When voltage exceeds 11 V check that polarity is correct.

   If voltage is less than 9 V and polarity is correct, voltage compliance of current source is inadequate.

2. Connect a milliampmeter in series with the current signal.

3. Verify that source can supply 20 mA to SVI II APN input. If 20 mA is not attainable, troubleshoot the source and set up.

NOTE

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

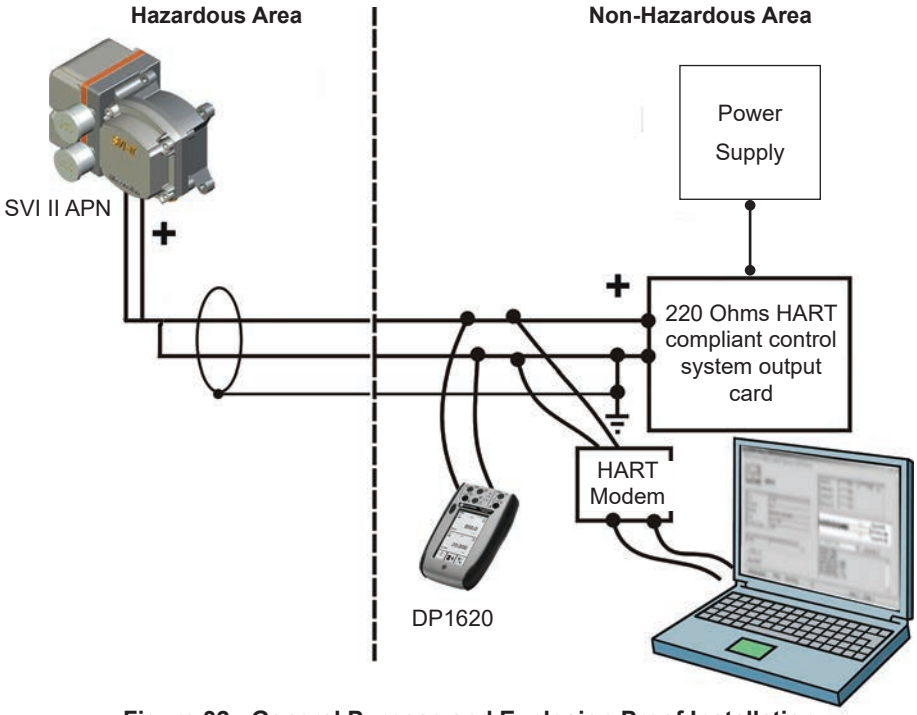


Figure 32 - General Purpose and Explosion Proof Installation

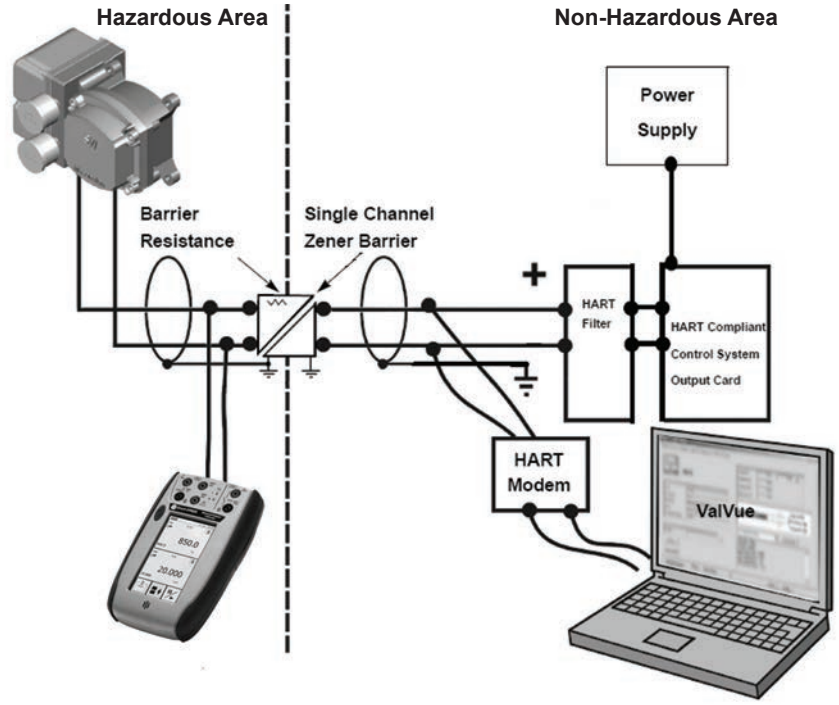


Figure 33 - Intrinsically Safe Installation

Appendix C. Optional Switch Load Limits

General Configuration Notes

The SVI II APN supports two identical contact outputs, SW #1 and SW #2 (Digital Output switches), that can be logically linked to status bits.

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

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

This section discusses the necessary precautions when configuring a system.

Without a load, when the switch is on (closed) the external voltage would be dropped across the switch. **This damages the switch** (Figure 34).

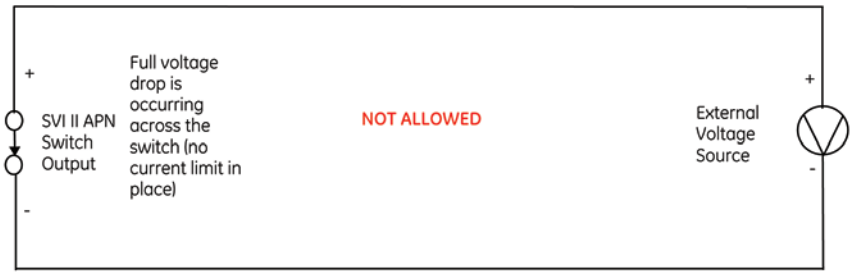


Figure 34 - Switch Installation Drawing without Load: Configuration Not Allowed

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

CAUTION

Incorrect polarity connection results in an effectively closed connection

CAUTION

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

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

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

When the switch is on (closed) the external voltage must be dropped across the load (Figure 35).

CAUTION

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

Inductive Load, Solenoid, Incandescent Lamp Configuration

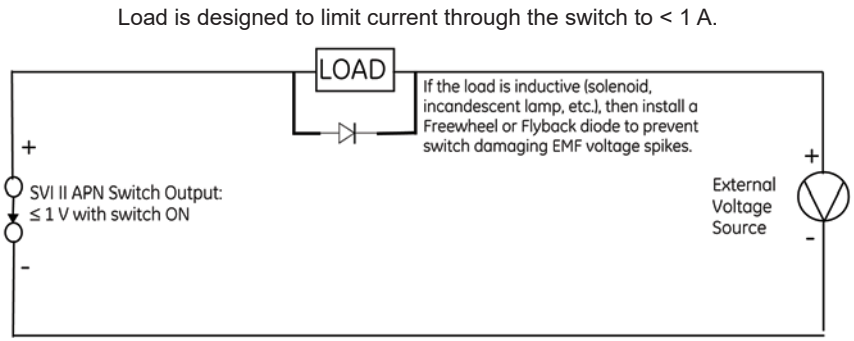
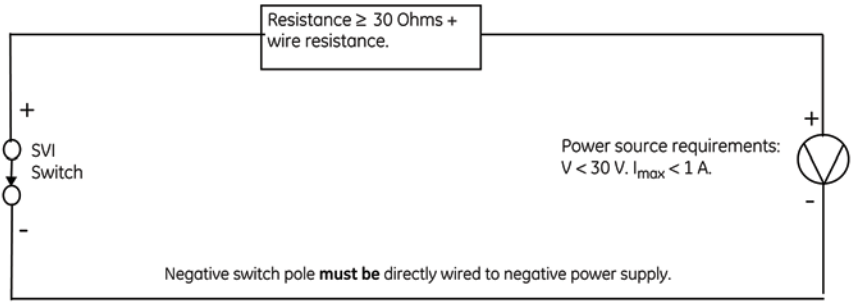


Figure 35 - Simplified Switch Installation Drawing: Correct Configuration

Distributed Control Systems Configurations

This section gives guidance for configuration in a DCS application. Figure 36 gives two generalized drawings that cover DCS applications to ensure switch safety.

Wiring Option #1



Wiring Option #2

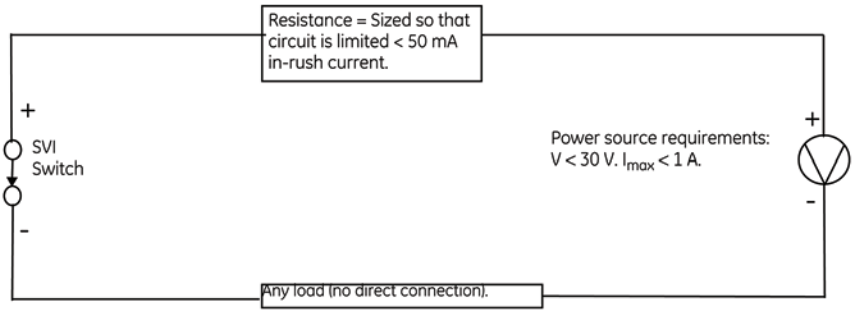


Figure 36 - DCS Switches Wiring Options

Configuration Considerations

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

Appendix D: Determining an SVI Positioner Compliance Voltage in a Control System

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

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

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

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

Compliance Test Set-Up

1. Configure a test set-up as in Figure 37.

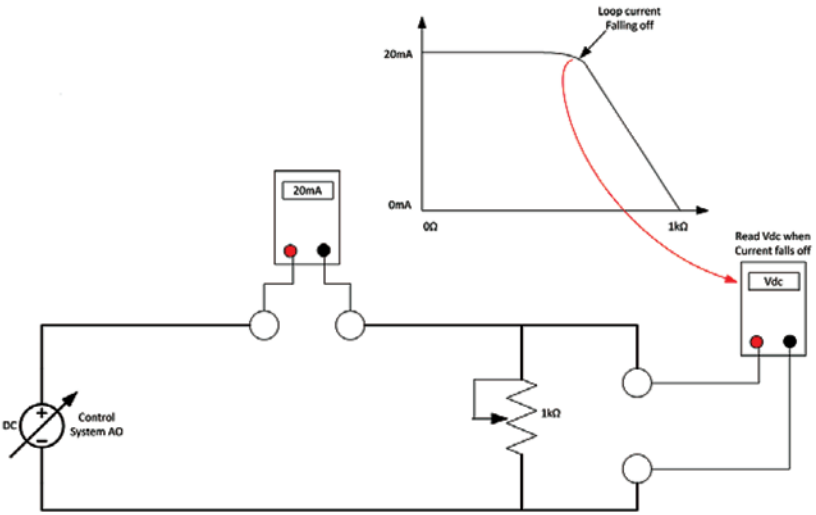


Figure 37 - Compliance Voltage Test Set-Up

2. Send 4 mA to the test set-up.

3. Increase the potentiometer value until the loop current reaches 3.95.

4. Read the voltage across the potentiometer, which should be > 11 VDC. This is the available system voltage at the minimum output..

5. Send 20 mA to the test set-up.

6. Increase the potentiometer value until the loop current reaches 19.95 mA.

7. Read the voltage across the potentiometer, which should be > 9 VDC. This is the available system voltage at the maximum output.

Table 16 lists some compliance voltage readings at positioner terminals at several currents.

Table 16: Expected Voltage Range at Positioner Terminals

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

Notes:

Notes:

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