About this Guide

This Quick Start Guide applies to the following instruments and approved software:
SVI II ESD
- with Firmware version 3.1.2 or greater
- with ValVue ESD version 1.0 or greater
- with GE DPI620 Handheld Communicator with DD published for SVI II ESD
- Masoneilan Device Type 203 or 0xCB
- with PRM PLUG-IN ValVue ESD version 1.0 or greater

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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.

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

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Pn 055201359-999-0000 Rev. M.
<table>
<thead>
<tr>
<th>Version/Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/05-2012</td>
<td>ES-727 updated.</td>
</tr>
<tr>
<td>E/03-2013</td>
<td>References to double-acting removed.</td>
</tr>
<tr>
<td>F/08-2013</td>
<td>Added Load Limits section and cross referenced to same from install. Updated ES-727 to Rev. R.</td>
</tr>
<tr>
<td>G/10-2015</td>
<td>Updated ES-727 to Rev. T.</td>
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<tr>
<td>J/09-2016</td>
<td>Updated references to firmware to add 3.1.8. Changed the download site throughout.</td>
</tr>
<tr>
<td>K/03-2017</td>
<td>Added section on Determine Compliance Voltage. Added section on Burst Mode. Added flyback diode to Load Limits section. Changed ES version to V.</td>
</tr>
<tr>
<td>L/12-2017</td>
<td>Updated Load Limits section. Updated ES-727 to Rev. W.</td>
</tr>
<tr>
<td>M/01-2018</td>
<td>Updated Load Limits section.</td>
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1. Safety Information

Introduction

This section provides information necessary to design, install, verify and maintain a Safety Instrumented Function (SIF) utilizing a Masoneilan Smart Valve Interface, SVI II ESD. This manual provides necessary requirements for meeting the IEC 61508 or IEC 61511 functional safety standards.

Terms and Abbreviations

The following terms and abbreviations are related to safety functions of the SVI II ESD and are used throughout this document.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Freedom from unacceptable risk of harm.</td>
</tr>
<tr>
<td>Functional Safety</td>
<td>The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system.</td>
</tr>
<tr>
<td>Basic Safety</td>
<td>The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition.</td>
</tr>
<tr>
<td>Safety Assessment</td>
<td>The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems.</td>
</tr>
<tr>
<td>Fail-Safe State</td>
<td>State where the SVI II ESD is de-energized and has exhausted Actuator 1 in a single acting configuration or has caused Actuator 1 to be at an equal or lower pressure than Actuator 2 in a dual acting configuration.</td>
</tr>
<tr>
<td>Fail Safe</td>
<td>Failure that causes the valve to go to the defined fail-safe state without a demand from the process.</td>
</tr>
<tr>
<td>Fail Dangerous</td>
<td>Failure that does not respond to a demand from the process (i.e. being unable to go to the defined fail-safe state).</td>
</tr>
<tr>
<td>Fail Dangerous Undetected</td>
<td>Failure that is dangerous and that is not being diagnosed by automatic stroke testing.</td>
</tr>
<tr>
<td>Fail Dangerous Detected</td>
<td>Failure that is dangerous but is detected by automatic stroke testing.</td>
</tr>
</tbody>
</table>
Fail Annunciation Undetected Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic and is not detected by another diagnostic.

Fail Annunciation Detected Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic or false diagnostic indication.

Fail No Effect Failure of a component that is part of the safety function but that has no effect on the safety function.

Low Demand Mode Mode where the frequency of demands for operation made on a safety-related system is no greater than twice the proof test frequency.

**Acronyms**

The following acronyms are related to safety functions of the SVI II ESD and are used throughout this document.

- **FMEDA**: Failure Modes, Effects and Diagnostic Analysis
- **HFT**: Hardware Fault Tolerance
- **MOC**: Management of Change. These are specific procedures often done when performing any work activities in compliance with government regulatory authorities.
- **PFDavg**: Average Probability of Failure on Demand
- **PST**: Partial Stroke Test, a test used to detect failure modes in the PST Controller, actuator, and valve assembly.
- **SFF**: Safe Failure Fraction, the fraction of the overall failure rate of a device that results in either a safe fault or a diagnosed unsafe fault.
- **SIF**: Safety Instrumented Function, a set of equipment intended to reduce the risk due to a specific hazard (a safety loop).
- **SIL**: Safety Integrity Level, discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 has the highest level of safety integrity and Safety Integrity Level 1 has the lowest.
- **SIS**: Safety Instrumented System – Implementation of one or more Safety Instrumented Functions. A SIS is composed of any combination of sensor(s), logic solver(s), and final element(s).
Documentation Symbols

Conventions used in this manual are as follows:

- *Italicized* letters are used when referencing a term used in the program display window.
- 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**.

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

**WARNING**

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

For SVI II ESD positioners intended for use with industrial compressed air or, natural gas systems only.

NOTE

See “Hazardous Location Installation” on page 78 for natural gas safety information.

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 ESD to the surrounding area, and may require additional precautions or specialized installations.

Intrinsically Safe Installation

Products certified for use in intrinsically safe installations MUST BE:

☐ Installed, put into service, used and maintained in compliance with national and local regulations and in accordance with the recommendations contained in the relevant standards concerning those environments.

☐ Used only in situations that comply with the certification conditions shown in this document and after verification of their compatibility with the zone of intended use and the permitted maximum ambient temperature.

☐ Installed, put into service and maintained by qualified and competent professionals who have undergone suitable training for instrumentation used in such areas.

WARNING

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

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

Use only genuine replacement parts which are provided by the manufacturer, to guarantee that the products comply with the essential safety requirements of the European Directives. Changes to specifications, structure, and components used may not lead to the revision of this manual unless such changes affect the function and performance of the product.

Product Support

For detailed product instructions and technical support refer to the SVI II ESD SIL3 Instruction Manual GEA18946.

Related Literature

Documents related to the SVI II ESD include:

- TUV Certificate No. SAS0016/07, Vers. 1.0
- Safety Instrumented Systems Verification, Practical Probabilistic Calculations, ISBN 1-55617-909-9, ISA

Reference Standards

Functional Safety reference standards related to the SVI II ESD include:

- ANSI/ISA 84.00.01-2004 (IEC 61511 Mod.) Functional Safety – Safety Instrumented Systems for the Process Industry Sector
SVI II ESD Device Description

An ESD valve is a valve that is operated to ensure that the process is brought to its safe state. During normal operation, these ESD valves are typically energized to stay open. In case of an unsafe situation, the ESD valve is de-energized by the Safety System. The SVI II ESD device performs this shutdown function for Safety Instrumented Functions (SIF) that require field devices to be certified for safety related applications according to IEC61508 and is certified by TUV for use up to SIL3 with a HFT of 0 in low demand applications. It is important to note that the built-in microprocessor is used for valve diagnostics only. The microprocessor has no direct role in performing the designated safety function therefore the SVI II ESD is considered a Type A device.

The SVI II ESD is a valve controller that mounts on a pneumatically actuated valve assembly. Its role is to position an emergency shutdown valve to 0% or 100% with a PFDavg in accordance with IEC61508 for SIL3 application.

Because of its capability of monitoring data from its embedded sensors, the SVI II ESD is capable of validating the health of its integral components. Also, with the ability of partially stroking the ESD valve while in normal operations (energized to stay open); it becomes possible to validate the health of the valve and actuator assembly. Periodic testing of the ESD valve reduces the PF-Davg by detecting dangerous failures.

Designing an SIF Using an SVI II ESD

The following must be taken into consideration when designing a SIF (Safety Instrumented Function) using the SVI II ESD:

- “Safety Function” on page 14
- “Environmental Limits” on page 15
- “Design Verification” on page 15
- “SIL Capability” on page 15
- “Connecting the SVI II ESD to the SIS Logic Solver” on page 16
- “General Requirements” on page 17

Safety Function

When de-energized, the SVI II ESD moves to its fail-safe position. For a single-acting PST controller the safe state is when the port Actuator 1 is exhausted to a pressure that is less than 1 PSIG (0.069 bar, 6.9 kPa). The valve actuation means must be of a type that automatically moves the valve to the safe state when the digital valve controller is in its safe state.

The SVI II ESD is intended to be part of final element subsystem as defined per IEC 61508 and the achieved SIL level of the designed function must be verified by the designer.
Environmental Limits

The designer of a SIF must check that the product is rated for use within the expected environmental limits as stated in Table 10 on page 73.

Application limits

Application limits for the SVI II ESD installed in a SIF include:

- The application of the SVI II ESD is limited for SIF where the safe state is the de-energized state (shutdown) of the valve. The PST Controller may be operated with either one of two control signals: 4 - 20 mA or 0 - 24 VDC.
- With a 4 - 20 mA control signal, normal operation is with a 20 mA current loop signal to the PST controller. A shutdown command is issued by taking the current to 5.6 mA or lower.
- With a 0 - 24 VDC control signal, normal operation is with a 24 VDC signal applied to the PST controller. A shutdown command is issued by interrupting the loop or taking the voltage signal to 3 VDC or lower.

Design Verification

The design verification criteria for the SIF and the SVI II ESD include:

- A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from the factory. This report details all failure rates and failure modes as well as the expected lifetime.
- The achieved Safety Integrity Level (SIL) of an entire Safety Instrumented Function (SIF) design must be verified by the designer via a calculation of PFDavg considering redundant architectures, proof test interval, proof test effectiveness, any automatic diagnostics, average repair time and the specific failure rates of all products included in the SIF. Each subsystem must be checked to assure compliance with minimum hardware fault tolerance (HFT) requirements. The exida exSILentia* tool is recommended for this purpose as it contains accurate models for the SVI II ESD and its failure rates.
- When using an SVI II ESD in a redundant configuration, include a common cause factor of 5% in safety integrity calculations.
- The failure rate data listed in the FMEDA report is only valid for the useful life time of an SVI II ESD. The failure rates increase sometime after this time period. Reliability calculations based on the data listed in the FMEDA report for mission times beyond the lifetime may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

SIL Capability

The SVI II ESD meets SIL 3 requirements as outlined below.
Systematic Integrity

The product has met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer. A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than the statement without prior use justification by end user or diverse technology redundancy in the design.

Random Integrity

The SVI II ESD’s safety critical function is maintained by a Type A Device. Therefore based on the SFF > 90%, when the SVI II ESD is used as the only component in a final element subassembly, a design can meet SIL 3 @ HFT=0.

When the final element assembly consists of many components (SVI II ESD, quick exhaust valve, actuator, isolation valve, etc.) the SIL must be verified for the entire assembly using failure rates from all components. This analysis must account for any hardware fault tolerance and architecture constraints.

Safety Parameters

For detailed failure rate information refer to the Failure Modes, Effects and Diagnostic Analysis Report for the SVI II ESD available from the factory.

Connecting the SVI II ESD to the SIS Logic Solver

When connecting the SVI II ESD to the SIS logic solver follow these guidelines:

- The SVI II ESD is connected to the safety rated logic solver which is actively performing the safety function. Connections must be made per the instructions supplied by the safety rated logic solver.
- The output rating of the I/O module must meet or exceed the electrical specifications of the SVI II ESD as referenced in ES727 (“Hazardous Location Installation” on page 78).
General Requirements

The following general requirements for the SVI II ESD must be adhered to:

☐ The system's response time must be less than process safety time. The SVI II ESD switches to its fail safe state in less than 100 ms. *Response time is actuator dependent.*

☐ You must add the SVI II ESD response time to actuator/valve response to get overall response time.

☐ All SIS components including the SVI II ESD must be operational before process start-up. The internal diagnostic test that monitors the SVI II ESD for faults has a one hour test interval. This test does not partial stroke the valve.

☐ In order to use the PST as an automatic diagnostic tool the PST must be scheduled (using ValVue ESD) to run at least once per month or ten times within the expected hazard demand interval whichever comes first. Detailed failure rate data is specified in the FMEDA report available from the factory.

☐ You must verify that the SVI II ESD is suitable for use in safety applications by confirming the SVI II ESD's nameplate is properly marked.

☐ Personnel performing maintenance and testing on the SVI II ESD must be qualified to do so.

☐ Results from the PST and proof tests must be recorded and reviewed periodically.

☐ The useful life of the SVI II ESD is discussed in the Failure Modes, Effects and Diagnostic Analysis Report for the SVI II ESD.

Installation

All issues related to installation are outlined below.

SVI II ESD Installation Configurations

Refer to “SVI II ESD Configurations” on page 41.

Physical Location and Placement Guidelines

Refer to “Physical Location and Placement Guidelines” on page 23.

Pneumatic Connections

Refer to “Pneumatic Connections” on page 35.

Electrical Connections

Refer to “Electrical Connection Guidelines” on page 40.
Operation, Setup, Commissioning

Refer to “Setup, Calibration and PST” on page 55.

Maintenance

Refer to “SVI II ESD Maintenance” on page 52.

Diagnostics

The SVI II ESD provides several types of diagnostic information:

- Continuous device diagnostics
- Self diagnostics of the pneumatics and the safety function that run every hour and require no user configuration
- Partial Stroke Testing (PST) diagnostics

PST

You can configure and run PST at runtime. For more information on PST refer to “Partial Stroke Testing” on page 70.
**Proof Test**

You can also manually run a proof test to detect failures within an SVI II ESD and ESD valve that are not detected by any automatic diagnostics of the system. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.

The frequency of proof testing, or the proof test interval, is to be determined in reliability calculations for the safety instrumented functions for which an SVI II ESD is applied. The proof tests must be performed more frequently or as frequently as specified in the calculation in order to maintain the required safety integrity of the safety instrumented function.

The following proof test is recommended. Report any failures that are detected and that compromise functional safety to the factory.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Read the SVI II ESD data record using a HART® handheld device or ValVue ESD software. Resolve any active faults before proceeding.</td>
</tr>
<tr>
<td>2</td>
<td>Bypass the valve, or isolate or take other appropriate action to avoid a false trip, following company Management of Change (MOC) procedures</td>
</tr>
<tr>
<td>3</td>
<td>Inspect the SVI II ESD for dirty or clogged ports and other physical damage</td>
</tr>
<tr>
<td>4</td>
<td>De-energize the SVI II ESD and observe that the actuator and valve move. Energize the SVI II ESD after the valve has moved its full stroke length.</td>
</tr>
<tr>
<td>5</td>
<td>Inspect the SVI II ESD for dirt, corrosion or excessive moisture. Clean if necessary and take corrective action to properly clean the air supply. This is done to avoid incipient failures due to dirty air.</td>
</tr>
<tr>
<td>6</td>
<td>Record any failures in your company’s SIF inspection database. Restore the loop to full operation.</td>
</tr>
<tr>
<td>7</td>
<td>Remove the bypass or otherwise restore normal operation</td>
</tr>
</tbody>
</table>

This test detects approximately 99% of possible DU failures in the SVI II ESD (Proof Test Coverage).

The person(s) performing the proof test of an SVI II ESD must be trained in SIS operations, including bypass procedures, maintenance and company Management of Change procedures. No special tools are required.
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2. Installation and Maintenance

Introduction

The SVI II ESD (Emergency Shutdown Device) is our solution to improve process integrity in a processing plant; designed to prevent and mitigate possibly uncontrollable situations.

The SVI II ESD is a PST controller that mounts on a pneumatically actuated valve assembly. Its role is to position an emergency shutdown valve to 0% or 100% with a probability of failure on demand (PFD) in accordance with IEC61508 for SIL3 application (SIL = Safety Integrity Level). It replaces the solenoid that is typically utilized to actuate a spring-return, while providing extensive online valve diagnostics.

Figure 1  SVI II ESD Positioner

Using the Quick Start Guide

The SVI II ESD Quick Start Guide is intended to help an experienced Field Engineer install, setup, and calibrate an SVI II ESD in the most efficient manner possible. This document provides basic installation and setup instructions and is not intended to replace the in-depth information contained in the SVI II ESD Instruction Manual GEA18946. If you experience problems that are not documented in this guide refer to the Masoneilan SVI II ESD Instruction Manual SIL3, GEA18946, or call your local representative. Sales offices are listed on the last page of this document.
Installation

Compliance voltage testing is best done before installation. See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 97.

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

Table 1: SVI II ESD Installation Steps

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Procedure</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attach mounting bracket to the actuator.</td>
<td>See page 25 for rotary valve and page 30 for reciprocating valve instructions.</td>
</tr>
<tr>
<td>2</td>
<td>Install the SVI II ESD magnetic assembly (rotary valves only).</td>
<td>See page 25 for instructions.</td>
</tr>
<tr>
<td>3</td>
<td>Assemble the SVI II ESD on the bracket that is mounted to the valve actuator.</td>
<td>See page 25 for rotary valve and page 30 for reciprocating valve instructions.</td>
</tr>
<tr>
<td>4</td>
<td>Connect the pneumatic tubing to the SVI II ESD.</td>
<td>See page 35 for instructions.</td>
</tr>
<tr>
<td>5</td>
<td>Connect the air supply to the SVI II ESD.</td>
<td>See page 39 for instructions.</td>
</tr>
<tr>
<td>6</td>
<td>Install the wiring for the SVI II ESD.</td>
<td>See page 40 for instructions.</td>
</tr>
<tr>
<td>7</td>
<td>Connect the PST controller to the HART® Control Loop segment by installing the SVI II ESD wiring.</td>
<td>See page 42 for instructions.</td>
</tr>
<tr>
<td>8</td>
<td>Power up the SVI II ESD.</td>
<td>See page 44 for instructions.</td>
</tr>
<tr>
<td>9</td>
<td>If appropriate, configure/calibrate using ValVue ESD</td>
<td>See page 62 and page 66 for instructions.</td>
</tr>
<tr>
<td></td>
<td>If appropriate, configure/calibrate using a HART® Hand Held Communicator</td>
<td>See page 67 for instructions.</td>
</tr>
</tbody>
</table>

**WARNING**

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

Before installing, using, or carrying out any maintenance tasks associated with this instrument, READ THE INSTRUCTIONS CAREFULLY.
Physical Location and Placement Guidelines

When determining the location of the SVI II ESD adhere to the following guidelines:

- The SVI II ESD must be accessible with sufficient room for cabling and pneumatic connections and must allow manual proof testing.
- Pneumatic piping to the actuator must be kept as short and straight as possible to minimize the airflow restrictions and potential clogging of the line. Long or kinked pneumatic tubes may also increase the valve closure time.
- The Breather/Vent port must be accessible and must be inspected for obstruction during manual proof testing.
- The SVI II ESD must be mounted in a mild vibration environment (see specifications at the end of this document). If excessive vibration can be expected special precautions must be taken to ensure the integrity of electrical and pneumatic connectors or reduce the vibration using appropriate damping mounts.

Necessary Precautions

To avoid injury or affecting the process when installing or replacing a PST controller 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.
- Bleed air from actuator and check that valve is in its de-energized position. It is now safe to disconnect and remove any valve mounted equipment that is being replaced.
SVI II ESD Components

Figure 2 provides a drawing of the SVI II ESD components.
Mounting the SVI II ESD on Rotary Valves

This section describes the procedure for mounting the SVI II ESD on rotary control valves that have less than 60° rotation, such as a Masoneilan Camflex® or a Masoneilan Varimax®. Figure 3 shows a side view of a Camflex actuator and the SVI II ESD actuator mounting brackets.

![Diagram of Camflex with Mounting Bracket (Side View)](image)

Mounting the SVI II ESD on a Rotary Actuator

Tools required:
- 3/16” Hex Key
- 5/32” Hex Key
- 3 mm, 4 mm, 5 mm Hex Key
- 7/16” Wrench

To mount the SVI II ESD:

1. Attach the SVI II ESD rotary mounting bracket to the valve actuator using two (2) 5/16 - 18 UNC flat-head cap screws. 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. On 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 ESD PST Controller. 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 may 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 end play 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.

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 ESD 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 ESD housing.
Travel Sensor Alignment

Table 2 shows the general guidelines for travel sensor alignment. Review the table prior to installing the SVI II ESD on a rotary valve actuator for proper alignment of the magnet.

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

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Dismantling the SVI II ESD from Rotary Valves

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

To remove the SVI II ESD PST Controller from a rotary valve perform Steps 1 - 9 on page 25 in reverse.

Mounting the SVI II ESD with NAMUR Kits

There are two versions of this kit:
- □ 20 and 30 mm
- □ 50 mm

**20 and 30 mm Mounting**

Tools required:
- □ 3 mm hex key
- □ 4 mm hex key

Refer to Figure 4 for this procedure.

To mount using this kit:

1. Attach the mounting bracket to the valve actuator using four (4) M5 x 0.8 x 10 flat-head cap screws.

![Figure 4 Namur 20/30 mm Mounting Kit](image)

2. Place the indicator disk with metal insert over the valve actuator shaft and secure using an M6 x 1.0 x 45 socket-head screw.
3. Place the Quarter Turn Mounting Plate into place sliding it through the anti-backlash spring into the dowel pin at the end of the plate into the hex head screw installed in step 2.

4. Secure the plate to the bracket using four (4) flat head cap screws.

### 50 mm Mounting

**Tools required:**

- 3 mm hex key
- 4 mm hex key

Refer to Figure 5 for this procedure.

To mount using this kit:

1. Attach the mounting bracket to the valve actuator using four (4) M5 x 0.8 x 10 flat-head cap screws.

2. Place the indicator disk with metal insert over the valve actuator shaft.

3. Place the Namur coupling and lever on top of the indicator disc and secure with an M6 x 1.0 x 25 socket-head screw.

4. Place the Quarter Turn Mounting Plate into place sliding it over the lever and through the anti-backlash spring.

5. Secure the bracket using four (4) flat head cap screws.

---

**Figure 5** Namur 50 mm Mounting Kit
Mounting the SVI II ESD on Reciprocating Valves

The process of mounting the SVI II ESD on a reciprocating valve consists of mounting the unit on the actuator that is attached to the valve. This section describes the procedure for mounting the SVI II ESD on Reciprocating Valves (using Masoneilan’s 87/88 Multi-Spring actuators as an example).

Mounting the SVI II ESD on a Reciprocating Actuator

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

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. Refer to Figure 6.

![Figure 6 Magnet Holder for Reciprocating Valves](image)

2. Mount the SVI II ESD 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 7 and Table 3 on page 32.

![Figure 7 Reciprocating Valve Mounting Bracket](image)
3. Select mounting hole A, B, C or D for the stroke of the valve. For example, hole B is shown in Figure 9 on page 32 for a size 10 actuator with 1.0" stroke. Unless otherwise specified, the SVI II ESD 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 8. Ensure that the travel pointer located on the coupling is correctly positioned.

5. Attach the right hand threaded rod end to the SVI II ESD 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 9 on page 32 and the Reciprocating Valve Linkage Selection, Table 3 on page 32.

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.).

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 8.

11. Adjust the turnbuckle until the hole in the SVI II ESD lever is aligned with the indicating hole in the bracket. Tighten both turnbuckle lock nuts. Refer to Figure 7.
12. 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 using the proper holes. Refer Table 3 on page 32.

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

Figure 9  Lever for Masoneilan Model 87/88 Multispring Actuator

Table 3: Reciprocating Valve Mounting Hole and Turnbuckle Length

<table>
<thead>
<tr>
<th>Masoneilan Actuator Size</th>
<th>Stroke</th>
<th>Mounting Hole</th>
<th>Lever Hole</th>
<th>Turnbuckle Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 and 10</td>
<td>0.5 - 0.8&quot; (12.7 - 20.32 mm)</td>
<td>A</td>
<td>A</td>
<td>1.25&quot; (31.75 mm)</td>
</tr>
<tr>
<td>10</td>
<td>0.5 - 0.8&quot; (12.7 - 20.32 mm)</td>
<td>A</td>
<td>A</td>
<td>1.25&quot; (31.75 mm)</td>
</tr>
<tr>
<td>10</td>
<td>&gt;0.8 – 1.5&quot; (20.32 - 41.5 mm)</td>
<td>B</td>
<td>B</td>
<td>1.25&quot; (31.75 mm)</td>
</tr>
<tr>
<td>16</td>
<td>0.5 - 0.8&quot; (12.7 - 20.32 mm)</td>
<td>B</td>
<td>A</td>
<td>2.90&quot; (73.66 mm)</td>
</tr>
<tr>
<td>16</td>
<td>&gt;0.8 – 1.5&quot; (20.32 - 41.5 mm)</td>
<td>C</td>
<td>B</td>
<td>2.90&quot; (73.66 mm)</td>
</tr>
<tr>
<td>16</td>
<td>&gt;1.5 – 2.5&quot; (41.5 - 63.5 mm)</td>
<td>D</td>
<td>C</td>
<td>2.90&quot; (73.66 mm)</td>
</tr>
<tr>
<td>23</td>
<td>0.5 - 0.8&quot; (12.7 - 20.32 mm)</td>
<td>B</td>
<td>A</td>
<td>5.25&quot; (133.35 mm)</td>
</tr>
<tr>
<td>23</td>
<td>&gt;0.8 – 1.5&quot; (20.32 - 41.5 mm)</td>
<td>C</td>
<td>B</td>
<td>5.25&quot; (133.35 mm)</td>
</tr>
<tr>
<td>23</td>
<td>&gt;1.5 – 2.5&quot; (41.5 - 63.5 mm)</td>
<td>D</td>
<td>C</td>
<td>5.25&quot; (133.35 mm)</td>
</tr>
</tbody>
</table>
Dismantling the SVI II ESD from Reciprocating Valves

**WARNING**

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

To remove the SVI II ESD PST Controller from a reciprocating valve perform Steps 1 - 12 on page 30 in the reverse order.

**Checking the Magnet**

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

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

**Performing a Visual Inspection**

To perform a visual inspection refer to Table 2 on page 27 and ensure that the magnet is correctly oriented for the actuator/valve configuration.

**Using ValVue* ESD to Check Magnet Position**

Use this procedure to check the magnet using ValVue ESD (provided with SVI II ESD). Also refer to Table 2 on page 27 for sensor information.

1. Connect to the PST Controller in accordance with the ValVue ESD instructions. For further information refer to the ValVue ESD On Line Help or Instruction Manual.
2. After the PST Controller has been installed and set up with a HART® Modem in a HART® compliant communications loop, install ValVue ESD on the computer that is connected to the HART® modem.
3. Run ValVue ESD.
4. Select the installed ESD PST Controller from the list of *Connected Devices* as shown in Figure 10 and click **Connect**.
5. Select the **Check** tab to view the current operating conditions of the selected PST Controller.
6. Read **Raw Position Data** on the **Check** screen (Figure 10).
7. The Raw Position Sensor value measured must in accordance with Table 2 on page 27.

ValVue ESD Connected Devices Screen

ValVue ESD Check Screen

Figure 10 ValVue ESD for Checking Magnet Position

Checking Actuator, Linkages, or Rotary Adapter

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

- 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.

**NOTE** For the aforementioned information, 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 PST Controller and checking the digital configuration.
Connecting the Tubing and Air Supply

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

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

This section describes the process for connecting the tubing and air supply to a PST Controller.

**Pneumatic Connections**

The SVI II ESD is intended for use with industrial compressed air or natural gas systems only that meets the requirements of ISA standard 7.3. Supply pressure must not exceed 120 psi. A coalescing filter can be used to assure that the supply air is sufficiently free of oil, water, and particulate contaminants. 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. Table 4 provides the pneumatic connections and air supply requirements for the SVI II ESD.

**Table 4: Pneumatic Connections and Air Supply Requirements**

<table>
<thead>
<tr>
<th>Recommended Piping Inlet/Outlet</th>
<th>1/2&quot; stainless steel or PVC tubing. The length of tubing between the SVI II ESD and the valve must be kept as short as possible and free of kinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Air Pressure</td>
<td>30 - 120 psi (2.07 - 8.27 bar) (207 - 827 kPa)</td>
</tr>
<tr>
<td>Dew Point</td>
<td>At least 18° F (10° C) below minimum anticipated ambient temperature</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>Filtered to 5 microns</td>
</tr>
<tr>
<td>Oil Content</td>
<td>Less than 1 ppm w/w</td>
</tr>
<tr>
<td>Contaminants</td>
<td>Free of all corrosive contaminants</td>
</tr>
</tbody>
</table>
**Natural Gas Supply Considerations**

If the pneumatic system is connected to natural gas, the pneumatic control system constantly bleeds a small amount of the natural gas into the area around the SVI II ESD. Also, during a vent cycle (actuator pressure relief), natural gas from the actuator is released into the area around the SVI vent port. Consider both sources of natural gas when evaluating the Hazardous Classification for the area (See GEA18946 Masoneilan SVI II ESD Smart Valve Interface with SIL3 Emergency Shutdown PST Controller Installation and Maintenance Manual for further discussion on installing an SVI II ESD in a natural gas environment).

Remote piping of the actuator venting is possible to reduce the amount of natural gas released into the area around the SVI II ESD (See GEA18946 Masoneilan SVI II ESD Smart Valve Interface with SIL3 Emergency Shutdown PST Controller Installation and Maintenance Manual for further discussion on installing an SVI II ESD in a natural gas environment). Installing remote actuator vent gas piping does not capture all gas emitted. A small amount of natural gas still bleeds constantly in the area around the SVI II ESD. Consider the bleeding and releasing of natural gas when evaluating the Hazardous Clarification for the area.

**NOTE**

*Area classification is the responsibility of the end user.*

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

**WARNING**

*Do not remove the instrument cover or connect to an electrical circuit unless the power is disconnected. Natural gas will escape into the surrounding atmosphere upon disconnecting any of the pneumatic connections or removing any cover or pressure containing component.*

**WARNING**

*EXPLOSION HAZARD - Do not disconnect equipment or remove cover unless power has been de-energized or the area is know to be non-hazardous. Natural gas may be contained within the SVI II ESD. Even after disconnecting the SVI II ESD from all the pneumatic connections Natural Gas may still be present within the SVI II ESD.*

**WARNING**

*EXPLOSION HAZARD - Natural gas may escape from the SVI II ESD upon removal of any cover or component. Ensure the cover is correctly installed before putting this unit into service.*
WARNING EXPLOSION HAZARD - An improperly installed cover could leak natural gas into the area. The interior of the SVI II ESD is positively pressure with supply medium. Appropriate safety measures must be taken to handle pressurized natural gas that may enter the electrical conduit or cable system.

WARNING EXPLOSION HAZARD - A missing or improperly installed conduit seal, cable seal, or cable gland could leak natural gas into the conduit/cable system, and/or into any area where the conduit/cabling system is present or connected to.

WARNING Natural gas will constantly bleed and possibly vent from the SVI II ESD if connected to a natural gas supply. Hazardous area clarification is the responsibility of the end user. Area ventilation and other safety measures may be required to maintain a safe environment.

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

WARNING Isolate the valve from the process and disconnect air tubing from the positioner. Disconnect air fully to avoid injury or process damage.
Single Acting PST Controller

**WARNING**

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

The supply and output connections for the SVI II ESD, located on bottom of the pneumatic block, are 1/4" NPT threaded. Output is toward the front, supply is toward the back.

Maximum allowable air supply pressure to the SVI II ESD 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 +10 psi.

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 ← J) to the actuator.
3. Air supply:
   - Supply pressure for single acting SVI II ESD:
     30 -120 psi (2.07 - 8.28 bar) (207 - 827.6 kPa)
   - Minimum tubing diameter 1/4" (6 mmx4 mm)

![Figure 11 Air Ports on Single Acting PST Controller](image-url)
Checking the Air Supply

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

1. Supply clean, dry compressed air to the filter regulator.
2. Turn on the air supply.
3. Adjust the filter regulator.
4. Supply pressure must be 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.
5. Inspect the tubing connections between the filter-regulator and the positioner for leaks.
6. Verify that the tubing is not bent or crushed.
7. 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.

For detailed information on pneumatic connections refer to “Pneumatic Connections” on page 35.
Wiring the SVI II ESD

There are two components to wiring the SVI II ESD; making an electrical connection for power and making a local control loop connection for HART® communication.

Electrical Connection Guidelines

When making the SVI II ESD electrical connections, follow these guidelines:

1. The SVI II ESD device is available in two control signal configurations: 20 mA or 24 VDC.
2. Provide sufficient electrical isolation between adjacent signal lines and between signal lines and ground for all wiring.
3. Use stranded 14 to 22 AWG (or equivalent gauge and flexibility).
4. Use conduit sealant to prevent condensation from entering the enclosure and, in Class 1 Div. 2 conditions to prevent hazardous gases and vapors from migrating through the conduit to the control room or an open ignition source.
5. Wire according to the National Electrical Code (ANSI-NFPA 70) or other applicable local codes.
6. The terminal clamps are designed for one wire only; DO NOT attempt to terminate multiple wires into one terminal.
7. Strip the wires to the recommended length (See product specifications).
8. Ensure all wire stands are fully inserted into the terminal block and no shorts between adjacent wires on the terminal block are possible.
9. Use care when running signal wiring near to or crossing conduit or wiring that supplies power to motors, solenoids, lighting, horns, bells, etc. Provide sufficient electrical isolation and shielding against electro-magnetic interference from items in the vicinity of the cable run.
10. Run AC power wiring in a separate conduit from DC power. All power wiring to and from the SVI II ESD must be in grounded conduit. Protect outdoor cable runs against lightning strike.
11. Connect the SVI II ESD to a high quality instrument grade ground sized as required by local electrical codes. A grounding stud is provided inside the enclosure.

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.

CAUTION
Refer to “Optional Switch Load Limits” on page 93” for guidelines on safely wiring switch load limits.
SVI II ESD Configurations

There are three possible SVI II ESD installation configurations each with a different wiring scheme.

- Analog Safety Demand (ASD)
- Discrete Safety Demand (DSD)
- Analog with Discrete Safety Demand (A/DSD)

**Analog Safety Demand (ASD)**

The Analog Safety Demand configuration is: 4 - 20 mA signal, power and trip signal with superimposed HART® communications (Figure 12).

**Discrete Safety Demand (DSD)**

The Discrete Safety Demand configuration is: 24 VDC, power and trip signal with superimposed HART® communications (Figure 13).
Analog with Discrete Safety Demand (A/DSD)

The Analog with Discrete Demand configuration is: 4 - 20 mA power input with superimposed HART® communications for control system and 24 VDC 2 wire for Safety System (Figure 14).

![Analog with Discrete Safety Demand (A/DSD) Configuration](image)

HART® Wiring Guidelines

In order for the SVI II ESD to communicate, the SVI II ESD must be physically connected to a HART® compliant network. “Connecting to the Control Loop” outlines wiring the SVI II ESD.

Connecting to the Control Loop

The SVI II ESD 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 ESD to the HART® loop using a cable specified by Field Comm®. A shielded cable is recommended.

To connect the Control Loop to the SVI II ESD:

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 ESD. There are two threaded openings on the positioner. Use the opening with the red plastic insert.
4. Maintain polarity + and - respectively.
Wiring a Position Retransmit

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

To connect:

1. Strip the insulation at the end of the wires. Strip approximately 1/4" (6.35 mm) of the insulation at the end of wires (wire size 14 to 28 AWG, 2.5 mm² to .08 mm²).

2. Connect the +/\ terminals from the 4-20 mA Out to the position retransmit input signal: + to + and - to -. See Figure 15 on page 49.

To troubleshoot retransmit connections:

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

3. 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.

Compliance Voltage in Single Drop Current Mode

The SVI II ESD requires 9.6 Volts at 20 mA and 11.0 Volts 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 ESD is unique in that it requires LESS Voltage at higher current which compliments the characteristic of the source requiring only 9.6 Volts at 20 mA. See “Determining an SVI Positioner Compliance Voltage in a Control System” on page 97.

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.
Powering Up the SVI II ESD

Verify the wiring and connections and then connect the current source.

Connecting a Power Source

Depending upon the configuration of the SVI II ESD, powering up the unit consists of connecting to the 4-20 mA current source or the 24 VDC power source.

**WARNING**

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

**NOTE**

When an SVI II ESD is turned on it is advisable to apply the air supply before applying the electrical input signal.
Powering Up the ASD Configuration

The ASD, or Analog Safety Demand, configuration uses a 4 - 20mA current source for power.

**CAUTION**

*Use of a low impedance voltage source damages the SVI II ESD. 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 ASD configuration of the SVI II ESD:

1. Loosen the four (4) cover screws and remove the cover of the SVI II ESD.
2. Connect the +/– terminals of the current source to the 4 - 20mA IN connector (on the terminal board). The current source + must connect to the terminal board connector +, and the same for -. See Figure 15 on page 49.
3. Reinstall the cover and display.
4. Adjust current to 20 mA.
   
   On initial power up of a newly installed SVI II ESD, the positioner starts up in SETUP mode using the default factory-installed instrument parameters. Once calibrated and configured and set to NORMAL, 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 (!) appears in the display's top left corner to indicate that further instrument status is available.
5. Proceed to Configuration on “Configuration” on page 62 and “Calibration” on page 66.
Powering Up the DSD Configuration

The DSD, or Discrete Safety Demand, configuration uses a 24 VDC power source. To power up the DSD configuration of the SVI II ESD:

1. Loosen the four (4) cover screws and remove the cover of the SVI II ESD.
2. Connect the +/− terminals of the 24 VDC power source to the 24 VDC ESD IN connector (on the terminal board). The voltage + must connect to the terminal board connector +, and the same for −. See Figure 16 on page 49.
3. Reinstall the cover and display.
4. Turn on the voltage source. On initial power up, of a newly installed SVI II ESD, the positioner runs in SETUP mode using the default instrument parameters installed at the factory. Once calibrated and configured and set to NORMAL, 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 (!) appears in the display’s top left corner to indicate that further instrument status is available.
5. Proceed to “Configuration” on page 62 and “Calibration” on page 66.

Powering Up the A/DSD Configuration

The A/DSD, or Analog/Discrete Safety Demand, configuration uses both a 4 - 20 mA current source (for the unit) and a 24 VDC source (for the safety trip) for power.

CAUTION

Use of a low impedance voltage source damages the SVI II ESD.
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 ESD:

1. Loosen the four (4) cover screws and remove the cover of the SVI II ESD.
2. Connect the +/− terminals of the current source to the 4 - 20mA IN connector (on the terminal board). The current source + must connect to the terminal board connector +, and the same for −. See Figure 14 on page 42.
3. Reinstall the cover and display.
4. Adjust the current to 20 mA.
5. Connect the +/− terminals of the 24 VDC power source to the 24 VDC ESD IN connector (on the terminal board). The voltage source + must connect to the terminal board connector +, and the same for −. Figure 17 on page 50.
6. Reinstall the cover and display.
7. Turn on the voltage source. On initial power up of a newly installed SVI II ESD, the positioner runs in SETUP mode using the default factory-installed instrument parameters. Once calibrated and configured and set to NORMAL, 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 (!) appears in the display's top left corner to indicate that further instrument status is available.


**NOTE**

*The safety function of the SIF (shutdown of the valve on demand) must be tested after installation.*
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.

All connections to electronic module in the SVI II ESD are made through the terminal board. There are three versions of the terminal board, dependent on the configuration you have; ASD, DSD, or A/DSD. The SVI II ESD terminal board has a terminal block with cage clamp connectors. Confirm that all applicable connections to the electronics module connectors are correct. Not all options are available for every model. Refer to Table 5 for available functionality.

Table 5: SVI II ESD Models and Functionality

<table>
<thead>
<tr>
<th>I/O ON SVI II ESD</th>
<th>SVI II ESD ASD Analog Safety Demand</th>
<th>SVI II ESD DSD Discrete Safety Demand</th>
<th>SVI II ESD A/DSD Analog Power with Discrete Safety Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog In (4-20mA)</td>
<td>Safety Trip Signal + HART® + Analog PST</td>
<td>Not Used</td>
<td>Device Power + Analog PST + HART®</td>
</tr>
<tr>
<td>ESD In (0-24 VDC)</td>
<td>Not Used</td>
<td>Safety Trip Signal + HART®</td>
<td>Safety Trip Signal</td>
</tr>
<tr>
<td>SW1 (1A, 24 VDC)</td>
<td>Not Configurable</td>
<td>Not Configurable</td>
<td>Not Configurable</td>
</tr>
<tr>
<td>SW2 (1A, 24 VDC)</td>
<td>Configurable Status</td>
<td>Configurable Status</td>
<td>Configurable Status</td>
</tr>
<tr>
<td>DI (switch input)</td>
<td>Unlatch (1)</td>
<td>Unlatch (1)</td>
<td>Unlatch (1)</td>
</tr>
<tr>
<td>PV (1-5 VDC)</td>
<td>Read Tight Shutoff Flow (2)</td>
<td>Read Tight Shutoff Flow (2)</td>
<td>Read Tight Shutoff Flow (2)</td>
</tr>
<tr>
<td>Local LCD / Buttons</td>
<td>ESD Status Local PST</td>
<td>ESD Status Local PST</td>
<td>ESD Status Local PST</td>
</tr>
</tbody>
</table>

(1) Latching is software configurable.

(2) 1 - 5 VDC variable is sent using HART® command #3 as the variable TV.
Figure 15  Connections to ASD Electronics Module (via Terminal Board)

Figure 16  Connections to DSD Electronics Module (via Terminal Board)
Figure 17 Connections to A/DSD Electronics Module (via Terminal Board)
Making Connections to the Terminal Board

Each terminal block on the terminal board has a cage clamp connector. One side of the connector has the actual connection for the wire, with a lever at the top. If there is an option present that is not properly connected to the terminal board or if adding a new option, connect the wires from the option as follows:

1. If the option’s wires have not been stripped, strip the insulation at the end of wires.
2. Locate the correct terminal block on the terminal board (see Figure 15 on page 49).
3. Push the lever back 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.

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. Side loading the cage clamp lever can cause damage.

NOTE

Position Retransmit: when wiring this feature:
Wire using the same gauge wire as for the 4-20 mA control loop.
In general, ensure that it is connected to the control system’s analog systems card.
Ensure the control loop is powered when using a meter to make any measurements.
SVI II ESD Maintenance

Repair and Replacement

Repairs may be made only by authorized personnel trained to repair Safety Devices.

CAUTION

*When working on safety rated equipment appropriate risk reduction safety measures must be in place.*

1. A conservative approach is taken in estimating the service interval for the digital valve controller in Safety Instrumented Systems. For SIS applications, perform preventive maintenance on the SVI II ESD after five years from the shipment date, if the average daily ambient temperature is below 60° C (140° F). Where ambient temperature exceeds 60° C (140° F) for extended periods, reduce this maintenance interval based on plant experience.

2. SVI II ESD preventive maintenance consists of replacing gaskets, O-rings in the device and a visual inspection of moving components to verify satisfactory condition. Following maintenance, the SVI II ESD must be reinstalled on the valve actuator and calibrated per the procedures in this Quick Start Guide or in the SVI II ESD Instruction Manual SIL3, GEA18946. After calibration, validate the SVI II ESD functional safety. All maintenance procedures must be performed only by authorized personnel trained to repair Safety Devices.

3. If alarms or alerts are detected during operation, maintenance or periodic inspection and test, immediately take corrective action according to the troubleshooting and repair procedures given in the Instruction Manual.

4. The tools required for repair of the SVI II ESD are also listed in the SVI II ESD Instruction Manual SIL3, GEA18946.

Factory Notification

Report any failures detected that compromise functional safety to the factory. Contact your local service representative. Sales Office locations are listed on the back cover of this document.

NOTE

*GE does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use of any GE’s Masoneilan product remains solely with the purchaser and end-user. The SVI II ESD requires recertification, which must be performed by GE authorized personnel trained to repair Safety Devices.*

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Display Cover Removal and Installation

The cover with display (Figure 18) is standard with the SVI II ESD. To replace the display cover, follow the instructions below for removal and installation.

**WARNING**

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

If natural gas is supplied, natural gas may escape from the SVI II ESD on removal of the cover or components.

Tools Needed for Cover Replacement

- 5 mm hex key for the cover
- 3 mm hex key for the lanyard

Removing the SVI II ESD Display Cover

To remove the SVI II ESD Display cover:

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

![SVI II ESD Pneumatic and Display Covers](image)

Figure 18  SVI II ESD Pneumatic and Display Covers
Installing the SVI II ESD Display Cover

The replacement Display Cover is shipped with a lanyard to prevent the cable (that connects from the display to the Terminal Board) from breaking. Insert the lanyard under the screw in the lower left corner that attaches the terminal board to the SVI II ESD housing.

To install the cover:

1. Install the lanyard and tighten the screw to 5 in/lb.
2. Using a 3 mm hex key, remove the screw from the lower left corner, connecting the terminal board to the SVI II ESD 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 “Powering Up the SVI II ESD” on page 44.

NOTE

The cover of the SVI II ESD 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/lb.

Ensure that:

☐ The gasket is seated in the groove in the housing flange.
☐ No wires or retaining cable can be trapped under the cover flange.
☐ The flange area is not corroded and the surface is not scarred.
☐ The four cover bolts are securely tightened to 50 in/lb.
3. Setup, Calibration and PST

Overview

This section provides information on SVI II ESD setup and calibration procedures to ensure proper valve positioning and Partial Stroke Testing (PST).

Perform the setup and calibration procedures in this section before putting the SVI II ESD into operation as the SIF.

SVI II ESD Setup

There are two SVI II ESD items to consider prior to actual setup and calibration:

1. SVI II ESD display and pushbuttons for accessing SVI II ESD menu functions.
2. SVI II ESD modes of operation.

Pushbuttons and Local Display

Local interface to the SVI II ESD consists of the LCD alphanumeric display and pushbuttons. The SVI II ESD can be controlled locally through the device-mounted pushbuttons and digital display, shown in Figure 1 on page 21. Using the display you can read the input signal, valve position, and actuator pressure. The display sequences from one variable to the next is every 1.5 seconds.

Using the pushbuttons you can change operating modes at any time and step through a menu structure to perform a wide range of manual operation, calibration, configuration, and monitoring functions. The SVI II ESD provides internal diagnostics and if a fault is detected it appears on the display. ValVue ESD provides advanced diagnostic functions. The pushbuttons do not support ValVue ESD advanced diagnostics functions.

NOTE

The positioner LCD may indicate Failsafe when an alarm condition exists. Use the pushbuttons to view and clear alarms. See Accessing Diagnostic Information in the Masoneilan SVI II ESD Smart Valve Interface with SIL3 Emergency Shutdown PST Controller Installation and Maintenance Manual.
Table 6 lists each display menu and provides a functional description of the menu, including parameters, where applicable.

**Table 6: Pushbutton Display Menus**

<table>
<thead>
<tr>
<th>Pushbutton Menu</th>
<th>Function/Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>Runs the SVI II ESD in normal operating mode, displays position, signal and pressure.</td>
</tr>
<tr>
<td>MANUAL</td>
<td>Executes manual mode in which the valve does not respond to input signal and you can adjust position manually. In MANUAL the valve responds to the Trip signal in addition to responding to HART®. MANUAL menu provides access to SETUP.</td>
</tr>
<tr>
<td>SETUP</td>
<td>Provides access to lower level setup menus; configuration (CONFIG), calibration (CALIB) and PST configuration.</td>
</tr>
<tr>
<td>CONFIG</td>
<td>Sets the following parameters: ATO/ATC, Pressure units, display language.</td>
</tr>
<tr>
<td>CALIB</td>
<td>Calibrates the SVI II ESD by running the STOPS (find stops) and TUNE (autotune) functions.</td>
</tr>
<tr>
<td>PST CONF</td>
<td>Configures the following PST parameters: TRAVEL (range in a percentage of 100% travel over for partial stroke testing to occur), PMIN (minimum amount of pressure allowed during PST), MAX TIME (maximum amount of time in seconds allowed for partial stroke), RAMPSPEED.</td>
</tr>
<tr>
<td>VIEW DATA</td>
<td>Displays the parameters set in CONFIG and PST CONF.</td>
</tr>
<tr>
<td>VIEW ERR</td>
<td>Displays all current errors.</td>
</tr>
<tr>
<td>CLR ERR</td>
<td>Clears current errors, one at a time.</td>
</tr>
<tr>
<td>RUN PST</td>
<td>Executes PST (Partial Stroke Testing).</td>
</tr>
</tbody>
</table>
Accessing 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 *, 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 exclamation point (!) appears in the SVI II ESD display window, it indicates instrument status available.

---

**Figure 19** SVI II ESD Display Pushbuttons
Pushbutton Locks and Configuration—Lock Jumper

The SVI II ESD offers several levels of accessibility. It may be desirable, after initial setup, to lock the pushbuttons so that the SVI II ESD parameters cannot be inadvertently changed by the buttons. Several levels of pushbutton locks are provided and described in Table 7.

<table>
<thead>
<tr>
<th>Level</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security Level 3</td>
<td>Allow Local Buttons: Buttons on the SVI II ESD are fully enabled.</td>
</tr>
<tr>
<td>Security Level 2</td>
<td>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.</td>
</tr>
<tr>
<td>Security Level 1</td>
<td>Lock Out Local Manual/Setup Mode: 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.</td>
</tr>
<tr>
<td>Security Level 0</td>
<td>Lock Out All Buttons: The buttons are disabled (level 0).</td>
</tr>
</tbody>
</table>

Checking Pushbutton Lock Security Using ValVue ESD

Before performing any functions with the local display, you must place the pushbuttons in the unlocked mode using ValVue ESD. The positioner is provided in the unlocked mode.

To check the pushbutton lock security using ValVue ESD:

1. Select the installed ESD positioner from the list of Connected Devices as shown in Figure 20 and click Connect.
2. Select the Configure tab to view and change the current Button Lock configuration.
Hardware Configuration Lock

Additional security is achieved using the hardware configuration-lock jumper shown in Figure 15 on page 49. When set to the secure position, configuration and calibration are not permitted by the local interface or by remote communications. Pushbuttons, ValVue ESD and handheld are locked out, except to examine configuration, calibration, and position. This is similar to Security Level 1 shown in Table 7 on page 58.

Modes of Operation

To run setup and calibration the SVI II ESD must be in the correct operating mode. The SVI II ESD has three modes of operation:

- Normal
- Manual
- Setup

Figure 21 on page 61 illustrates the menu structure of the NORMAL, MANUAL and SETUP modes of operation. When the SVI II ESD is powered up for the first time it is in the CONFIG (configuration) mode, since the device needs to be configured.

Device Trip

The SVI II ESD goes to the failsafe state whenever the safety function is triggered or if one of the critical faults (checksum errors, stack errors, Factory Write Latched Event, or MCU Internal Malfunction - see Critical status tab in online help) occurs. When tripped, **Tripped** appears on the LCD, as well as on the ValVue ESD's software interface. The trip occurs irrespective of the mode that the SVI II ESD is in at that moment.

If the LATCH function is enabled, **LATCHED** appears on the display when tripped. To reset the latch condition, either:

- Use the local pushbuttons by clicking + three times until the word **UNLATCH** appears and then clicking on the *.
- Use ValVue ESD and go to the alarm page and clicking the button **Clear Latch**.
- Use a handheld or a HART® host with the DD or DTM.
- Wire a button to the DI terminal. The DI terminal resets the LATCH condition by means of a short circuit on its input.
Normal Operation

In Normal mode, the SVI II ESD responds to the input signal and positions the ESD valve accordingly.

In configurations where the safety function is triggered by current, when the input signal current falls below 5.6 mA, the SVI II ESD de-energizes the ESD valve. In the same configuration, when the input signal current rises above 14 mA, the SVI II ESD energizes the ESD valve.

In configurations where the safety function is triggered by a discrete 0 - 24 VDC signal, when the input signal voltage falls below 3 V, the SVI II ESD de-energizes the ESD valve. In the same configuration, when the input signal voltage rises above 18 V, the SVI II ESD energizes the ESD valve.

Manual Operation

In Manual mode, the valve does not respond to the input signal. Instead it remains stable in the position that the valve was in when manual mode was entered or a new position selected by using HART® or pushbutton interface. However, the Shutdown function is activated if the signal is less than 5.6 mA (ASD and A/DSD) or 3 VDC (A/DSD and DSD).

Setup

In the Setup mode, you can set calibration and configuration parameters. Additionally, you can run response time tests, step response tests, and valve signatures.
Figure 21  NORMAL Operation and MANUAL Menu Structures
Configuration

To perform configuration and calibration you can use either the pushbutton display, the HART® handheld communicator, a HART® Host with the DD loaded, or the ValVue ESD software. Refer to “Pushbuttons and Local Display” on page 55 or the SVI II ESD Instruction Manual SIL3, GEA18946 for instructions.

The following section describes configuration and calibration with the optional local display and pushbuttons.

WARNING

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

NOTE

In this document, all calibration and configuration procedures are described using ValVue ESD software and an SVI II ESD with pushbuttons and display.
Notes on Aggressiveness

Setting Aggressiveness

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

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

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

ValVue ESD Software

ValVue ESD provides advanced diagnostic, maintenance capabilities and complete calibration and configuration for the SVI II ESD. The software also performs Partial Stroke Testing (PST), scheduled and on demand, performs valve diagnostics (proof testing) and provides results in graphic, informational and historical formats. The software has a database to store test results for comparison with future results for predictive maintenance. It is password protected against access to remote instruments. It is set up with administration features.

System Requirements

Windows® Server 2003 SP2, Windows® Server 2008, XP SP2, or 7, 64 MB RAM, a serial or USB port connected to a HART® modem.
Configuration with Pushbuttons

To change the current configuration parameters:

1. On power up if the VI II ESD is not in NORMAL mode, switch to NORMAL mode. The display alternates between POS and SIGNAL indicating NORMAL mode.

2. Press + to access MANUAL mode.

3. With MANUAL mode displayed, press * to select the MANUAL mode the display alternates between POS –M and SIG indicating MANUAL mode.

4. Press * and SETUP appears.

5. Press * again; CONFIG appears.

6. Press the * button to access the CONFIGuration menu.

7. Set the configuration parameters: Air Action, Air Pressure Units and Language. For each parameter:
   a. Press * to access and change the parameter.
   b. Press + to move to the next parameter.
   c. Press + to return to SETUP.
   d. Press + to return to NORMAL mode.
**Viewing Configuration Data**

To view SVI II ESD configuration data:

1. Access the VIEW DATA menu from the MANUAL menu by pressing the + button.
2. Press * to examine the configuration.
3. Press + to scroll through and observe the factory configuration.
4. Press + until MANPOS appears.
5. Select with *.
   - When the adjustment screen appears.
6. Stroke the valve open by holding + down. The rate of set point change is slow to begin, but increases speed while the + is pressed.
7. Stroke the valve to several values.
8. Verify the action is as desired.

**Table 8: VIEWDATA Settings**

<table>
<thead>
<tr>
<th>Configuration Parameter</th>
<th>Typical Setting</th>
<th>Optional Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Action</td>
<td>ATO</td>
<td>ATC</td>
</tr>
<tr>
<td>Air Pressure Units</td>
<td>PSI</td>
<td>BAR</td>
</tr>
<tr>
<td>Language</td>
<td>ENGLISH</td>
<td>FRENCH, GERMAN, ITALIAN, PORTUGUESE, SPANISH, JAPANESE (simplified)</td>
</tr>
</tbody>
</table>

**Viewing Status Messages**

To view SVI II ESD 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 is displayed for a second or two.
Calibration

**WARNING**  *In order to calibrate the SVI II ESD, it must be in SETUP mode.*

To calibrate the SVI II ESD:

1. On power up if the SVI II ESD is not in NORMAL mode, switch to NORMAL mode. The display alternates between POS and SIGNAL indicating NORMAL mode.
2. Press + to access MANUAL mode.
3. With MANUAL mode displayed, press * to select the MANUAL mode the display alternates between POS –M and SIG indicating MANUAL mode.
4. Press * and SETUP appears.
5. Press * again; ↓CONFIG appears.
6. Press + to display ↓CALIB.
7. Select CALIB by pressing *. STOPS appears.
8. Press * to activate the Find Stops calibration procedure.
   - 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.
AutoTune and Stops

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

To autoTUNE the SVI II ESD:

1. Press * to begin the autoTUNE procedure.
   Numerical messages display, indicating the procedure is working.
2. TUNE appears when autoTUNE is complete.
3. Press + repeatedly until ↑SETUP appears.
4. Press * to return to SETUP menu ↓CALIB appears. The valve moves to the value set by the current calibrator.
5. Stroke the valve through its range to verify that the movement is as desired.
6. Press + to return to SETUP.
7. Press + to return to NORMAL mode.

Check-out with a HART® Handheld Communicator

Connect the HART® Handheld Communicator (HHC) to the SVI II ESD as shown in Figure 22. Refer to the product manual for the HART® Communication devices.

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. For example, the following message appears if the instrument has been serviced and the air is not connected.
Process applied to the non-primary variable is outside the operating limits of the field device.

Proceed with the following steps:

1. Press **NEXT**.
2. Field device has more status available.
3. Press **NEXT**.
4. **Ignore next 50 occurrences** of status?.
5. Press **YES**.
6. Change to **MANual** mode.
7. Scroll to line **6 “EXAMINE”**, press **->**.
8. Scroll down to line **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 line **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**.
Diagnostics

The SVI II ESD provides two types of diagnostic information; the continuous diagnostics that require no user configuration for which no valve movement occurs and Partial Stroke Testing (PST) diagnostics that you can configure and run at any time. You can also manually run a proof test (see page 19).

Partial Stroke Test Diagnostics

The SVI II ESD is capable of partially stroking the valve to detect failures in the final control element assembly. The PST is configured using the pushbutton display or through ValVue ESD. Upon detection of a failure or deviation from the user configurable conditions the annunciation channel SW 1 sets its state to low.

The PST can be configured to start automatically or can be initiated through setting the current input to 16.4 mA. +/- 0.1mA, local control panel pushbutton, or initiated locally by an operator. When configured to run automatically or when initiated through a safety rated logic solver, additional diagnostic credit can be taken for the PST.

In addition to the safety rated I/O, HART® communications are available to provide additional information on the SVI II ESD status. Additional diagnostic functions include:

- With ASD or A/DSD modes, the device is capable of capturing and storing the shutdown event when the safety function is engaged and/or when the valve is positioned using the control signal (4-20 mA or 0-24 VDC).
- The SVI II ESD can provide general information of the device’s sensor health (Temperature, Actuator Pressure, Air supply, Current, etc.).
- Capable of annunciating faults resulting from a PST.
- Discrete output (SW1) is de-energized for any fault related to the I/P, relay, or valve/actuation assembly, resulting from a PST or during normal operation.
- For most fault conditions, the ESD device attempts to remain in the energized state until an ESD command is given (unless specified otherwise during setup).
Partial Stroke Testing

Key components of Safety Instrumented System (SIS) are final control elements such as emergency shutdown devices, i.e. the SVI II ESD. The SVI II ESD and its associated valve are not continually moving like a typical control valve, but are normally expected to remain static in one position and then reliably operate upon an emergency situation. Valves that remain in one position for long periods of time can become stuck in that position and may not operate when needed. To ensure the integrity of the ESD valve the SVI II ESD requires periodic testing.

One of the great features of the SVI II ESD is the ability to test the safety valve on-line, without removing the safety valve from the SIS. The SVI II ESD allows you to automatically, or on demand perform a Partial Stroke Test (PST) which returns relevant variables about valve operation and can allow you to detect potentially dangerous failures.

PST Configuration

Before running PST, configure the parameters; travel, maximum pressure, maximum time, ramp speed, and spring. You can configure PST parameters from the pushbutton display and also using ValVue ESD. Refer to Table 6 on page 56 for PST configuration parameters.

PST Configuration with Display

When using the LCD display to configure PST:

1. Access the PST Configuration (PST CONF) menu. (Refer to Figure 21 on page 61 for menu structure.).
2. Scroll through each PST parameter and adjust accordingly.

PST Configuration with ValVue ESD

When using ValVue ESD to configure PST:

1. Select the Configure screen in ValVue ESD.
2. Set the PST parameters to the appropriate settings.
3. Apply and save changes.
Starting PST

There are several methods to start a PST (summarized in Table 9):

- SVI II ESD pushbutton display by selecting “Run PST”. Refer to Figure 21 on page 61 for menu structure.
- ValVue ESD software interface (standalone or integrated with leading control systems). You can run the PST from the top level screen of ValVue ESD or on the PST screen.
- HART® handheld device, issuing a HART® command.
- By issuing a loop current of 16.4 mA for 3 - 5 seconds (ASD or A/DSD models).
- Using the scheduler in SVI II ESD that automatically starts a PST at a specific date and time.

<table>
<thead>
<tr>
<th>PST Initialization</th>
<th>PST Trigger or Launching Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Demand</td>
<td>Analog set to 16.4 mA</td>
</tr>
<tr>
<td></td>
<td>ValVue ESD</td>
</tr>
<tr>
<td></td>
<td>LCD</td>
</tr>
<tr>
<td></td>
<td>Handheld or any HART® Host with DD support</td>
</tr>
<tr>
<td>Scheduled</td>
<td>Built-In calendar in SVI II ESD</td>
</tr>
</tbody>
</table>
This page intentionally left blank.
# A. Specifications and References

## Physical and Operational Specifications

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

<table>
<thead>
<tr>
<th>Table 10: Environmental Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature Limits</td>
</tr>
<tr>
<td>Storage Temperature Limits</td>
</tr>
<tr>
<td>Temperature Effect</td>
</tr>
<tr>
<td>Supply Pressure Effect</td>
</tr>
<tr>
<td>Relative Humidity</td>
</tr>
<tr>
<td>Humidity Effect</td>
</tr>
<tr>
<td>Insulation Resistance</td>
</tr>
<tr>
<td>MTBF</td>
</tr>
<tr>
<td>Electromagnetic Compatibility Electrostatic</td>
</tr>
<tr>
<td>Fast Transient Burst</td>
</tr>
<tr>
<td>Vibration Influence Measured at SVI II ESD Housing</td>
</tr>
<tr>
<td>Magnetic Field Influence</td>
</tr>
</tbody>
</table>
### Table 11: Operational Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy</strong></td>
<td>+/- 0.5% (typical +/-0.10% or less) Full Span</td>
</tr>
<tr>
<td><strong>Hysteresis and Deadband</strong></td>
<td>+/- 0.3% Full Span</td>
</tr>
<tr>
<td><strong>Repeatability</strong></td>
<td>+/- 0.3% Full Span</td>
</tr>
<tr>
<td><strong>Conformity</strong></td>
<td>+/- 0.5% Full Span</td>
</tr>
<tr>
<td><strong>Start-Up Drift</strong></td>
<td>Less than 0.02% in first hour</td>
</tr>
<tr>
<td><strong>Long Term Drift</strong></td>
<td>Less than 0.003% per month</td>
</tr>
<tr>
<td><strong>Position Travel Limits</strong></td>
<td>Rotary: 18 - 140° Reciprocating: 0.25” - 2.5” (6 mm - 64 mm) Note: Above 2.5” (64 mm) consult factory for mounting instructions.</td>
</tr>
<tr>
<td><strong>Position Auto Tune</strong></td>
<td>SVI II ESD 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</td>
</tr>
<tr>
<td><strong>Start Up Time (from no power)</strong></td>
<td>Less than 200 mS</td>
</tr>
<tr>
<td><strong>Minimum current to maintain HART®</strong></td>
<td>3.0 mA</td>
</tr>
</tbody>
</table>
### Table 12: Safety Rated Inputs

<table>
<thead>
<tr>
<th>Device</th>
<th>Terminal</th>
<th>Signal</th>
<th>Action</th>
<th>Safety Integrity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASD</td>
<td>4 - 20 mA IN</td>
<td>&lt; 5.6 mA</td>
<td>De-energize to Trip</td>
<td>3</td>
</tr>
<tr>
<td>A/DSD</td>
<td>24 VDC IN</td>
<td>&lt; 3 VDC</td>
<td>De-energize to Trip</td>
<td>3</td>
</tr>
<tr>
<td>DSD</td>
<td>24 VDC IN</td>
<td>&lt; 3 VDC</td>
<td>De-energize to Trip</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 13: Input Signal, Power, and Display Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>Taken from 4-20 mA control signal</td>
</tr>
<tr>
<td>Compliance Voltage Rating</td>
<td>ASD - 9.6 V at 20 mA, 11.0 V at 4.0 mA</td>
</tr>
<tr>
<td></td>
<td>DSD - 24 V at 12 mA</td>
</tr>
<tr>
<td></td>
<td>A/DSD - 9.6 V at 20 mA, 11.0 V at 4.0 mA</td>
</tr>
<tr>
<td>Minimum Cut-off Current</td>
<td>3.2 mA</td>
</tr>
<tr>
<td>Wire Size</td>
<td>14/28 AWG</td>
</tr>
<tr>
<td>Strip Length</td>
<td>0.22” / 6 mm</td>
</tr>
<tr>
<td>Digital Communication</td>
<td>HART® Communication protocol signal from ValVue ESD software on a personal computer or a hand held device. HART® point to point and burst mode.</td>
</tr>
<tr>
<td>Local Display Liquid Crystal</td>
<td>Three lines of nine alpha numeric characters. Display becomes unreadable between 0 °C and -10 °C. Display is shutdown at -15 °C.</td>
</tr>
<tr>
<td>Push Buttons</td>
<td>Three Explosion Proof / Flameproof push buttons</td>
</tr>
</tbody>
</table>
### Table 14: Construction Material Specifications

<table>
<thead>
<tr>
<th>Part</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing and Cover</td>
<td>Aluminum ASTM B85 Alloy SG100A standard</td>
</tr>
<tr>
<td></td>
<td>Stainless Steel optional (316L) Note: SST version is also SIL3</td>
</tr>
<tr>
<td>Weight</td>
<td>Standard - 7.4 lbs./ 3.357 kg</td>
</tr>
<tr>
<td></td>
<td>Stainless Steel - 16 lbs/ 7.257 kg</td>
</tr>
<tr>
<td>Relay and Manifold</td>
<td>Single Acting - PPS, 300 Series Stainless Steel, nitrile diaphragms</td>
</tr>
<tr>
<td>I/P Motor</td>
<td>430 stainless steel, PPS, 300 series stainless steel</td>
</tr>
<tr>
<td>Mounting Bracket</td>
<td>300 series stainless steel</td>
</tr>
<tr>
<td>Magnet Holder</td>
<td>Corrosion Protected Anodized Aluminum 6061 T6</td>
</tr>
<tr>
<td>Pole Ring</td>
<td>416 stainless steel</td>
</tr>
<tr>
<td>Levers</td>
<td>300 Series stainless steel</td>
</tr>
</tbody>
</table>

### Table 15: System Connectivity

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>HART® Information</td>
<td>HART® rev 5, ManufacturerID 0065, DeviceID 00CB</td>
</tr>
<tr>
<td>DD Registered with HART®</td>
<td>Yes, from HART® Communication Foundation at <a href="http://www.hartcomm.org">www.hartcomm.org</a></td>
</tr>
<tr>
<td>Communication Foundation</td>
<td></td>
</tr>
<tr>
<td>Yokogawa PRM</td>
<td>ValVue ESD Plug-In application available</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Valve signature, partial stroke test signature, emergency shutdown signature, stroking speed, friction high, friction low, valve breakout pressure, spring range, air supply droop, filling and exhaust rate. Integration of alarms with host using HART® Command #48.</td>
</tr>
<tr>
<td>DD for Handheld</td>
<td>Yes</td>
</tr>
<tr>
<td>HART CMD #3</td>
<td>HART® 4-20 mA input signal</td>
</tr>
<tr>
<td></td>
<td>PV = Valve Position, 0-100%</td>
</tr>
<tr>
<td></td>
<td>SV = Actuator Pressure (P1-P2)</td>
</tr>
<tr>
<td></td>
<td>TV = Supply Pressure</td>
</tr>
<tr>
<td></td>
<td>QV = P2 for double acting units (not applicable)</td>
</tr>
</tbody>
</table>
Table 16: Pneumatics Single Acting Standard Flow

<table>
<thead>
<tr>
<th>Air Supply</th>
<th>Dry, oil-free, 5 micron filtered air (See ISA S7.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action</td>
<td>Direct</td>
</tr>
<tr>
<td>Supply Pressure</td>
<td>30 - 120 psi max. (2.07 - 8.27 bar, 207 - 827 kPa)</td>
</tr>
<tr>
<td></td>
<td>Regulate 10 psi above actuator spring range. Do not exceed actuator rating.</td>
</tr>
<tr>
<td>Air Delivery - Single Acting Relay</td>
<td>11.55 scf/min (325 sL/min) filling, 14.12 scf/min (400 sL/min) venting at 30 psi (2.1 bar, 207 kPa) supply</td>
</tr>
<tr>
<td></td>
<td>19.25 scf/min (545 sL/min) filling, 23.48 scf/min (665 sL/min) venting at 60 psi (4.14 bar, 414 kPa) supply</td>
</tr>
<tr>
<td></td>
<td>27 scf/min (765 sL/min) filling, 32.84 scf/min (930 sL/min) venting at 90 psi (6.21 bar, 621 kPa) supply</td>
</tr>
<tr>
<td></td>
<td>34.6 scf/min (980 sL/min) filling, 42.37 scf/min (1200 sL/min) venting at 120 psi (8.28 bar, 828 kPa) supply</td>
</tr>
<tr>
<td>Air Capacity (flow coefficient)</td>
<td>Loading CV = 0.57</td>
</tr>
<tr>
<td></td>
<td>Venting CV = 0.53</td>
</tr>
<tr>
<td>Air Consumption</td>
<td>0.212 scf/min (6 sL/min) at 30 psi (2.1 bar, 207 kPa) supply</td>
</tr>
<tr>
<td></td>
<td>0.282 scf/min (8 sL/min) at 60 psi (4.14 bar, 414 kPa) supply</td>
</tr>
<tr>
<td></td>
<td>0.424 scf/min (12 sL/min) at 90 psi (6.21 bar, 621 kPa) supply</td>
</tr>
<tr>
<td></td>
<td>0.529 scf/min (15 sL/min) at 120 psi (8.28 bar, 828 kPa) supply</td>
</tr>
<tr>
<td>Air Supply Failure</td>
<td>On supply failure the actuator output P1 falls to 0 psi.</td>
</tr>
<tr>
<td>Loss of Input Signal</td>
<td>Output drops to low pressure.</td>
</tr>
<tr>
<td>Output Pressure</td>
<td>120 psi (8.28 bar, 828 kPa) max</td>
</tr>
<tr>
<td>CV</td>
<td>0.59 filling, 0.72 venting</td>
</tr>
<tr>
<td>Sweet Natural Gas</td>
<td>H₂S content not more than 20 ppm</td>
</tr>
</tbody>
</table>
Hazardous Location Installation

The following pages provide the agency approved installation procedure for hazardous locations (ES-727).

NOTE
The installation procedure is accurate at time of print. For further hazardous installation information please consult the factory.
ES-727

SPECIAL INSTRUCTIONS FOR INSTALLING MASEONEILAN SVI II ESD IN AREAS WHERE THERE IS A POTENTIAL FOR EXPLOSIVE GAS ATMOSPHERE OR INFLAMMABLE DUST

<table>
<thead>
<tr>
<th>Doc Number</th>
<th>ES-727</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revision</td>
<td>W</td>
</tr>
<tr>
<td>PDR ECO-0029774</td>
<td>11/15/2017</td>
</tr>
<tr>
<td>Written By</td>
<td>P. Levesque</td>
</tr>
<tr>
<td>Checked</td>
<td>T. Kabir</td>
</tr>
<tr>
<td>Approved</td>
<td>T. Kabir</td>
</tr>
</tbody>
</table>

Page 1 of 13

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6 INTRINSICALLY SAFE REQUIREMENTS 5
7 DESCRIPTION OF FLAMEPROOF AND INTRINSICALLY SAFE MARKINGS 6
8 NOTES FOR INTRINSICALLY SAFE INSTALLATION 10
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1 INTRODUCTION

This manual covers the requirements for safe installation, repair, and operation of the SVI II ESD as it relates to operation in areas where there is a potential for explosive atmosphere or inflammable dust. Adherence to these requirements assures that the SVI II ESD will not cause ignition of the surrounding atmosphere. Hazards related to control of the process are beyond the scope of this manual.

For mounting instructions on specific valves refer to the mounting instructions supplied with the mounting kit. Mounting does not affect the suitability of the SVI II ESD for use in a potentially hazardous environment.

The SVI II ESD is manufactured by:

Dresser LLC.
12970 Normandy Blvd.
Jacksonville FL 32221 – USA

2 DEFINITIONS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Full Name</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVI</td>
<td>Smart Valve Interface</td>
<td>Masoneilan digital instrument for controlling valves</td>
</tr>
<tr>
<td>ESD</td>
<td>Emergency Shut Down</td>
<td></td>
</tr>
<tr>
<td>ASD</td>
<td>Analog Safety Demand</td>
<td>4-20mA powers device and initiates Safety Function</td>
</tr>
<tr>
<td>DSD</td>
<td>Discrete Safety Demand</td>
<td>24VDC powers device and initiates Safety Function</td>
</tr>
<tr>
<td>A/DSD</td>
<td>Analog w/ Discrete Safety</td>
<td>4-20mA powers device and 24VDC initiates Safety Function</td>
</tr>
<tr>
<td></td>
<td>Demand</td>
<td></td>
</tr>
</tbody>
</table>

3 GENERAL REQUIREMENTS

Installation and maintenance must be performed only by qualified personnel.

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 5ºC above the highest expected ambient temperature.

Approved wire seals against ingress of water and dust are required and the 1/2 inch NPT fittings must be sealed with tape or thread sealant in order to meet the highest level of ingress protection.

!WARNING!
Failure to adhere to the requirements listed in this manual may cause loss of life and property.
Where the protection type depends on wiring glands, the glands must be certified for the type of protection required.

The metal housing is a die-casting alloy, which is predominately aluminum.

**Before powering the SVI II ESD:**

1. Verify that the pneumatic 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 I.S. installation. **Never** install a device, which was previously installed without an intrinsically safe barrier, in an intrinsically safe system.

3. Under normal operation, compressed supply gas is vented from the SVI II ESD to the surrounding area, and may require additional precautions or specialized installations.

4. If the Installation is Non-Incendive, then check that all the electrical connections are made to Approved Devices and wiring meets local and national codes.

5. Verify that the markings on the label are consistent with the application.

6. Verify that the air supply pressure can not exceed:
   a. For Single Acting 100 PSI (6.8 Bar)

### 4 MODEL NUMBER DESCRIPTION OF SVI II ESD

<table>
<thead>
<tr>
<th>SVI2</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single Acting</td>
<td>Standard Flow</td>
<td>ASD w/ HART</td>
<td>FM, CSA ATEX (XP, DIP, IS, N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>High Capacity</td>
<td>Display Buttons Industrial</td>
<td>DSD w/ HART</td>
<td>Retransmit Digital Out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Plug-in Electronics Module (MNCB)</td>
<td>ASD w/ HART</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Display Buttons Offshore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>ESD - Emergency Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Regional Certifications Include:** CU-TR, Nepsi, CCOE, Inmetro, Kosha, IA

### 5 FLAMEPROOF AND DUST IGNITION PROOF REQUIREMENTS

#### 5.1 General

- The 1/2 inch NPT fittings must enter the housing at least five full turns.
- The cover flange must be clean and free of corrosion products.
5.2 Cable Glands
Certified cable glands are required based on the hazardous area the device is installed in. That is, the particular cable gland used must have the same certification as the tick-box checked off on the label (See Section 6, Figure 1).

5.3 Bolting
"X" Marking on label - M8 X 1.25-6g cover screws must be supplied by Masoneilan. No substitution allowed. Minimum yield stress to be 296 N/mm²2 (43,000 psi)

5.4 Carbon Disulphide Exclusion
Carbon Disulphide is excluded.
(IEC 60079-1, Clause 15.4.3.2.2., carbon disulphide is excluded for enclosures with a volume greater than 100cm³)

5.5 Electrostatic Discharge
"X" Marking on label - Potential Electrostatic Charge Hazard – For safe operation use only wet cloth when cleaning or wiping device, and only when local conditions around the device are free of potentially explosive atmospheres. Do not use dry cloth. Do not use solvent.

5.6 Dust
"X" Marking on label - Instruments installed in dusty hazardous areas, Zones 20, 21 and 22; must be cleaned regularly to prevent the buildup of dust layers on any surface. To avoid the risk from electrostatic discharge, you must follow the guidance as detailed in EN TR50404. For safe operation, use only wet cloth when cleaning or wiping the device. Cleaning must only be done when local conditions around the device are free of potentially explosive atmospheres. Do not use dry cloth or any solvents.

6 INTRINSICALLY SAFE REQUIREMENTS

6.1 DIV 2 (No I.S. Barrier)
WARNING: EXPLOSION HAZARD – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

6.2 Category II (Zone 0)
For operation in hazardous area Category II 1, over-voltage protection of the electrical connections needs to be installed according to EN 60079-14

For operation in hazardous area Category II 1 the ambient temperature needs to be lowered according to the requirements of EN 1127-1 (reduction factor of 80%). The maximum allowed ambient temperature for Category 1 inclusive the requirement of EN1127-1 is:

\[ T_6: T_a = -40°C \text{ to } +43°C \]
6.3 Category II 1 (Zone 0)

"X" Marking on Label - Since the SVI2-abcdefg ("SVI-II ESD") enclosures contain greater than 10% aluminum, care must be taken during installation to avoid impacts or friction that could create an ignition source.

6.4 Category II 3 (Zone 2)

When installing in Category 3 (Zone 2) areas using ‘ic’ protection, ‘ic’ safety barriers are required.

7 DESCRIPTION OF FLAMEPROOF AND INTRINSICALLY SAFE MARKINGS

Applicable Model Numbers:

SVI2-abcdefgh, where “a” thru “h” can take on the following values:

a = 6 ; b = 1 ; c = 1,2 ; d = 1,2,3,4 ; e = 3 ; f = 1 ; g = 1,2,3 ; h = 1,5

The label may not appear exactly as shown, but must contain the following information listed below. Other information is allowed on the label.
7.1 Manufacturers Name and Location
Dresser LLC.
12970 Normandy Blvd.
Jacksonville FL 32221 USA

7.2 Summary of Agency Markings
(Factory Mutual)

{Certifying Agency}

In group a xp installations conduit seal required within 18 inches of enclosure

IS – CL I/II/III; DIV 1; GP A, B, C, D, E, F, G
XP – CL I; DIV 1; GP A, B, C, D
NI – CL I; DIV 2; GP A, B, C, D
DIP – CL II/III; DIV 1; GP E, F, G
S – CL II/III; DIV 2; GP F, G

{Certifying Agency}

CL I, DIV 1; GP B, C, D
CL II, DIV 1; GP E, F, G
CL III, DIV 1
IS – CL I; DIV 1; GP A, B, C, D
IS – CL II; DIV 1; GP E, F, G
IS – CL III; DIV 1

{Explosion Protected Mark}

{CE Conformity Marking, QAN Notified Body Number}

FM17ATEX0072X
II 1G Ex ia IIC T6..T4 Ga
II 1D Ex ia IIIC T96°C Da

{Certificate Number}
{Intrinsically Safe, gas}
{Intrinsically Safe, dust}

Certifying Agency

FM
Approved

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Masonellan SVI II ESD Quick Start Guide | 85
II 2G Ex db mb IIC T6..T4 Gb {Flameproof/Encapsulation, gas}
II 2D Ex tb IIC T96°C Db {Protection by Enclosure, dust}
FM17ATEX0093X {Certificate Number}
II 3G Ex ic IIC T6..T4 Gc {Intrinsically Safe, gas}
II 3D Ex tc IIC T96°C Db {Protection by Enclosure, dust}

(IEC)
IECEx FMG 07.0007X {Certificate Number}
Ex ia IIC T6..T4 Ga {Intrinsically Safe}
Ex db mb IIC T6..T4 Gb {Explosionproof, gas}
Ex tb IIC T96°C Db {Protection by enclosure, dust}
Ta=-40°C to +85°C {Operating Temperature}
IP66 {Ingress Protection}

7.3 Operating Ranges
7.3.1 Temp: -40°C to +85°C
7.3.2 Voltage: 30 Volts
7.3.3 Pressure: 150 psig (1.03MPa)
7.3.4 Current: 4-20mA

7.4 Enclosure Type
Type 4X-IP66

7.5 Temperature Code
T6 Ta=60°C, T5 Ta=75°C, T4 Ta=85°C

7.6 Notes Related to Explosionproof Rating
DO NOT OPEN EVEN WHEN ISOLATED WHEN EXPLOSIVE ATMOSPHERES ARE PRESENT

7.7 Notes Related to Intrinsic Safety
1) REFER TO ES-727 FOR ADDITIONAL CAUTIONS OR WARNINGS
2) Supply Connection Wiring Rated for 5°C Above Max Ambient
3) PERMANENTLY MARK THE PROTECTION TYPE CHOSEN. ONCE THE TYPE HAS BEEN MARKED, IT CAN NOT BE CHANGED

7.8 Model Code:
SVI2-abcdefgh (see section 4 above for explanation)
7.9 **Serial Number:**
SN-nnyywynnnn

**Figure 1, * Intrinsically Safe Installation Wiring Requirements**

**HAZARDOUS LOCATION**
SEE 8.1, 8.2

**NON-HAZARDOUS LOCATION - UNSPECIFIED EXCEPT**
THAT BARRIERS MUST NOT BE SUPPLIED FROM SOURCES CONTAIN UNDER NORMAL OR ABNORMAL CONDITIONS A SOURCE OF POTENTIAL WITH RESPECT TO EARTH IN EXCESS OF 250 VOLTS RMS OR 250 VOLTS DC

Each intrinsically safe cable must include a grounded shield or be run in a separate grounded metal conduit

*Applies to ‘ia’ and ‘ic’*
8. NOTES FOR INTRINSICALLY SAFE INSTALLATION

8.1 Hazardous Locations

Refer to the device label for the description of the environment in which the device may be installed.

8.2 Field Wiring

Intrinsically Safe wiring must be made with grounded shielded cable or installed in grounded metal conduit.

The electrical circuit in the hazardous area must be capable of withstanding an A.C. test voltage of 500 volts R.M.S. to earth or frame of the apparatus for 1 minute.

Installation must be in accordance with Masoneilan guidelines. The installation including the barrier earthing requirements must comply with the installation requirements of the country of use.

Factory Mutual requirements (USA): ANSI/ISA RP12.6 (Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations) and the National Electrical Code, ANSI/NFPA 70. Division 2 installations must be installed per the National Electrical Code, ANSI/NFPA 70. See 0. In group A XP installations, conduit seal required within 18 inches of enclosure entrance.

CSA requirements (Canada): Canadian Electrical Code Part 1. Division 2 installations must be installed per the Canadian Electrical Code Division 2 Wiring Methods. See 0.

ATEX requirements (EU): Intrinsically safe installations must be installed per EN60079-10 and EN60079-14 as they apply to the specific Category.

8.3 Entity Requirements

Cable capacitance and inductance plus the I.S. apparatus unprotected capacitance (Ci) and inductance (Li) must not exceed the allowed capacitance (Ca) and inductance (La) indicated on the associated apparatus. If the optional Hand Held Communicator is used on the Hazardous Area side of the barrier, then the capacity and inductance of the communicator must be added and the communicator must be agency approved for use in the hazardous area. Also, the current output of the Hand Held Communicator must be included in the current output of the associated equipment.

The barriers may be active or passive and from any certified manufacturer as long as the barriers comply with the listed entity parameters.

8.3.1 SVI II ESD 4-20 mA IN Terminals (+) and (-)

These terminals power the SVI II-ESD. The barrier is the Controller Output Type, for example MTL 728.

<table>
<thead>
<tr>
<th>Entity Parameters</th>
<th>Vmax</th>
<th>Imax</th>
<th>Ci</th>
<th>Li</th>
<th>Pmax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 VDC</td>
<td>125 mA</td>
<td>7 nF</td>
<td>10 uH</td>
<td></td>
</tr>
</tbody>
</table>
8.3.2 SVI II ESD 4-20mA OUT Terminals (+) and (-)

These terminals provide a 4 to 20 mA signal related to valve position. The 4 to 20 OUT terminals behave much like the terminals of a transmitter so a Transmitter type barrier with 250 Ohm series resistance (internal or external) is used for this connection (Example: MTL 788 or 788R).

Use of the 4-20 OUT feature is certified to ATEX intrinsically safe requirements and is approved for use in Zone 0. Use of the 4-20 mA OUT feature has not been certified by FM or CSA. The 4-20 mA OUT feature may not be used in an intrinsically safe installation when FM or CSA intrinsically safe approval is required. The 4-20 mA OUT feature is certified by FM and CSA for use in a DIV 2 area and in a DIV 1 area when the SVI II-ESD2 is installed in accordance with flameproof requirements.

<table>
<thead>
<tr>
<th>Table 2, 4-20mA OUT Entity/NIFW Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entity Parameters</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>30 VDC</td>
</tr>
</tbody>
</table>

8.3.3 SVI II ESD PV 1-5VDC Terminals (+) and (-)

The Process Transmitter and the SVI II-ESD PV Input are both barrier protected. The transmitter 4 to 20 mA signal is converted to 1 to 5 volts at the Transmitter barrier. The 1 to 5 volt signal is monitored by the DCS and used by the SVI II-ESD for the embedded process controller. The sense resistor may be in the barrier or in the Digital Control System.

The Process Transmitter must be approved for use with the Process Transmitter Barrier. An example of a suitable Process Transmitter barrier is MTL 788 or 788R. An example of the PV 1-5VDC Terminal barrier is MTL 728.

<table>
<thead>
<tr>
<th>Table 3, PV 1-5VDC Entity/NIFW Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entity Parameters</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>30 VDC</td>
</tr>
</tbody>
</table>

8.3.4 SVI II-ESD SW Terminals (+) and (-)

There are two independent isolated solid state switch contact outputs on the SVI II-ESD. They are labeled SW#1 and SW#2. The switches are polarity sensitive – that is, conventional current flows INTO the plus terminal. Examples of suitable barriers are MTL 707, MTL 787 and MTL 787S.

<table>
<thead>
<tr>
<th>Table 4, SW 1 &amp; SW 2 Entity/NIFW Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entity Parameters</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>30 VDC</td>
</tr>
</tbody>
</table>
8.3.5 DI (Digital In) Terminals

The Digital In terminal is suitable for direct connection to a passive switch. No barrier is required. Connect only to passive (Un-powered) switch.

Table 5, DI Entity/NIFW Parameters

<table>
<thead>
<tr>
<th>Entity Parameters</th>
<th>( U_{o/Voc} )</th>
<th>( P_o )</th>
<th>( C_a )</th>
<th>( L_a )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.5 V</td>
<td>194mW</td>
<td>1 uF</td>
<td>8 mH</td>
</tr>
</tbody>
</table>

8.3.6 24 VDC IN (+) and (-)

The 24 VDC IN circuit is connected thru a Controller output type barrier, for example MTL 728.

Table 6, 24 VDC IN Entity/NIFW Parameters

<table>
<thead>
<tr>
<th>Entity Parameters</th>
<th>( V_{max} )</th>
<th>( I_{max} )</th>
<th>( C_i )</th>
<th>( L_i )</th>
<th>( P_{max} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 VDC</td>
<td>125 mA</td>
<td>7 nF</td>
<td>10 uH</td>
<td>8</td>
</tr>
</tbody>
</table>

8.4 Use in Dust Atmospheres

Dust-tight conduit seal must be used when installed in dust hazard environments.

8.5 Safe Guards for I.S. Barriers

A device which has previously been installed without an approved I.S. barrier must NEVER be used subsequently in an intrinsically safe system. Installing the device without a barrier can permanently damage the safety related components in the device making the device unsuitable for use in an intrinsically safe system.

9 REPAIR

THE FLAME PATHS OF THE EQUIPMENT ARE NOT INTENDED TO BE REPAIRED. CONSULT THE MANUFACTURER OF REPAIR OF A FLAME PATH JOINT IS NECESSARY.

WARNING: EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN A HAZARDOUS LOCATION

Only Masoneilan qualified ESD service personnel are permitted to make repairs. The only replacement part offered for the ESD is the display cover. For more information, contact Masoneilan Dresser LLC. 50 Thomas Patten Dr. Randolph MA 02368 USA.

9.1 Cover (display)

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.
Secure the four cover bolts by applying a torque of 55±5 in-lbs.

10 HISTORY

The table below describes the revision history of this document.
A – Added, M - Modified D – Deleted

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Changed figure, table, chapter</th>
<th>A</th>
<th>M</th>
<th>Title or brief description</th>
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<td>Section 3</td>
<td>-</td>
<td></td>
<td>First edition issued</td>
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<td>M</td>
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<td>ADR-002964 - Modified Entity parameters, Model code designations, General Layout</td>
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<td>ADR-003244</td>
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<td></td>
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<tr>
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<td>Figure 1</td>
<td>M</td>
<td></td>
<td>ADR-003666</td>
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<td>N</td>
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<td>A</td>
<td></td>
<td>ADR-003737</td>
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B. Optional Switch Load Limits

General Configuration Notes

The SVI II ESD 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 23).

<table>
<thead>
<tr>
<th>Switch OFF</th>
<th>Switch ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{SWITCH}$</td>
<td>$\leq 1 \text{ V (Switch saturation voltage)}$</td>
</tr>
<tr>
<td>$I_{SWITCH}$</td>
<td>$\leq 0.200 \text{ mA (Switch leakage current)}$</td>
</tr>
</tbody>
</table>

Incorrect polarity connection results in an effectively closed connection.

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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 $\leq 1V$.

When the switch is on (closed) the external voltage must be dropped across the load (Figure 24).

**CAUTION**

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

The load must be designed such that the current in the circuit is $\leq 1$ 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**

Load is designed to limit current through the switch to $< 1$ A.

If the load is inductive (solenoid, incandescent lamp, etc.), then install a Freewheel or Flyback diode to prevent switch damaging EMF voltage spikes.

**Figure 24** Simplified Switch Installation Drawing: Correct Configuration
Distributed Control Systems Configurations

This section gives guidance for configuration in a DCS application. Figure 25 gives two generalized drawings that cover DCS applications to ensure switch safety.

**Wiring Option #1**

![Wiring Option #1 Diagram]

- Resistance ≥ 30 Ohms + wire resistance.
- Power source requirements: $V < 30 V$, $I_{max} < 1 A$.
- Negative switch pole must be directly wired to negative power supply.

**Wiring Option #2**

![Wiring Option #2 Diagram]

- Resistance = Sized so that circuit is limited < 50 mA in-rush current.
- Power source requirements: $V < 30 V$, $I_{max} < 1 A$.
- Any load (no direct connection).

**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).
Checking Switch Operation

ValVue Commands

This procedure gives an example, using the settings in Figure 26, to see if a switch is operating:

1. Click the **Configure** tab, click and Figure 26 appears.

![Figure 26 I/O Configure](image)

2. Switch from **Normally Opened** to **Normally Closed** or vice versa, click **OK** and **Apply Changes**.

3. Click the **Check** tab.

4. Select **Command 142 Read Switches** from the pulldown list and click **Send Cmd**.

The information field below populates with the configured switch states.

Ensure that the switch just reconfigured has changed state.
C. 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 setup as in Figure 27.

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

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

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 17 lists some compliance voltage readings at positioner terminals at several currents.

**Table 17: Expected Voltage Range at Positioner Terminals**

<table>
<thead>
<tr>
<th>Current</th>
<th>Compliance Voltage Requirement at Positioner Terminals</th>
<th>Expected Voltage Measured at Positioner Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mA</td>
<td>11 V</td>
<td>10 to 11 V</td>
</tr>
<tr>
<td>8 mA</td>
<td>10.5 V</td>
<td>9.5 to 10.5 V</td>
</tr>
<tr>
<td>12 mA</td>
<td>10 V</td>
<td>9 to 10 V</td>
</tr>
<tr>
<td>16 mA</td>
<td>9.5 V</td>
<td>8.5 to 9.5 V</td>
</tr>
<tr>
<td>20 mA</td>
<td>9 V</td>
<td>8 to 9 V</td>
</tr>
</tbody>
</table>
D. Burst Mode Operations

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

To see how the Burst mode is configured see the SVI II ESD online help.

The Burst mode can send the following commands:

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

---

**Connecting the SPA with the SVI II ESD**

- **must be set as as a secondary master if the SPA is in polling mode to be able to connect**
  - **PV** = Position
  - **SV** = Actuator Pressure
  - **TV** = Supply Pressure
  - **QV** = Pressure 2 N/A

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

*Figure 28  Burst Mode Configuration*
DIRECT SALES OFFICE LOCATIONS

AUSTRALIA
Brisbane
Phone: +61-7-3001-4319
Fax: +61-7-3001-4399

Perth
Phone: +61-8-6595-7018
Fax: +61-8-6595-7299

Melbourne
Phone: +61-3-8807-6002
Fax: +61-3-8807-6577

Singapore
Phone: +65-6858-1000
Fax: +65-6858-1772

bhge.com

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