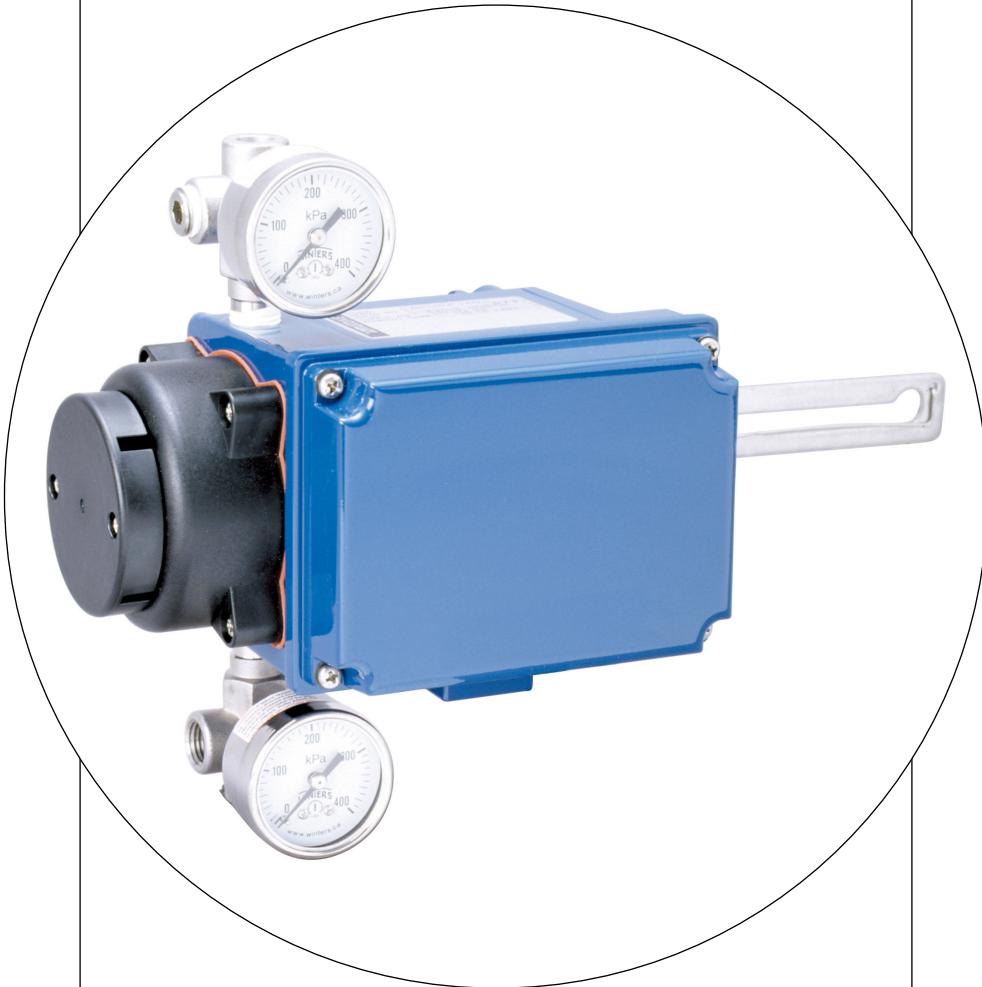


Smart Valve Positioner 100 Series

Model AVP100/102

User's Manual



NOTICE

While the information in this manual is presented in good faith and believed to be accurate, Azbil Corporation disclaims any implied warranty of merchantability or fitness for a particular purpose and makes no express warranty except as may be stated in its written agreement with and for its customer.

In no event shall Azbil Corporation be liable to anyone for any indirect, special or consequential damages. This information and specifications in this document are subject to change without notice.

Safety

Precautions for Use

For safe use of the product, the following symbols are used in this manual.



WARNING

Warnings are indicated when mishandling the product might result in the death or serious injury of the user.



CAUTION

Cautions are indicated when mishandling the product might result in minor injury to the user or damage to property.

- In describing the product, this manual uses the icons and conventions listed below.



Use caution when handling the product.



The indicated action is prohibited.



Be sure to follow the indicated instructions.

Handling Precautions:





Handling Precautions indicate items that the user should pay attention to when handling the SVP.







To use this product correctly and safely, always observe the following precautions.

We are not responsible for damage or injury caused by the use of the product in violation of these precautions.



Handling Precautions for This Product





Installation Precautions

 WARNING	
	When installing, use proper fittings and proper tightening torque for connections to the process and to the exhaust. Gas leakage is dangerous because process gas and calibration gas are flammable. Please refer to the leak check instructions in this manual and verify that there is no gas leakage.
	Do not use the product except at the rated pressure, specified connection standards, and rated temperature. Use under other circumstances might cause damage that leads to a serious accident.
	For wiring work in an explosion-proof area, follow the work method stated in the explosion-proof policy.





 CAUTION	
	After installation, do not step or stand on this unit. Doing so may damage the device or cause injury.
	Bumping the glass of the display with a tool may cause damage or injury. Be careful.
	Install the device correctly. Incorrect or incomplete installation will cause output errors and violation of regulations.
	This product is quite heavy. Protect your feet with safety shoes when working.
	Do not subject the product to shock or impact.



Wiring Precautions

 WARNING	
	Do not do wiring work with wet hands or while electricity is being supplied to the product. There is a danger of electric shock. When working, keep hands dry or wear gloves, and turn off the power.

 CAUTION	
	When wiring, check the specifications carefully and make sure to wire correctly. Incorrect wiring can cause device damage or malfunction.
	Supply electric power correctly according to the specifications. Supplying power that differs from the specifications can damage the device.
	Use a DC power supply that has overload protection.

Maintenance Precautions

 WARNING	
	When removing this device for maintenance, be careful of residual pressure or residual process gas. Leakage of process gas is dangerous.
	When working on the vent, check its direction so that people do not come into contact with vented gas. There is a danger of burns or other physical harm.
	When the device is being used in an explosion-proof area, do not open the cover. Opening the cover may cause an explosion.

 CAUTION	
	This product was kept under carefully controlled conditions until it was shipped. Never try to modify this device. Doing so could damage it.

Unpacking

Handle the equipment with all due care to prevent any damage to prevent damage.

Verify that the following items are included:

- Smart Valve Positioner 100 Series Model AVP100 (1) / AVP102(1)
- Feedback lever (1) and hex socket bolt (2).
- Hex wrench (1) for feedback
- Pressure gauge (option)
- Joint (option)
- Manual (option)

Storage

When storing your SVP without its original packaging, store it indoors, at normal temperature (25°C) and humidity (~65%) store it in a place free from vibration and shock and not exposed to rain or water.

If you are storing your SVP after it has been used, clean the SVP thoroughly and then firmly tighten the terminal box cover and seal the wiring, piping connections and bleed hole on the pilot cover using Azbil Corporation-supplied caps or tape to prevent entry of moisture.

Precautions for worker safety

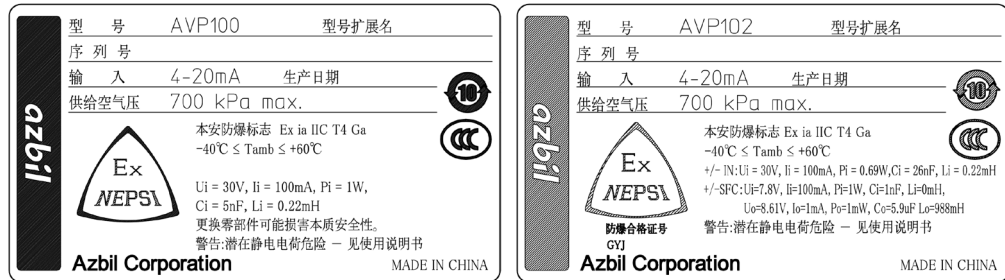
- Do not stand on the installed SVP or use it as a step.
- Take utmost care not to in voluntarily touch the SVP while it is in operation. Its surface may be very hot or very cold, depending on the operating environment.

Approval

CCC Intrinsically Safe Approval for Smart Valve Positioner Model AVP100/102

CCC 本安防爆

This section describes the explosion-proof performance of products with the nameplate shown below.



1. 防爆标志

AVP100 Ex ia IIC T4 Ga
 AVP102 Ex ia IIC T4 Ga

2. 国家防爆标准

GB/T 3836.1-2021 爆炸性环境 第 1 部分：设备 通用要求
 GB/T 3836.4-2021 爆炸性环境 第 4 部分：由本质安全型 "i" 保护的 设备

3. 产品安全使用特殊条件

AVP100

- 1) 当产品安装于要求 EPL Ga 级的场所时，用户须采取有效措施防止产品外壳由于冲击或摩擦引起的点燃危险。
- 2) 产品含非金属材质，应采取措施避免静电电荷产生引燃危险。仅允许使用湿布擦拭。
- 3) 关联装置应优先选用隔离式安全栅；如选用齐纳式安全栅，应符合 GB/T 3836.15-2017 标准关于本安电路接地的要求。
- 4) 使用环境温度：-40 °C ~+60 °C

AVP102

- 1) 当产品安装于要求 EPL Ga 级的场所时，用户须采取有效措施防止产品外壳由于冲击或摩擦引起的点燃危险。
- 2) 产品含非金属材质，应采取措施以防静电引燃危险。
- 3) 关联装置应优先选用隔离式安全栅；如选用齐纳式安全栅，应符合 GB/T 3836.15-2017 标准关于本安电路接地的要求。
- 4) 使用环境温度：-40 °C ~+60 °C

4. 产品使用注意事项

- 1) 产品的使用环境温度范围与温度组别的关系如下表所示：

温度组别	使用环境温度范围
T4	-40 °C ~ +60 °C

- 2) 产品必须与经防爆认可的关联装置配套共同组成本安防爆系统方可使用于现场存在爆炸性气体混合物的危险场所。其系统接线必须同时遵守阀门定位器和所配关联装置的使用说明书要求, 接线端子不得接错。产品本安参数如下 :

AVP100 电气参数如下 :

端子号	最高输入电压 U _i (V)	最大输入电流 I _i (mA)	最大输入功率 P _i (W)	最大内部等效参数	
				C _i (nF)	L _i (mH)
+/- IN	30	100	1	5	0.22

AVP102 电气参数如下 :

端子号	最高输入电压 U _i (V)	最大输入电流 I _i (mA)	最大输入功率 P _i (W)	最大内部等效参数	
				C _i (nF)	L _i (mH)
+/- IN	30	100	690	26	0.22
+/- SFC	7.8	100	1000	1	0

端子号	最高输入电压 U _o (V)	最大输入电流 I _o (mA)	最大输入功率 P _o (W)	最大内部等效参数	
				C _o (nF)	L _o (mH)
+/- SFC	8.61	1	1	5.9	988

- 3) 用户不得自行更换该产品的元器件及零部件, 应会同产品制造商共同解决运行中出现的故障, 以杜绝损坏现象的发生。
- 4) 产品的安装、使用和维护应同时遵守产品说明书及下列相关标准、规范的要求 :
- GB/T 3836.13-2021 爆炸性环境 第 13 部分 : 设备的修理、检修、修复和改造
 - GB/T 3836.15-2017 爆炸性环境 第 15 部分 : 电气装置的设计、选型和安装
 - GB/T 3836.16-2022 爆炸性环境 第 16 部分 : 电气装置的检查与维护
 - GB/T 3836.18-2017 爆炸性环境 第 18 部分 : 本质安全电气系统
 - GB 50257-2014 电气装置安装工程爆炸和火灾危险环境 电气装置施工及验收规范

CCC 本安防爆

This section describes the explosion-proof performance of products with the nameplate shown below.



1. 防爆标志

AVP100 Ex ia IIC T4...T6 Ga

2. 国家防爆标准

GB/T 3836.1-2021 爆炸性环境 第 1 部分：设备 通用要求

GB/T 3836.4-2021 爆炸性环境 第 4 部分：由本质安全型 "i" 保护的的设备

3. 产品安全使用特殊条件

AVP100

- 1) 当产品安装于要求 EPL Ga 级的场所时, 用户须采取有效措施防止产品外壳由于冲击或摩擦引起的点燃危险。
- 2) 产品含非金属材料, 应采取措施避免静电电荷产生引燃危险。仅允许使用湿布擦拭。
- 3) 关联设备应优先选用隔离式安全栅; 如选用齐纳式安全栅, 应符合 GB/T 3836.15-2017 标准关于本安电路接地的要求。
- 4) 使用环境温度: $-40\text{ }^{\circ}\text{C} \sim +40\text{ }^{\circ}\text{C}$ (T6), $-40\text{ }^{\circ}\text{C} \sim +60\text{ }^{\circ}\text{C}$ (T4/T5)。

4. 产品使用注意事项

- 1) 产品的使用环境温度范围与温度组别的关系如下表所示:

温度组别 使用环境温度范围

温度组别	使用环境温度范围
T4/T5	$-40\text{ }^{\circ}\text{C} \sim +60\text{ }^{\circ}\text{C}$
T6	$-40\text{ }^{\circ}\text{C} \sim +40\text{ }^{\circ}\text{C}$

- 2) 产品必须与经防爆认可的关联设备配套共同组成本安防爆系统方可使用于现场存在爆炸性气体混合物的危险场所。其系统接线必须同时遵守阀门定位器和所配关联设备的使用说明书要求, 接线端子不得接错。产品本安参数如下:

AVP100 电气参数如下:

端子号	最高输入电压 U_i (V)	最大输入电流 I_i (mA)	最大输入功率 P_i (W)	最大内部等效参数	
				C_i (nF)	L_i (mH)
+/- IN	30	95	0.66	6	0.2

- 3) 用户不得自行更换该产品的元器件及零部件, 应会同产品制造商共同解决运行中出现的故障, 以杜绝损坏现象的发生。

- 4) 产品的安装、使用和维护应同时遵守产品说明书及下列相关标准、规范的要求：
- GB/T 3836.13-2021 爆炸性环境 第 13 部分：设备的修理、检修、修复和改造
 - GB/T 3836.15-2017 爆炸性气体环境用电气设备 第 15 部分：危险场所电气安装 (煤矿除外)
 - GB/T 3836.16-2017 爆炸性气体环境用电气设备 第 16 部分：电气装置的检查和维护 (煤矿除外)
 - GB/T 3836.18-2017 爆炸性环境 第 18 部分：本质安全系统
 - GB 50257-2014 电气装置安装工程爆炸和火灾危险环境 电气装置施工及验收规范

CCC 型号

AVP10y- ① - ② ③ - ④

where:

y=0(Positioner& SFN communication)

y=2(Positioner with HART communication& SFN communication)

		Code
① Structure	CCC Intrinsically safe	H
② Supply Air-pressure classification Pressure gauge T-joint	(Pressure Gauge)	
	None	X
	With T-joint only (without pressure gauge)	T
	140 ≤ Ps ≤ 150 kPa with T-joint and pressure gauge (200 kPa)	1
	150 < Ps ≤ 300 kPa with T-joint and pressure gauge (400 kPa)	2
	300 < Ps ≤ 450 kPa with T-joint and pressure gauge (600 kPa)	3
③ JOB code	450 < Ps ≤ 700 kPa with T-joint and pressure gauge (1000 kPa)	5
	None	X
	For Particular Customer	Q
	For Particular Customer	B
④ Option	For Particular Customer	G
	None	XX
	Without feedback lever	LX
	With bracket for PSA1,2	YS
	With bracket for PSA3,4	YQ
	With bracket for PSA6	YL
	With bracket for PSA7	Y8
	With bracket for HA2,3	YT
	With bracket for HA4	YN
HART COMMUNICATION Lower Ta -20 °C	HA	

NEPSI Intrinsically Safe Approval for Smart Valve Positioner Model AVP102

NEPSI 本质安全认证

1. 标志资讯

GYJ22.1840X

Ex ia IIC T4 Ga $-40\text{ }^{\circ}\text{C} \leq T_{amb} \leq +60\text{ }^{\circ}\text{C}$

ELECTRICAL PARAMETERS: $U_i = 30\text{ V}$, $I_i = 100\text{ mA}$, $P_i = 690\text{ mW}$, $C_i = 26\text{ nF}$, $L_i = 0.22\text{ mH}$

$U_i = 7.8\text{ V}$, $I_i = 100\text{ mA}$, $P_i = 1\text{ W}$, $C_i = 1\text{ nF}$, $L_i = 0$

$U_o = 8.61\text{ V}$, $I_o = 1\text{ mA}$, $P_o = 1\text{ mW}$, $C_o = 5.9\text{ }\mu\text{F}$, $L_o = 988\text{ mH}$

2. 适用的标准

-GB/T 3836.1-2021

-GB/T 3836.4-2021

3. 产品安全使用特殊条件

防爆合格证号后缀“X”表明产品具有安全使用特殊条件，具体内容如下：

1. 当产品安装于要求 EPL Ga 级的场所时，用户须采取有效措施防止产品外壳由于冲击或摩擦引起的点燃危险。当产品安装于要求 EPL Ga 级且气体级别为 IIC 的场所时，用户须采取有效措施防止外壳塑料部分静电引燃危险。
2. 产品的使用环境温度范围： $-40\text{ }^{\circ}\text{C} \sim +60\text{ }^{\circ}\text{C}$ 。
3. 关联装置应优先选用隔离式安全栅；如选用齐纳式安全栅，应符合 GB/T 3836.15-2017 标准关于本安电路接地的要求

4. 产品使用注意事项

1. 产品必须与经防爆认可的关联设备配套共同组成本安防爆系统方可使用于现场存在爆炸性气体混合物的危险场所。其系统接线必须同时遵守智能阀门定位器和所配关联设备的使用说明书要求，接线端子不得接错。产品本安电气参数如下：

电源 / 输入回路 (+/- IN 端子)

最高输入电压 U_i (V)	最大输入电流 I_i (mA)	最大输入功率 P_i (mW)	最大内部等效参数	
			C_i (nF)	L_i (mH)
30	100	690	26	0.22

监控 / 输出回路 (+/- SFC 端子)

最高输入电压 U_i (V)	最大输入电流 I_i (mA)	最大输入功率 P_i (mW)	最大内部等效参数	
			C_i (nF)	L_i (mH)
7.8	100	1000	1	0

监控 / 输出回路 (+/- SFC 端子)

最高输出电压 U_o (V)	最大输出电流 I_o (mA)	最大输出功率 P_o (mW)	最大外部参数	
			C_o (μF)	L_o (mH)
8.61	1	1	5.9	988

2. 用户不得自行更换该产品的元器件及零部件，应会同产品制造商共同解决运行中出现的故障，以杜绝损坏现象的发生。
3. 产品的安装、使用和维护应同时遵守产品说明书及下列相关标准、规范的要求：
GB/T 3836.13-2021 爆炸性环境 第 13 部分：设备的修理、检修、修复和改造
GB/T 3836.15-2017 爆炸性环境 第 15 部分：电气装置的设计、选型和安装
GB/T 3836.16-2017 爆炸性环境 第 16 部分：电气装置的检查与维护
GB/T 3836.18-2017 爆炸性环境 第 18 部分：本质安全电气系统
GB 50257-2014 电气装置安装工程爆炸和火灾危险环境 电气装置施工及验收规范

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Chapter 1. Introduction

1-1. SVP models

The SVP is an intelligent valve positioner that can be connected to a 4-20 mA controller output signal line. Since all adjustments can be performed electrically, the relationship between the input signal and the position of the control valve can be set arbitrarily. Split range and other special settings are also easy to set up.

Integral type

Model AVP100: Analog signal (4-20 mA DC) without travel transmission

Model AVP102: Analog signal (4-20 mA DC) with HART communication protocol

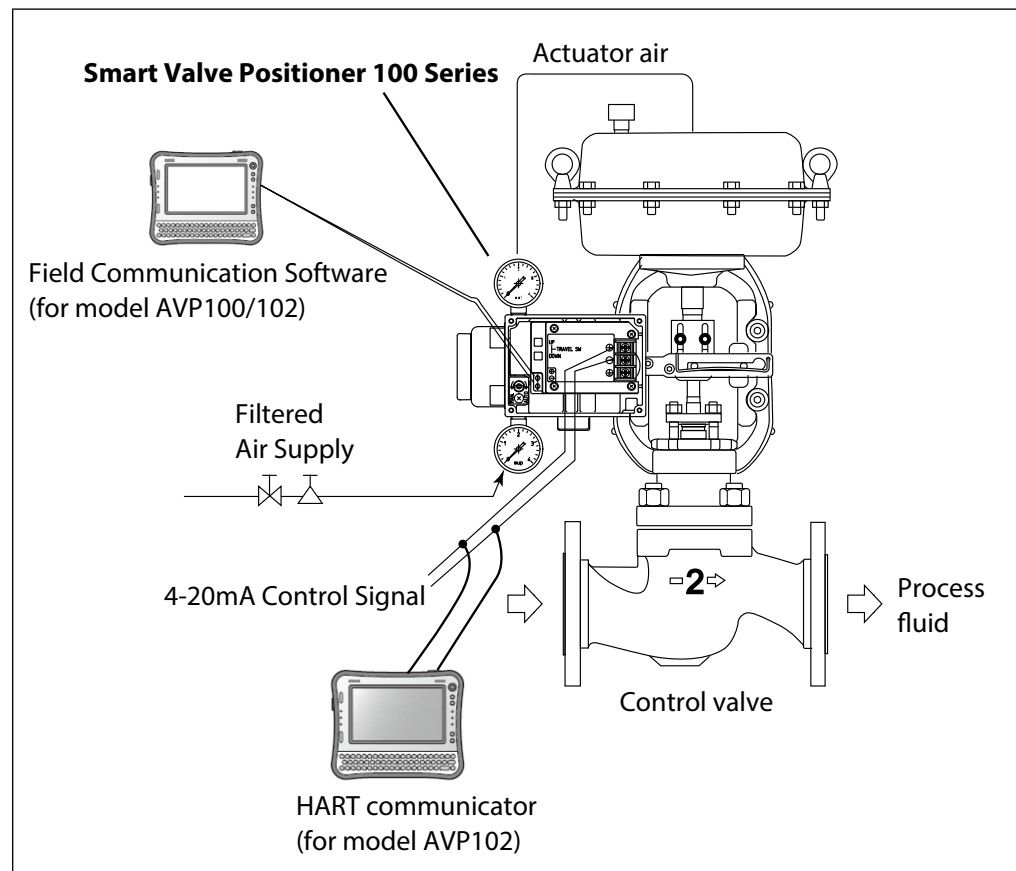


Fig. 1-1. Overview

1-2. Communication

There are three ways to communicate with the SVP: manually, using the Field Communication Software (model CFS100) or using a HART communicator.

1-2-1. Manual communication

Initial SVP configuration is typically performed using a screwdriver. Auto-Setup and travel calibration, which detect the characteristics of the valve, as well as Zero/Span adjustment can all be performed manually.

Without further configuration, the SVP provides valve travel from fully open to fully closed from a 4-20 mA analog signal (refer to ordered specifications) or analog HART signal.

1-2-2. Using the Field Communication Software (Model CFS100)

Azbil Corporation's Field Communication Software (model CFS100) can be used for all configuration, calibration and maintenance of the SVP. SVP-specific communicator functions are documented fully in this manual. Refer to the operation manual for Smart Valve Positioner (CM2-CFS100-2010)

1-2-3. Using a HART communicator

Emerson Electric HART communicator model 375 can be used for all configuration, calibration and maintenance of model AVP102 SVP-specific communicator functions are documented fully in this manual. See the HART communicator manual to learn more about the HART communicator.

1-2-4. HART communication (for model AVP102)

This figure shows the structure of a system in which the position detected by the SVP, the values of the SVP settings, and the results of self diagnostics are output in the HART communication protocol.

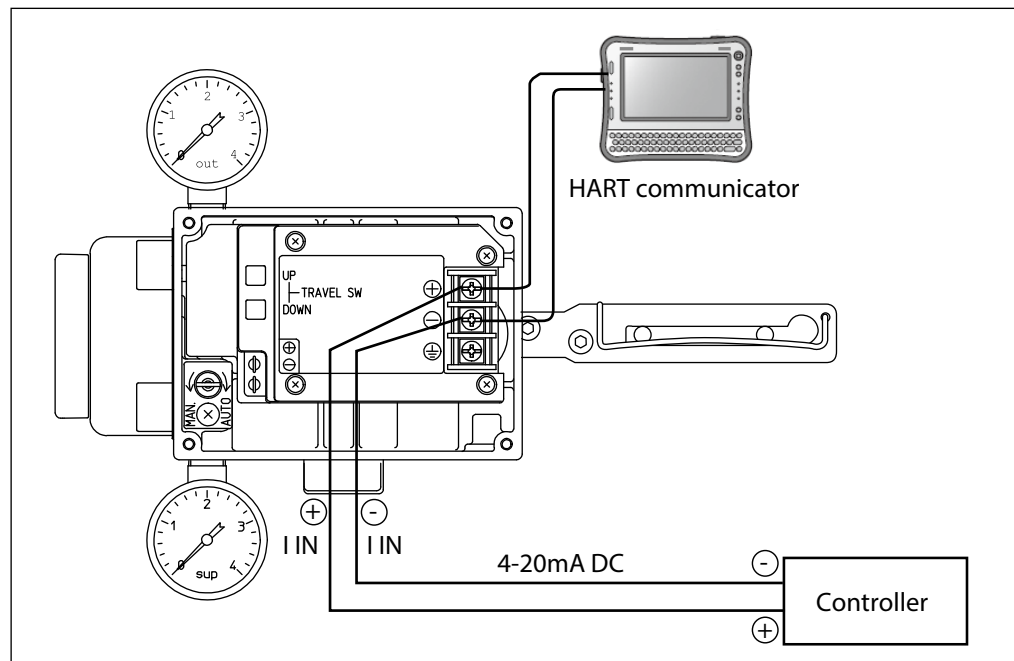


Fig. 1-2. HART communication structure

1-3. SVP diagrams

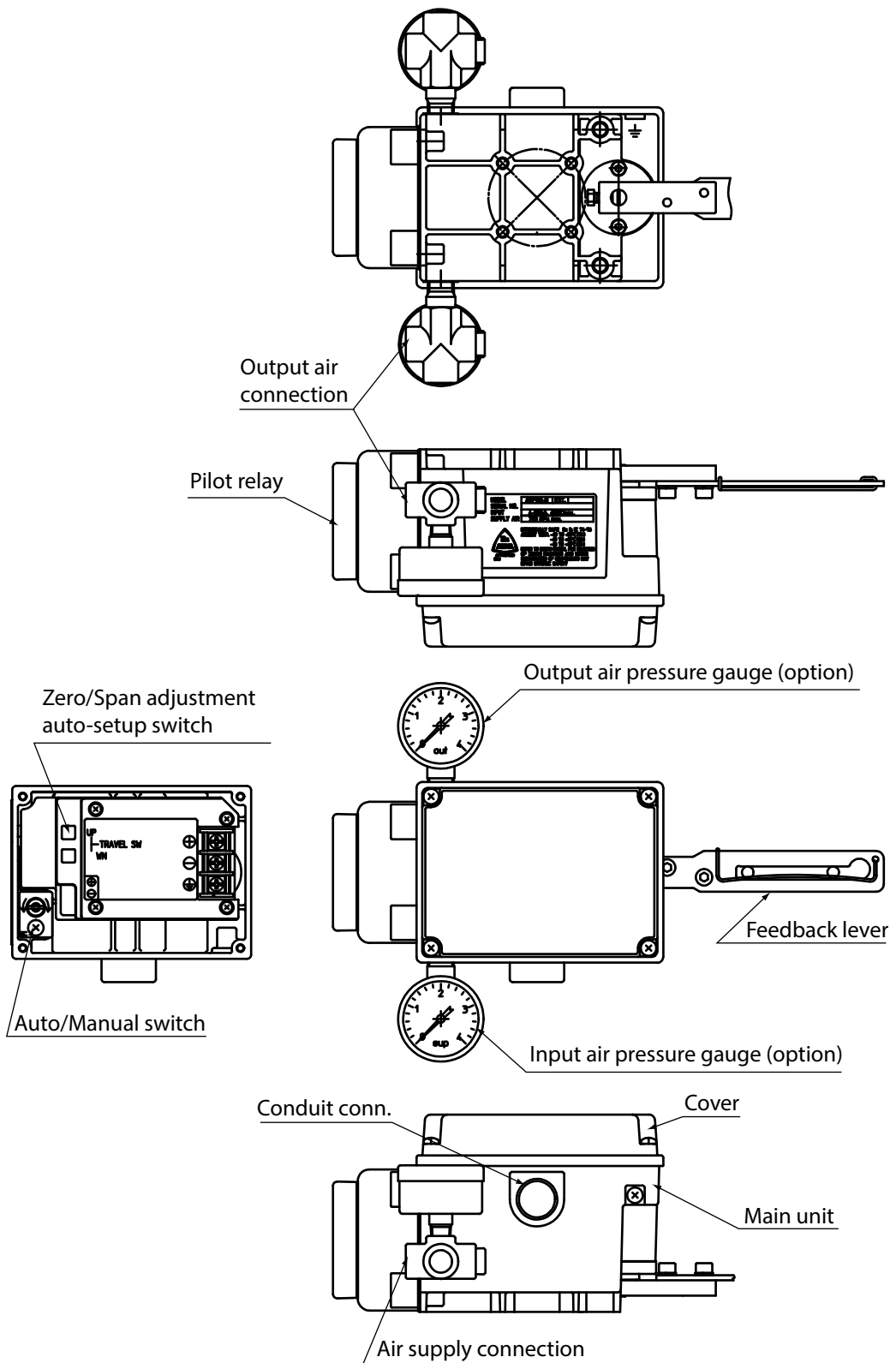


Fig. 1-3. SVP diagram

Chapter 2. Installation

Installation and calibration of Azbil Corporation Smart Valve Positioner 100 Series

The SVP is designed to withstand severe operating conditions. Still, the installation location must satisfy certain criteria or unexpected operation may result. The Smart Valve Positioner 100 Series is designed to operate:

- in ambient temperatures of -40°C to +80°C
- in relative humidity of 10 to 90%
- where there is no chance of sudden temperature and humidity changes
- where magnetic field induction is not more than 400A/m.
- Avoid installing the SVP near a large transformer, high-frequency furnace, etc.
- For HA Actuators, vibration cannot be more than 2G (5 to 400 Hz)

Azbil Corporation's Smart Valve Positioner 100 Series are designed for use in combination with a control valve that uses a direct- or reverse- acting or rotary actuator. The main SVP unit weighs about 1.7 kg. It should be attached in the same way you would attach a conventional electropneumatic positioner.

 WARNING
--

When attaching the SVP, take every precaution to avoid physical injury. Be aware of sharp objects such as the edges of the cover and any sharp edges on the unit. Setting up the SVP includes opening and closing the valve several times, often unpredictably. Take appropriate measures to prevent injury to personnel and adverse effects on the process.
--

The type and size of the actuator determine the type of mounting plate as well as SVP settings. If you ordered your SVP with the actuator type specified, then the SVP should come with the proper mounting kit, and the correct actuator settings should already be programmed into the SVP. The Auto-setup program is then used to calibrate the SVP. Be aware that incorrect settings not only reduce the SVP's effectiveness, but may also cause damage to or failure of the SVP.

If you are removing the SVP from an existing valve, first disconnect any operating lines providing air pressure, electric power, or a control signal to the positioner.

When the SVP is installed in a hazardous environment, (e.g. corrosive atmosphere), shutting off the air supply is not recommended unless the SVP is being removed. The air pressure prevents corrosive gas from entering the SVP.

<i>Before installing the SVP, check for:</i>	
Variations	Use the appropriate mounting plate and feedback lever length for the actuator.
Clearance	Do not install the SVP in such a place that it will be difficult to maintain or that will interfere with piping, wiring, or adjustment. Check for mechanical interference and valve operating clearance.
Orientation	Install the SVP in the correct direction. Avoid installation where the left of the SVP (where pilot relay is located) would be on top.
Fragility	Damage to the SVP may result from excessive impact or force. Do not force the feedback lever or bend the feedback pin.
Secureness	Be sure to tighten bolts and nuts securely on the SVP and control valve.

2-1. SVP assembly

2-1-1. Attaching SVP feedback lever

The SVP is factory shipped with the feedback lever removed. Follow the assembly procedures for the SVP and the feedback lever given below.

Linear motion actuator

- Assemble the feedback lever and the SVP using the two provided hex socket bolts.
- Ensure that the rotation angle of the feedback lever does not exceed 20° from the horizontal (40° travel). In case of exceeding 20°, use the optional extension lever.

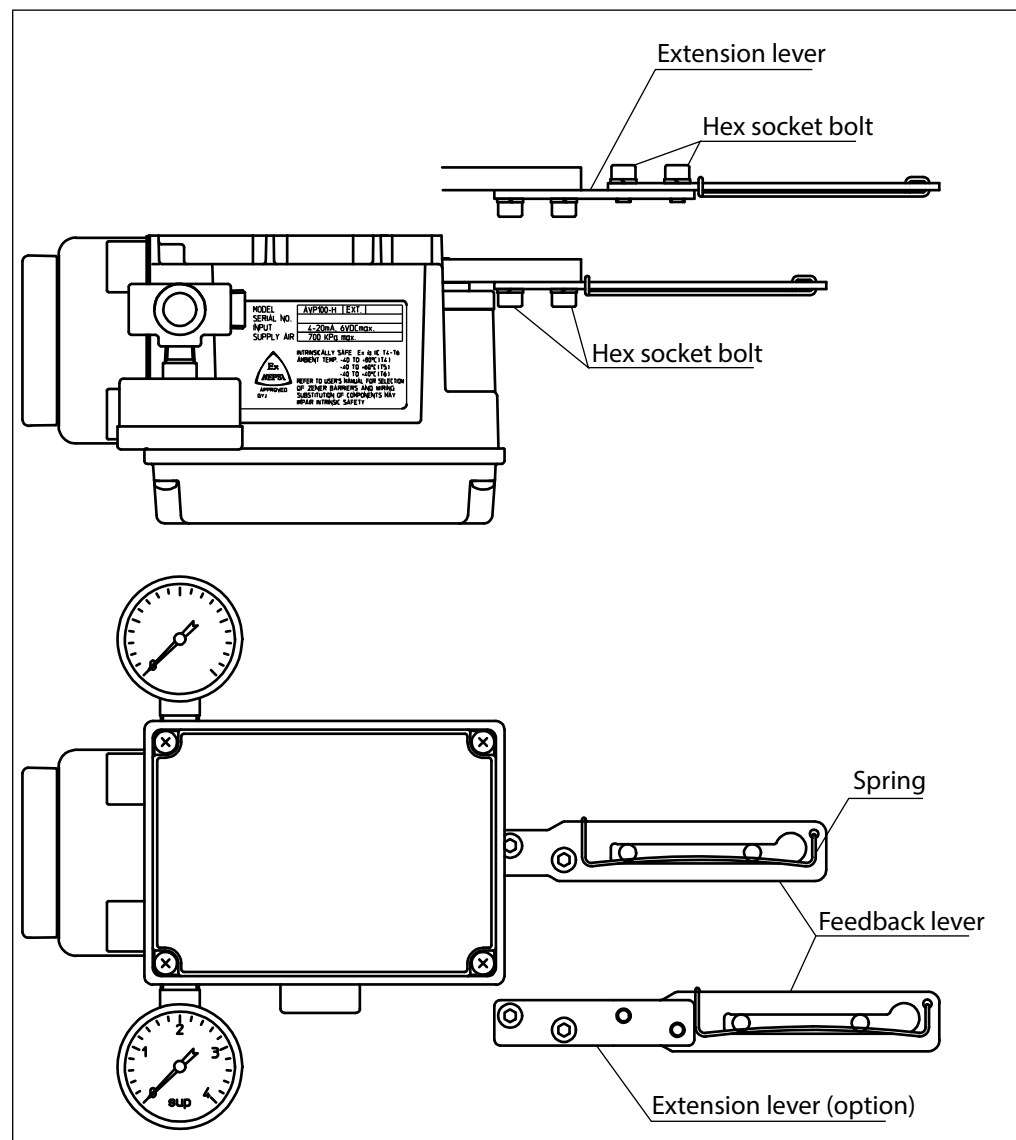


Fig. 2-1. SVP feedback lever

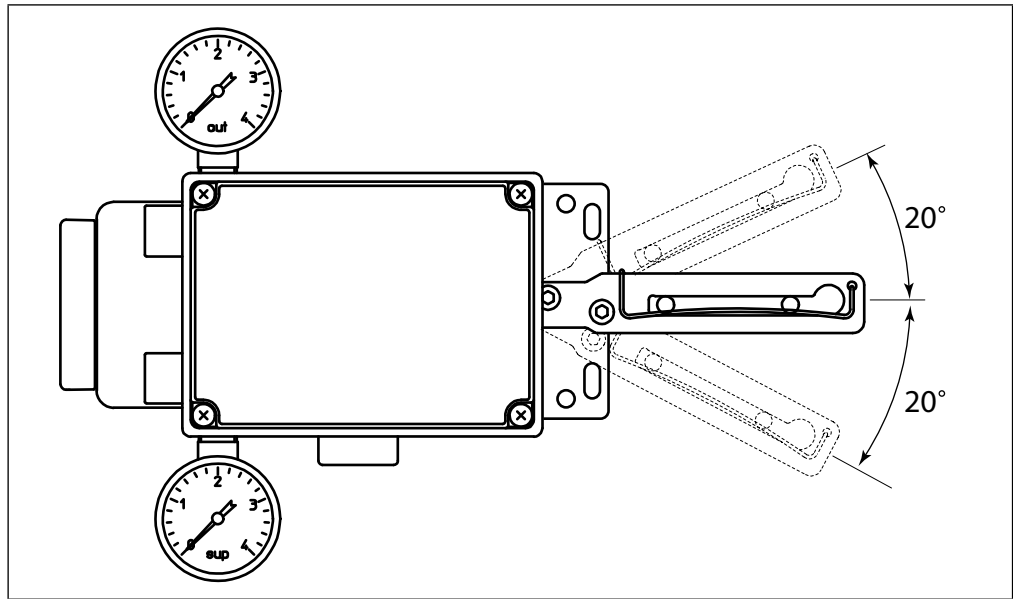


Fig. 2-2. SVP maximum range motion

Rotary motion actuator

- Place the coupling onto the angle sensor and fasten it with the bolt.
- Insert the spring pin into the hole in the coupling.
- Install the feed back lever so that the tip of the spring pin fits into the small hole on it to meet the tip of the spring pin.
- Fasten the feedback lever using the hex head bolt and washer.

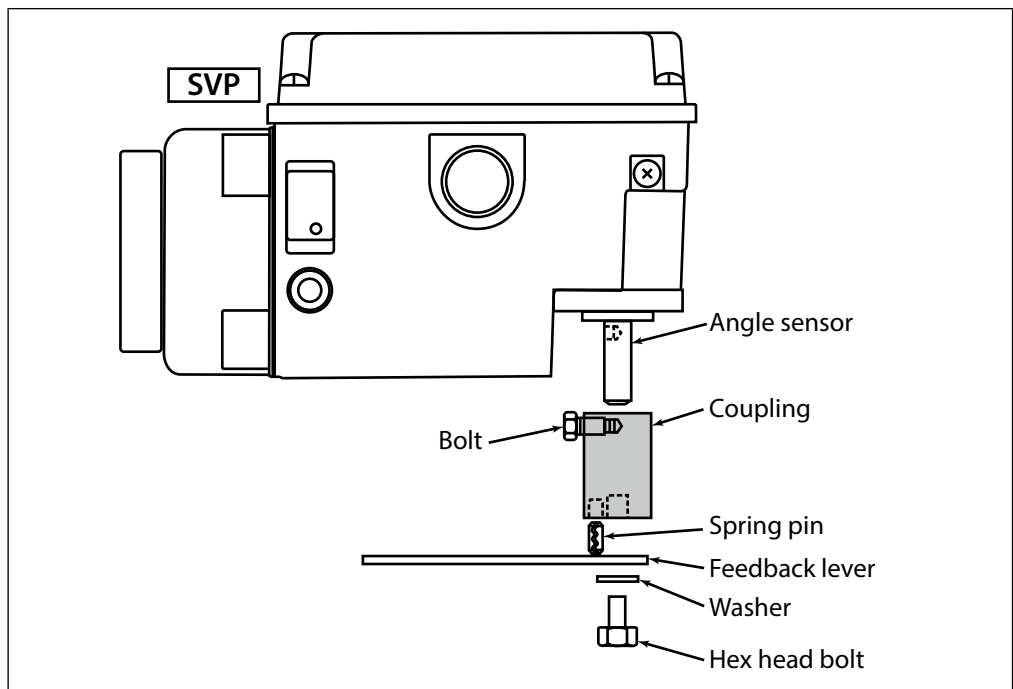


Fig. 2-3.

2-2. SVP Installation procedure

The Smart Valve Positioner 100 Series can be attached onto a variety of actuators. Example actuator mountings are shown below. Please refer to the installation instructions that were included with your actuator mounting kit.

Example1: How to mount the SVP onto a linear motion actuator.

- Fasten the mounting plate onto the SVP securely, using the 2 provided hexagon head bolts (M8) and spring washers.
- Assemble the connector pin assembly to the pointer with the hexagon socket head flange bolt.
- Set the valve travel to 50%.
- Fasten the assembled SVP to the actuator using the bolts and washers provided while guiding the 1/4 inch (6 mm) feedback pin through the slot on the feedback arm above the spring with the feedback lever set to be horizontal.
- Make sure that the feedback lever and pin form a right angle as shown below.

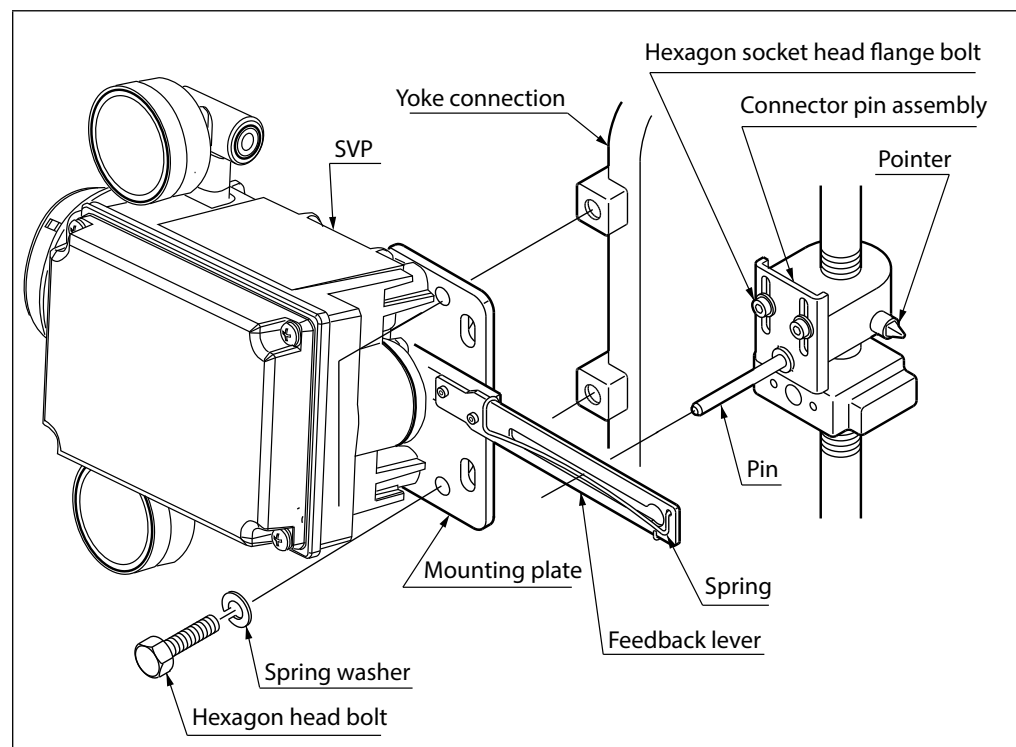


Fig. 2-4.

Example 2: How to mount the SVP to a rotary motion Actuator

- Attach the mounting bracket to the SVP securely using the provided hexagon head bolts (M6) and washers.
- Assemble the arm and the connector pin with a hexagon nut and a washer.
- Set the valve travel to 50%.
- Fasten the assembled arm to the valve stem using a hexagon head bolt in the correct.
- Mount the SVP to the actuator using hexagon head and washers.
- Make sure the feedback lever will fit together with the connector pin at a right angle as shown below.

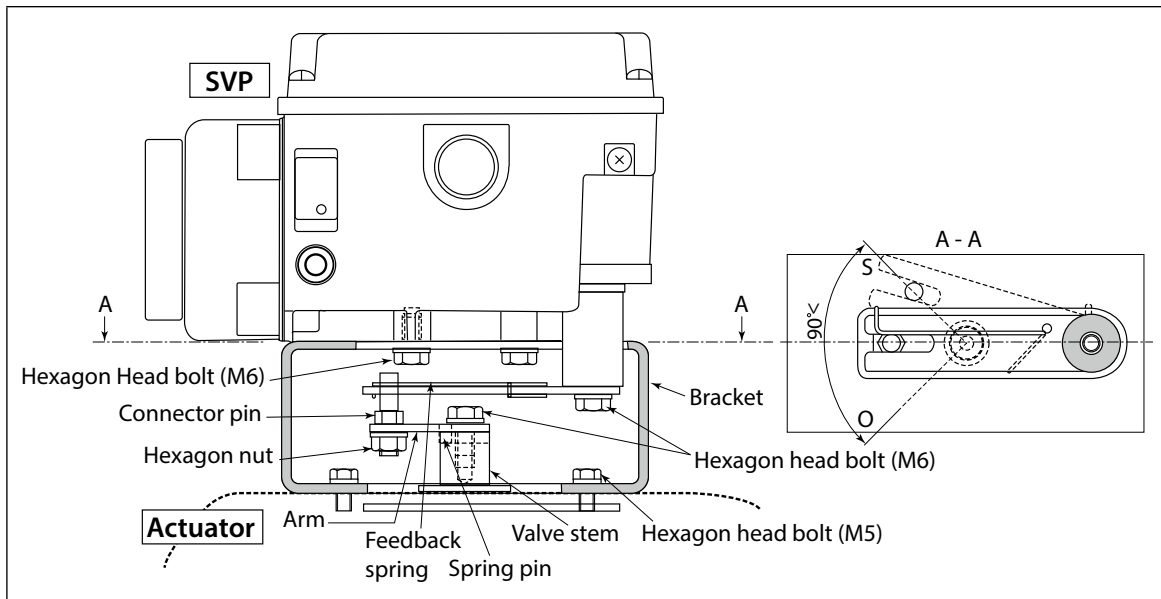


Fig. 2-5.

2-3. Air supply

Clean and dry supply air ensures long-term stability of the SVP. A typical air supply system is shown below:

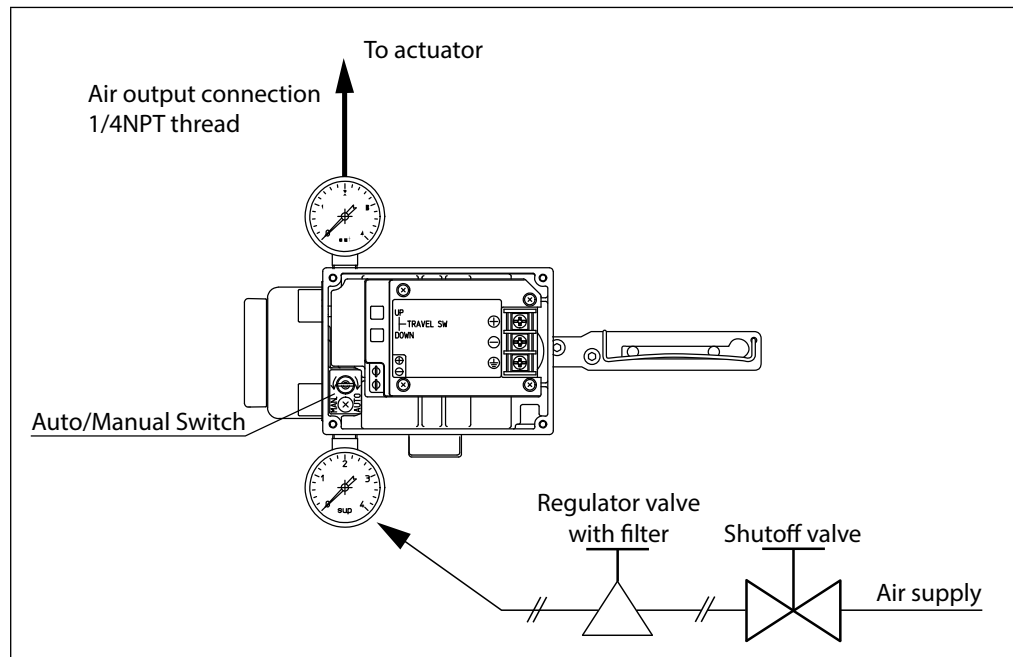


Fig. 2-6.

Air supply must be clean; it should not contain foreign substances (moisture, oil, or dust). The air must be dry, with a dew point at least 10°C lower than the SVP's lowest site operating temperature. For example, if the lowest environmental temperature the SVP is exposed to is 0°C, then supply air should not condense at temperatures under -10°C.

A shutoff valve, an air regulator (if not provided with your SVP) and a 3µm or better filter must be installed between the air supply and the SVP as close as possible to the SVP unit. The shutoff valve enables disconnection of the SVP from the control valve for ease of maintenance.

Recommended piping practices:

- Air supply pipes should have an inside diameter of 6mm (10mm outside diameter tubing recommended).
- Pipes should match the installation environment, i.e. for a corrosive environment, use vinyl-clad copper pipes.
- Use joints that precisely fit the pipes.
Sealing tape is preferable to solid or liquid sealants for pipe joints to SVP air connections. Prevent sealing tape/sealant from entering pipes.
- Use the right length of piping; avoid excess lengths.
- Completely flash pipes before use, checking for burrs and other problems.
- Check for leaks after installation.

2-4. Initial SVP adjustment

⚠ WARNING
Switching the SVP air supply from automatic to manual will divert air directly to the actuator, actuate the control valve and affect the process. Take the necessary precautions before turning the A/M switch.

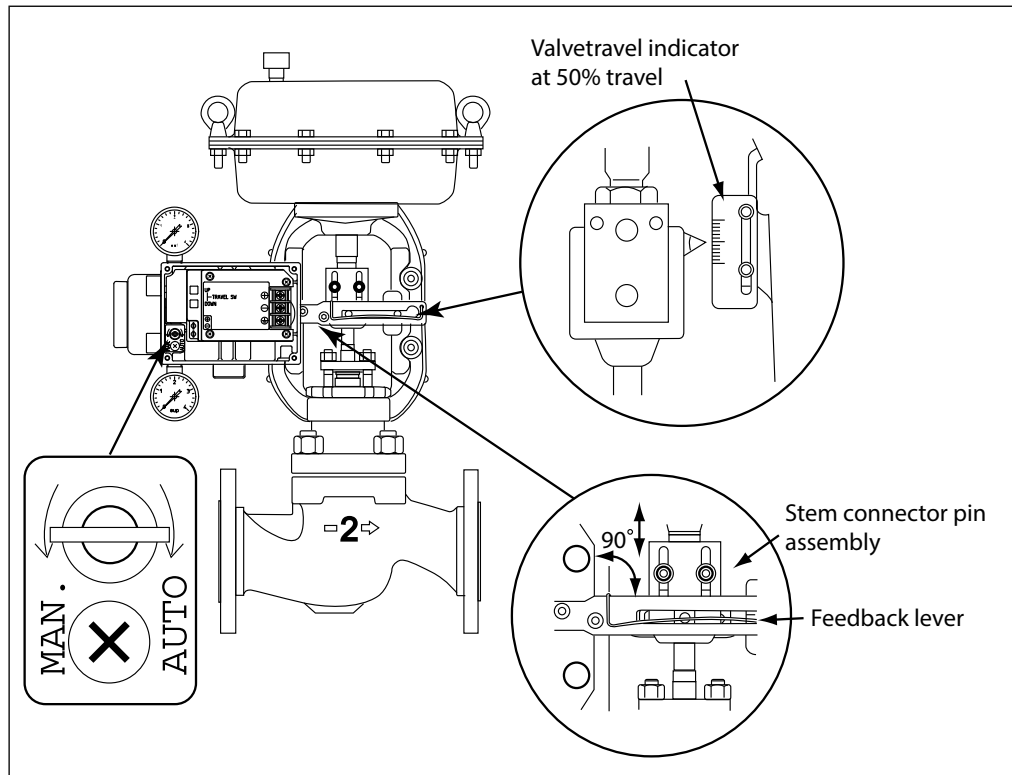


Fig. 2-7.

This step in the assembly is to ensure the correct initial relationship between the air supply and the feedback lever position.

- (1) Using a flat-head screwdriver, rotate the A/M switch 180° counter-clockwise. This puts the SVP in Manual or bypass mode, allowing the regulator valve to change valve position. The supply and output air pressure gauges should both have the same reading.
- (2) Position control valve to mid-travel (50% position) by adjusting air pressure regulator valve.
- (3) Adjust the stem connector pin assembly so that the SVP feedback lever is horizontal and the stem connector pin forms a 90° angle with the feedback lever.
- (4) Set the SVP back to Auto mode using a flat-head screwdriver to rotate the A/M switch 180° clockwise.

2-5. Electrical wiring

The wiring terminals are located in the main unit of the SVP. Typical wiring from the control room to the SVP and possible way to connect the Field Communication Software (model CFS100) or HART communicator are illustrated below.

The Field Communication Software (model CFS100) can be connected directly to the hooks. Apply sufficient waterproofing treatment using nonhardening sealants made of silicone resins.

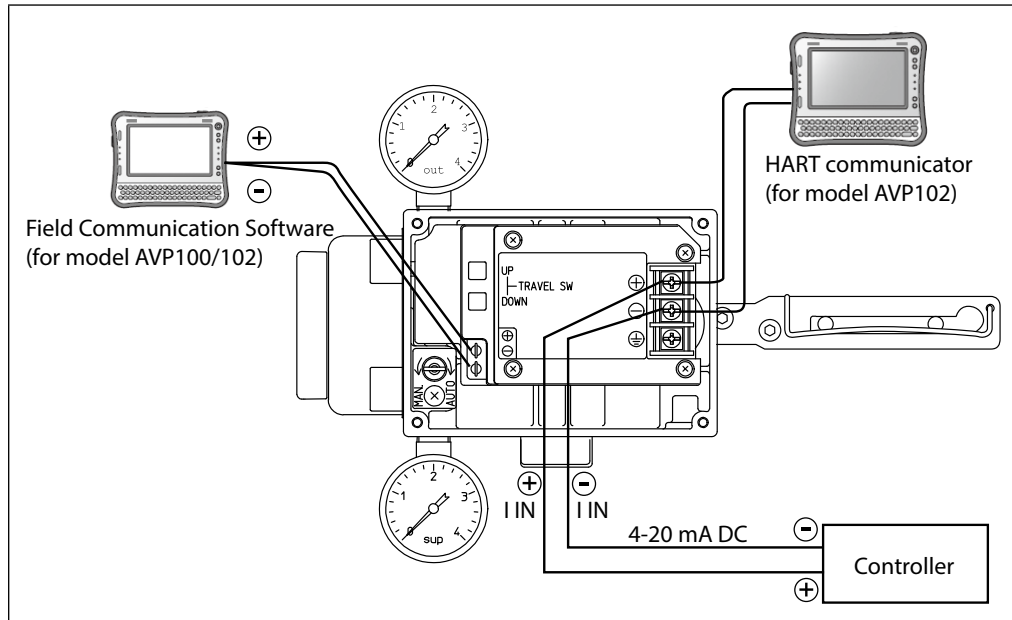


Fig. 2-8.

⚠ WARNING

Close the cover tightly and do not open it while the SVP unit is energized in a hazardous environment; doing so may cause an explosion.

2-5-1. Wiring guidelines

- Power down before doing any wiring.
- SVP requires a 4 to 20 mA DC control signal, which also provides power to the unit. SVP requires a minimum of 3.85 mA DC to operate and current should never exceed 24 mA DC.
- The SVP needs protective grounding on either the internal or external grounding terminal (<100 Ω resistance)
- Maximum permissible cable length is 1.28 km.
- Use stranded cables having a conductor cross-section of 1.25 mm² and suitable for 600 V such as shown in the conductor table in Article 310 of the NEC (National Electric Code). Outside diameter on cables must be 6.35 mm to 11 mm. Use shielded wires for locations exposed to noise.
- Avoid installing cables near noise-making devices such as large capacity transformers and motors. Do not lay signal/control cables in the same tray or duct with noisy switching power cables.

 WARNING
Zener barrier should be installed in safe areas and observe the Zener Barrier Manual. The circuit shall be considered to be connected to ground from a safety point of view.

2-5-2. Wiring procedure

- (1) Unscrew the screw on the cover and remove the cover.
- (2) Remove one or both of the supplied Azbil Corporation conduit connection blind plugs depending on how you plan to wire the SVP.
- (3) Insert cables into the conduit connection. Strip and attach the appropriate wires to the terminals, checking for polarity. Crimp contacts with insulated sleeves are recommended.
- (4) Tighten the terminal screws fully, to a torque of 1.5 N•m (15 kgf•cm).
- (5) Put the cover onto the SVP and fasten the screw.

2-6. SVP for springless double-acting actuators (Reversing relay)

When an SVP is installed on a valve with a springless (double-acting) actuator, air pressure is needed on both the bottom and top of the actuator diaphragm to provide valve opening and closing proportional to a control signal. A reversing relay is used for this purpose.

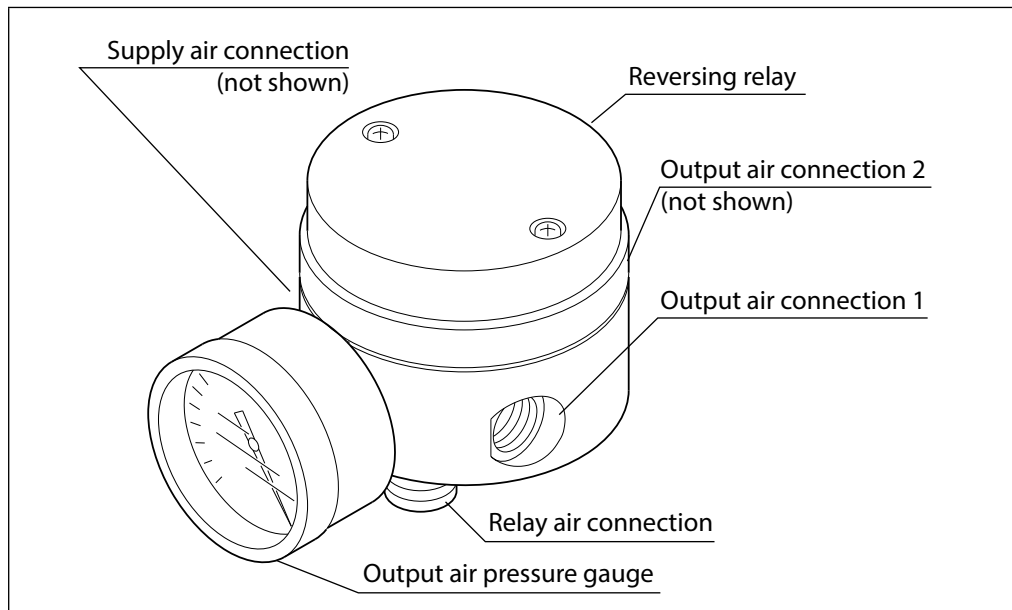


Fig. 2-9.

Note) Make sure that the air piping connections and air pressure ranges as inscribed on the bottom of the reversing relay match your SVP.

The reversing relay has two Output air connections:

- Output air connection 1 (OUT1) which passes through the SVP's output air pressure
- Output air connection 2 (OUT2) with the balance of the supply pressure (minus SVP output air)

2-6-1. Installing the reversing relay on an SVP

Remove the dust plug from the output air connection. Screw the Relay air connection of the reversing relay into the output air connection on the top of the SVP. Sealing tape is preferable to solid or liquid sealants for pipe joints to SVP air connections. Prevent sealing tape/sealant from entering pipes.

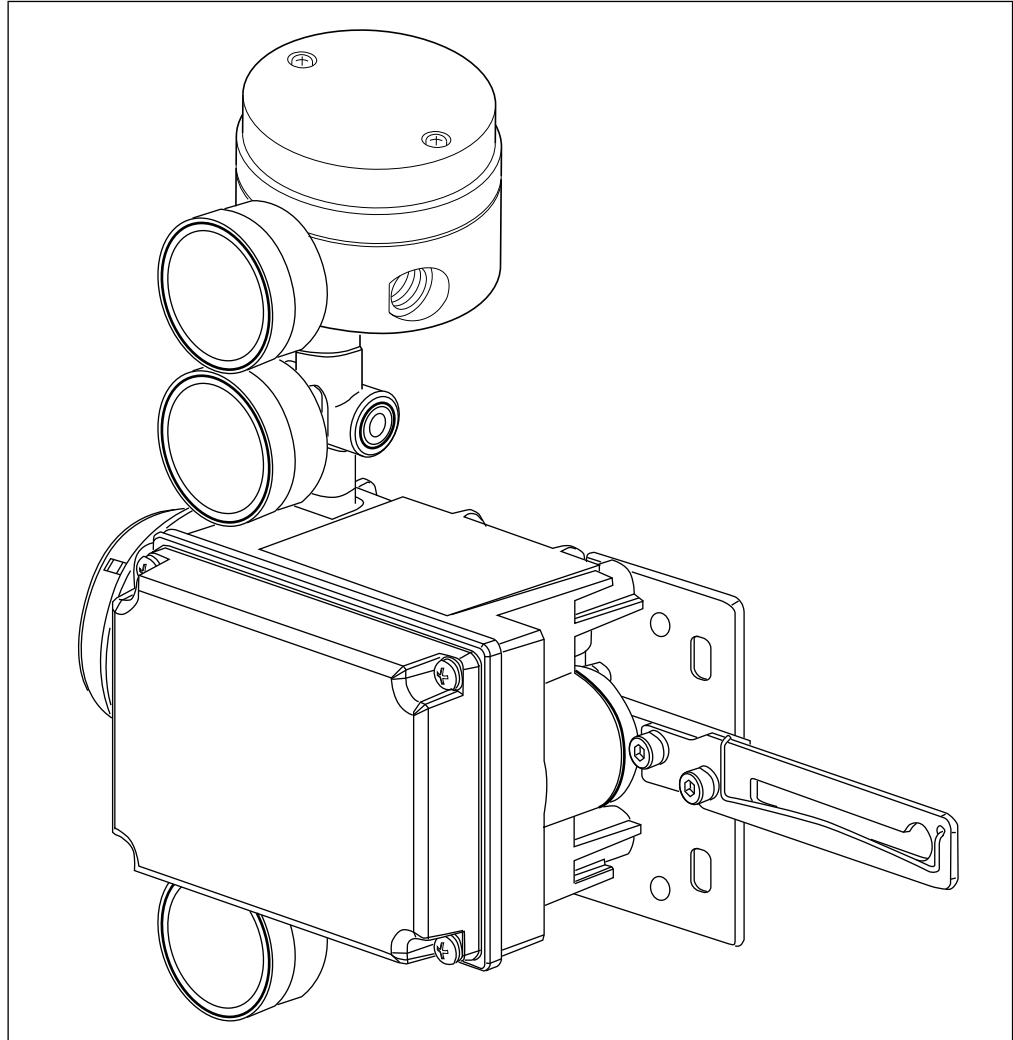


Fig. 2-10. Reverse relay installed on an SVP

2-6-2. Double-acting SVP without air regulator directly attached

Using a T-connector, connect the air supply from the regulator and filter to both the SVP **Supply air connection** and the **Supply air connection** on the reversing relay using sealing tape. Make sure to connect only one regulator to an SVP and reversing relay combination.

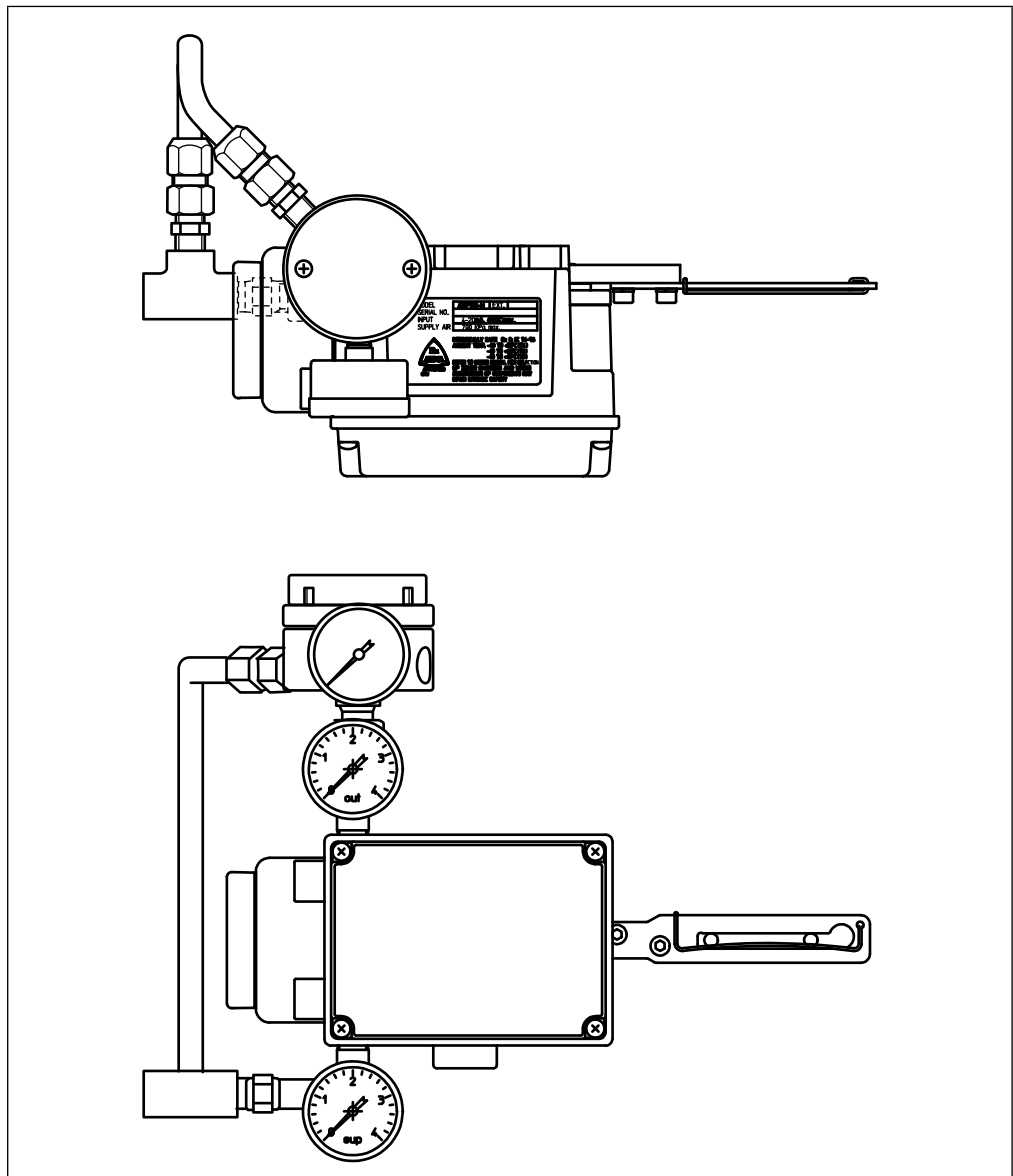


Fig. 2-11. Double-acting SVP without air regulator directly attached

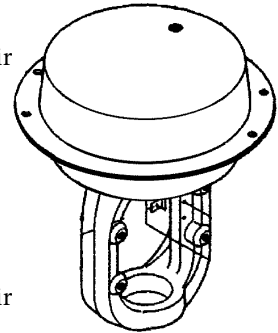
Note) Please note that the Auto/Manual switch is not used on Double-Acting SVPs. When using the SVP as a double-acting positioner, use the valve handwheel or air pressure regulator to perform SVP calibration such as that shown on page 2-8 and the “Zero/span adjustment” on page 4-9, ignoring the instructions to operate the A/M switch.

2-6-3. Attaching double-acting SVP to a diaphragm actuator

Reverse-acting actuator

Connect **OUT1** of the Reversing Relay to the bottom actuator air port

Connect **OUT2** of the Reversing Relay to the top actuator air port



Direct-acting actuator

Connect **OUT1** of the Reversing Relay to the top actuator air port

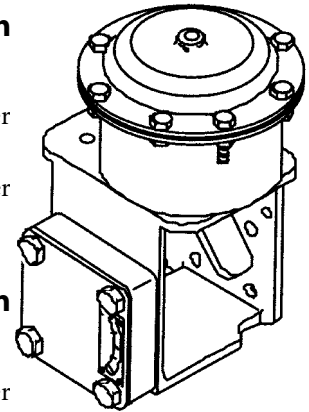
Connect **OUT2** of the Reversing Relay to the bottom actuator air port

2-6-4. Attaching double-acting SVP to a rotary actuator

Reverse-acting actuator (clockwise rotation with increased pressure)

Connect **OUT1** of the Reversing Relay to the actuator chamber that rotates the trunnion clockwise with added pressure

Connect **OUT2** of the Reversing Relay to the actuator chamber that rotates the trunnion counter-clockwise with added pressure



Reverse-acting actuator (counter-clockwise rotation with increased pressure)

Connect **OUT1** of the Reversing Relay to the actuator chamber that rotates the trunnion counter-clockwise with added pressure

Connect **OUT2** of the Reversing Relay to the actuator chamber that rotates the trunnion clockwise with added pressure

If the actual air piping is different than described above, the functions of the SVP as a positioner will not be affected. However, various valve and SVP diagnostics usually performed with the Field Communication Software (model CFS100) will not return accurate information. To enjoy the capabilities of the SVP to the fullest, piping should match the diagrams and instructions above to maintain the relationship between the parameter settings described throughout this user manual.

Lever	Valve direction	Control Valve	AVP Setting	
			Actuator	Valve action
	Shut → Open (Up → Down)	Direct Shut 4 mA, Open 4 mA	Reverse	Reverse
		Reverse Shut 4 mA, Open 4 mA	Direct	Reverse
	Shut → Open (Down → Up)	Direct Shut 4 mA, Open 4 mA	Direct	Direct
		Reverse Shut 4 mA, Open 4 mA	Reverse	Direct

2-6-5. Auto-setup

Perform Auto-setup normally as per the instructions on page 3-1 through page 3-2 (perform the manual Zero-span adjustment on page 3-3 if necessary). When an SVP is attached to a rotary actuator, Zero and Span are sometimes set in reverse. Use the Field Communication Software (model CFS100) to manually set the Actuator to the correct action (Direct or Reverse) as per the steps on page 4-10.

If after Auto-setup, the SVP exhibits excessive overshooting (hunting), decrease the actuator parameter as per the steps on page 4-11.

- Perform Auto-setup by referring to page 3-1 through 3-3 “Auto Setup, Zero-Span Adjustment”

Chapter 3. Adjustments

3-1. Auto-setup

Auto-setup is a unique program for automatically making various positioner adjustments.

After installing your SVP, Auto-setup should be performed. The travel switch on the SVP provides non-interactive closed and open valve position setting.

The following valve actuator characteristics are automatically detected during Auto-setup:

■ Zero-span adjustment

(However, as a default, the span point is taken to be 10% of the overstroke. If a span adjustment is performed after auto-setup completes, change the overstroke value and save the change value.)

■ Actuator operation setup

■ Lower Range Value (LRV) and Upper Range value (URV) of Input signal

If actuator operation is reverse operation: LRV = 4 mA, URV = 20 mA

If actuator operation is direct operation: LRV = 20 mA, URV = 4 mA

■ Actuator size setting

■ Hysteresis setting

(Hysteresis of ground packing is selected out of LIGHT, MEDIUM and HEAVY.)

■ Valve assembly calibration

If you specified the type of actuator your SVP will be installed on, then the required overtravel for tight shut-off will have been programmed into your SVP. The required overtravel for tight shut-off is the maximum shut off less 1%. If you didn't specify the type of actuator, and you are using a non-Azbil Corporation actuator, then please refer to page 4-11 for instructions on how to enter the actuator type using the Field Communication Software (model CFS100). Tight shut-off requires the proper overtravel setting.

 **WARNING**

While Auto-setup is running, the valve will cycle from open to closed. Take appropriate measures to prevent injury to personnel and adverse effects on the process.

It is recommended that Auto-setup and initial calibration of your SVP be performed using the travel switch on the SVP.

You may also use a portable communicator to initiate Auto-setup and initial calibration.

Because Auto-Setup and Zero-Span calibration must be observed for accurate valve positioning, these two steps will typically be performed by the travel switch. Other functions including loop test, valve travel inquiry, split-ranging and tag number assignment require the Field Communication Software (model CFS100).

3-1-1. Auto-setup using the travel switch

Observation of the SVP is necessary when performing Auto-setup and Zero-span adjustment. If the SVP was not ordered with the valve or actuator specified and the SVP is being used on a push down to open acting valve, then you must first set the valve action in the SVP before performing Auto-setup. Refer to “4.4 Device Configuration and Adjustment” on page 4-8. The travel switch is two position switches used for triggering Auto-setup and doing manual zero-span calibration.

Step	Procedure
1	Set the input signal to the SVP to 18 ± 1 mA DC
2	Open the front cover of SVP, and push travel switch “UP” (“DOWN” for FloWing Rotary VFR valve).
3	Hold this position until the valve starts to move (approximately 3 seconds). This starts the auto-setup routine. Release the travel switch.
4	The valve moves from fully shut to fully open twice. The valve then opens to about 50% and stays this way for up to three minutes.
5	Confirm that the auto-setup routine is complete by varying the input signals. The entire auto-setup procedure should take about three minutes.

Note) While executing the auto setup program, do not set the input signal below 4 mA. (As long as the signal is in the range of 4-20 mA, changing the input signal during auto setup will not affect the program.)

If the input signal drops below 4 mA while auto-setup is running, then autoseup will fail and must be restarted. After completing auto-setup, keep at least 4 mA of signal (power) for at least thirty seconds to make sure data and parameters are stored in SVP memory.

After the operation has completed, check valve operation by varying the input signal and verifying that the valve goes to the correct position corresponding to the signal. If the span position has shifted, perform a span adjustment operation.

In some cases, the auto-setup routine will not properly detect your valve, especially if the valve's actuator is smaller than Azbil Corporation's HA1 type actuator (diaphragm capacity of 850 cm^3 {52 inches³}) or the operation stroke is smaller than 14.3 mm {9/16 inch}. Please contact an Azbil Corp. representative for assistance.

3-2. Zero-span adjustment

After Auto-setup, the SVP has calibrated itself to the fully shut (zero) and fully open (span) values of the valve. If the valve is not achieving the proper relationship between its travel and the control signal of the SVP, then please adjust Zero-span manually by following the steps below.

Note) Travel switch will only work if the shut off and full open input signals (Example: 4-20) are the same as the shut off and full open input signal settings stored or factory set in the SVP.

Procedure for adjusting the shut valve position (zero)

Step	Procedure
1	Input current signal that corresponds to the value being fully shut from the controller (or constant - current supply). (Example: 4 mA)
2	Adjust the valve fully shut position by pushing the travel switch “UP” or “DOWN”. See Fig. 3-1. and Fig. 3-2. for how to use the travel switch. (If the forced shutdown function is operating, the valve will not move. To change the forced shutdown setting, see “4-4-2. Zero/span adjustment” on page 4-9. The default value is set to 1.0%.)
3	If you changed the forced fully closed with a communicator, change it back to the proper setting now.

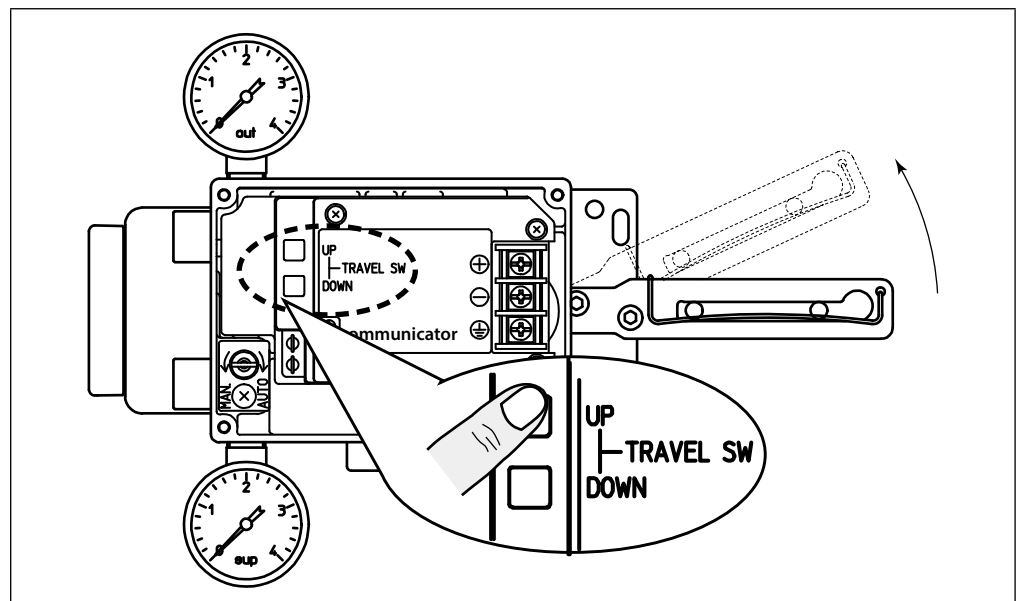


Fig. 3-1.

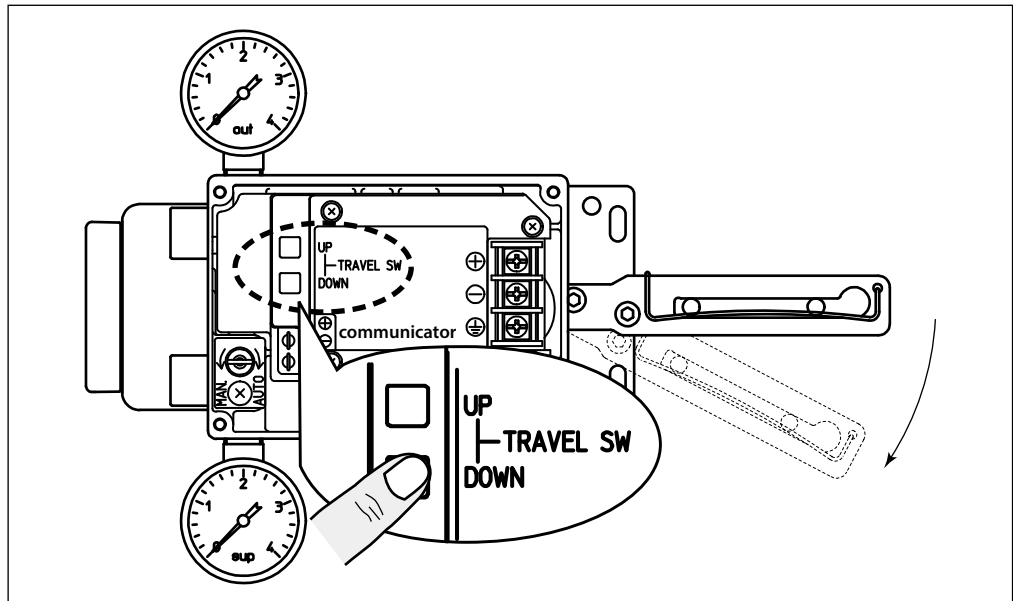


Fig. 3-2.

Procedure for adjusting the fully opened valve position (span)

Step	Procedure
1	From the controller or from a constant current supply, provide an input signal that corresponds to the valve fully opened (Example: 20 mA)
2	Adjust the fully opened valve position by pushing the travel switch “UP” or “DOWN” until the valve position moves slightly.

Note) After completing Zero-span adjustment, verify accurate valve operation by varying the input signal.

Chapter 4. Communication-Based Operation

Overview of this chapter

This chapter describes operations that are performed using communication.

Refer to this chapter for information regarding the basics of operations, the relationship between modes and data settings, data setting and modification, the saving of various types of data, etc.

4-1. Starting Communication

Before starting communication

Confirm the following points before starting communication.

- Electrical wiring of the device is completed (see the “Wiring method” below).
- There is an input signal from the controller (constant-current supply).

Note) If there is no 4 to 20 mA DC signal from the controller, connect a constant-current supply (3.85 to 21.5 mA DC) to the input signal terminal. When doing so, be sure to remove the wires coming from the controller off of the terminals.

4-1-1. Wiring method

Introduction

The wiring method for communicating with this device will now be described.

■ With HART® communication

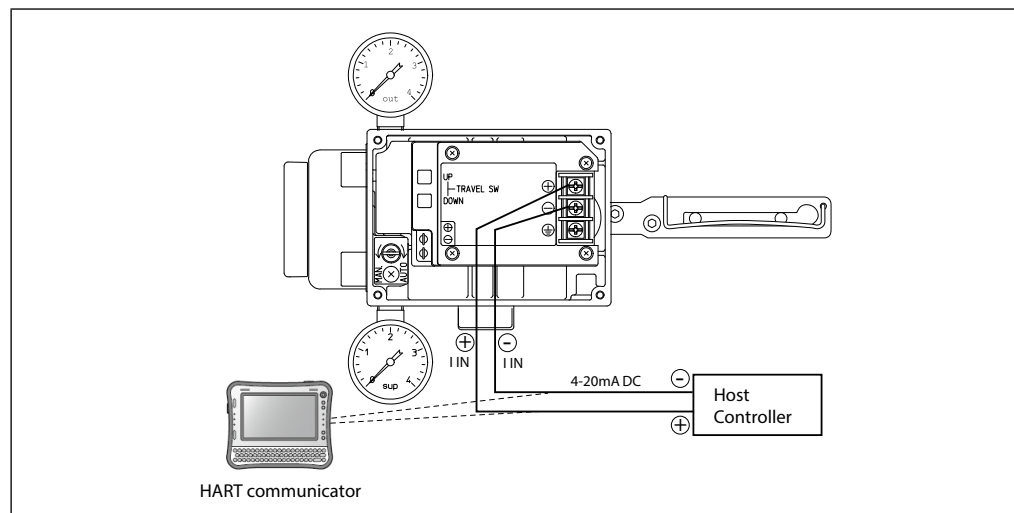


Fig. 4-1. Wiring of HART® Communication Tool (Model AVP102)

■ With SFN communication

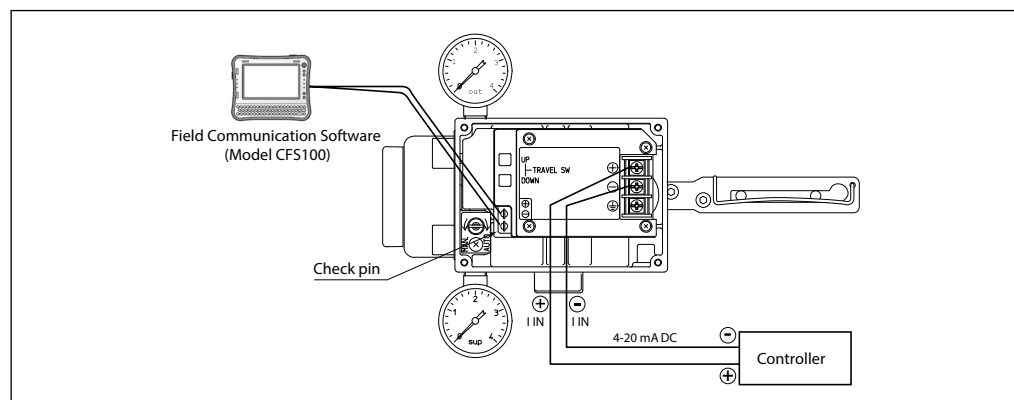


Fig. 4-2. Wiring with Field Communication Software (Model AVP100/102)

4-2. Communication-Based Operation

Operations such as adjustment and configuration of the device and reading on the device will now be described with reference to the menus of the Field Communication Software (model CFS100). Regarding operating methods, see *Field Communication Software Model: CFS100 Instruction Manual (Smart Valve Positioner Edition)* (No. CM2-CFS100-2010).

By communicating with this device, the following can be performed.

■ 4.3 Operation Data Confirmation

4.3.1 Measured value confirmation

4.3.2 Adjustment data confirmation

■ 4.4 Device Configuration and Adjustment

4.4.1 Auto-setup

4.4.2 Zero/span adjustment

4.4.3 Control valve system configuration

4.4.4 Control parameter configuration

4.4.5 Input signal range configuration

4.4.6 Flow rate characteristics configuration

4.4.7 Forced fully open/closed setting

■ 4.5 Device Information Confirmation and Modification

4.5.1 Device information/production number confirmation and modification

4.5.2 Device software revision information confirmation

■ 4.6 Maintenance

4.6.1 Mode modification

4.6.2 Input signal calibration

4.6.3 Dummy input signal

4.6.4 Dummy EPM drive signal

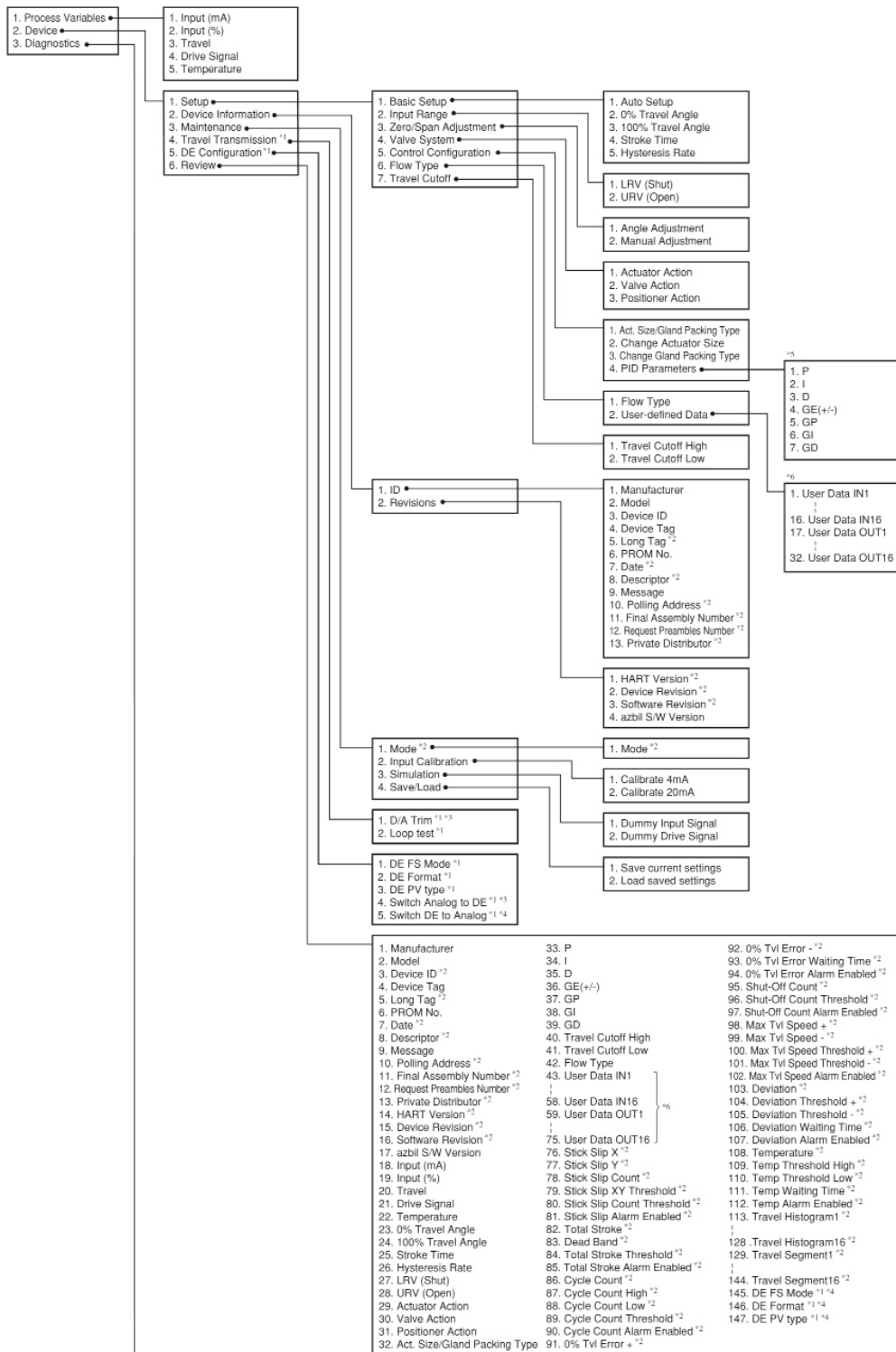
4.6.5 Configuration data saving

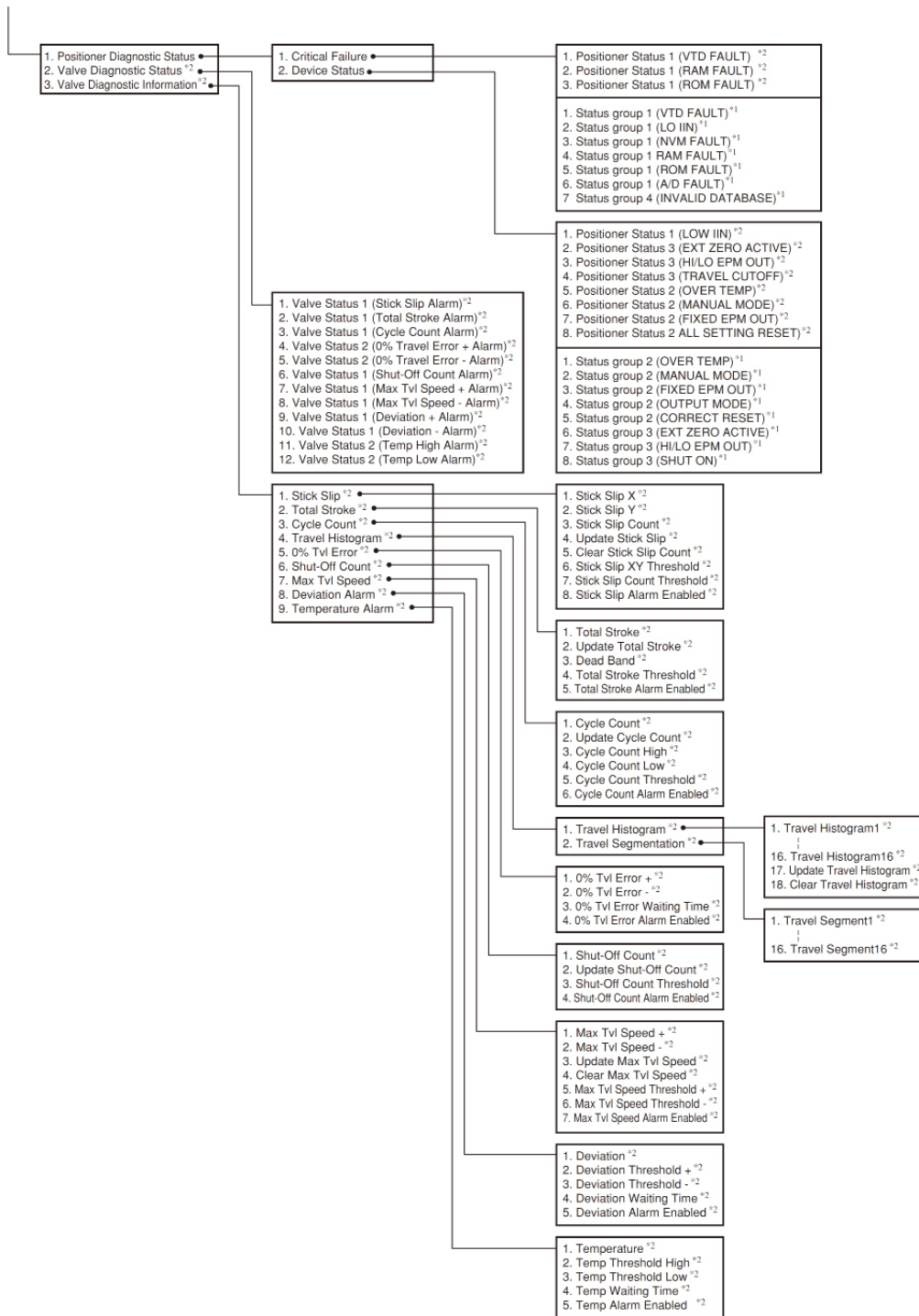
4.6.6 Saved configuration data retrieval

■ 4.7 Valve Diagnostic Parameter Configuration

■ 4.8 Self-diagnostics

4-2-1. Menu Tree





- *1. Not displayed on the HART® version.
- *2. Not displayed on the SFN version.
- *3. Not displayed when DE communication selected.
- *4. Enabled when DE communication selected (not shown).
- *5. Displayed when “Actuator Size” is “Param0.”
- *6. Displayed when “Flow Type” is “User-defined.”

Versions

This chapter describes the functions of the following versions.

[Model AVP100]

Azbil software version: 3.5 or later

[Model AVP102]

HART® Version 6

Device revision: 1

Software revision: 1 or later

Azbil software version: 6.1 or later

4-3. Operation Data Confirmation

Allows confirmation of measured values and adjustment data for the operating state of the device.

The following items can be checked.

4-3-1. Measured value confirmation

Select [Process Variables]. You will be able to check the following items.

- (1) Input (mA)
Displays the electric current input value.
- (2) Input (%)
Displays the input signal (%).
- (3) Travel
Displays the valve position (%).
- (4) Drive Signal
Displays the EPM (electro-pneumatic module) drive signal (%).
- (5) Temperature
Displays the positioner internal temperature (°C).

4-3-2. Adjustment data confirmation

Select [Device] >> [Setup] >> [Basic Setup]. You will be able to check the following items.

- (1) 0 % Travel Angle
Displays the angle specified as the valve fully closed point.
- (2) 100 % Travel Angle
Displays the angle specified as the valve fully open point.
- (3) Stroke Time
Displays the valve full stroke time that was measured when auto-setup was executed.
- (4) Hysteresis Rate
Displays the friction level of the gland packing that was measured when auto-setup was executed.

4-4. Device Configuration and Adjustment

In device configuration and adjustment, the configuration and adjustment that are necessary for this device to operate properly are performed. For the HART® version, first set the mode of the device to “Out of service.”


Select [Device] >> [Maintenance] >> [Mode] >> [Mode]. You will be able to change the mode.

Note) For the HART® version, when finished performing adjustment and configuration, set the mode to “In service.”

4-4-1. Auto-setup

Use auto-setup for the following items.

- (1) Zero/span adjustment
- (2) Actuator action direction configuration
- (3) Input signal LRV and URV configuration
- (4) Actuator size selection
- (5) Hysteresis difference selection
- (6) Travel transmission fail safe selection

 WARNING	
<ul style="list-style-type: none"> • During auto-setup, the valve moves from fully open. Take appropriate measures beforehand to ensure that the movement of the valve will not cause injury or have an effect on the process. 	

step	Procedure
1	Confirm that the input signal is 4 mA or higher.
2	Select [Device] >> [Setup] >> [Basic Setup] >> [Auto Setup] to execute the method.
3	Following the screen display, execute the operation. The control valve will start to move. This operation takes about two to three minutes.
4	When the operation ends, “Auto Setup is Completed” is displayed on the screen. When control via the input signal becomes possible, auto-setup ends.
5	Vary the input signal and check the movement to confirm that adjustment is being performed appropriately.

4-4-2. Zero/span adjustment

[Valve fully closed position configuration]

The procedure for setting the valve fully closed position is shown below.

step	Procedure
1	Select [Device] >> [Setup] >> [Zero/Span Adjustment] >> [Angle Adjustment] >> [Zero].
2	Input the input signal that is to fully close the valve.
3	If the forced fully closed setting (travel cutoff low) is 0 % (default value + 0.5 %) or higher, the screen for configuring the travel cutoff low will appear. Set it to 0 % or lower.
4	From the [Zero Adjustment] menu, select a combination of the angle size and the increment or decrement for which to perform the adjustment. To increment by 0.03°, select [Increment/0.03].
5	Perform zero adjustment by carrying out step 4 above multiple times.
6	When adjustment is complete, select [Exit] on the [Zero Adjustment] menu.
7	The screen for the forced fully closed setting will appear. If you have already modified this value, return to the original value.
8	Select [Exit] from the [Zero/Span Adjustment] menu.

[Valve fully open position configuration]

The procedure for setting the valve fully closed position is shown below.

step	Procedure
1	Select [Device] >> [Setup] >> [Zero/Span Adjustment] >> [Angle Adjustment] >> [Span].
2	Input the input signal that is to fully open the valve.
3	From the [Span Adjustment] menu, select a combination of the angle size and the increment or decrement for which to perform the adjustment. To decrement by 0.03°, select [Decrement/0.03].
4	Perform span adjustment by carrying out step 3 above multiple times.
5	When adjustment is complete, select [Exit] on the [Span Adjustment] menu.
6	The screen for setting the forced fully open value will appear. Set it if necessary. (Normally, this will not need to be set.)
7	Select [Exit] from the [Zero/Span Adjustment] menu.

4-4-3. Valve system

Configures the control valve control system.

Actuator action, valve action, and positioner action are set and modified here.

Actuator action

Select [Direct] or [Reverse]. If the feedback lever moves downward in response to increasing air pressure to the actuator, set this to [Direct]; if the feedback lever moves upward, set this to [Reverse]. (This will be set automatically if auto-setup is performed.)

The procedure for configuring actuator action is shown below.

step	Procedure
1	Select [Device] >> [Setup] >> [Valve System] >> [Actuator Action].
2	Specify [Direct] or [Reverse] actuator action.
3	Send the modified setting to the device using the transmission button.

Valve action

Select [Direct] or [Reverse]. If the feedback lever moves downward when the control valve moves in the direction from open to closed, set this to [Direct]; if the feedback lever moves upward, set this to [Reverse].

The procedure for configuring valve action is shown below.

step	Procedure
1	Select [Device] >> [Setup] >> [Valve System] >> [Valve Action].
2	Specify [Direct] or [Reverse] valve action.
3	Send the modified setting to the device using the transmission button.

Positioner action

Select [Direct] or [Reverse]. To make the device's output air pressure go to zero when the power supply is cut off, set this to [Direct]; to make the output air pressure go to the maximum level, set this to [Reverse].

Note) Modifying the positioner action requires EPM (electro-pneumatic module) reconfiguration. Reconfiguration should be performed by an Azbil Corp. service representative.

The procedure for configuring positioner action is shown below.

step	Procedure
1	Select [Device] >> [Setup] >> [Valve System] >> [Positioner Action].
2	Specify [Direct] or [Reverse] positioner action.
3	Send the modified setting to the device using the transmission button.

4-4-4. Control configuration

For the device's dynamic characteristics, the PID parameters are selected based on the combination of actuator size and gland packing type.

Actuator size

Select the actuator size from parameters 0 to 9, A, B, and C (Param 0 to 9, A, B, and C). (This is selected automatically when auto-setup is executed.)

If auto setup cannot be executed or the desired parameter cannot be set by auto setup, see the table below to select a PARAM that is suitable for the installed actuator.

Table 4-1. Actuator Size Parameter Table

Actuator Size (ACTUATOR SIZE)	Operating Speed [s]	Typical Actuator Type	Actuator Capacity (Typical Value) [cm ³]
PARAM C	to 0.58	—	—
PARAM B	to 0.8	—	—
PARAM A	to 1.02	—	—
PARAM 1	to 1.5	PSA1, PSK1	600
PARAM 2	to 3	PSA2, HA2	1,400
PARAM 3	to 6.6	PSA3, HA3	2,700
PARAM 4	to 12	PSA4, HA4	6,600
PARAM 5	to 99	VA5	25,300
PARAM 6	to 20	VA6, PSA6	8,100
PARAM 7	to 1.9	RSA1	760
PARAM 8	to 4.3	RSA2	3,800
PARAM 9	to 99	VR3, VR3H	5,800
PARAM 0	—	—	Set individually*

* Consult with Azbil Corporation service personnel.

Actuator size configuration procedure

step	Procedure
1	Select [Device] >> [Setup] >> [Control Configuration] >> [Act. Size/Gland Packing Type], and check the current setting.
2	Select [Device] >> [Setup] >> [Control Configuration] >> [Change Actuator Size], and select from parameters 0 to 9, A, B, and C. If parameter 0 has been selected, the gap action type PID parameters can be set individually. (Parameters 7 to 9 are specifically for the Azbil Corporation VFR control valve RSA/VR actuator.)

Gland packing type

For the hysteresis difference due to friction of the control valve gland packing, select from [Heavy], [Medium] and [Light]. (This is selected automatically when autoseup is executed.) Regarding the types of gland packing, see Table 4-2 below.

Table 4-2. Gland Packing Type Parameter Table

Hysteresis* (HYSTERESIS)	Gland packing material example
Heavy (HEAVY)	Graphite packing
Medium (MEDIUM)	Yarn packing
Light (LIGHT)	V type PTFE packing

* This cannot be decided on the basis of material because it depends on the frictional force of the gland packing.

Gland packing type configuration procedure

step	Procedure
1	Select [Device] >> [Setup] >> [Control Configuration] >> [Act. Size/Gland Packing Type], and check the current setting. If the actuator size is 0, A, B, or C, the gland packing type is not displayed.
2	Select [Device] >> [Setup] >> [Control Configuration] >> [Change Gland Packing Type], and select [Light], [Medium], or [Heavy].

Gap PID parameters

For actuator size, if parameter 0 has been selected, the gap operation type PID parameters can be set individually. The gap action PID method is utilized as the dynamic characteristics algorithm for this device. In the gap action type PID method, deviation values (the gap) above and below the set-point value are set up, and the PID parameters are changed depending on whether the process value is inside or outside the gap. The merits of this method are that it is relatively simple to tune and that it enables both fast response and stability. The meaning of each parameter is described below.

Table 4-3. Gap Action Type PID Parameters

Parameter	Parameter Meaning	Units
P	Reciprocal of the in-gap proportional band	% ⁻¹
I	Inside-gap integrated time	s
D	Inside-gap differentiated time	s
GE	Gap width	%
GP	Reciprocal of the out-of-gap proportional band	% ⁻¹
GI	Outside-gap integrated time	s
GD	Outside-gap differentiated time	s

Example:

$P = 2.000$ indicates that $2\ \%^{-1} = \frac{1}{0.02}\ \% = 50\ \%$. This means using 50 % as the proportional band, as it is commonly called.

Note) The input setting range for these values is -19999 to +19999.

The GP, GI, and GD parameters cannot be set when GE is 0.

Gap PID parameter configuration procedure

step	Procedure
1	Select [Device] >> [Setup] >> [Control Configuration] >> [Change Actuator Size], and set the actuator size to the parameter 0. The PID parameters will be displayed.
2	Select [Device] >> [Setup] >> [Control Configuration] >> [PID Parameter]. You will be able to check or modify seven PID parameters (P, I, D, GE, GP, GI, and GD).
3	Enter values to set the seven respective PIDs. For the SFN version, start the method and enter the values in order.
4	For the HART® version, send the modified setting to the device using the transmission button.

4-4-5. Input range

This procedure sets the electric current input value when the valve is fully closed (LRV) and the electric current input value when the valve is fully open (URV). Values can be entered in the 4 to 20 mA range. A split range can be specified as well.

Note) Set these values so that the electric current input span (the difference between LRV and URV) is in the 4 to 16 mA range.

If the span is 8 mA or less, the accuracy will be 1.5 % of full scale.

Input range configuration procedure

The procedure for setting the desired electric current input values is shown below.

Configuration procedure for electric current input values (mA) for valve fully closed

step	Procedure
1	Select [Device] >> [Setup] >> [Input Range].
2	Select [LRV (Shut)], and enter the electric current input value when the valve is fully closed.
3	Send the modified setting to the device using the transmission button.

Configuration procedure for electric current input values (mA) for valve fully open (100 % position)

step	Procedure
1	Select [Device] >> [Setup] >> [Input Range].
2	Select [URV (Open)], and enter the electric current input value when the valve is fully open (when the position is 100 %).
3	Send the modified setting to the device using the transmission button.

4-4-6. Flow Type

This function sets, from among four types of flow rate characteristics, the relationship between the input signal and the position. A sketch of the four characteristics (linear, equal percent, quick open, and user-defined) is shown below.

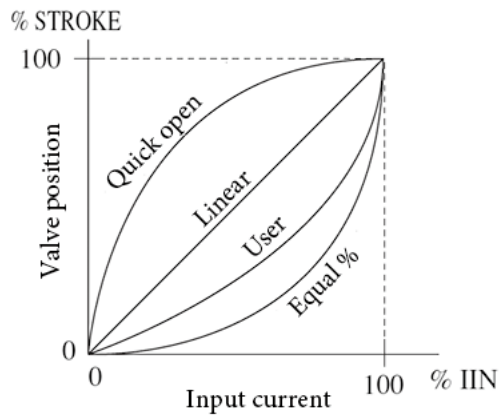


Fig. 4-3. Flow Characteristics Overview

Note) If this has been set to user-defined, the flow rate characteristics conversion data can (must) be specified.

Flow Type configuration procedure

step	Procedure
1	Select [Device] >> [Setup] >> [Flow Type].
2	Select from [Linear], [Equal Percent], [Quick Open], and [User-defined]. If [User-defined] has been selected, specify the flow rate characteristics conversion data [User-defined Data].
3	Send the modified setting to the device using the transmission button.

User-defined Data

This function sets user-defined flow rate characteristics conversion data. There are 16 data points for input and 16 for output. For each point, specify an input signal (User Data IN1-16) and an output signal (User Data OUT1-16). The characteristics will be the result of connecting the 16 points with straight lines.

Note) Input all 16 points (input signal and position).

Specify the input values in order from smallest to largest.

Specify the values such that the characteristics increase monotonically.

User-defined data configuration procedure

step	Procedure
1	For [Device] >> [Setup] >> [Flow Type], select [User-defined].
2	Select [User-defined], and enter all parameters User Data IN1-16 and User Data OUT1-16.
3	Send the modified setting to the device using the transmission button.

4-4-7. Travel Cutoff

Sets the input signal values (%) that force the valve fully open and fully closed. The valve will be fully closed at input values less than the forced fully closed value, and will be fully open at input values greater than the forced fully open value. The input signal values (%) for the valve forced fully open and fully closed are set independently. An overview of the input/output characteristics when forced fully closed/open values have been set is shown below.

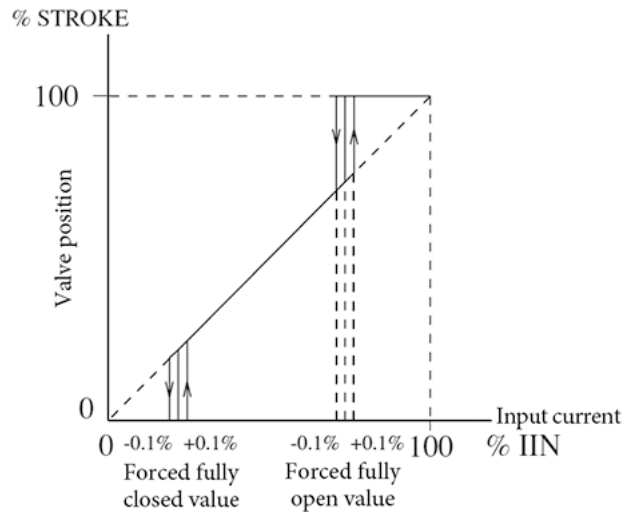


Fig. 4-4. Forced Fully Open/Closed Settings

Note) Set these parameters such that the forced fully open setting (Travel Cutoff High) is greater than the forced fully closed setting (Travel Cutoff Low).

If a span adjustment is performed after auto-setup has been executed, the forced fully open setting will be 1 % less than the overstroke percentage.

The forced fully open and forced fully closed settings have a hysteresis difference of 0.1 %

As a result of configuring the forced fully closed setting, the control valve can become fully closed when the input signal drops to the preset value or lower, so set the output limiter (Lo) on the host to -1 % or higher.

Travel Cutoff Low configuration procedure

step	Procedure
1	Select [Device] >> [Setup] >> [Travel Cutoff] >> [Travel Cutoff Low].
2	Specify the input signal value at which to force the valve fully closed.
3	Send the modified setting to the device using the transmission button.

Travel Cutoff High configuration procedure

step	Procedure
1	Select [Device] >> [Setup] >> [Travel Cutoff] >> [Travel Cutoff High].
2	Specify the input signal value at which to force the valve fully open.
3	Send the modified setting to the device using the transmission button.

4-5. Device Information Confirmation and Modification

Allows confirmation and modification of device information.

4-5-1. Device information/production number confirmation and modification

Select [Device] >> [Device Information] >> [ID]. You will be able to check or modify the following items.

- (1) Manufacturer
Displays the manufacturer of the device. "Azbil Corporation" is displayed.
- (2) Model
Displays the name and model number of the device. "SVP-V2" is displayed.
- (3) Device ID (HART® version only)
Displays device-specific information.
- (4) Device Tag
Displays and allows modification of the tag number assigned to the device.
- (5) Long Tag (HART® version only)
Displays and allows modification of the long tag number assigned to the device.
- (6) PROM No.
Displays ID information.
- (7) Date (HART® version only)
Displays and allows modification of specific dates such as the last configuration date for the device.
- (8) Descriptor (HART® version only)
Displays and allows modification of information required to manage the device.
- (9) Message
Displays and allows modification of messages registered to the device.
- (10) Polling Address (HART® version only)
Displays and allows modification of the address of the device. When multiple devices are connected to the same loop, indicates device addresses (split range, multidrop connection, and the like).
- (11) Final Assembly Number (HART® version only)
Displays and allows modification of specific management numbers such as the last configuration date for the device and system.
- (12) Request Preambles Number (HART® version only)
Displays the number of preambles that the device requests from the host.
- (13) Private Distributor (HART® version only)
Displays the name of the distributor of the device.

4-5-2. Device software revision information confirmation

Select [Device] >> [Device Information] >> [Revisions]. You will be able to check the following items.

- (1) HART® Version (HART® version only)
Displays the revision number of the HART® universal commands supported by model AVP102.
- (2) Device Revision (HART® version only)
Displays the revision number of the device-specific commands supported by model AVP102.
- (3) Software Revision (HART® version only)
Displays the revision number of the software in the same device revision.
- (4) Azbil Software Version
Displays the software revision number. This is Azbil Corporation's internal management number, and has a one-to-one correspondence with the software revision above.

4-6. Maintenance

4-6-1. Mode

The HART® version has two modes. One is “In service” and the other is “Out of service.”

When performing calibration or adjustment, or when changing settings, the control valve will move, so first verify that these operations will not result in problems that could adversely affect plant operation. Then set the mode to “Out of service.”

After completing calibration or adjustment, or after changing settings, set the mode to “In service.” These operations cannot be performed when the device mode is “In service.”

Mode modification procedure

step	Procedure
1	Select [Device] >> [Maintenance] >> [Mode]
2	Select [Out of Service] or [In Service].
3	Send the modified setting to the device using the transmission button.

4-6-2. Input calibration

Calibrates the difference between the electric current input of 4 mA (or 20 mA) from the controller and the input signal of 4 mA (or 20 mA) perceived by the device.

4 mA electric current input calibration procedure

step	Procedure
1	Select [Device] >> [Maintenance] >> [Input Calibration] >> [Calibrate 4 mA].
2	Set the electric current input (controller output) to 4 mA.
3	The electric current input value perceived by the device will be displayed on the screen. If that value is satisfactory for performing calibration, click [OK].
4	After a while, calibration will end, and then the input signal value will be displayed. Check whether it is correctly configured.

20 mA electric current input calibration procedure

step	Procedure
1	Select [Device] >> [Maintenance] >> [Input Calibration] >> [Calibrate 20 mA].
2	Set the electric current input (controller output) to 20 mA.
3	The electric current input value perceived by the device will be displayed on the screen. If that value is satisfactory for performing calibration, click [OK].
4	After a while, calibration will end, and then the input signal value will be displayed. Check whether it is correctly configured.

4-6-3. Dummy input signal

Sets the input signal via communication, regardless of the value of the input signal from the controller. This function can be effective when, for instance, isolating problems during troubleshooting. For example, if the control valve does not move in response to input signals from the controller, but the valve operates correctly in response to the simulated current input, it follows that the problem is somewhere between the wiring and the host system.

Dummy input signal configuration procedure

step	Procedure
1	Select [Device] >> [Maintenance] >> [Simulation] >> [Dummy Input Signal].
2	Select a dummy input signal ([0 %], [50 %], [100 %], or [Other]) from the [Dummy Input Signal] menu.
3	If you selected [Other], enter a value (0 to 100 %).
4	To cancel the dummy input signal, select [Clear] from the [Dummy Input Signal] menu.
5	To exit the [Dummy Input Signal] menu, select [Exit].

4-6-4. Dummy Drive Signal

Cuts off the drive signal from the PID control unit, and applies the dummy drive signal to the EPM (electro-pneumatic module).

Dummy Drive Signal configuration procedure

step	Procedure
1	Select [Device] >> [Maintenance] >> [Simulation] >> [Dummy Drive Signal].
2	Select a dummy EPM drive signal ([0 %], [50 %], [100 %], or [Other]) from the [Dummy Drive Signal] menu.
3	If you selected [Other], enter a value (0 to 100 %).
4	To cancel the dummy EPM drive signal, select [Clear] from the [Dummy Drive Signal] menu.
5	To exit the [Dummy Drive Signal] menu, select [Exit].

4-6-5. Save Current Settings

Saves all of the device's internal data (settings) in place of the factory shipment data specifications (the data that was set based on the model number).

Use the "Load saved settings" operation to retrieve the saved data.

We recommend saving the configuration data after the device has been installed and all configuration has been completed.

Save current settings procedure

step	Procedure
1	Select [Device] >> [Maintenance] >> [Save/Load] >> [Save current settings] to execute the command.
2	When the data is saved, "Save current settings was completed" is displayed.

4-6-6. Load saved settings

Returns all of the device's internal data settings to the settings at the time of shipping.

This is useful when for instance installing the device on a different control valve.

- If this function is executed, the settings for valve fully open and valve fully closed (zero/span adjustment) will also be reset to the settings at the time of shipment. Overwrite these settings again the next time the device is used.
- If "Save Current Settings" in the configuration settings was executed before this function, the internal data saved at that time will be restored.

Load saved settings procedure

step	Procedure
1	Select [Device] >> [Maintenance] >> [Save/Load] >> [Load saved settings] to execute the command.
2	When the data has been retrieved, "Load saved settings is completed" is displayed.

4-7. Valve Diagnostic Parameter Configuration

Performs configuration necessary for valve diagnostics.

4-7-1. Stick-Slip

A stick-slip value quantitatively represents abnormal valve movements caused by adhesion, seizing, and the like. Select [Diagnostics] >> [Valve Diagnostic Information] >> [Stick Slip]. You will be able to check or modify the following items. To change a value, select the item and then change it.

Stick-Slip X

Displays the Stick Slip X value.

Stick-Slip Y

Displays the Stick Slip Y value.

Stick-Slip Count

Displays the Stick Slip Count.

Update Stick Slip

Updates the Stick Slip X value, Stick Slip Y value, and Stick Slip Count to the most recent values.

- Select the [Update Stick Slip] menu to execute the update.

Clear Stick Slip Count

Resets the count to zero.

- Select the [Clear Stick Slip Count] menu to reset the count.

Stick Slip XY Threshold

Displays and allows modification of the XY threshold. This is the value which, when reached or exceeded by the stick-slip value (Stick Slip Y divided by Stick Slip X), results in incrementation of the count. (An alarm is not activated merely as a result of this value being exceeded, but an alarm is activated if the count threshold is exceeded.)

Stick Slip Count Threshold

Displays and allows modification of the count threshold value. An alarm occurs if the number of times the XY threshold is exceeded reaches or exceeds this value.

Stick Slip Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-7-2. Total Stroke

This value is the result of totaling the distances (% , mm) that the valve moved.

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Total Stroke]. You will be able to check or modify the following items. To change a value, select the item and then change it.

Total Stroke

Displays and allows modification of the total stroke value.

Update Total Stroke

Updates the total stroke distance to the latest value.

■ Select the [Update Total Stroke] menu to execute the update.

Dead Band

Displays and allows modification of the dead band. The dead band is the minimum position width [\pm %FS] for calculating the total stroke distance.

Total Stroke Threshold

Displays and allows modification of the threshold. An alarm occurs if the stroke distance reaches or exceeds this value.

Total Stroke Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-7-3. Cycle Count

Counts the total number of times that the valve position reverses after at least the specified amount of valve travel.

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Cycle Count]. You will be able to check or modify the following items. To change a value, select the item and then change it.

Cycle Count

Displays and allows modification of the motion reversal count.

Update Cycle Count

Updates the reversal count to the latest value.

■ Select the [Update Cycle Count] menu to execute the update.

Cycle Count High, Cycle Count Low

Displays and allows modification of the upper and lower threshold values for position width.

Cycle Count Threshold

Displays and allows modification of the threshold. An alarm occurs if the reversal count reaches or exceeds this value.

Cycle Count Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-7-4. Travel Histogram

Indicates how frequently the valve travels in the specified position ranges, as a proportion of the total travel time.

[Travel Histogram]

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Travel Histogram] >> [Travel Histogram]. You will be able to check the following items.

Travel Histogram 1 to Travel Histogram 16

Displays the frequency of the specified position region as a percentage.

Update Travel Histogram

Updates per-position frequency distribution values 1 to 16 to the latest values.

■ Select the [Update Travel Histogram] menu to execute the update.

Clear Travel Histogram

Deletes the per-position frequency distribution values.

■ Select the [Clear Travel Histogram] menu to delete the values.

[Travel Segmentation]

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Travel Histogram] >> [Travel Segmentation]. You will be able to check or modify the following item.

Travel Segmentation 1 to Travel Segmentation 16

Displays and allows modification of the 15 position regions for the 16 positions.

4-7-5. 0 % Travel Error

When the valve is fully closed, the zero point from when zero adjustment was performed is compared to the current zero point, and an alarm occurs if the discrepancy between them is greater than or equal to a specified deviation and if this discrepancy persists for longer than the specified time.

Select [Diagnostics] >> [Valve Diagnostic Information] >> [0 % Travel Error]. You will be able to check or modify the following items. To change a value, select the item and then change it.

0 % Tvl Error +, 0 % Tvl Error –

Displays and allows modification of the deviation on the “+” side and “–” side.

0 % Tvl Error Waiting Time

Displays and allows modification of the waiting time. An alarm occurs if the deviation continues for longer than this waiting time.

0 % Tvl Error Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-7-6. Shut-Off Count

Counts the total number of times that the valve is fully closed.

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Shut-Off Count]. You will be able to check or modify the following items. To change a value, select the item and then change it.

Shut-Off Count

Displays and allows modification of the total fully closed count.

Update Shut-Off Count

Updates the fully closed count to the latest value.

■ Select the [Update Shut-Off Count] menu to execute the update.

Shut-Off Count Threshold

Displays and allows modification of the threshold. An alarm occurs if the fully closed count reaches or exceeds this value.

Shut-Off Count Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-7-7. Max Travel Speed

The maximum operating speed per unit time of the valve.

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Max Travel Speed]. You will be able to check or modify the following items. To change a value, select the item and then change it.

Max Tvl Speed +, Max Tvl Speed –

Displays and allows modification of the maximum operating speed on the “+” side and “–” side.

Update Max Tvl Speed

Updates the maximum operating speed to the latest value.

■ Select the [Update Max Tvl Speed] menu to execute the update.

Clear Max Tvl Speed

Deletes the maximum operating speed.

■ Select the [Clear Max Tvl Speed] menu to clear the count.

Max Tvl Speed Threshold +, Max Tvl Speed Threshold –

Displays and allows modification of the thresholds on the “+” side and “–” side. An alarm occurs if the maximum operating speed is outside the range specified by the thresholds.

Max Tvl Speed Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-7-8. Deviation Alarm

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Deviation Alarm]. You will be able to check or modify the following items.

Deviation

Displays the position deviation value.

Deviation Threshold +, Deviation Threshold –

Displays and allows modification of the thresholds on the “+” side and “–” side. An alarm occurs if the position deviation exceeds this value.

Deviation Waiting Time

Displays and allows modification of the waiting time. An alarm occurs if the position deviation exceeds the threshold and this amount of time has elapsed.

Deviation Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-7-9. Temperature Alarm

Select [Diagnostics] >> [Valve Diagnostic Information] >> [Temperature Alarm]. You will be able to check or modify the following items.

Temperature

Displays the temperature

Temp Threshold High, Temp Threshold Low

Displays and allows modification of the upper and lower thresholds. An alarm occurs if the temperature goes beyond one of these values and the waiting time has elapsed.

Temp Waiting Time

Displays and allows modification of the waiting time. An alarm occurs if the temperature goes beyond a threshold and this amount of time has elapsed.

Temp Alarm Enabled

Displays and allows modification of the alarm enabled/disabled status. If the status is Enabled, alarms will occur, and if the status is Disabled, alarms will not occur.

4-8. Self-diagnostics

This device provides a self-diagnostics function. This is useful for troubleshooting. For information regarding measures to take in response to each message, see “6-1. Troubleshooting.”

4-8-1. Critical Failure

Select [Diagnostics] >> [Positioner Diagnostic Status]. You will be able to check the status conditions shown below. If the value of this item is ON, a failure was observed.

Explanation of self-diagnostics messages (major failures)

Message	Description / Cause
VTD FAULT	VTD (angle sensor) error. The feedback lever has become detached. The feedback lever has exceeded the allowable angular range. The VTD connector has become detached. (For the remote type, the cable is cut.)
RAM FAULT	RAM electrical part failure
ROM FAULT	ROM electrical part failure

4-8-2. Device Status

Select [Diagnostics] >> [Positioner Diagnostic Status] >> [Device Status]. You will be able to check the status conditions shown below. If the value of this item is ON, a failure was observed.

Explanation of self-diagnostics messages (minor failures)

Message	Description / Cause
LOW IIN	The input signal (current) is too low (3.80 mA or less)
EXT ZERO ACTIVE EXT SWITCH ACTIVE	External zero/span adjustment switch is being used.
HI/LO EPM OUT	The EPM drive signal exceeds the normal operating range.
EXT ZERO ACTIVE EXT SWITCH ACTIVE	External zero/span adjustment switch is being used.
TRAVEL CUTOFF	The valve is in the forced fully open/closed state.
OVER TEMP	The perceived internal temperature of the device is lower than -45 °C or higher than +85 °C.
FIXED EPM OUT SIMULATION MODE	A dummy input signal has been set.
MANUAL MODE SIMULATION MODE	A dummy EPM drive signal has been set.
ALL SETTINGS RESET	The adjustment data and setting data has been initialized.

4-8-3. Valve Diagnostic Status

Select [Diagnostics] >> [Valve Diagnostic Status]. You will be able to check the status conditions shown below. If the value of an item is ON, an alarm was triggered.

Status	Details
Stick Slip Alarm	The Stick Slip Alarm occurs when the valve exhibits stick and slip movement.
Total Stroke Alarm	The Total Stroke Alarm occurs when the total distance of the valve plug/stem stroke movement exceeds the threshold.
Cycle Count Alarm	The Cycle Count Alarm occurs when the number of control valve reverse operation cycles exceeds the threshold
0 % Tvl Error + Alarm	The 0 % Tvl Error + Alarm occurs when there is upward deviation between current 0 % travel angle and initial 0 % travel angle.
0 % Tvl Error – Alarm	The 0 % Tvl Error – Alarm occurs when there is downward deviation between current 0 % travel angle and initial 0 % travel angle.
Shut-Off Count Alarm	The Shut-Off Count Alarm occurs when the total number of valve closures exceeds the threshold.
Max Tvl Speed + Alarm	The Max Tvl Speed + Alarm occurs when the maximum stem movement speed in the upward direction in a day exceeds the threshold.
Max Tvl Speed – Alarm	The Max Tvl Speed – Alarm occurs when the maximum stem movement speed in the downward direction in a day exceeds the threshold.
Deviation + Alarm	The Deviation + Alarm occurs when there is a positive deviation between current travel (%) and input signal (%).
Deviation – Alarm	The Deviation – Alarm occurs when there is a negative deviation between current travel (%) and input signal (%).
Temp High Alarm	The Temp High Alarm occurs when the measured temperature exceeds the upper threshold.
Temp Low Alarm	The Temp Low Alarm occurs when the measured temperature falls below the lower threshold.

4-9. Precautions

A message like the one below may be displayed on a host device. If so, take the indicated countermeasure to address the problem.

[475 Communicator]

- If Actuator Size is set to "Param0" and GE (+/-) in "PID Parameters" is set to any value other than "0.0," then even if GE (+/-) is changed to "0.0" and GP, GI, and GD are also changed, and these settings are then transmitted, the background color of the changed items will remain yellow.

→ Return to the level above this and display "PID Parameters" again.

Chapter 5. Maintenance

5-1. Auto/Manual selection switch

The Auto/Manual switch selects the control method for the pneumatic output from the positioner to be either automatic operation or manual operation.

Automatic operation

- An air pressure output corresponding to the input signal is output from the SVP.
- See Fig.5-2.

Manual operation

- The supplied air pressure is output directly from the positioner.
- This allows manual operation using a pressure regulator.
- See Fig.5-3.

CAUTION

The double acting actuator has no manual operation function.

WARNING

The valve may move suddenly when the A/M switch is operated. Prepare yourself and the process in advance so that the process is not adversely affected when the valve operates.

5-1-1. Structure of the A/M switch

The structure of the A/M switch is shown below.

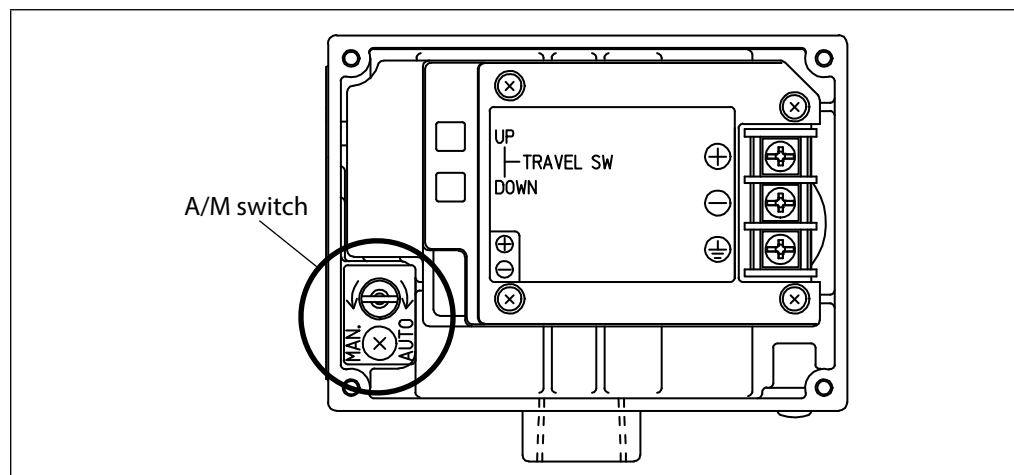


Fig. 5-1. Structure of the A/M Switch

5-1-2. Operating procedure

The technique for switching the A/M switch is shown below.

Switching from automatic (normal) operation to manual operation

- Use a flat-bladed screwdriver to turn the A/M switch once fully in the counterclockwise.

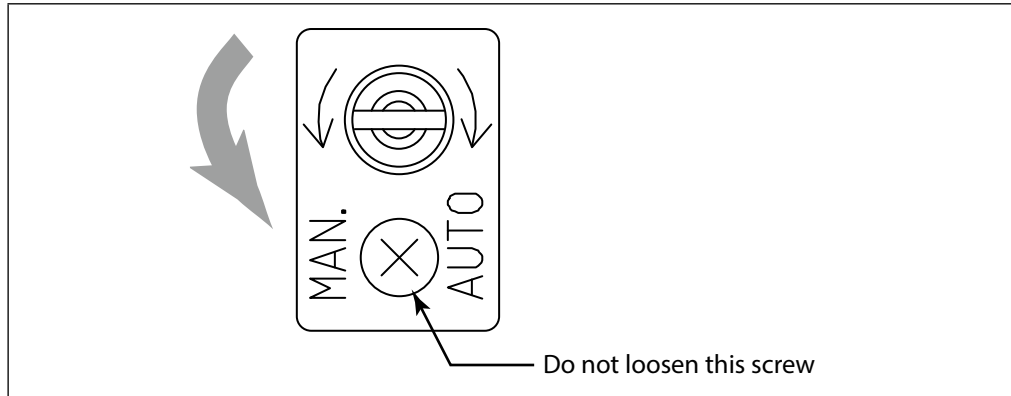


Fig. 5-2. Switching from automatic (normal) operating state to manual operating State

Note) Do not loosen the A/M switch cover plate screw.

Switching from manual operation to the automatic operation

- Use a flat-bladed screwdriver to turn the A/M switch in the clockwise direction until it stops.

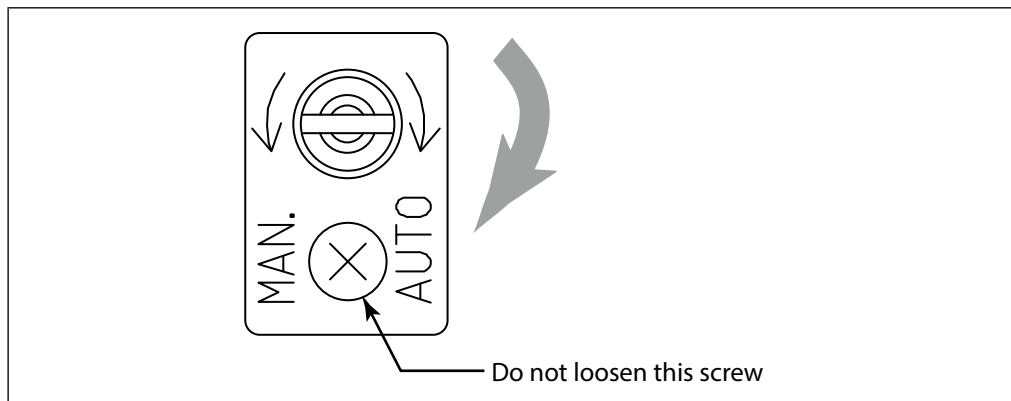


Fig. 5-3. Switching from manual operating state to automatic operating state

5-2. Filter replacement and restriction maintenance

The contamination from the instrumentation air that collects in the restriction in the SVP can be removed during maintenance. For the instrumentation air, use dry air which has been cleaned of 3 µm (or smaller) solid particles. Always use a Phillips screwdriver.

Procedure

Step No.	Procedure
1	Cut off the air supply to the SVP.
2	Remove the setscrews from the A/M switch nameplate section. <i>Note) Be careful not to drop the A/M switch cover plate washers and corrugated washers when removing the screws.</i>
3	Turn the A/M switch to the MAN (manual) position.
4	Use nippers or another tool to cut the holder and remove the old filter. <i>Note) Dispose of the old holder and filter appropriately.</i>
5	Use wire to remove the contamination from the restriction. (diameter 0.3 mm) <i>Note) Be careful not to damage the restriction when removing the contamination. Do not use an air gun. Do not allow any oils or greases to contaminate the restriction.</i>
6	Wrap a new filter around the A/M switch, and press it in place with the holder.
7	Screw down the A/M switch until it stops.
8	Reassemble the A/M switch section name plate together with the A/M switch cover plate using the setscrews.

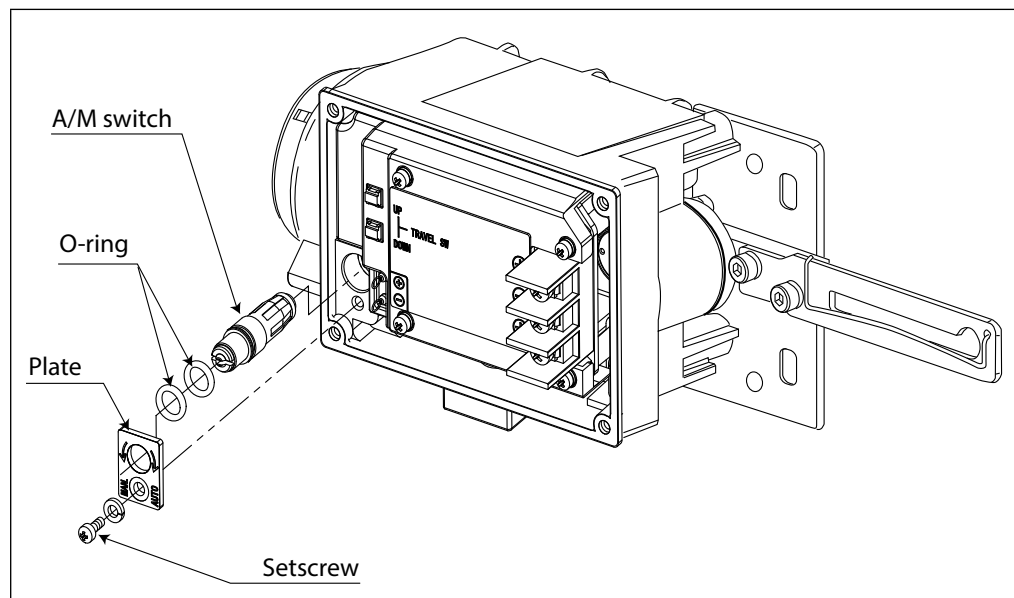


Fig. 5-4. A/M switch

5-3. Cleaning the flapper

If contamination from the instrumentation air has accumulated on the flapper, clean the flapper as described below.

⚠ CAUTION	
If air pressure is supplied to the SVP, the nozzle back pressure may change causing the valve position may change suddenly when the flapper is cleaned. Only clean the flapper in a state where no one will be injured and plant operation will not be adversely influenced even if the valve moves suddenly.	

Procedure

Step No.	Procedure
1	Remove the cover.
2	Remove four screws from the cover plate.
3	Remove the plate by sliding it to the left.
4	Provide pieces of paper with a thickness of 0.2 mm. Standard business cards will do.
5	Use the scraps of paper to clean the contamination from the gap between the EPM nozzle and the flapper.
6	After cleaning the gap, reassemble the plate and cover.

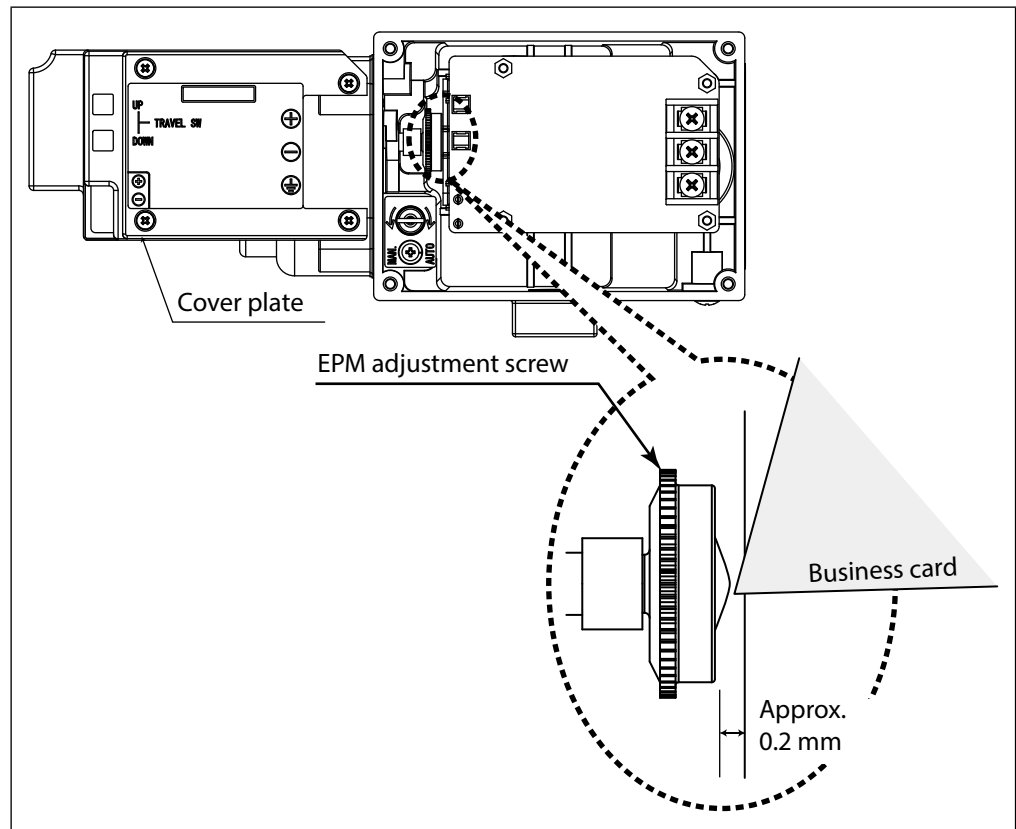


Fig. 5-5. EPM balance adjustment

5-4. EPM (Electro-pneumatic converter module) balance adjustment

In situations such as when excessive mechanical shocks and other external disturbances have been applied to the SVP itself, or when contamination from the instrumentation air has collected in the nozzle flapper area, the internal EPM (electropneumatic converter module) balance point may be displaced and the response characteristics degraded. This can lead to malfunctions occurring. If the balance point displacement cannot be rectified by cleaning the nozzle flapper area, EPM adjustment will be necessary.

⚠ CAUTION

The EPM balance adjustment can cause the valve position to change rapidly. Only perform this adjustment in a state where no one will be injured and plant operation will not be adversely influenced even if the valve moves suddenly.

Procedure

Step No.	Procedure
1	Remove the cover and the cover plate.
2	After supplying the stipulated air pressure, set the input signal to 50%.
3	Observe the EPM drive signal using the Field Communication Software (model CFS100). (Refer to “4-6-4. Dummy Drive Signal” on page 4-19)
4	Adjust the EPM drive signal to have a 50% \pm 5% duty by turning the EPM adjustment screw.

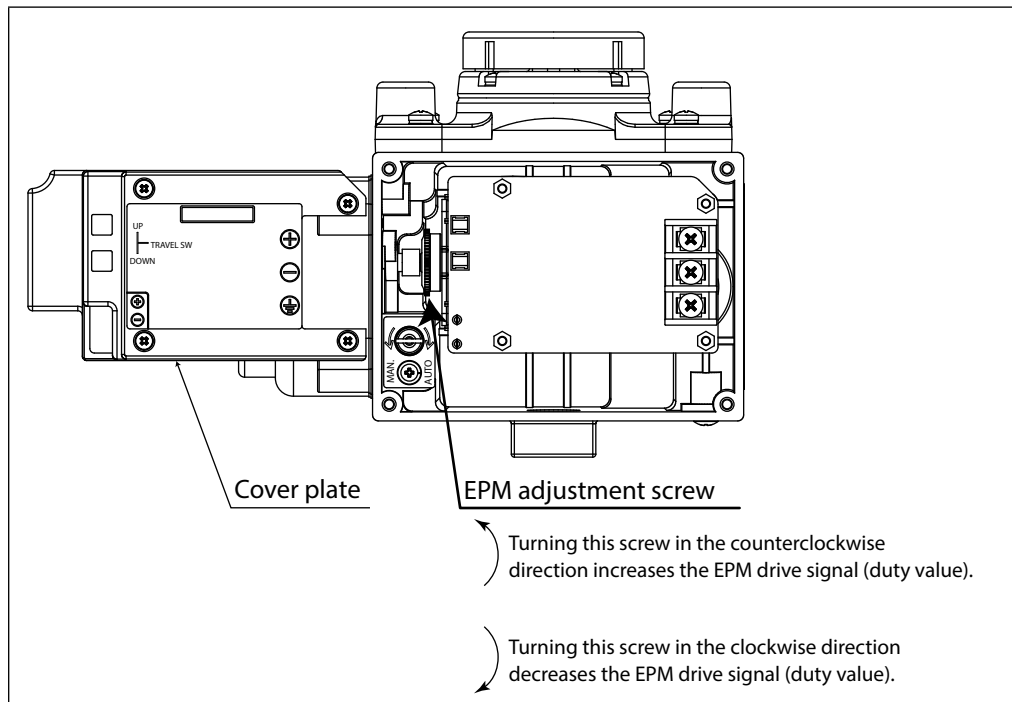



Fig. 5-6. EPM balance adjustment

5-5. Installation resistance test

 **CAUTION**

As a general rule, please do not perform the insulation resistance test. Performing this test may result in damage to the varistor for absorbing internal surge voltage.
If you absolutely must perform the test, please perform it carefully in accordance with the designated procedures.

5-5-1. Test procedures

- Disconnect the device's external wiring.
- Short circuit the + and - terminals of the input and output respectively.
- Perform the tests between ground terminal and its respective short-circuit between the + and - terminals.
- Applied voltage and judgment standards are as follows. To avoid damage to the instrument, do not apply voltage greater than the values listed below.

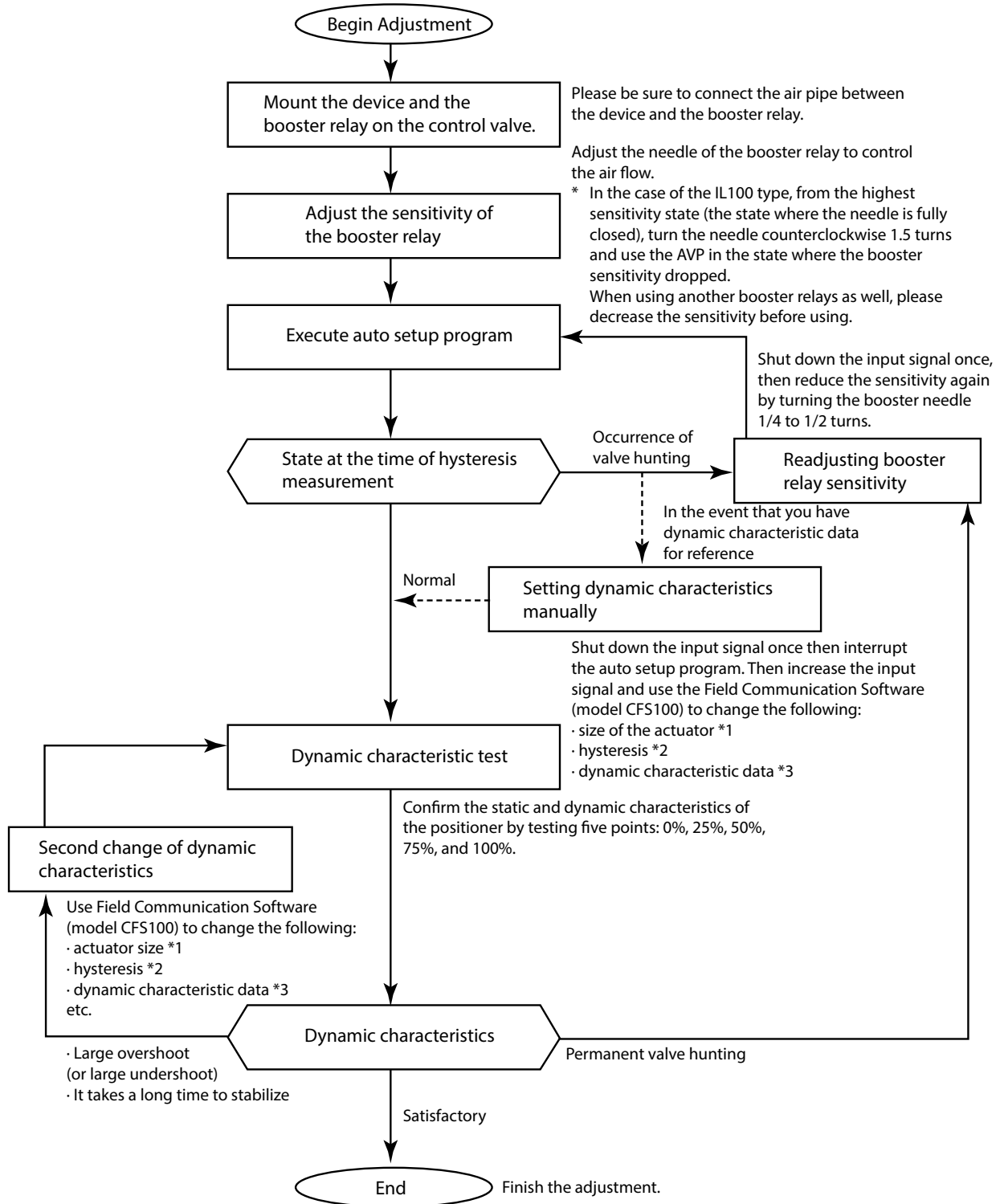
5-5-2. Judgment criteria

The judgment standard for the test is as follows:

Test	Judgment Standard
Insulation Resistance Test	More than 20 MΩ at test voltage 25V DC (25°C, under 60% RH)

5-6. Adjustment procedure when using the SVP attached to the booster relay

When using the device attached to the booster relay, please adjust using the following procedure:



*1: Change the actuator size parameter from 6 to 5, 5 to 4, etc. in decreasing numerical order.

*2: Change the hysteresis parameters in order from light to medium and medium to heavy.

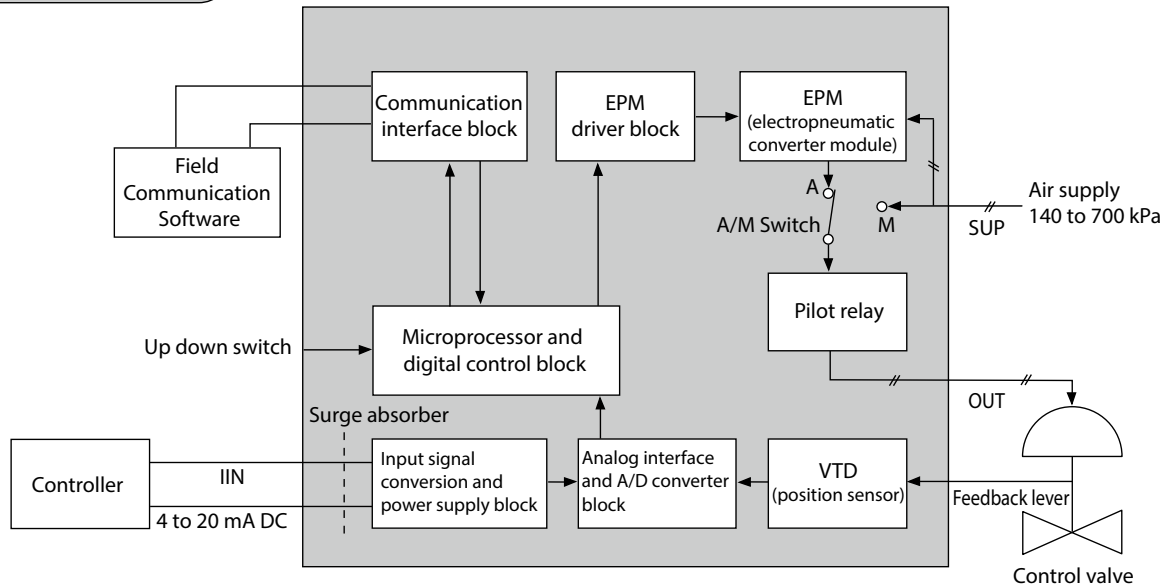
*3: Reduce P, GP, reduce I, GI, increase D, GD, etc.

5-7. Table of default internal data values

Item		Default value
Tag number		XXXXXXXX
Output format		ANALOG XMTR
Burnout direction		DOWN SCALE
Actuator operation		REVERSE
Positioner operation		DIRECT
Valve operation		DIRECT
Actuator size		PARAM 1
Hysteresis		HEAVY
PID parameters (parameter 0)	P	1.200
	I	4.000
	D	0.5000
	GE	+/-0.000%
	GP	0.7000
	GI	4.000
	GD	0.5000
Flow characteristics		LINEAR
User defined flow characteristics data		(Pressure balance type adjustment valve (ADVB/ADVM) linear characteristics data)
Valve fully closed value (LRV)		4.000mA
Valve fully open value (URV)		20.00mA
Forced fully closed input value		0.5000%IIN
Forced fully open input value		109.00%IIN
Digital output settings	Output signal mode	Single Range
	Amount of data mode	DE-4Byte
	Failsafe mode	F/S=B/O Hi

5-8. SVP internal block diagram and SVP I/O flow

Model AVP100



Model AVP102

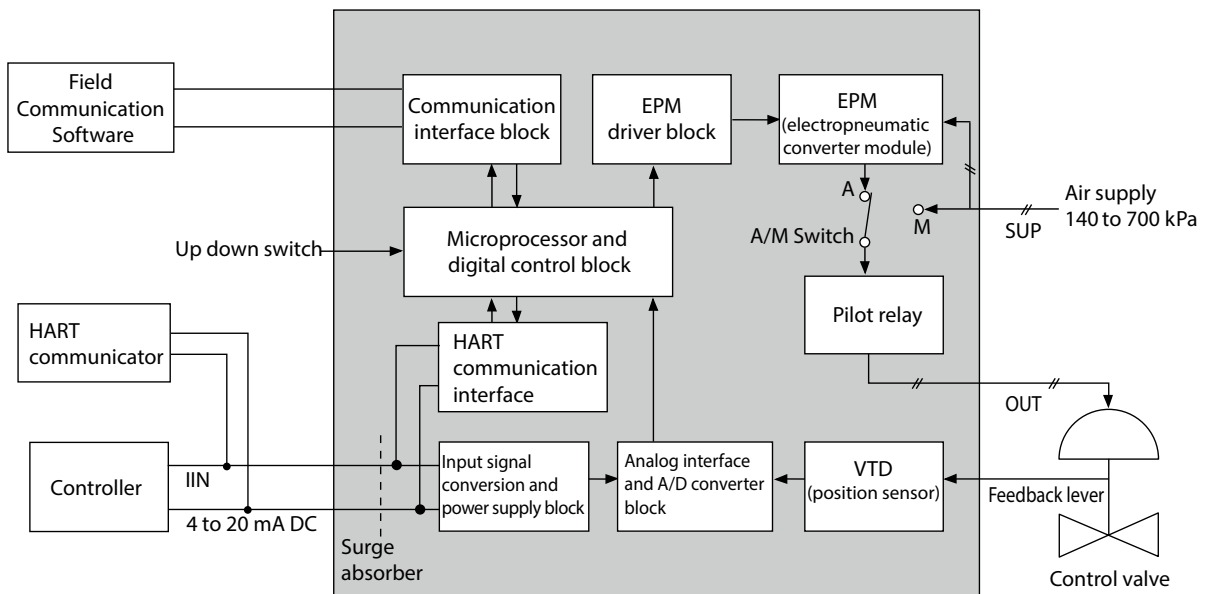


Fig. 5-7. SVP block diagram

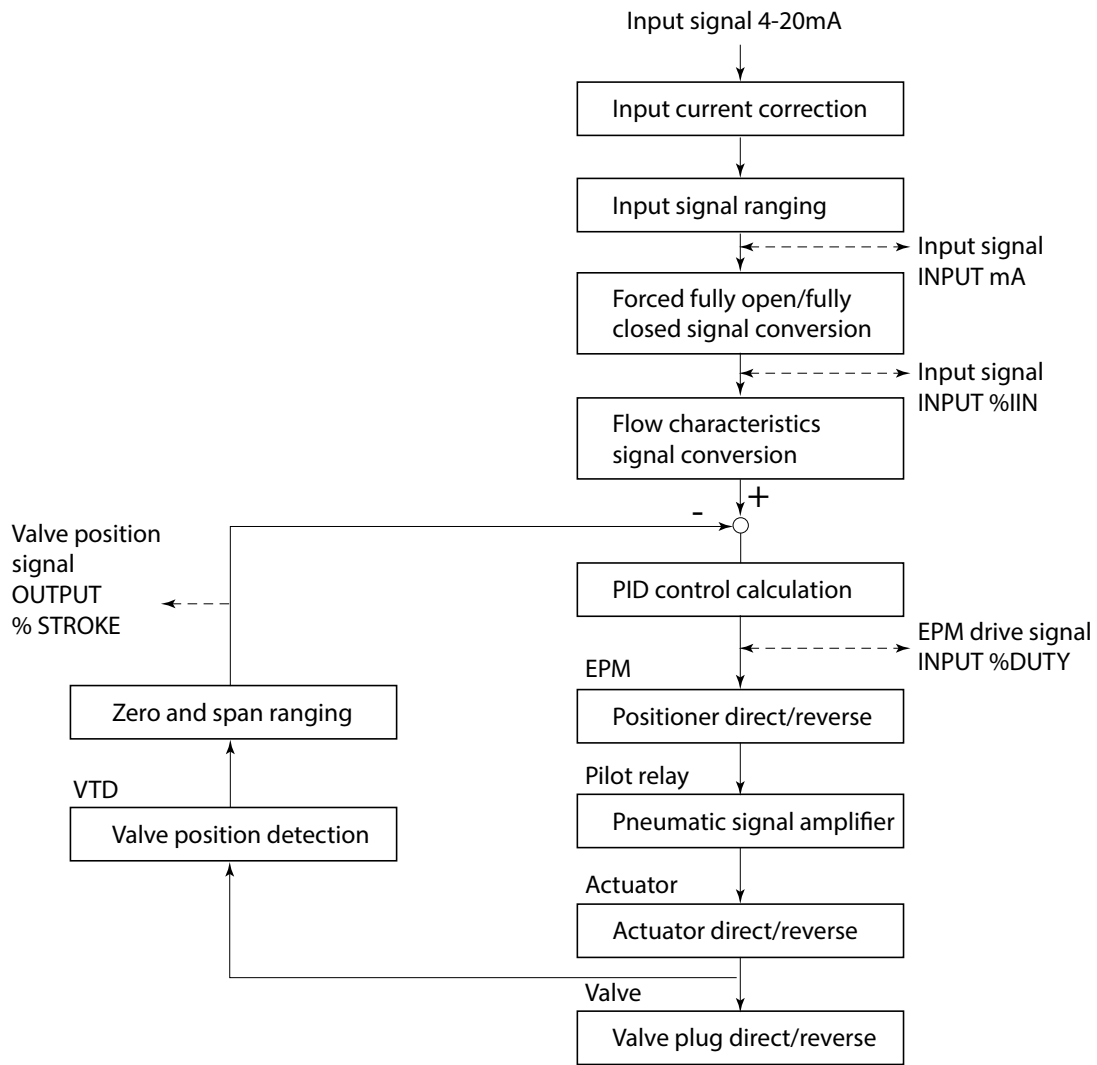


Fig. 5-8. SVP I/O flow

Chapter 6. Troubleshooting

6-1. Troubleshooting

The SVP is a precision instrument and requires the same level of care as any other field device. Unlike an air-actuated control valve, the SVP contains many electronic components and mechanical parts which must have proper settings and calibration. Poor SVP performance is usually easy to correct by adjusting settings.

A Minor Failure indicates no immediate danger or serious trouble in the operation of the SVP. The SVP will continue to operate normally. Connecting the Field Communication Software (model CFS100) or HART Communicator or requesting a self-diagnostic through the supervisory monitoring system (model AVP100/102) is necessary to discover and determine Minor Failures.

A Major Failure indicates serious trouble in the operation of the SVP and, if no action is taken, may lead to damage to the SVP itself. Should serious trouble occur during SVP operations, the SVP will drive the valve to the fail-safe position. The Field Communication Software (model CFS100) or HART Communicator, or the supervisory monitoring system (model AVP102) are used to determine Major Failures.

6-1-1. Using the Field Communication Software (Model CFS100)

Refer to the operation manual for Smart Valve Positioner (CM2-CFS100-2010)

6-1-2. Using a HART Communicator

If you have a HART Communicator connected to the SVP, you can perform a selfdiagnostic:

step	Procedure
1	Make sure the HART Communicator is in the Ready State.
2	Select [5. Device Status] >> [2. Failures] or [3. Notices].
3	If the message is displayed, see the following page for a list of error conditions as well as the HART error code and possible solutions.

If after reading this troubleshooting section and solutions, the specifications of the SVP still do not match your requirements, or the SVP fails, contact an Azbil Corporation representative. “Troubleshooting Codes” on page 6-4.

6-1-3. General troubleshooting

If, after attaching your SVP to a control valve and performing Auto-Setup or manual calibration, you are experiencing performance problems, follow the troubleshooting steps below.

If the troubleshooting procedures below do not fix the problem, contact an Azbil Corporation representative.

SVP does not operate (no output air pressure)

step	Procedure
1	Make sure that the SVP feedback lever is not exceeding a 20° angle of rotation. If it is, add an extension bracket to the feedback lever to provide the necessary feedback lever length.
2	Check for air leaks in air supply.
3	Check electrical input signals.
4	Check Auto/Manual switch in Auto.
5	Check the flapper and the filter clears.
6	If communication can be made with the Field Communication Software (model CFS100) or HART Communicator, perform self diagnostics and take action based on errors messages. Refer to “Troubleshooting Codes” on page 6-4.

Absence of full stroke or slow response

step	Procedure
1	Check the zero (fully closed) and span (fully opened) are properly adjusted.
2	Check the filter and the flapper clean.
3	Check the EPM drive signal is within range of 50 ±25% duty.

Hunting or Overshoot

step	Procedure
1	Change hysteresis setting from LIGHT to MEDIUM, or from MEDIUM to HEAVY. If problem persists, set hysteresis at HEAVY and change the actuator size setting to smaller PARAM number.
2	If problem persists, PARAM number sets zero (0) and varying the gain may be required for your valve, refer to “4-4-4. Control configuration” on page 4-11.
3	Check permissible angle of rotation of feedback lever.

Abnormal action of control valve

(although output air is supplied, the control valve does not operate properly)

step	Procedure
1	Check the zero (fully closed) and span (fully opened) are properly adjusted.
2	Confirm that the internal SVP settings for actuator size, hysteresis, etc. are appropriate for your control valve. Refer to “4-4-4. Control configuration” on page 4-11.

No communication possible with the Field Communication Software (model CFS100) or HART Communicator

step	Procedure
1	Check input signal wiring. 4 mA is required for the SVP to operate.
2	Refer to “4-1-1. Wiring method” on page 4-2.
3	If the Field Communication Software (model CFS100) or HART Communicator will not power on, check the batteries.

Troubleshooting Codes

Message	Cause	Correction
LO IIN	Input signal is too low (3.8 mA or lower).	Provide an input signal of at least 3.8mA.
VTD FAULT	(Valve position sensor) Feedback lever has fallen off or has turned beyond the allowable turning angle ($\pm 20^{\circ}\text{C}$) ■ VTD connector has become disconnected. ■ VTD input line has been disconnected or short-circuited.	Check if feedback lever has fallen off and that it is within permissible turning angle. Contact Azbil Corporation.
A/D FAULT	(Analog/Digital conversion)	Contact Azbil Corporation.
NVM FAULT	(Non-Volatile Memory)	Contact Azbil Corporation.
RAM FAULT	(RAM error)	Contact Azbil Corporation.
ROM FAULT	(ROM error)	Contact Azbil Corporation.
SHUT ON	SVP is forced fully closed	Apply an input signal above the forced fully shut value. Use the Field Communication Software (model CFS100) to check and/or adjust the forced fully open/close values (%).
HI/LO EPM OUT	Electro-pneumatic Module is outside normal range - No air is being supplied - Valve is closed - Galling of valve stem - Clogged nozzle - Clogged orifice - Input signal is 4 mA or less	■ Check air supply pressure ■ See that the input signal is 4 mA or greater ■ Confirm A/M switch is Auto ■ Clean air nozzle ■ Clean orifice ■ Adjust the EPM balance (Refer to page 5-5) ■ Change the input signal and check that the device is operating normally.
EXT ZERO ACTIVE	Zero and span adjustment switch is being made.	Release the zero and span adjustment switch.
MANUAL MODE	Dummy input signal from Field Communication Software (model CFS100)/HART.	Cancel the dummy current input.
FIXED EPM OUT	Dummy EPM pseudo-drive signal from Field Communication Software (model CFS100)/HART.	Cancel the dummy EPM signal.
OUTPUT MODE	Dummy pseudo-signal output state for Field Communication Software (model CFS100)/HART.	Cancel the dummy output.
CORRECT RESET	Data was reset at the time of shipment.	Set actuator type and other parameters before use.
OVER TEMP	Abnormal Temperature within SVP unit.	Check SVP temp and move it to a cooler location.

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use
 Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.
 - *1. A design that is safe even if the user makes an error.
 - *2. A design that is safe even if the device fails.
 - *3. Avoidance of device failure by using highly reliable components, etc.
 - *4. The use of redundancy.

3. Precautions and restrictions on application

3.1 Restrictions on application

Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

- *5. Nuclear power quality: compliance with JEAG 4121 required
- *6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes," etc.
- *7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

3.2 Precautions on application

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility

to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities
[When used outside a radiation controlled area and where nuclear power quality is not required]
[When the limit switch for nuclear power is used]
 - * Machinery or equipment for space/sea bottom
 - * Transportation equipment
[Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment
 - * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
 - * Facilities/applications associated directly with billing
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

- (1) Installation, adjustment, guidance, and attendance at a test run
- (2) Maintenance, inspection, adjustment, and repair
- (3) Technical guidance and technical education
- (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

Document Number: CM2-AVP100-2001D
Document Name: Smart Valve Positioner 100 Series
Model: AVP100/102
User's Manual

Date: 1st edition: June 2017
8th editon: Apr. 2024
Edited by: Azbil Corporation
Issued: Azbil Control Instruments (Dalian) Co., Ltd.

Azbil Control Instruments (Dalian) Co., Ltd.