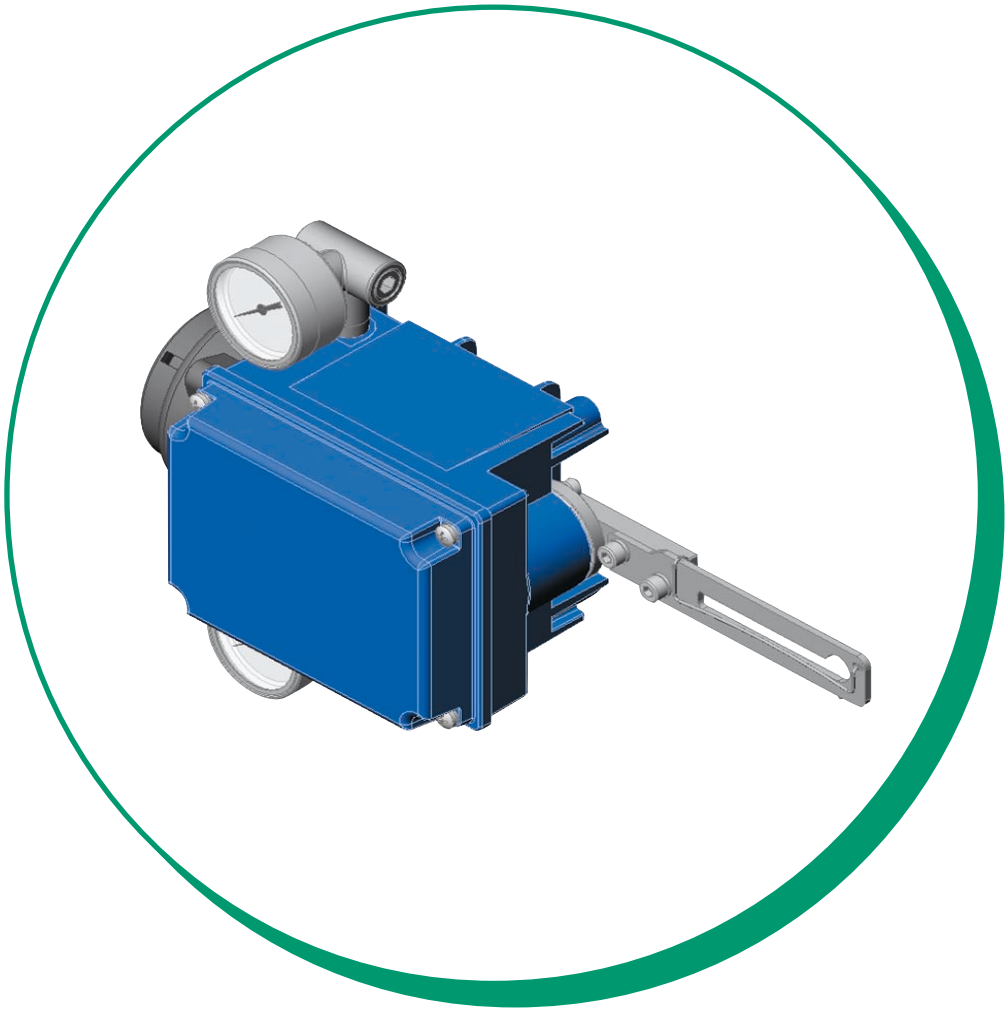
YAMATAKE

SVP3000 Alphaplus Smart Valve Positioner Model: AVP100

User's Manual



Yamatake Corporation

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Safety

Safety Notice

Proper installation, correct operation, and post-installation maintenance are essential for safe use of your Smart Valve Positioner.

The safety instructions presented in this Manual conform to ANSI (American National Standards Institute) Z535-4. Safety instructions are classified as Warnings, Cautions, and Notes.

⚠ WARNING

Failure to observe safety instructions in this category may result in personal injury or even death. Equivalent to definition “warning” in ANSI regulations. Warnings are printed in boldface.

⚠ CAUTION

Failure to observe safety instructions in this category could result in damage to or breakdown of equipment or facilities. Equivalent to definition “caution” in ANSI regulations.

~Note *Information that can be useful to the user. Equivalent to definition “note” in ANSI regulations.*

Unpacking

Handle with care to prevent damage. Check that the following items are included:

- SVP3000 Alphaplus Smart Valve Positioner
  Model AVP100
- Feedback lever and hex socket bolt
- Hex wrench for feedback and terminal box cover
- Any accessories that were ordered
- User Documentation

Storage

If storing your SVP without its original packaging then store it indoors, at normal temperature (25°C) and humidity (~65%) 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 and then firmly tighten the terminal box cover and seal the wiring, piping connections and bleed hole in the pilot cover using Yamatake-supplied caps or tape to prevent entry of moisture.

Safe Working Procedures

- Do not stand on the installed SVP or use it as a step.
- Do not unnecessarily touch the SVP while it is in operation. The surface may be very hot or very cold, depending on the operating environment.

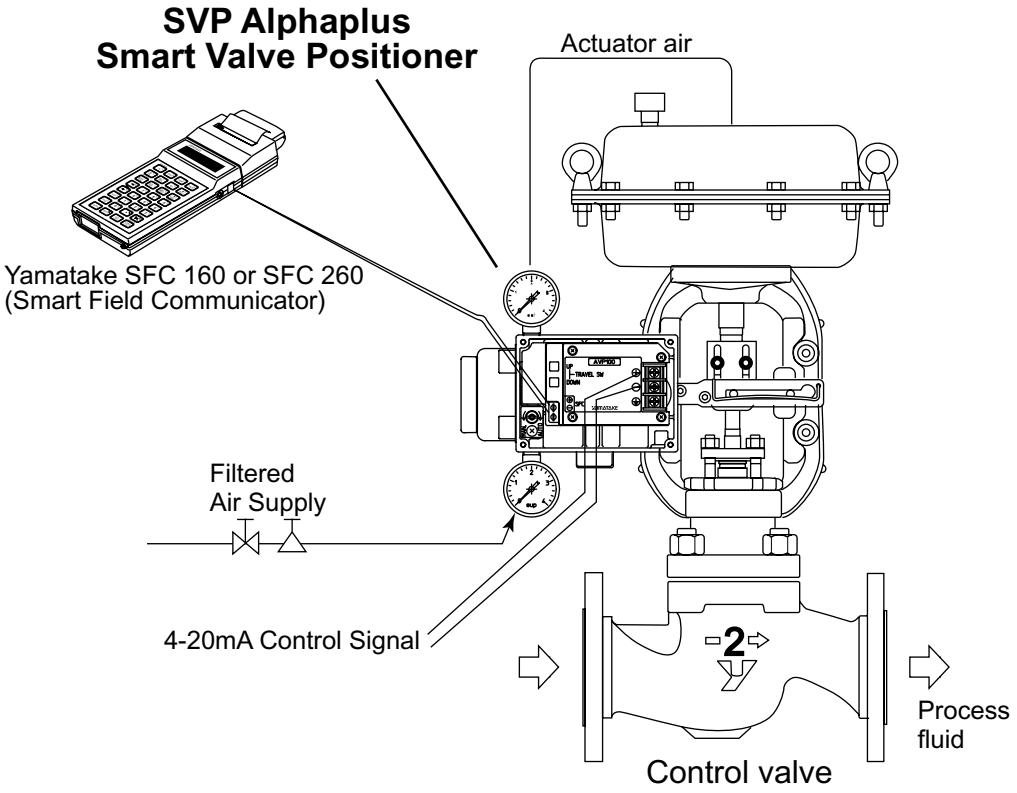
Chapter 1 : Smart Valve Positioner

YAMATAKE SVP3000 Alphaplus Series Smart Valve Positioners are high performance microprocessor based current-to-pneumatic valve positioners.

An SVP3000 receives a control signal from a control device and modulates the air supply to the control valve actuator, providing an accurate valve position that is proportional to the control signal.

SVP3000 series Smart Valve Positioners have automatic configuration, communications capabilities and self-diagnostics that increase productivity and efficiency of plant operation.

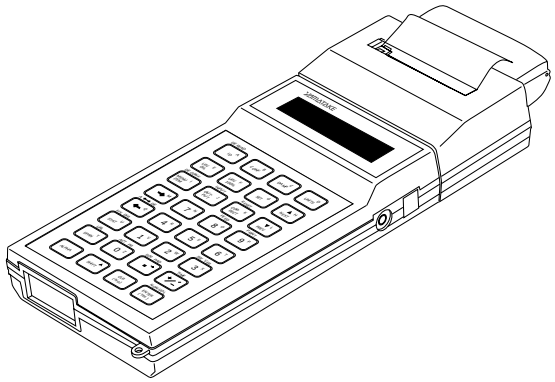
The AVP100 model uses a two-wire 4 to 20 mA loop making them a direct addition or replacement for any existing control system.



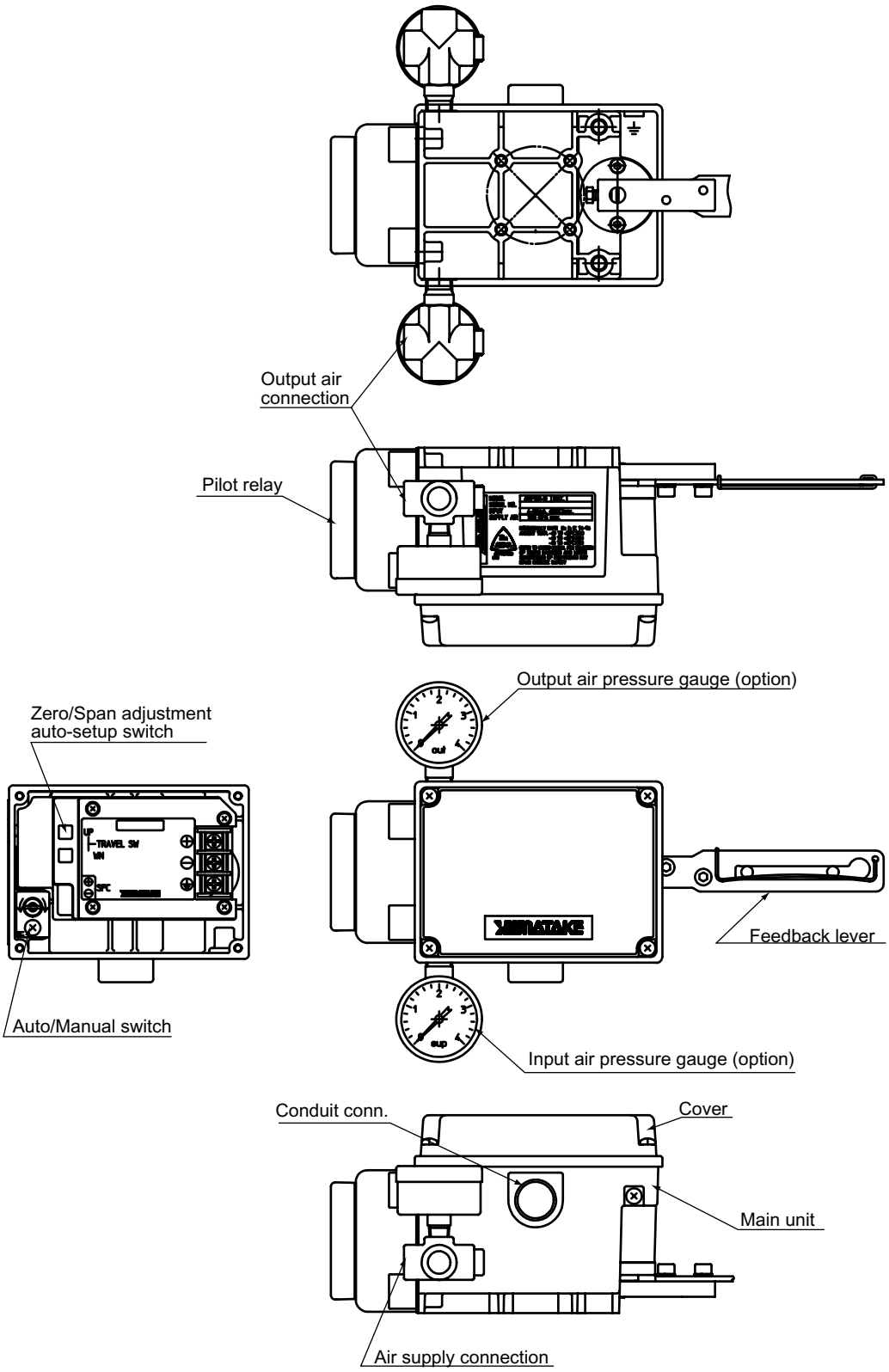
1-1 : Communications Overview

Initial SVP configuration is typically performed simple operation. Auto-setup and travel calibration, which detect the characteristics of the valve, as well as Zero/Span adjustment can all be performed in this manner.

Yamatake Model SFC160/260 Smart Field Communicators are used for all configuration, calibration, and maintenance of the SVP. SVP-specific SFC functions are documented fully within this manual. Operation of the SFC itself is explained in User Manual CM2-SFC100-2001 “SFC Manual,” published by Yamatake.



1-2 : SVP3000 Diagrams



Chapter 2 : Installation

Installation and Calibration of YAMATAKE Smart Valve Positioners

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 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 400 A/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)

Yamatake Smart Valve Positioners 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 1.7kg. 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.

Before installing the SVP, check for:

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 packed with the feedback lever removed. Assemble the feedback lever and the SVP using the two provided hex socket bolts. The feedback lever can rotate up to 20° from the horizontal (40° travel). If this limit is exceeded, then the SVP will not operate properly. For large actuators, use the optional extension lever.

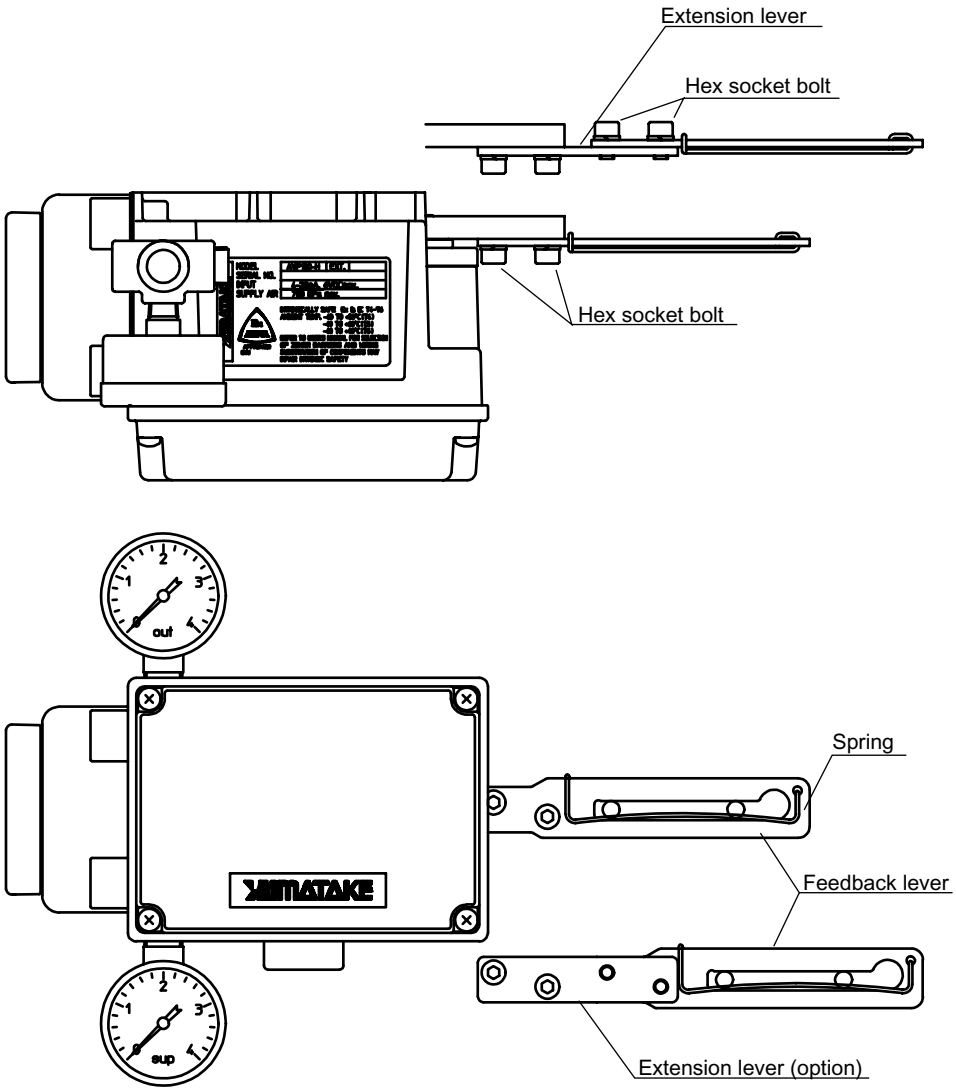


Figure 2-1 SVP Feedback lever

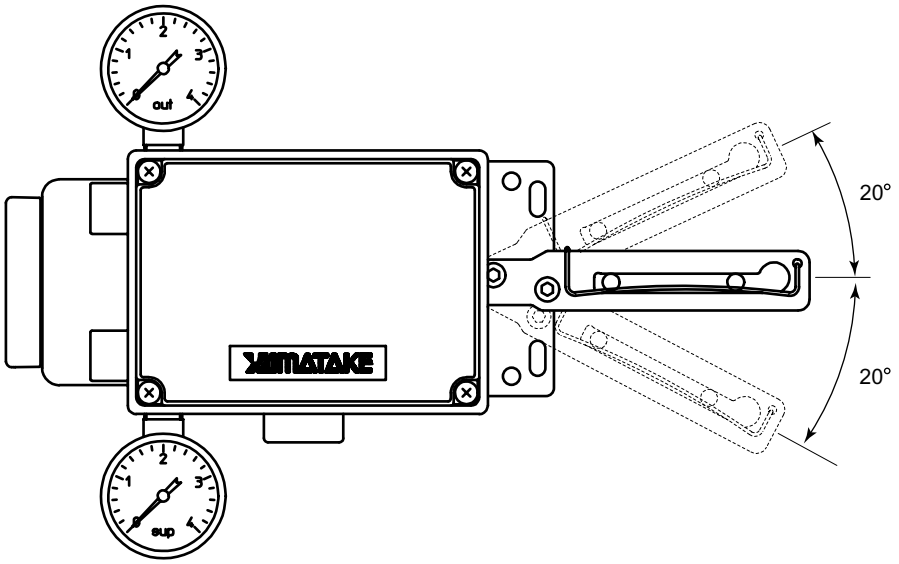


Figure 2-2 SVP Maximum range motion

2-1-2 :SVP Installation Procedure

The SVP should come with an actuator mounting kit appropriate to your control valve and actuator. Fasten the mounting plate to the SVP securely, using the 2 provided hexagon head bolts and spring washers.

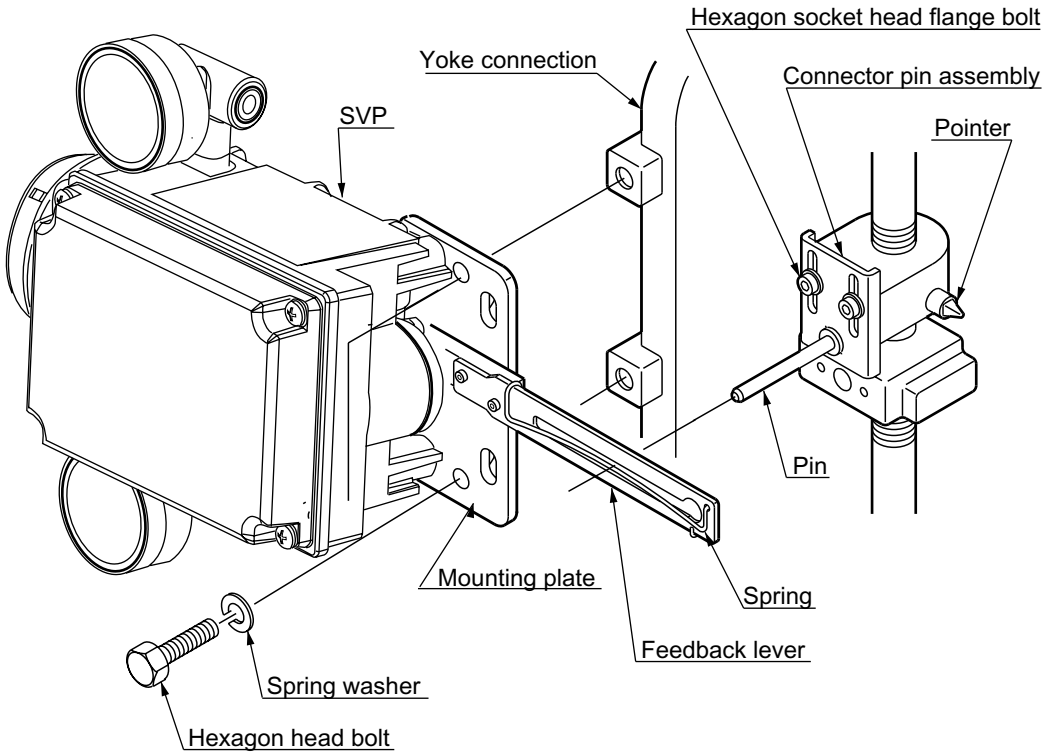
There may be a selection of actuator mounting holes provided, depending on the type of mounting kit supplied. Select the proper set of mounting holes that will position the SVP at approximately 50% of the valve travel with the feedback lever horizontal.

Fasten the assembled SVP to the actuator using the bolts and washers provided while guiding the 1/4 in. (6mm) feedback pin through the slot in the feedback arm above the spring. Make sure that the feedback lever and pin form a right angle, as shown.

2-2 : SVP Assembly

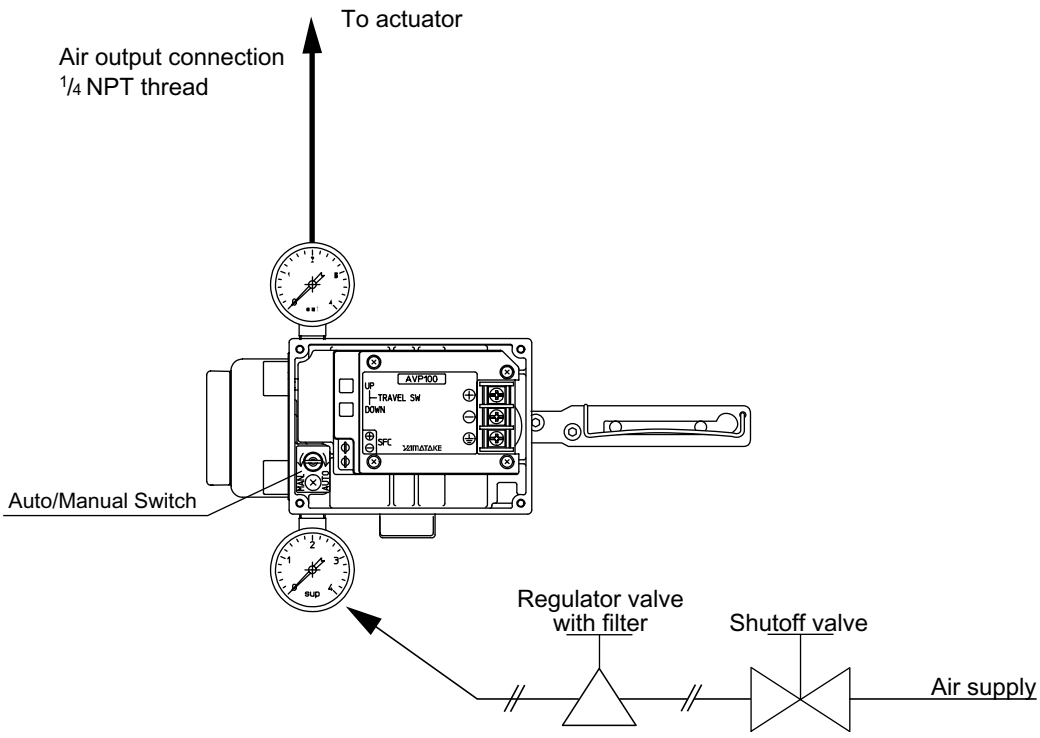
The Smart Valve Positioner can be attached to a variety of actuators. Example actuator mountings are shown below. Please refer to the installation instructions that came with your actuator mounting kit.

Attaching SVP to a typical globe valve (PSA Actuator AGVB valve] shown):



2-3 : Air Supply

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



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:

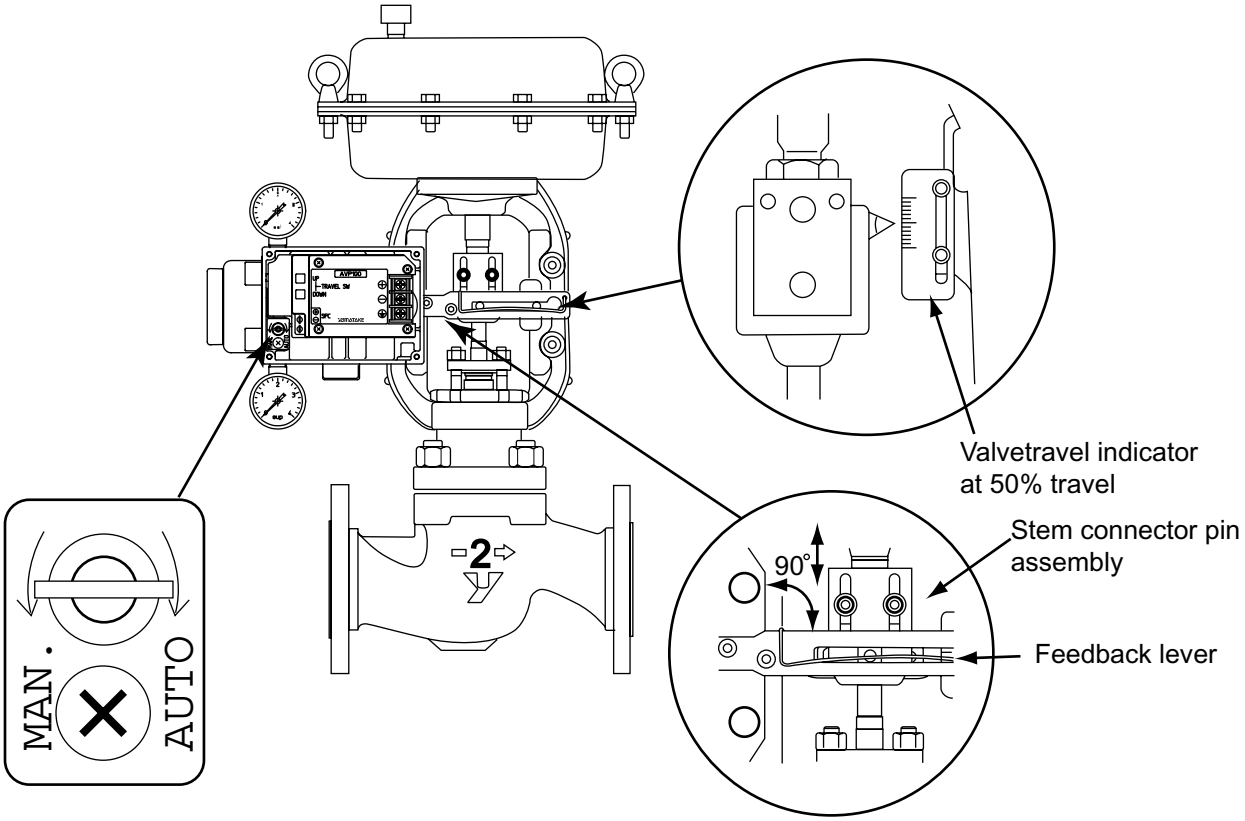
- Air supply pipes should have an inside diameter of 6mm (10mm outside diameter tubing recommended).
- Pipes should match the installation environment, i.e. for a corrosive environment, use vinyl-clad copper pipes.
- Use joints that precisely fit the pipes.

  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.



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.

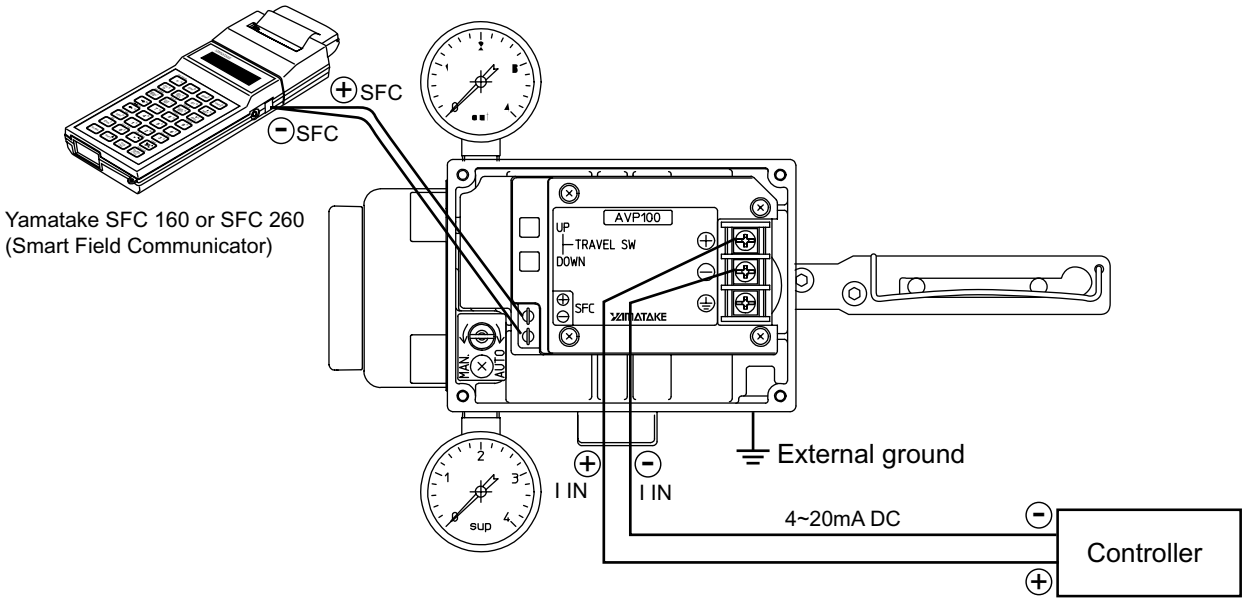
2-5 : Electrical Wiring

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 a Smart Field Communicator (SFC) are illustrated below.

An SFC can be connected directly to the hooks. Apply sufficient waterproofing treatment using nonhardening sealants made of silicone resins.

AVP100 (2-wire)

Model AVP100 operates from a 4-20mA analog input.



⚠ 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.
Wires from the terminal box must be sealed with proper fittings according to National Electrical Code (NEC) regulations when installed in hazardous environments.
Refer to NEC Article 501, 502, 503 for wiring details.

2-5-1 :Wiring Guidelines

- Power down before doing any wiring.
- SVP3000 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 (<100Ω resistance)
- Maximum permissible cable length is 1.28km.
- Use stranded cables having a conductor cross-section of 1.25 mm2 and suitable for 600V such as shown in the conductor table in Article 310 of the NEC (National Electric Code). Outside diameter on cables must be 6.35mm 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.

2-5-2 :Wiring Procedure

(1) Unscrew the screw on the cover and remove the cover.

(2) Remove one or both of the supplied Yamatake conduit connection blind plugs depending on how you plan to wire the SVP.

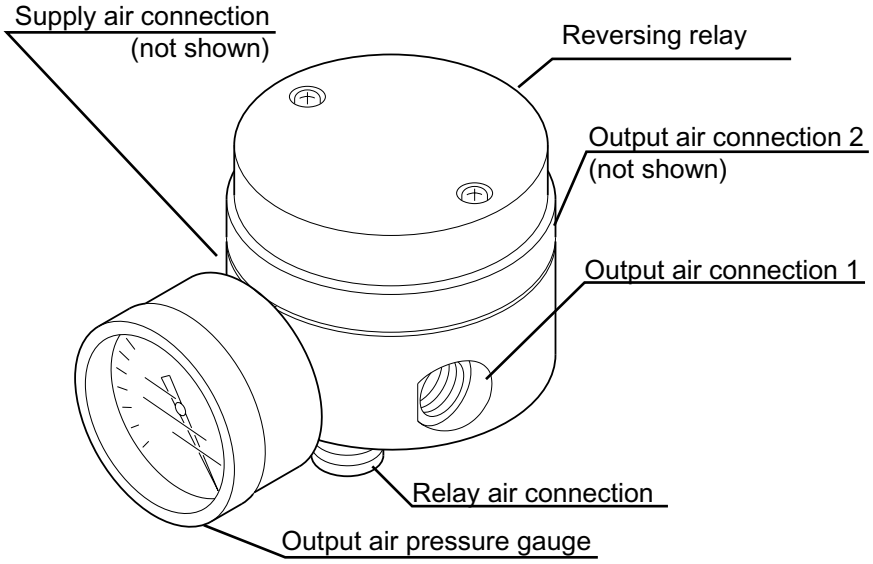
(3) Insert cables into the conduit connection. Strip and attach the appropriate wires to the terminals, checking for polarity. Crimp contacts with insulated sleeves are recommended.

(4) Tighten the terminal screws fully, to a torque of 1.5$N \bullet m$ (15 $kgf \bullet cm$).

(5) Put the cover onto the SVP and fasten the screw.

2-6 : Double-Acting SVP for Springless 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.



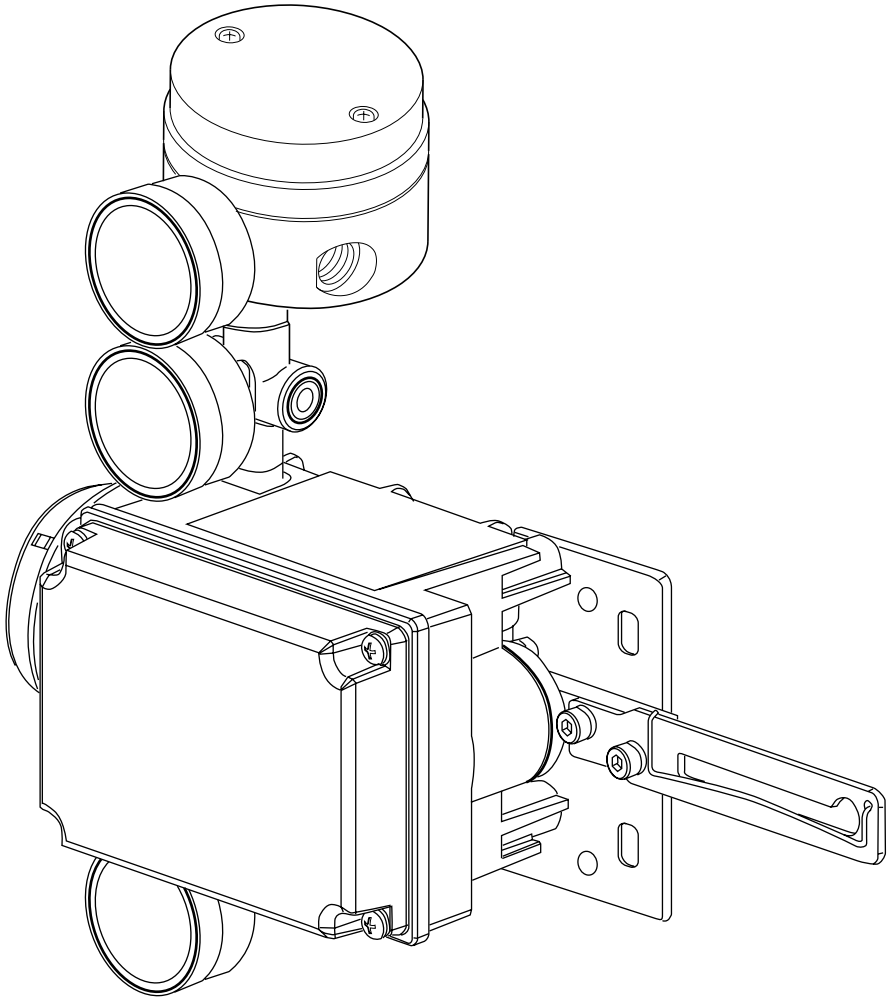
~Note *Make sure that the air piping connections and air pressure ranges as inscribed on the bottom of the reversing relay match your SVP.*

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

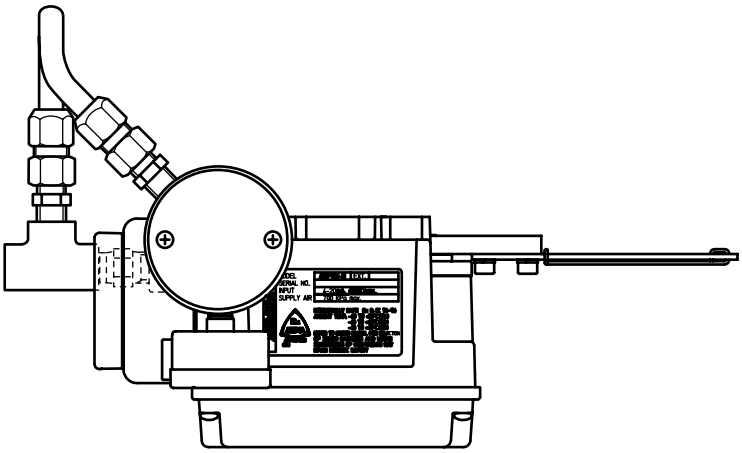
Remove the dust plug from the output air connection. Screw the Relay air connection of the reversing relay into the output air connection on the top of the SVP. Sealing tape is preferable to solid or liquid sealants for pipe joints to SVP air connections. Prevent sealing tape/sealant from entering pipes.

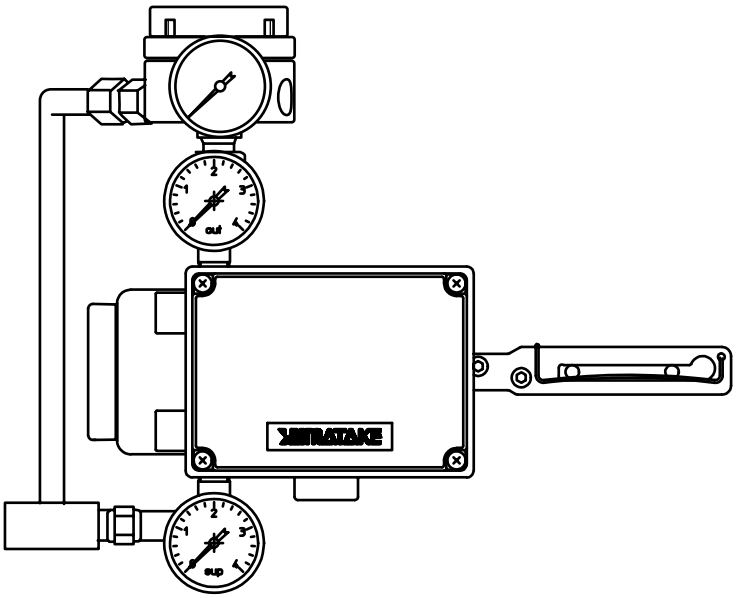


Reverse relay installed on an SVP

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.





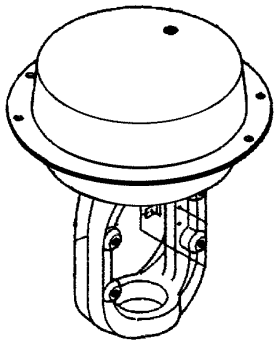
~Note ***Please note that the Auto/Manual switch is not used on Double-Acting SVPs.*** *When using the SVP3000 as a double-acting positioner, use the valve handwheel or air pressure regulator to perform SVP calibration such as that shown on page 2-7 and the "Zero-span adjustment by air pressure" on page 3-10, 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

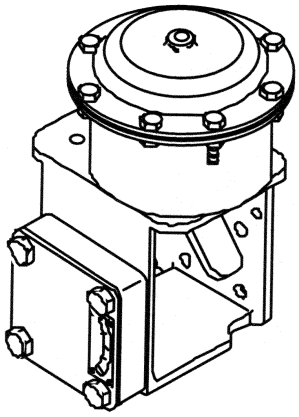
Connect **OUT2** of the Reversing Relay to the bottom actuator air port

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



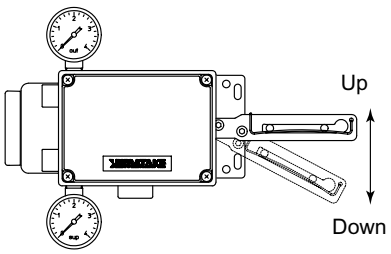
Reverse-Acting Actuator (counter-clockwise rotation with increased pressure)

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 SFC 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.

Table 2-1:

Lever	Valve direction	Control Valve	AVP Setting	
			Actuator	Valve action
	Shut→Open	Direct Shut 20mA, Open 4mA	Reverse	Reverse
		Reverse Shut 4mA, Open 20mA	Direct	Reverse
	Shut→Open	Direct Shut 20mA, Open 4mA	Direct	Direct
		Reverse Shut 4mA, Open 20mA	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 an SFC to manually set the Actuator to the correct action (Direct or Reverse) as per the steps on page 3-11.

If after Auto-setup, the SVP exhibits excessive overshooting (hunting), decrease the actuator parameter as per the steps on page 3-13.

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

Chapter 3 : Adjustments

Auto-setup

Auto-setup is a unique program for automatically making various positioner adjustments. After installing your SVP3000, Auto-setup should be performed. The travel zero-span adjustment switch on the SVP provides non-interactive closed and open valve position setting.

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

(1) Zero-span adjustment

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

(3) Actuator size setting

(4) Hysteresis setting

(5) 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-Yamatake actuator, then please refer to page 3-11 for instructions on how to enter the actuator type using an SFC (Smart Field Communicator). 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 SVP3000 be performed using the Zero-span adjustment 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 an SFC.

3-1 : Auto-setup

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 “3-8 : Manual SVP Settings” on page 3-11.

The travel switch is two position switchs used for triggering Auto-setup and doing manual zero-span calibration.

(1) Set the input signal to the SVP to 18 ±1 mA DC (use 4-20 mA DC power supply or a control signal)

(2) Open the front cover of SVP, push travel switch “UP“
(“DOWN” for FloWing Rotary VFR valve).
Hold this position until the valve starts to move (approximately 3 seconds). This starts the Auto-setup program. Release the switch.

The valve will move from fully shut to fully open twice. The valve will then open to about 50% and stay for up to 2 minutes. Confirm that Auto-setup is complete by varying input signals. The entire Auto-setup procedure should take about three minutes.

~Note *In some cases, the Auto-setup program will not properly detect your valve, especially if the valve’s actuator is smaller than Yamatake’s HA1 type actuator (diaphragm capacity of 850cm3) or the operation stroke is smaller than 14.3mm.*

Please contact your Yamatake representative for assistance.

Auto-setup and Zero-span operations use input signals to distinguish between the adjustment of the shut-off position (zero) and the fully opened position (span). As a result, calibration will not be accurate and the SVP will provide undesired results if the input signal for shut (zero) and fully open (span) are not ±1mA of the fully shut and fully open values programmed into the SVP.

After completing Auto-setup, verify accurate valve operation by varying the input signal.

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

If you have an Smart Field Communicator (SFC) connected to your SVP during an Auto-setup procedure and you performed the Auto-setup with a Zero-span adjustment switch, be sure to press the 

key on the SFC to read the new data from the SVP.

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 *Zero-span adjustment switch will only work if the shut off and full open input signals (i.e. 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)

(1) In order to properly calibrate the Zero position of your SVP, the forced fully closed setting (the percentage open below which the valve shuts completely) may either be set to 0% (if using an SFC is appropriate for the SVP's location) with the instructions on page 3-5, or you may determine the input signal just above the forced fully closed setting with the following equation:

To calculate the proper Zero position in mA for your SVP:

$$shut \cdot value(mA) + 0.005mA + \left(\frac{open \cdot value - (shut \cdot value)}{100} \times forced \cdot fully \cdot closed \cdot setting\right)$$

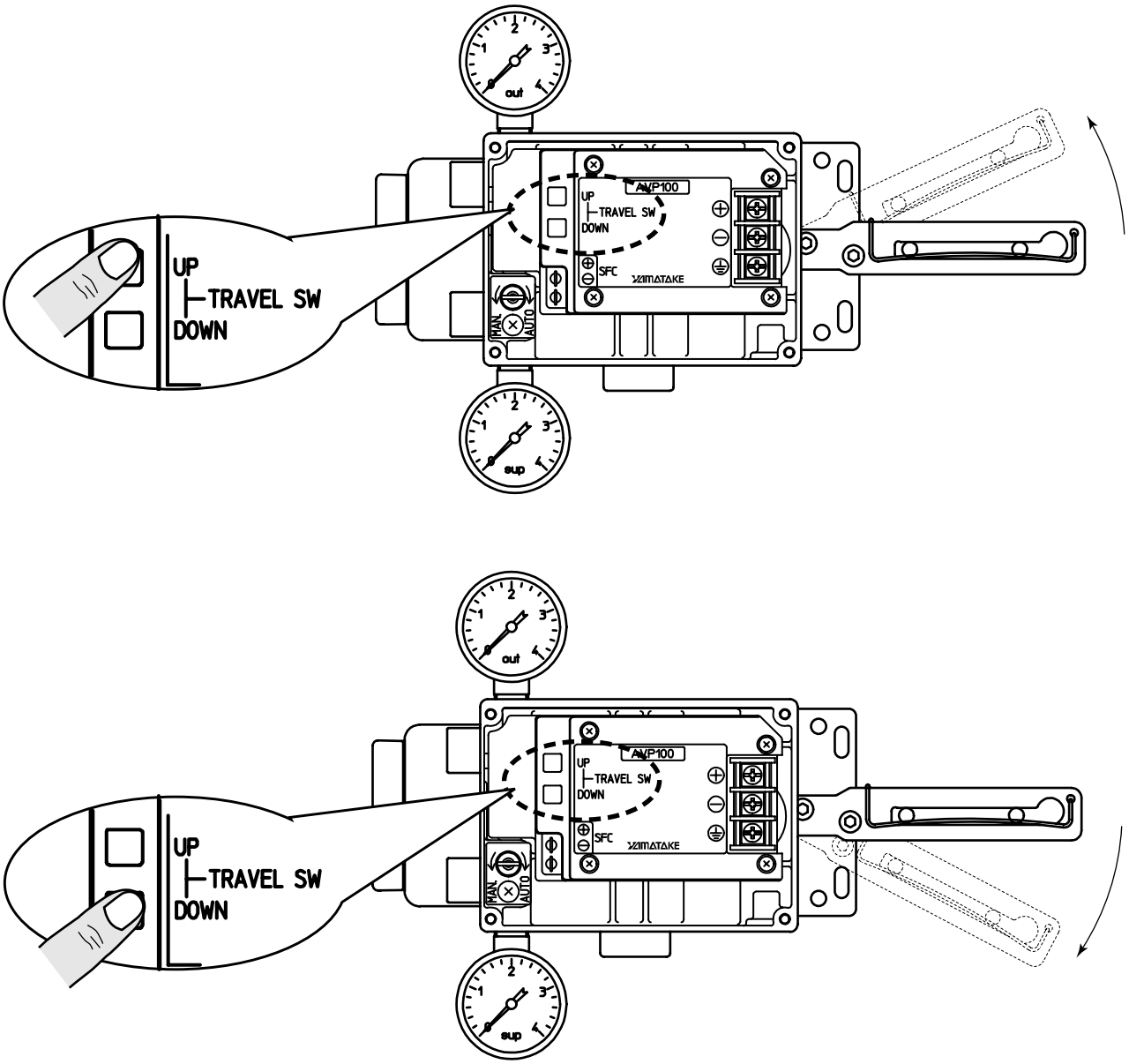
for example, the proper Zero position in mA for a 4-20mA range is:

$$4(mA) + 0.005mA + \left(\frac{20mA - 4mA}{100} \times 0.5\right) = 4.085mA$$

(2) From the controller or from a constant current supply, provide an input signal that corresponds to the valve closed (but not forced fully shut). This will be 4mA if you set the forced fully shut to 0% with an SFC, or a value such as 4.085mA if you used the equation above.

(3) Push the Zero-span adjustment switch "UP"until the valve opens slightly. Then, turn the Zero-span adjustment switch "DOWN"until the output air pressure gauge drops to 0 kgf/cm^2. Zero calibration is now complete.

(4) If you changed the forced fully closed **with an SFC, change it back to the proper setting now**.



Procedure for Adjusting the Fully Opened Valve Position (span)

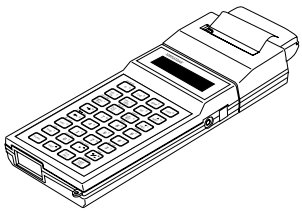
(1) From the controller or from a constant current supply, provide an input signal that corresponds to the valve fully opened (i.e. 20mA)

(2) Adjust the fully opened valve position by pushing the Zero-span adjustment 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.*

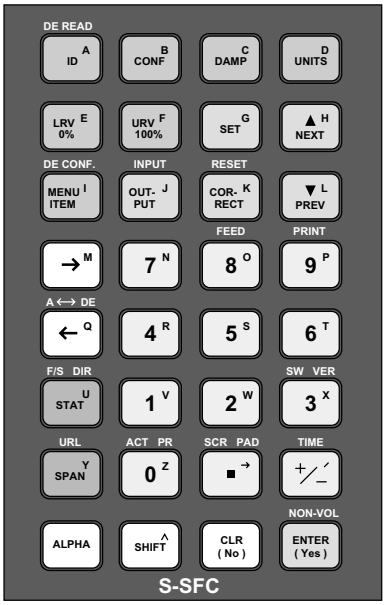
3-3 : Smart Field Communicator

The SFC has been developed as a communicator for connection to a range of Yamatake Smart Field products. This section includes only those instructions necessary for using an SFC with the Yamatake SVP3000. For further instructions, refer to the SFC Instruction Manual (CM2-SFC100-2001).



⚠ WARNING

Ensure that a sudden action of the valve, caused by a communicator operation, will not in any way harm people or equipment.
When Auto-setup is started, it will open and close the valve regardless of input signal status. Take necessary precautions before starting Auto-setup to prevent any harm to process operations or to personnel.
Always use the communicator in a non-hazardous location, otherwise an explosion may result from an electrical discharge.



~Note *Make sure the software revision in your model SFC 160/260 is version 7.5 or newer.*

~Note *Make sure the polarity of the SFC wiring is correct.*

~Note *If a colon (:) appears on the SFC screen in the 8th place on the upper line of the display, the battery needs replacement or recharging. Turn off the SFC and replace the batteries.*

~Note *While Auto-setup is running, do not drop the input signal below 4 mA or you will have to restart the Auto-setup procedure.*

~Note *When any operation is completed, keep an input signal of at least 4mA for at least 30 seconds to ensure that the settings are recorded in memory.*

~Note *Power must be supplied on both input and output sides of the SVP when using an SFC. If there is no controller available, connect a constant power supply (such as a CCS) to the input signal terminal.*

~Note *Make sure the SVP is connected to a constant power supply. If the SVP is connected to a controller (a top-level control room), then make sure the loop is in manual and that a constant power supply will be maintained.*

~Note *Connect the SFC (powered off) to the output testing clip loops next to the terminals screws.*

Be careful not to short the wires.

3-4 : SFC Keyboard Operations

Press keys slowly and firmly. No reaction on the screen would indicate that the key pressed was not accepted.

Questions displayed on the screen require that you press NON-VOL ENTER (Yes) (yes) or CLR (No) (No) to acknowledge.

Keys pressed during communication with the SVP are ignored. Wait until communications are complete.

During communication with the SVP, either the cursor on the screen will be invisible,

or 

SFCM00006015D will be displayed.

3-5 : SFC Errors

If a Hash (#) mark appears in the lower right corner of the screen, then an alarm condition exists. Either there is an error, or the SVP is in Dummy I/O state.

Press SHIFT ^ - F/S DIR STAT U to see what error conditions exist. If there is more than one, then each error condition will flash for 3 seconds. See the Troubleshooting section for further explanation and resolution of error conditions.

3-6 : SFC Starting Communications

1) Power on the SFC.

2) | LOOP IN MANUAL ? | is displayed. Press NON-VOL ENTER (Yes)

3) If your SVP configuration has analog valve position output (or none), then press DE READ ID A

If your SVP configuration has digital valve position output, then press SHIFT ^ - DE READ ID A .

It may take up to 45 seconds to start communications between the SFC and SVP.

4) A TAG No. entry screen appears

SVP TAG No.
SVP XXXXXXXX

You may either enter a Tag number (up to 8 alphanumeric characters) or press CLR (No) to exit.

Press ALPHA to toggle between letter and number entry.

Press NON-VOL ENTER (Yes) , CLR (No) when you are finished.

5) The SFC is now in the **Ready State**.

Before performing ANY operation on an SFC connected to an SVP, make sure you are in the Ready State.

Pressing CLR (No) several times will get you back to the Ready State.

SVP PCV-123
READY...

(Example TAG No. of PCV-123 shown)

3-7 : Auto-setup and Zero-span using the Smart Field Communicator

Auto-Setup Procedure

1)Press CONF (B) to enter configuration mode. You will see

```
SVP CONFIG
SYSTEM CONFG?
```

2)Press ▼ PREV (L) twice to get

```
MAINTE MODE
```

Press NON-VOL ENTER (Yes).

3) The screen will now display

```
MAINTE MODE
AUTO SETUP?
```

. Press NON-VOL ENTER (Yes).

4) Press NON-VOL ENTER (Yes). The screen will now display

```
AUTO SETUP
ARE YOU SURE!?
```

Press NON-VOL ENTER (Yes).

5) Once Auto-setup begins, the SVP opens and closes the valve twice and then opens it to 50% for as long as 2 minutes to detect the valve characteristics.

6) Although actual time depends on the valve size, Auto-setup usually takes about 3 minutes.

7) Confirm proper valve operation by varying input signals. Follow the zero and span adjustment procedure below if Auto-setup did not correctly set them.

8) Press DE READ ID (A), DE READ ID (A), CLR (No) to return to the Ready State.

Zero-span adjustment by input signal

First, you must set the forced fully closed setting to 0%

1) Press [B CONF] to enter configuration mode. You will see

```
SVP CONFIG
SYSTEM CONFG?
```

2) Press [▲ H NEXT] four times to get

```
ON / OFF CONFIG?
```

. Press [NON-VOL ENTER (Yes)] .

3) You will see the Shut Off Value screen

```
SHUT OFF VALUE
0.5000% IIN
```

.

Enter in a value of 0 and press [NON-VOL ENTER (Yes)] .

4) Press [▲ H NEXT] twice, [NON-VOL ENTER (Yes)] , [CLR (No)] . Shut-off is now set to 0%.

5) From the controller or from a constant current supply, provide an input signal that corresponds to the valve shut-off (i.e. 4mA)

6) Make sure the SFC screen displays

```
SVP       PCV-123
 READY...
```

7) Press the [LRV] button twice. You should see

```
LRV   PCV-123
SHUT
```

8) Press the [RESET COR- K RECT] button to start adjusting the Shut position. Default fine-tuning adjustment is 0.006°.

Press [DE CONF. MENU I ITEM] to cycle the adjustment between 0.006°, 0.03°, 0.3°, 3°, and 30°.

Press [▼ L PREV] and [▲ H NEXT] to adjust the shut off position.

```
CORRECT LRV
INC/DEC 0.006°
```

9) Once the valve is shut, press [CLR (No)] twice. Then press [SHIFT ^] + [NON-VOL ENTER (Yes)] to save.

10) From the controller or from a constant current supply, provide an input signal that corresponds to a full-open valve (i.e. 20mA)

11) Make sure the SFC screen displays

```
SVP       PCV-123
 READY...
```

12)Press the URV 100% button twice. You should see

```
URV    PCV-123
OPEN
```

13) Press the RESET COR-RECT button to start adjusting the Open position. Default fine-tuning adjustment is 0.006°.

Press DE CONF. MENU ITEM to cycle the adjustment between 0.006°, 0.03°, 0.3°, 3°, and 30°.

Press ▼ PREV and ▲ NEXT to adjust the shut off position.

```
CORRECT URV
INC/DEC 0.006°
```

Once the valve is fully open, press CLR (No) twice. Then press SHIFT + NON-VOL ENTER (Yes) to save.

Zero-span adjustment by air pressure

1) Set the forced fully closed setting to 0% (" Zero-span adjustment by input signal" on page 3-9 steps 1-3)

2) From the controller or from a constant current supply, provide an input signal that corresponds to the valve shut-off (i.e. 4mA)

3) Using the Auto/Manual switch, set the SVP to manual mode (see (1), page 2-7).

4) Using the air regulator valve, adjust the supply air pressure to fully close the valve.

5) Make sure the SFC screen displays

```
SVP      PCV-123
 READY...
```

6) Press the LRV 0% button twice. It displays

```
LRV    PCV-123
SHUT
```

7) Make sure the valve is in the shut-off position. The screen should display

```
VTD  SET?
```

8) Press SET, NON-VOL ENTER (Yes), CLR (No), SHIFT + NON-VOL ENTER (Yes) to finish the zero setting and save.

9) From the controller or from a constant current supply, provide an input signal that corresponds to the valve fully open (i.e. 20mA)

10) Using the air regulator valve, adjust the supply air pressure to fully open the valve.

11) Make sure the SFC screen displays

```
SVP      PCV-123
 READY...
```

12) Press the URV F 100% button twice. It displays

```
URV    PCV-123
OPEN
```

13) Make sure the valve is in the shut-off position. The screen should display

```
VTD  SET?
```

14) Press SET G, NON-VOL ENTER (Yes), CLR (No), SHIFT ^ + NON-VOL ENTER (Yes) to finish the span setting and save.

15) Return the Auto/Manual switch to automatic.

16) Adjust the regulator valve to restore the original supply air pressure.

3-8 : Manual SVP Settings

If your SVP was ordered without a specified Actuator, then several parameters need to be entered manually into the SVP using an SFC.

1) Connect an SFC to the SVP (Refer to "2-5 : Electrical Wiring" on page 2-8.).

2) From the Ready State, press CONF B to enter configuration mode. You will see

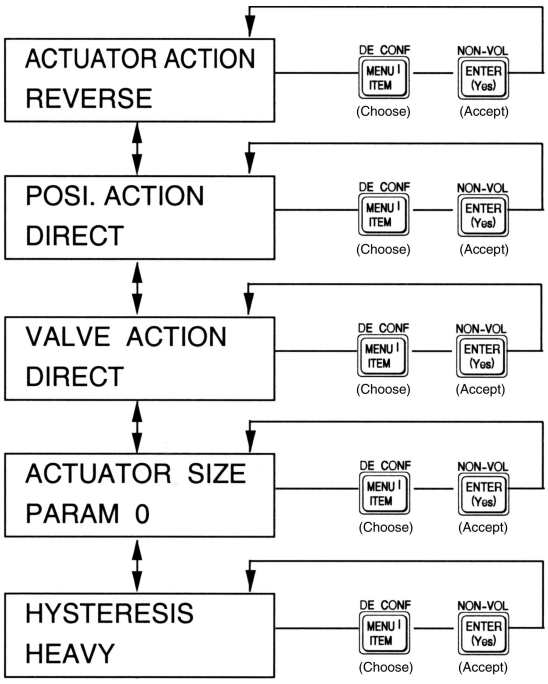
```
SVP CONFIG
SYSTEM CONFG?
```

3) Press NON-VOL ENTER (Yes), then press ▼ L PREV and ▲ H NEXT to cycle through the following tree of settings:

Press URV F 100% to choose an option and NON-VOL ENTER (Yes) to confirm.

Example Actuator types and sizes:

Actuator type	PARAM
VA1, HA1, PSA1	1
VA2, HA2, PSA2	2
VA3, HA3, PSA3	3
VA4, HA4, PSA4	4
VA5	5
VA6	6
VR1	7
VR2	8
VR3	9
Other	0



Select the size of hysteresis error resulting from the friction of the gland packing of the control valve:

Gland Packing Material	HYSTERSIS
Graphite packing	HEAVY
Braided PTFE packing	MEDIUM
PTFE Chevron packing	LIGHT

After you have changed all necessary settings, save the changes to the SVP.

Press ▼ L PREV or ▲ H NEXT until you see this screen:

SYSTEM CONFIG
DOWNLOAD DATA?

Press NON-VOL ENTER (Yes) to write the settings to the SVP.

SYSTEM CONFIG
DATA LOADED!

Manual SVP Settings - Gain

If the predefined actuator types do not effectively control the valve, then choose the unspecified actuator type (page 3-11). Once you set the actuator type to 0, you must manually set the Gain to properly actuate the Valve. Also, in case of hunting or over-shoot, varying the Gain may be required for your valve. Note that the CTL CONFIG menu item won't appear unless you have chosen an actuator type of 0.

From the Ready State, press B CONF. Press ▲ H NEXT to get to

```
CTL CONFIG
```

.

Press NON-VOL ENTER (Yes).

Using the number pad on the SFC, enter in a new Gain or fine-tuning amount (P). If the SVP is hunting, then make the P value smaller.

```
CTL CONFIG
P=2.000
```

"P=2.000" represents $2\%^{-1}$ = 1/2% = 50%

Press NON-VOL ENTER (Yes), ▼ L PREV.

```
CTL CONFIG
DOWNLOAD DATA?
```

Then press NON-VOL ENTER (Yes).

```
CTL CONFIG
DATA LOADED!
```

Manual SVP Settings - PID

The SVP employs a gap-action type PID method with upper and lower limits to compensate for oscillation above and below a setpoint.

This method provides high responsiveness and high stability with relatively simple tuning.

The PID parameters are:

Parameter	Description	Unit
P	Reciprocal of the proportional band inside the gap	$\%^{-1}$
I	Reciprocal of the integrated time inside the gap	S^{-1}
D	Differentiated time inside the gap	S
GE	Gap width	%
GP	Reciprocal of the proportional band outside the gap	$\%^{-1}$
GI	Reciprocal of the integrated time outside the gap	S^{-1}
GD	Differentiated time outside the gap	S

If GE (Gap width) is set to 0, then GP, GI, and GD cannot be set.

From the Ready State, press 

. Press 

to get to CTL CONFIG.

Press 

or 

to cycle through P, I, D, GE, GP, GI, GD, and DOWNLOAD.

Press 

and then enter the desired value for each parameter.

Press 

, 

.

```
CTL CONFIG
DOWNLOAD DATA?
```

Press 

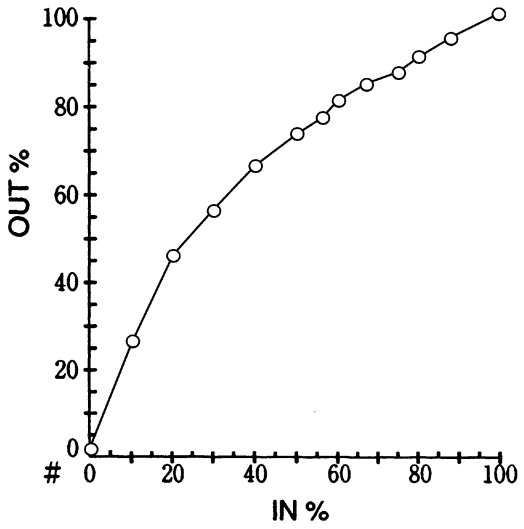
to save your changes.

3-9 : Configuring Control Signal / Valve Travel relationship using an SFC

Control valves normally provide a range of fully shut to fully open with a 4 to 20 mA (or 20mA to 4mA for Direct-acting actuators) control signal. However, there are many situations where a linear 4 to 20 mA range is not appropriate. The valve may need to open with an equal percentage instead of linearly, or be a quick-opening valve. You may also need to operate two valves in series, or two alternate valves (such as hot and cold) from a single control signal.

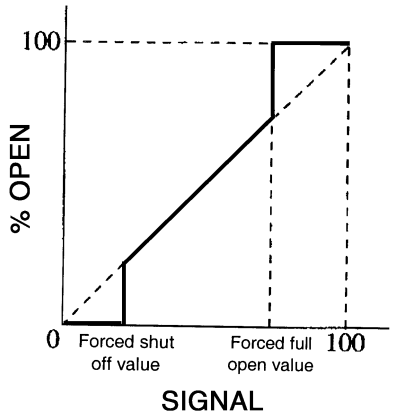
With the Yamatake SVP3000 Smart Valve Positioner, you can easily create the proper relationship between control signal and actual valve opening. Through the use of an SFC, any range curve, including split-ranging for two or more valves, can be set by entering an array of sixteen input (IN%) and output (OUT%) values.

The table and graph below show an example Flow Characteristic curve for a Reverse-acting actuator operating within 4-20 mA with a custom curve. Sixteen points have been entered into the SVP. As you can see, where point 2 is closed, point 1 is forced fully shut (with an SFC value of -19999), producing tight shut-off. Points 13, 14, and 15 are redundantly set to fully open, and point 16 is forced fully open (with an SFC value of 19999).

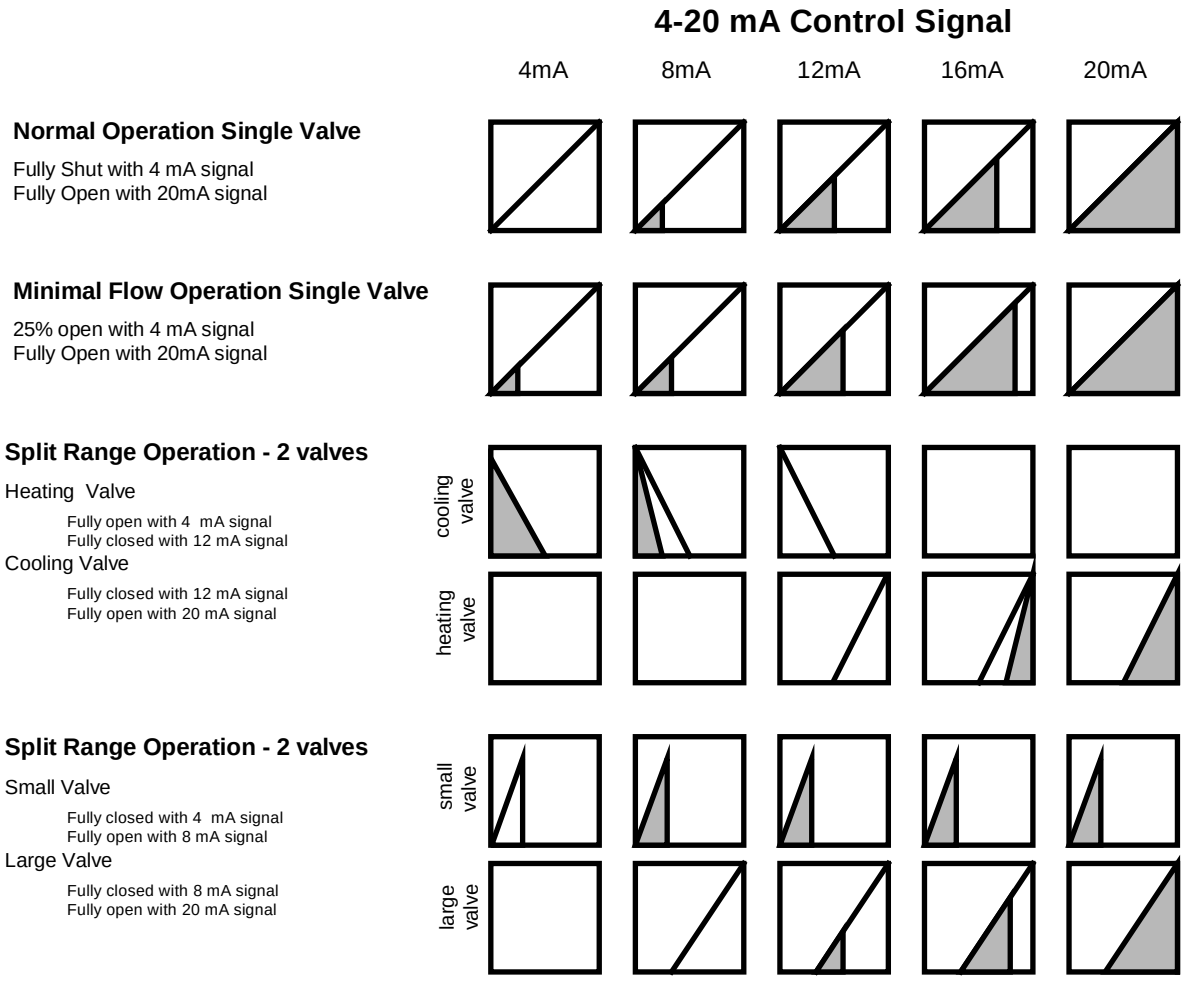


Point	Control Signal Input %	Valve Opening %	SFC IN % ENTRY	SFC OUT % ENTRY
1	4mA 0%	Forced Fully Shut 0%	-19999	-19999
2	4mA 0%	0%	0.000	0.000
3	4.53 mA 3.34%	5.26 %	3.34	5.26
4	4.68 mA 4.85%	10.52%	4.85	10.52
5	5.49 mA 9.33%	21.05%	9.33	21.05
6	6.09 mA 13.09%	31.05%	13.09	31.05
7	6.70 mA 16.86%	42.10%	16.86	42.10
8	7.94 mA 24.60%	52.60%	24.60	52.60
9	10.81 mA 42.59	63.20%	42.59	63.20
10	14.45 mA 65.30	73.68%	65.30	73.68
11	17.4 mA 83.75%	84.21%	83.75	84.21
12	19.32 mA 95.76%	94.70%	95.76	94.70
13	20mA 100%	100%	100.0	100.0
14	20 mA 100%	100%	200.0	200.0
15	20 mA 100%	100%	400.0	400.0
16	20 mA 100%	100%	19999	19999

As explained earlier (“ Zero-span adjustment by input signal” on page 3-9 steps 1-4), the SVP has forced fully shut and forced fully open settings, which depend on the actuator and valve to be used. These will have already been programmed into your SVP.



3-9-1 :Examples



Flow Characteristics Examples

Normal Operation Single Valve

A single valve ranging from fully closed to fully open in a 4 to 20 mA signal.

Minimal Flow Operation Single Valve

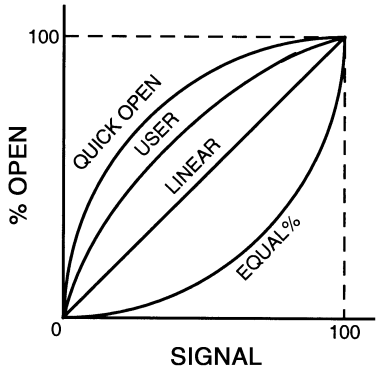
A single valve might start at 25% open and range to fully open in a 4 to 20 mA signal (Low fire burner application).

Split Range Operation - Hot + Cold valves

Two valves might be used in heating-cooling applications where one valve (heating) is fully open at 4mA and fully shut at 12 mA, while the other valve (cooling) is also fully shut at 12 mA and fully open at 20 mA. They might be a gap between the operation of the two valves or they might overlap.

Split Range Operations - 2 valves

A small valve might be fully shut at 4 mA and fully open at 8mA, with a larger valve fully shut at 8 mA and fully open at 20 mA.



The SVP receives a control signal (typically 4 to 20mA) and based on the flow characteristic setting in the SVP, provides a certain % valve opening.

This flow characteristic can be Linear, Equal %, Quick Open, or a User-defined array of 16 points defining a curve (see the examples on page 3-15 to page 3-17).

To set the flow characteristic of your SVP, connect an SFC and make sure it is in the Ready State.

Press the B CONF button and then press ▼ L PREV until you see

CONFORM CONFIG

.

Press the DE CONF. MENU I ITEM button to cycle between LINEAR, EQUAL%, QUICK OPEN, and USER settings.

Now press NON-VOL ENTER (Yes) twice to confirm the setting. If you chose USER, then proceed to the steps below.

Once you have chosen the USER flow characteristic, you must determine the appropriate sixteen steps or points with input signal and valve % opening. Once you have defined a curve, you enter those values into the SVP using an SFC.

From the Ready State, press B CONF and then press ▼ L PREV until you see.

CNV CONFIG

Press ▼ L PREV to rotate between the sixteen points, enter in the value for each, and press NON-VOL ENTER (Yes) to confirm each setting.

Once you have set the sixteen points, you should see the screen shown.

CNV CONFIG DOWNLOAD DATA?

Press NON-VOL ENTER (Yes) to save your new settings.

If desired, you may print the settings on an SFC by pressing ▼ L PREV until you see

Then press NON-VOL ENTER (Yes) to print.

If ordered with process conditions specified, then the SVP will be shipped with the proper input signal range. If you need to change these, or the SVP was sent without any valve or actuator specifications, and the input signal range is not 4 mA to 20 mA, then follow the steps below to set the proper input signal range.

Setting the input signal value for the shut-off valve

From the Ready State, press [LRV E 0%] three times.

SVP PCV-123 READY...	LRV PCV-123 SHUT 4.000mA

Enter in a new input signal value for the shut-off valve.

Press [NON-VOL ENTER (Yes)] to save the shut-off value. Press [CLR (No)] to return to the ready state.

Setting the input signal value for the fully-open valve

From the Ready State, press [URV F 100%] three times.

SVP PCV-123 READY...	LRV PCV-123 SHUT 20.000mA

Enter in a new input signal value for the fully-open valve.

Press [NON-VOL ENTER (Yes)] to save the fully-open value. Press [CLR (No)] to return to the ready state.

3-10 : Verifying SVP Input Signal, EPM Output, and Valve Travel Output

The mode of communication between the SVP and an SFC is normally in SVP or Valve Positioner mode. Some functions require you to switch into SVT or Valve Travel Transmitter mode. With the OUT_PUT button, you can verify what input signal is being received by the SVP, the%DUTY output from the Electropneumatic Module.

From the Ready State, press [DE CONF. MENU I ITEM] to switch between SVP and SVT modes.

Press [INPUT OUT- J PUT] to display the information. (Press [SHIFT ^] - [INPUT OUT- J PUT] to determine EPM in SVT mode)

Chapter 4 : Maintenance

Should diagnostics indicate the presence of dirt in the A/M screw assembly (the filter, holder and O-ring), the filter should be changed and maintenance done on restriction.

Maintenance Procedure - Auto/Manual switch

1) Remove the screw from the A/M switch nameplate

~Note *After removing screw, set parts aside for easy replacement*

2) With a flathead screwdriver, turn the A/M switch counterclockwise

~Note *First reduce the air supply to prevent forceful ejection of the A/M switch*

3) Cut holder with clipper. Remove filter. Dispose of old filter and holder

4) Using a wire or tool of .01” gauge diameter, clean throttle hole

⚠ CAUTION

To avoid damage to the throttle hole do not use an airgun. Do not oil the throttle.

5) Wind new filter around A/M switch and secure with new holder

6) Reassemble A/M switch

7) Reassemble name plate and cover plate of A/M switch

Electropneumatic Module (EPM)

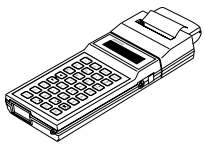
Excessive shock should be prevented because the point of balance of the EPM (electropneumatic module) may be affected, resulting in poor responsiveness, or malfunction. To restore the EPM to its original performance level, adjustment is required. Please contact Yamatake.

Chapter 5 : 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 an SFC 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. An SFC is used to determine major failures.



If you have an SFC connected to the SVP and a Hash (#) mark appears in the lower right corner of the screen, then an alarm condition exists. To determine the error:

Make sure the SFC is in the Ready State.

Press SHIFT ^ - F/S DIR STAT U to see which error conditions exist. If there is more than one, then each

error condition will flash for 3 seconds. See page 5-2 to see a list of error conditions as well as the SFC error code and text message that is returned for each error, and possible solutions.

5-1 : Troubleshooting Codes

SFC Code	SFC Message	Cause	Correction
1	LOW IIN	Input signal too low (3.8mA or lower)	Provide an input signal of at least 3.8mA
2	VTD FAULT	(Valve position sensor) Feedback lever has fallen off or has turned beyond the allowable turning angle	Check if feedback lever has fallen off and that it is within permissible turning angle
3	A/D FAULT	(Analog/Digital conversion)	Contact YAMATAKE
4	NVM FAULT	(Non-Volatile Memory)	Contact YAMATAKE
5	RAM FAULT	(RAM error)	Contact YAMATAKE
6	ROM FAULT	(ROM error)	Contact YAMATAKE
7	SHUT DN	SVP is forced fully closed	Apply an input signal above the forced fully shut value Use the SFC to check and/or adjust the forced fully open/close values(%)
8	HI/LO EPM OUT	Electropneumatic Module is outside normal range No air being supplied Valve is closed Galling of valve stem Clogged nozzle Clogged orifice	Check air supply pressure Confirm A/M switch is Auto Clean orifice Adjust the EPM balance
9	EXT ZERO ACTIVE	External Zero-span adjustment is being made	Release the external Zero-span adjustment screw
A	MANUAL MODE	Dummy input signal from SFC	Cancel dummy current input
B	FIXED EPM OUT	Dummy EPM pseudo-drive signal from SFC	Cancel dummy EPM signal
C	OUTPUT MODE	Dummy pseudo-signal output state for SFC	Cancel dummy output
D	CORRECT RESET	Data was reset at the time of shipment	Set Actuator type and other parameters before use
E	OVER TEMP	Abnormal Temperature within SVP unit	Check SVP temp and move to cooler location

5-2 : General Troubleshooting

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

If the troubleshooting procedures below do not fix the problem, please contact your Yamatake representative.

Non-Operation of the SVP (no output air pressure)

1) Confirm that the internal SVP settings for actuator size, hysteresis, etc. (page 3-9 and page 3-10) are appropriate for your control valve.

2) Make sure that the SVP feedback lever is not exceeding a 20º angle of rotation. If it is, add an extension bracket to the feedback lever to provide the necessary feedback lever length.

3) Check for air leaks in air supply

4) Check electrical input signals

5) If communication can be made with a SFC perform self diagnostics as described on page 5-1 and page 5-2 and take action based on errors messages.

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

1) Change the A/M switch to manual (page 2-7) and adjust the air pressure using the regulator valve from fully open to fully closed. Watch to see if valve stem moves smoothly. If it does not, this may indicated galling or hardening of the valve packing.

2) Confirm that the internal SVP settings for actuator size, hysteresis, etc. (page 3-11) are appropriate for your control valve.

3) Hunting, Overshoot

- Change hysteresis setting from medium to heavy. If problempersists, set hysteresis at heavy and change the actuator size setting to smaller PRAM numbers.
- Check permissible angle of rotation of feedback lever.

4) Absence of full stroke, Slow response

- Check the zero (fully closed) and span (fully opened) are properly adjusted
- Check the EPM drive signals are within range of 50+/-25%

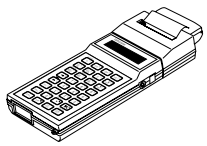
No communication possible with an SFC

1) Check input signal wiring. 4mA is required for the SVP to operate.

2) Check that the SFC and SVP are wired properly (“2-5-1 :Wiring Guidelines” on page 2-9).

3) If the SFC will not power on, check the batteries.

5-3 : Troubleshooting - Printing



To get a printed summary of the internal SVP settings and parameters, from the Ready

State, press SHIFT - PRINT 9 P (SFC with printer attachment only).

An example of a configuration print is shown below.

	'94-12-03 14:30	Date/hour
	TAG NO. PCV-0123	Tag number
	PROM# : 2012345637	Serial number
	SW VER : 1.0	Software version
	ANA/DE : ANALOG XMTR	Output format
	F/SAFE : DOWNSCALE	Burnout direction
	SV : T= 17℃(64°F)	Inside sensor temperature
	FORM : USER	Flow characteristic
	A ACT : REVERSE	Actuator action
	P ACT : DIRECT	Positioner action
	V ACT : DIRECT	Valve action
	A SIZE: PARAM 0	Actuator size
*1	HYST : HEAVY	Hysteresis (gland packing)
	LRV : 4.000 mA	Lower limit of input range (input value for shut off valve)
	URV : 20.00 mA	Upper limit of input range (input valve for full open valve)
*2	P : 2.000	P
*2	I : 10.00	I
*2	D : 0.2500	D
*2	GE : +/-5.000 %	GE
*2,3	GP : 1.000	GP
*2,3	GI : 10.00	GI
*2,3	GD : 0.2500	GD
	SHT LO: 0.5000 %IIN	Input valve for forced shut off valve
	SHT HI: 109.00 %IIN	Input valve for forced full open valve
*4	INPUT : 12.00 mA	Input current value (mA)
*4	: 50.00 %IIN	Input current value (%)
*4	OUTPUT: 50.00 %STROKE	Valve position
*4	EPM : 58.20 %DUTY	EPM (electropneumatic module) drive signal
*5	UDC	User-defined flow characteristics conversion data
	NO. IN % OUT %	
	1 : -19999 , -19999	
	2 : 0.000 , 0.000	
	:	
	:	
	15 : 100.00 , 100.00	
	16 : 19999 , 19999	
*4	STATUS CHECK= OK	Result of SVP self-diagnosis

*1) Not printed when the actuator size is set at PARAM0.

*2) Not printed when the actuator size is set at PARAM1 to 9.

*3) Not printed when GE is set 0.

*4) In case of minor trouble, # is printed at the right end.

*5) Not printed when the output format is set at LINEAR, EQUAL%, or QUICK OPEN.

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