# Smart Valve Positioner 700 Series with HART Communication Protocol



# azbil

#### Notice

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### Introduction

Thank you for purchasing our AVP702 Smart Valve Positioner. The AVP702 (called "the device" below) is a smart valve positioner that can be connected to the 4 to 20 mA loop.

The auto setup function makes it easy to set up the valve.

All adjustments and setup can be performed from the HART communication. The Local User Interface (LUI), which consists of the LCD (liquid crystal display) and operation buttons, facilitates monitoring of input signals, valve opening, pressure display, and other items as well as basic adjustments.

In addition, the built-in pressure sensor can be used to measure the supply air pressure and output air pressure. As a result, the device can not only perform self-diagnostics but can also be combined with the control valve maintenance support system called "Valstaff" in order to monitor the characteristics, operating status, and other data of the control valve, helping to improve the maintenance efficiency of control valves. This instruction manual describes how to handle the device. Read this manual to make full use of the features of this product.

#### Scope of this manual and related documents

This document describes the functions and method of installation and adjustment of this device. For details on HART communication, refer to *Smart Valve Positioner 700 Series with HART Communication Protocol Model AVP701/702 HART Communication Manual* (No. CM2-AVP702-2002\*).

For details on the control valve diagnostic items, refer to the "Smart Valve Positioner 700 Series Control Valve Diagnostic Function Manual" (No. CM2-AVP700-2003\*).

\* If you need the above documents, please contact one of our sales representatives.

# Safety precautions

#### Symbols

The purpose of the safety precautions listed here is to ensure the user uses the product safely and correctly, to prevent harm to the user and other people and damage to property.

Make sure to obey the safety precautions.

Many different symbols are used in this manual.

Their appearances and meanings are as described below. Thoroughly understand the explanation before starting to read the main text.

**Warning** Wrong handling may cause the death or severe injury of the user.

Cautions Wrong handling may cause a minor injury to the user or damage to equipment.

#### Sample symbols

|            | This symbol indicates "warnings" and "cautions" that you must pay attention to when handling the device. |
|------------|--|
| $\bigcirc$ | This symbol indicates "prohibited" actions that must not be taken.                                       |
| 0          | This symbol indicates "instructions" for the action that must be taken.                                  |

### Precautions for safe work

|            | ⚠Warning   |  |  |  |
|------------|--|--|--|--|
|            | Do not perform wiring with wet hands or while the device is energized. This may lead to electric shock. Turn the power off before starting the work and work with dry hands or use gloves.     |  |  |  |
| •          | Follow the work procedure defined in the explosion protection guidelines of countries when performing the power distribution work in an explosion-proof area.                                  |  |  |  |
| $\bigcirc$ | For devices equipped with the pressure-resistant, explosion-proof specifications, open/close the explosionproof enclosure and the cover according to "Chapter 7 Notes on the Explosion-Proof". |  |  |  |
|            | <b>∆</b> Cautions  |  |  |  |
| $\bigcirc$ | Do not get on the installed device or use it as a step stool. This is dangerous because the device may tip over.   |  |  |  |
| $\bigcirc$ | Do not touch the device during operation without reason. This is dangerous because the surface may be hot or cold depending on the usage environment.  |  |  |  |
| 0          | Be careful not to touch the edge of the cover or the screw threads of the main unit when opening the cover of the terminal box. You may be injured by these parts.                             |  |  |  |
| 0          | Use a DC power supply with overload protection. Overload may cause smoke or fire.  |  |  |  |
| 0          | If a tool or other item touches the glass part of the display, it may break, leading to an injury.<br>Be careful. Wear safety glasses during work.   |  |  |  |
| 0          | This product is heavy. Be careful where you step and wear safety shoes during work.  |  |  |  |
| $\bigcirc$ | Do not touch the feedback lever or other moving part while the device is operating. You may be injured by getting your hand or other body part caught in them.                                 |  |  |  |
| 0          | Properly use the power supply based on the specifications. Inputting a different power supply may damage the device.   |  |  |  |
| 0          | Use gloves and other protective equipment during work in a hot, cold, or other severe environment.   |  |  |  |
| $\bigcirc$ | Do not move the device close to a magnet or magnetic driver. The control valve may operate.  |  |  |  |
| 0          | Apply the correct supply air pressure in acoordance with the specification of the device. The overpressure may cause abnormal actions of the control valve or damage to the pressure gauge.    |  |  |  |

### Precaution for disposal of Electrical and Electronic Equipment

#### **Disposal of Electrical and Electronic Equipment (for Environmental Protection)** This is an industrial product subject to the WEEE Directive. Do not dispose of electrical and electronic equipment in the same way as household waste. Old products contain valuable raw materials and must be returned to an authorized collection point for correct disposal or recycling.

## **Unpacking, Verification, and Storage of Product**

### Unpacking

This device is precision measuring equipment. Carefully handle it to prevent accidents or damage.

After unpacking, check that the items below are included.

- The device
- Feedback lever and hexagon socket bolts x 2
- (4-mm) hexagon wrench x 1 (for feedback lever) (Included only when the device is shipped alone.)
- Regulator (optional)
- Mounting plate set (optional)
- Pressure-resistant packing cable adapter and pressure-resistant elbow (option for explosion-proof specifications)
- Instruction manual (this document) (Included if specified at the time of purchase.)
- · Extension lever and hexagon socket bolts x 2 (optional)

### **Specifications check**

The specifications are shown on the nameplate of the main unit. Check that the specifications are the same as what you specified. In particular, confirm the following points.

- Tag No. (TAG No.)
- Model (MODEL)
- Work No. (PROD.)
- Input current range (INPUT)
- Supply air pressure (SUPPLY)
- Explosion protection certification seal (for explosion-proof specifications)

### 



When using the device in an explosion-proof area, be sure to select the model that satisfies the necessary explosion-proof requirements. Non-explosion-proof products cannot be used in an explosion-proof area.

### Contact

For inquiries about this device, please contact us.

When contacting us, let us know the model number and production number.

### Storage

When storing the device after purchase, obey the following precautions.

- · When storing the device before it has been used
  - 1. Store the device as packed at shipment.
  - 2. Store the device at an indoor location with little vibration or shocks and at normal temperature and humidity (about 25°C, 65%).
- · When storing the device after it has been used
  - 1. Tightly secure the terminal box cover and block the conduit connection port with tape to prevent humidity intrusion.
  - 2. Block the three pneumatic piping connection ports (SUP , OUT1 and OUT2) with tape to prevent humidity and dust intrusion.
  - 3. Pack the device in the same way as at shipment.
  - 4. Store the device at an indoor location with little vibration or shocks where it will not be exposed to rain or water and at normal temperature and humidity (about 25°C, 65%).

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### Chapter 1 Structure of the 700 Series Control System

This chapter describes the device configuration of the control system that uses the device.

- · Description of the configuration of the input/output system in the device
- Description of the structure of the main unit of the device and the name and function of each part

#### 1-1 System Configuration

This device is a smart valve positioner that can be connected to the 4–20 mA DC signal lines of the controller output. It makes various adjustments using electricity, so the relationship between input signals and control valve travel can be set to any desired value. In addition, by connecting the device using four lines, the control valve travel is transmitted to the host monitoring system as a 4–20 mA DC analog signal. (Only the AVP701 model supports valve travel transmission.)

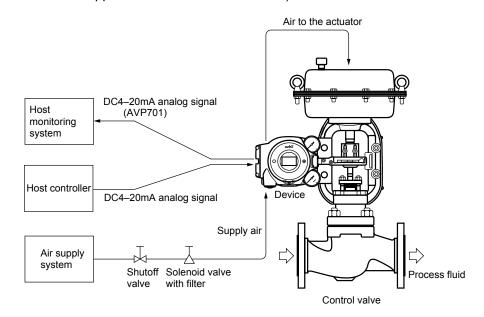


Figure1-1 Concept Diagram of the 700 Series Control System

### 1-2 System Configuration without Motion Transmission

This shows the configuration for a system that does not use the motion transmission function of this device (model AVP702).

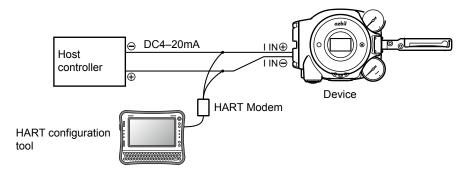


Figure1-2 System Configuration without Motion Transmission (Model AVP702)

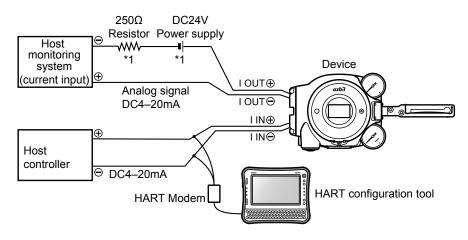
#### 1-3 System Configuration with Motion Transmission

This device (model AVP701) has a function for motion transmission of the control valve.

To output the travel signal to the host monitoring device using analog values, configure the system with motion transmission. Normally, the travel from fully closed to fully open are output as 4–20 mA DC.

This shows an example of a system configuration for outputting valve travels detected with this device as 4–20 mA DC analog signals.

With this system configuration, analog signals are output directly to the higher-order host monitoring system from this device.



\*1: For the detailed information of the power supply and resistor, please refer to the figure 2-18 of 2-3-4 Input Signals and Travel Transmission Power



### 1-4 Structure of the Device and Description of Each Part

#### 1-4-1 Structure of the Device

#### 1) Major components

The structure of the main unit of the device is shown in the figure below.

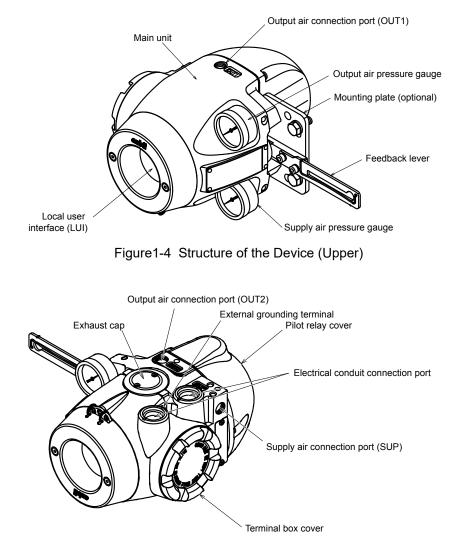


Figure1-5 Structure of the Device (Lower)

### 2) Name and description of each part

The table below describes each part.

| Table 1 1 F | Docorintion | of Each Dart |
|-------------|-------------|--------------|
|             | Jescription | of Each Part |

| Name  | Description   |  |  |
|---|---|--|--|
| Main unit   | - Houses electronic circuits, an electro-pneumatic transducer (EPM), a position sensor (VTD), and a pressure sensor.  |  |  |
| Pilot relay cover   | <ul> <li>Cover of the pilot relay that amplifies the air signal from the EPM (electro-pneumatic transducer) and transduces it into the air signal sent to the actuator.</li> <li>When you must adjust the balance pressure to switch between the pilot relay for the single-acting actuator and the pilot relay for the double-acting actuator, remove this cover.</li> </ul> |  |  |
| Auto/Manual (A/M) switch  | - This switch is used to switch how the output air between the auto operation status and the manual operation status is controlled. This switch is built into the pilot relay. This switch can be seen by removing the pilot relay cover.   |  |  |
| Feedback lever  | - Extracts and transmits the movement of the control valve lift to the VTD (position sensor).   |  |  |
| - The LUI allows you to adjust the zero span, perform auto setup, and operate the device with the LCD (liquid crystal display) and operation without using the communicator.  |   |  |  |
| Supply air pressure gauge   | - Indicates the pressure of supply air.   |  |  |
| Output air pressure gauge   | - Indicates the pressure of output air.   |  |  |
| Supply air connection port (SUP)  | - Supply air is input to this port.<br>- "SUP" is displayed at this port.   |  |  |
| Output air connection port (OUT1)   | <ul> <li>Output air is sent out of this port to the actuator.</li> <li>"OUT1" is displayed at this port.</li> </ul>   |  |  |
| Output air connection port (OUT2)       - Output air is sent out of this port to the actuator.         - This port is blocked with a blind plug in the single-acting actuator.         - OUT2 is displayed at the output port for the double-acting actuator. |   |  |  |
| Mounting plate (optional)       - The mounting plate is used to mount the device onto the actuator.         - The shape of the mounting plate differs depending on the specification (actuator model).  |   |  |  |

#### 1-4-2 Structure of Terminal Box

#### 1) Major components

This contains the input signal (controller output) terminal, output signal (motion transmission) terminal, and internal ground terminal.

The structure of the terminal box is as shown below.

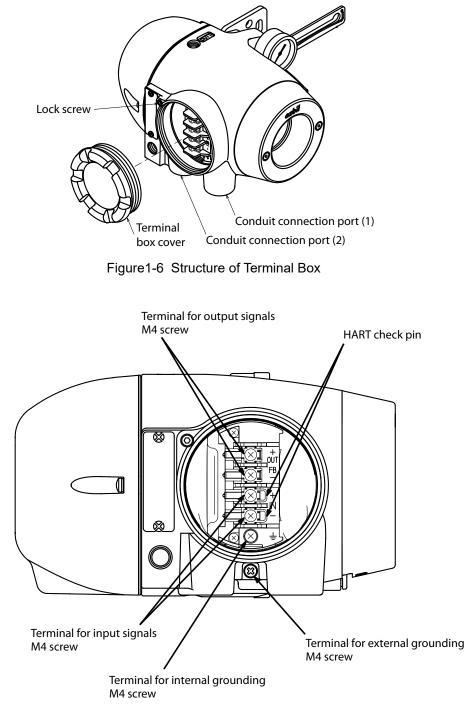


Figure 1-7 Terminal Block in the Terminal Box

#### 2) Name and description of each part

The table below describes each part of the terminal box.

| Table 1-2 Description | on of Each Part |
|-----------------------|-----------------|
|                       |                 |

| Name                             | Description  |
|----------------------------------|--|
| Terminal box cover               | <ul> <li>- Lid of terminal box.</li> <li>- This cover has a pressure-resistant explosion-proof structure.</li> </ul>   |
| Lock screw                       | - Used to secure the terminal box cover.   |
| Terminal for input signals       | - Shown as IN.<br>- Connects the signal cable from the host controller.  |
| Terminal for output signalsl     | <ul> <li>Shown as OUT.</li> <li>Connects the signal cable for motion transmission.</li> <li>The AVP702 model (without motion transmission) does not have the terminal screws.</li> </ul> |
| Internal grounding terminal      | - Internal terminal for grounding. The cable for grounding is connected to this terminal.  |
| Conduit connection port (1)      | - Service entrance for a cable.  |
| Conduit connection port (2)      | <ul><li>Service entrance for a cable.</li><li>This entrance is normally blocked with a blind plug.</li></ul>   |
| Check pin for HART communication | - By connecting the connection hook for the setting device communication cable to this pin, it is possible to communicate with this device.  |

### **M**Warning

When using a pressure-resistant explosion-proof model in a dangerous place, be sure to use the specified cable adapter for pressure-resistant packing for the conduit connection port. Securely close the terminal box cover all the way. Then, rotate the lock screw counterclockwise to secure the terminal box cover.

#### **!** Handling Precautions:

V

Ground either the external or internal grounding terminal according to the specifications. Be careful not to ground the device at two points.

#### 1-4-3 Display on the Local User Interface (LUI)

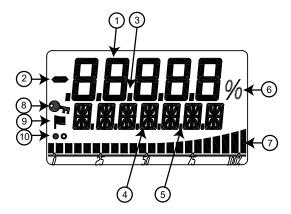


Figure1-8 Segments on the LCD

Table 1-3 Description of Each Part

| No.  | Displayed element              | Main display  |
|------|--------------------------------|---|
| (1)  | 7 segments (5 digits)          | Displays the main numerical values such as the specified opening.   |
| (2)  | Minus sign                     | Displays the sign for the 7-segment number.   |
| (3)  | Decimal point<br>(five places) | Displays the decimal point for the 7-segment number.  |
| (4)  | 16 segments<br>(7 digits)      | Displays the unit, status, or other data.   |
| (5)  | Dot (6 places)                 | Displays the 16-segment auxiliary display, separator, or other data.  |
| (6)  | Percentage                     | Displays %.   |
| (7)  | Bar graph (22 bars)            | Displays the bar graph in percentage at a set point, etc.   |
| (8)  | Key mark                       | On: LUI operation is unavailable.<br>Off: LUI operation is available.<br>Blinking: LUI is in operation.   |
| (9)  | Flag mark                      | When the self-diagnostic alarm is activated, the key mark is displayed.<br>For detailed information of the alarms,please refer to the status monitor of page 3-4. |
| (10) | Display refresh mark           | Display during operation<br>White and black circles alternately blink.  |

For a display example, refer to "LUI Display List" in Appendix A.

#### **!** Handling Precautions:

The LUI buttons may not respond well near an electromagnetic inductor (such as a large transformer or high-frequency furnace).

Remove sand, dust, and other foreign objects from the rubber parts of the operation buttons before operating the LUI. Operating the LUI with foreign objects on it may damage the rubber parts.

Do not pull the rubber parts of the operation buttons. This may deteriorate the sealability, possibly causing malfunction.

### Chapter 2 Installation of the 700 Series

This chapter describes the usage conditions, installation, piping, and wiring of the device.

#### 2-1 Usage Conditions

The device must be installed in the location, which satisfies the following conditions. Also, the divice must be used in accordance with its specification.

|  | ,   |                   | ne z-i rtange or                 | - 5 -                             |   |                           |
|--|---|-------------------|----------------------------------|-----------------------------------|---|---------------------------|
|  |   | Units             | Basic<br>operating<br>conditions | Normal<br>operating<br>conditions | Marginal<br>operating<br>conditions       | Transportation conditions |
|  | General model                                     | °C                | 23 ± 2                           | -40 to +80                        | -40 to +80                                | -40 to +70                |
|  | TIIS flameproof model                             | °C                | 23 ± 2                           | -20 to +55                        | -20 to +55                                | -40 to +70                |
| Operating  | IECEx/FM/FMC/<br>CCC/KCs<br>flameproof<br>model   | °C                | 23 ± 2                           | -30 to +75                        | -30 to +75                                | -40 to +70                |
| temperature<br>range                               | FM Intrinsically<br>Safe (ic) and<br>Nonincendive | °C                | 23 ± 2                           | -24 to +75                        | -24 to +75                                | -40 to +70                |
|  | ATEX/IECEx<br>intrinsically safe<br>model         | °C                | 23 ± 2                           | -40 to +60                        | -40 to +60                                | -40 to +70                |
|  | LUI   | °C                | 23 ± 2                           | 0 to 50                           | -40 to +80                                | -40 to +70                |
| Inp  | out current                                       | mA                | 4 to 20                          | 3.84 to 21.6                      | 0 to 3.84 <sup>Note 5</sup><br>21.6 to 24 | _                         |
| Vibration  | Amplitude <sup>Note 1</sup>                       | mm <sub>p-p</sub> | 0                                | 15/(5 to 8 Hz)                    | 15/(5 to 10 Hz)                           | 15/(5 to 10 Hz)           |
| VIDIALION  | Acceleration <sup>Note 1 Note 2</sup>             | m/s <sup>2</sup>  | 0                                | 20/(8 to 400 Hz)                  | 40/(10 to 400 Hz)                         | 40/(10 to 400 Hz)         |
| Friction   | of applied valve                                  | %                 | 3 to 20                          | 3 to 20                           | 0 to 3<br>20 to 100                       | _                         |
| Supply air pressure Ps<br>(140 kPa ≤ Ps ≤ 700 kPa) |   | kPa               | Ps ± 1%                          | 140 to 700                        | 0 to 710                                  | _                         |
| Installatio  | on orientation <sup>Note 3</sup>                  | ٥                 | ±1 Note 4                        | ±180                              | ±180                                      | ±180                      |
| Hum  | nidity range                                      | %RH               | 50 ± 10                          | 5 to 100                          | 5 to 100                                  | 5 to 100                  |

Table 2-1 Range of Usage Conditions

Each operating condition is defined as follows.

- Basic operating condition: Range in which the accuracy is guaranteed

- Normal operating condition: Range in which the positioner normally operates

- Marginal operating condition: Range in which performance is not guaranteed but the device can be without being permanently damaged

- Transportation condition: Environment condition range in which the non-operating device is not permanently damaged during transportation

Note 1: Vibration conditions when the positioner cover is positioned at the center front.

Note 2: The pressure gauge is not applied.

- Note 3: The slope characteristics are not included.
- Note 4: The status where the drive shaft of the direct-acting actuator is perpendicular to the ground and that is used as the reference.
- Note 5: In the range of 3.5 mA to 3.84 mA, HART communication is possible though the operation of the positioner is not guaranteed. (The output air pressure assumes that the power is cut. The pressure sensor value is not guaranteed.)

#### 2-2 Selection Criteria for Installation Location

The device is designed to withstand severe conditions, but the installation location should be selected according to the criteria described below to maximize performance.

#### 2-2-1 Selection Criteria for Installation Location

Install the device in a location that satisfies all of the following conditions.

- Operating temperature range that conforms to the explosion protection rules
- Relative humidity: 5 to 100%RH
- Ambient temperature change rate: ±20°C/hr or slower
- Electromagnetic induction: 400 A/m or less (Avoid places near a large transducer, high-frequency furnace, or other such equipment.)
- Do not use a transceiver near the device.
- Vibration: 20 m/s<sup>2</sup> (5 to 400 Hz) or less (The vibration conditions defined for the device are the vibrations at the positioner part.)

#### 2-2-2 Criteria for instrumentation air

The device employs a nozzle flapper structure in the electropneumatic transduction section. If instrumentation air is contaminated (includes oil, water, or other substance), the positioner function of the device may not function properly or an irrecoverable failure may occur. Therefore, the quality of instrumentation air supplied to the device is defined as follows.

- Solid material : No particles with a diameter larger than 3 µm.
- Oil : Less than 1 ppm.
- Supply air humidity : The dew point temperature is at least 10°C lower than that of the device.

(This criterion is based on Japanese Industrial Standards JIS C 1805-1(2001).)

Select a compressor and main line or terminal-installation type compressed air purifier by referring to the above specifications.

#### (1) Compressed air purifier for the main line

Select a compressed air purifier for the main line, such as a main line filter or microalescer, to satisfy the above specifications.

Domestic compressed air purifier manufacturers of Japan: SMC Corporation and CKD Corporation

(2) Compressed air purifier to be installed on the terminal

If an air purifier cannot be installed on the main line due to installation of a control valve or for other reasons, use an compressed air purifier that can be installed on the terminal in order to satisfy the above specifications.

#### <Example devices>

- Products from SMC Corporation

Mist Separator AM150 or AM250 Series

(Filtering level: 0.3 µm, Secondary oil mist concentration: 1.0 mg/m<sup>3</sup>)

- CKD Corporation

Oil mist filter

M1000 or M3000 Series

Mantle S Type (Filtering level: 0.3 µm, Remaining oil: 1.0 mg/m<sup>3</sup>)

#### **!** Handling Precautions:

Select a compressed air purifier with specifications suited to the usage conditions. Even when you install the above oil removal equipment, it is necessary to properly inspect and maintain the air circuit section for long-term stable operation. Install the oil removal equipment before use and perform periodic inspection and maintenance.

The warranty is void if the device fails because the quality of the above instrumentation air was not sufficient.

### 2-3 Installation Procedure

#### 2-3-1 Mounting the 700 Series onto the Actuator

The device is a smart valve positioner for use with a control valve that uses a directacting or rotary actuator. The main unit of the device weighs approximately 4.2 kg. The basic mounting procedure is the same as that for conventional electropneumatic positioners.

|   | <b>∆</b> Cautions   |
|---|---|
| 0 | Be careful not to get injured by sharp parts such as the edge of the main unit or actuator<br>or screw threads during mounting.<br>The type of mounting plate, mounting method, and mounting procedure differ depending<br>on the actuator model to be mounted in the device.   |
|   | <ul> <li>If the device is not properly mounted, not only will the device not be able to operate at its true performance but it may be damaged or fail. Pay attention to the following points.</li> <li>The mounting plate and its accessories differ depending on the specifications (actuator model). Be sure to use the appropriate mounting plate and accessories for</li> </ul> |
|   | <ul> <li>the actuator to be mounted.</li> <li>When installing the control valve, ensure as much surrounding space as possible<br/>and put the device in the correct orientation taking maintainability (such as piping,<br/>wiring, and adjustment) into consideration.</li> </ul>  |
|   | - Deliver the device to the installation location in the packaged state if possible.  |
|   | <ul> <li>Do not apply excessive force to the feedback lever during mounting.</li> </ul>   |
|   | - Do not bend the feedback pin.   |
| Ω | <ul> <li>Do not block the exhaust port located underneath.</li> </ul>   |
| U | - Install the device so that the electrical conduit connection port does not face upward.   |
|   | - Securely tighten bolts.   |
|   | <ul> <li>If the pressure regulator with filter is installed with the device, install with the drain of the pressure regulator with filter facing downward. If the pressure regulator with filter cannot be attached vertically (with the drain facing downward), install it separated from the AVP with the proper orientation.</li> </ul>  |
|   | <ul> <li>In order to avoid the possibility of rainwater entering the pressure gauge, install the<br/>gauge such that it does not face upward or downward. In addition, the pressure<br/>gauge has a rainwater drain on its underside, so install the gauge with this hole<br/>facing downward.</li> </ul>   |
|   | <ul> <li>If you install this device with the LCD facing upwards, use the LCD cover and<br/>pressure gauge elbows as necessary, depending on the circumstances. For details,<br/>refer to 6) below, "Installing the device with the LCD facing upwards."</li> </ul>  |

1) Mounting the feedback lever

Assemble the feedback lever from the front of the main unit of the device using the two included hexagon socket bolts.

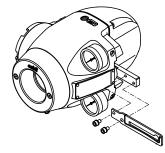
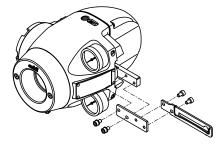
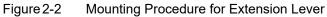


Figure 2-1 Mounting Procedure for Feedback Lever

Assemble the extension lever as shown in the figure below if necessary.





#### 2) Mounting example

A typical mounting method is shown in the figure below. If your actuator is not shown in the figure below, refer to the assembly diagram included with the device.

[Direct-Acting Actuator HA2 to 4, PSA1 to 4, 6, VA1 to 6 from Azbil Corporation]

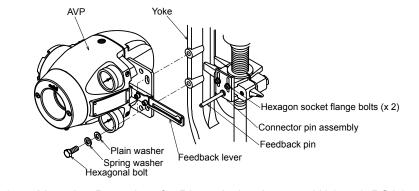
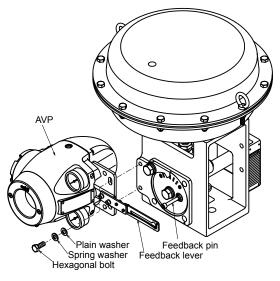


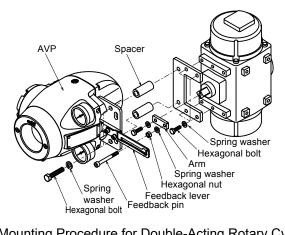
Figure 2-3 Mounting Procedure for Direct-Acting Actuator HA2 to 4, PSA1 to 4, 6, VA1 to 6 from Azbil Corporation

#### [RSA1, 2, VR3 actuator from Azbil Corporation]





#### [Example of double-acting rotary cylinder actuator]





#### 3) Mounting procedure

The procedure for mounting the feedback lever onto the actuator is shown below.

| Step | Work   |
|------|--|
| 1    | Tightly secure the mounting plate by inserting hexagonal bolts (M8×20) with spring washers into the (two) screw holes at the rear of the device.   |
| 2    | Tightly secure the device (mounting plate) onto the mounting<br>seat of the actuator by using bolts and washers. At this time,<br>insert the actuator feedback pin into the slotted hole of the<br>feedback lever in the device. |

4) Connection of feedback pin and feedback lever (1)

There are several points to be careful of when connecting the feedback lever to the device and the actuator feedback pin. Connect correctly.

- Only a pin with a diameter of 6 mm can be used.
- Insert the pin between the guide and the spring.

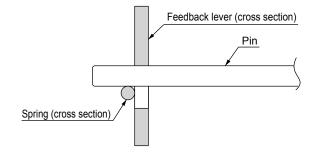


Figure 2-6 Connection of Feedback Lever and Feedback Pin

- Make the feedback lever perpendicular to the pin when viewed from the above.

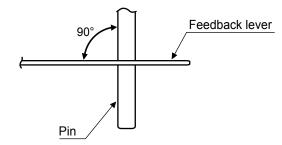


Figure 2-7 Angle between Feedback Lever and Pin

- Mount the lever so that it is horizontal when opened by 50%.
- The allowable rotation angle of the feedback lever is horizontal ± 30°. If the angle exceeds ±30°, the self-diagnostic function detects Valve Travel Detector Out of Range and the device will not operate normally. (The accuracy is guaranteed when the rotation angle is between ±4° and ±20°.)

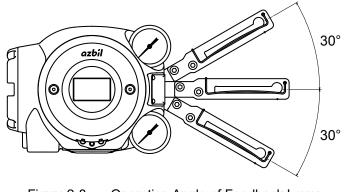


Figure 2-8 Operation Angle of Feedback Lever

- When assembling the lever onto a rotary cylinder so that the shaft of the rotary cylinder is positioned between the feedback pin and the 700 Series as shown in the figure below, select Rotary/90° (for 90°) or Rotary/other (for angles other than 90°) as the Actuator Type according to the rotation angle.

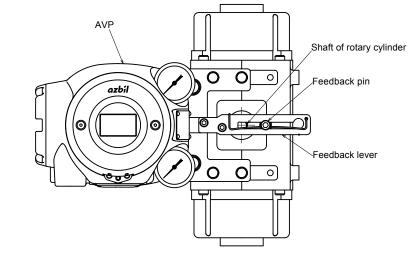


Figure 2-9 Connection of the Rotary Cylinder to the Feedback Pin and Feedback Lever

- When the rotary cylinder is large and the lever is assembled so that the feedback pin is positioned between the 700 Series and the shaft of the rotary cylinder as shown in the figure below, select Rotary (sub)/90° (for 90°) or Rotary (sub)/other (for angles other than 90°) as the Actuator Type according to the rotation angle.

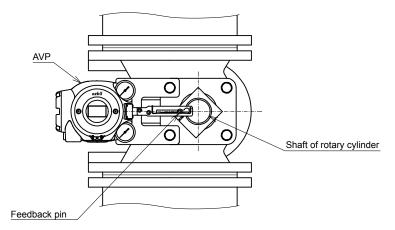


Figure 2-10 Feedback Pin and Feedback Lever Connection for Rotary Cylinder (Large Cylinder)

#### 5) Maintenance space behind the device

The device has a nozzle flapper mechanism in the back of the main unit. When cleaning the flapper, you must remove the pilot relay cover secured to the back with three screws. Design the clamp and feedback mechanism to ensure maintenance space for cleaning.

#### 6) Installing the device with the LCD facing upwards

If you install the device with the LCD facing upwards, use the accessories below as required depending on the circumstances. (Refer to 6-9, "Resale Parts.")

• LCD cover (material: silicone rubber)

This cover reduces deterioration of the LCD due to sunlight (ultraviolet radiation). Use the cover if the device is used in a place with strong sunlight (outdoors, etc.).

### **≜**Cautions

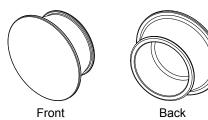
Before mounting or removing the LCD cover, it is necessary to remove the face cover from the main unit. Take care as you work not to touch sharp parts of the face cover, such as the rim. You might be injured.

#### **!** Handling Precautions:

Remove the face cover when checking the LCD.

• Pressure gauge elbows

The elbows are for mounting the pressure gauges if the device is installed in a place with direct exposure to rainwater (outdoors, etc.). (If the pressure gauges are installed facing upward, they will be damaged by rainwater.



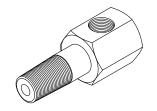
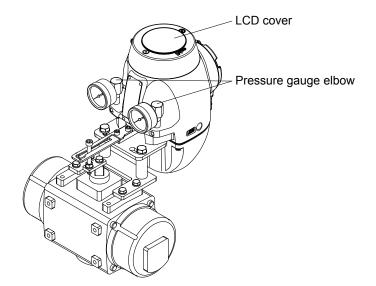
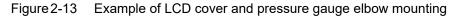


Figure 2-11 LCD cover

Figure 2-12 Pressure gauge elbow





#### 2-3-2 Pneumatic Piping Connection

This section describes how to supply the air for the device to drive the actuator.

#### 1) Air supply system

Supply air must be clean and dry to stably use the device for a long time. A typical example of an air supply system is shown in the figure below.

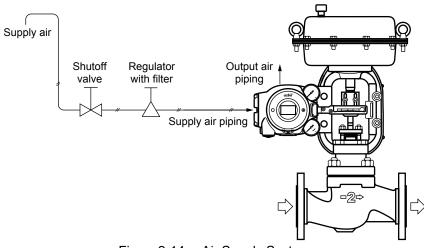


Figure 2-14 Air Supply System

#### 2) Supply air

Use supply air that conforms to the instrumentation air standards (on page 2-2).

#### 3) Regulator with filter

- The regulator with filter is used to adjust the pressure of the supply air to the device.
- Install this valve as close to the main unit of the device as possible.
- The control valve can be manually operated by using the A/M switching function. (The double-acting actuator does not support manual operation.)
- Use a 3-µm or finer filter.
- The filter removes solid materials from supply air.
- If the filter is not equipped, separately insert a (3-µm or finer) filter immediately before the regulator.
- Install the regulator so that the drain faces downward.
- If you select the built-in Azbil regulator, the filter is built into the device before shipment.

#### 4) Shutoff valve

- The shutoff valve is used to temporarily stop supplying air to the device.
- With this valve, the device or control valve can be removed without having to stop the whole air supply system during maintenance or other operations.

- 5) Piping
  - Use piping with an inside diameter of 6 mm.
  - When using the device in a corrosive atmosphere, select piping appropriate to the environment of the installation location. For example, you may use the vinyl-coated copper pipe.
  - To prevent air leaks, be sure to use a fitting that is appropriate for the pipe.
- 6) Connection positions

The positions of the supply air connection port and output air connection port are shown in the figure below. Select the dimensions of the connection port screws according to the specifications.

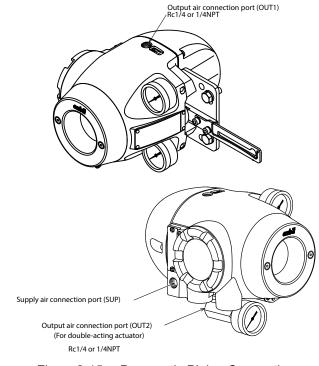


Figure 2-15 Pneumatic Piping Connection

### **!** Handling Precautions:

When connecting the electromagnetic valve for emergency shutoff, air valve, or other part, install it between the output air connection and the actuator rather than the supply air connection side of the device.

### 7) Mounting procedure

The procedure for connecting pneumatic piping to operate the device is shown below.

| Step | Work   |
|------|--|
|      | Connect the joint for piping to the connection port using seal tape.   |
|      | I Handling Precautions:  |
| 1    | <ul> <li>Use seal tape as the seal material. Avoid using solid<br/>or liquid seal material if possible.</li> </ul>   |
|      | - Do not let the seal tape get in the piping.  |
|      | <ul> <li>If you do use a liquid seal, make sure that no drops<br/>of the seal material get in the piping.</li> </ul>   |
| 2    | Connect the supply and output pipes to each joint in consideration of the arrangement of the piping.  I Handling Precautions:  |
|      | <ul> <li>For the double-acting actuator, the connection<br/>between output air connection ports OUT1 and<br/>OUT2 and the actuator is determined by the<br/>valve operation. Check the valve operation before<br/>connecting pipes.</li> </ul> |
|      | <ul> <li>Sufficiently flush piping before connection to prevent<br/>burrs on the piping or other foreign objects from<br/>getting in the piping.</li> </ul>  |
|      | - Keep the output air piping as short as possible.   |
| 3    | After all piping is complete, make sure that air does not leak.  |

#### 2-3-3 Electrical Wiring Connection

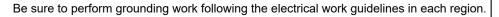
This section describes the methods for electrical wiring for signal input from the controller and signal output to the monitoring system.

### A Warning

Turn the power off before starting wiring work. Otherwise, electric shock may occur.

When using the explosion-proof 700 Series in a dangerous place, be sure to connect the wiring while following "Chapter 7 Precautions for the Explosion-Proof 700 Series."

### **A**Cautions

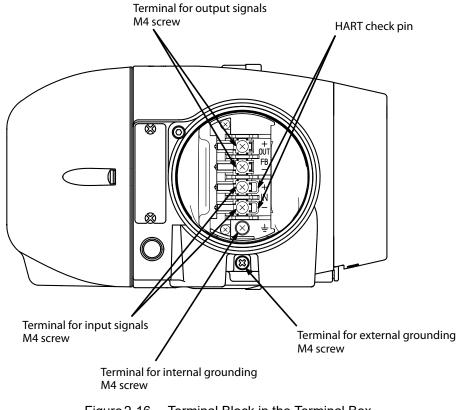


#### **!** Handling Precautions:

Be sure to attach a blind plug to the unused conduit connection port so that it is completely covered.

1) Connection positions

The figure below shows the terminal block in the terminal box.





#### 2) Terminal for external grounding

Connect the external grounding terminal to the case with two washers as follows.

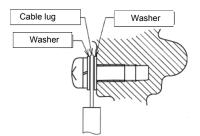


Figure 2-17 Connection of External Grounding Terminal

3) Without motion transmission (model AVP702)

Remove the terminal box cover and connect the wires as shown in the figure below.

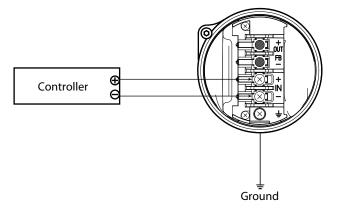
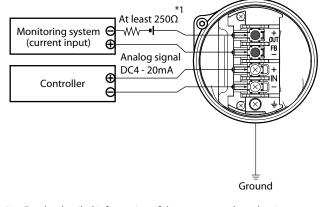


Figure 2-18 Electrical Wiring without Motion Transmission (2-conductor cable)

Use only one of the two ground terminals (internal or external) and perform the ground work according to all local laws and ordinances governing electrical work.

4) With motion transmission (model AVP701)

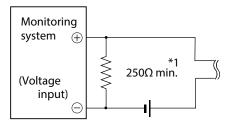
Remove the terminal box cover and connect the wires as shown in the figure below.



\*1: For the detailed information of the power supply and resistor, please refer to the figure 2-18 of 2-3-4 Input Signals and Travel

Figure 2-19 Electrical Wiring with Motion Transmission (4-conductor cable)

 Use the following wiring method if the monitoring system is a voltage input (1 to 5 V) device.



\*1: Refer to the figure 2-18

Figure 2-20 Wiring when the Monitoring System Is a Voltage Input Device

• Use only one of the two ground terminals (internal or external) and perform the ground work according to all local laws and ordinances governing electrical work.

#### 2-3-4 Input Signals and Travel Transmission Power

1) Input signal

The input signals to this device are 4–20 mA DC. These input signals are also used as the power source to drive the internal circuit.

#### **!** Handling Precautions:

- Do not use any more than 24 mA DC.
- It will not operate properly with less than 3.85 mA DC.



**≜**Cautions

Do not apply the overvoltage to the terminals for the input signal. The overvoltage may cause the failure of the device due to fire damage of the printed wiring boards.

2) Travel Transmission Power

The travel transmission power is 17.9-45 V DC.

The load resistance of connections to the travel transmission loop should fall within the operating range shown below for the power voltage to be used.

#### **!** Handling Precautions:

Do not apply the travel transmission power than 45 V DC.

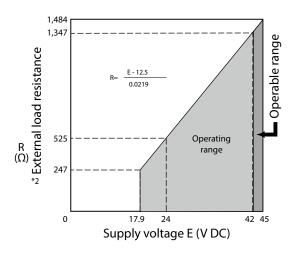


Figure 2-21 Supply Power Voltage/Load Resistance Features

#### 2-3-5 Cables

1) Selection and conditions of cables

The criteria for selection and the conditions of cables for wiring are described below.

- We recommend using 600-V plastic insulated sheath electric wire CVV (JIS C 3401 by Japanese Industrial Standards) for control with a conductive cross-section of 1.25 mm<sup>2</sup> or a stranded cable with equivalent or higher performance.
- When routing cable in a place subject to electromagnetic noise, use shielded wire CVVS (JCS 4258 by the Japanese Electric Wire & Cable Makers' Association) and metal conduits.
- Select a sheath material that withstands the cable installation environment (including the ambient temperature, corrosive gas, and corrosive liquid).
- Use cable with an outside diameter of 7 to 12 mm. When using a pressure-resistant packing cable adapter, be sure to use packing appropriate for the outside diameter of the cable.
- A crimping terminal with insulated sleeve (for M4 screw) is recommended for terminals.
- The maximum permissible cable length is 1500 m.

#### 2) Cable installation

Comply with the following when installing cables between this device and the actuator.

- Avoid installing cables near devices that generate noise such as large capacity transformers, motors, or driving power sources.
- Do not install cables in the same tray or duct with other driving power cables.
- We recommend the use of electrical metal conduits and ducts to prevent water and mechanical damage to electrical lines. Also, always use water-tight glands at conduit connection ports.
- Use electrical metal conduits and ducts for locations exposed to electromagnetic noise.
- When using shielded cable, the cable must be connected to a single point ground on the DCS side.

#### **!** Handling Precautions:

Model AVP701/702 are intended for use in industrial locations defined in CE marking directive (EN 61326-1).

#### 3) Wiring procedure

The procedure for electrical wiring to operate the device is shown below.

| Step | Work  |
|------|---|
|      | Loosen the locking bolts (M4) on the terminal box cover with a                                      |
| 1    | hex wrench (3). (Rotate the screw clockwise.)   |
|      | Rotate the terminal box cover counterclockwise to remove it.  |
| 2    | Handling Precautions:   |
|      | Be careful not to damage the paintwork with a tool or other object.                                 |
| 3    | Remove the dust-proof plug from the conduit connection port.  |
|      | Insert the cable into the conduit connection port.  |
| 4    | I Handling Precautions:   |
|      | Be careful not to damage the sheath of the cable.   |
| 5    | Wire the cable to the relevant terminal in the terminal box.  |
|      | Handling Precautions:   |
|      | - Be careful of the polarity.   |
|      | - Sufficiently tighten the terminal screw. The recommend  |
|      | tightening torque is 1.5 N⋅m.   |
| 6    | Apply sufficient waterproof treatment to the conduit to prevent                                     |
|      | rainwater or other liquid from entering inside.   |
|      | Handling Precautions:   |
|      | We recommend using silicon non-hardening seal material.   |
| 7    | Mount the terminal box cover, tighten it securely, and then   |
|      | secure the cover by rotating the lock screw counterclockwise.                                       |
|      | Cautions  |
|      | Be careful not to get your finger caught in the clamp.  |
|      | Be careful not to hurt your finger with the edge of cover<br>or the screw threads of the main unit. |
|      |   |
|      | <b>Handling Precautions:</b>  |
|      | Be careful not to damage the paintwork of the device with a tool or other object.                   |

#### **!** Handling Precautions:

The input resistance for the AVP701/702 models must be the equivalent of 475  $\Omega$  (600  $\Omega$  if equipped with overvoltage protection)/20 mA DC and the inter-terminal voltage must be at least 9.5 V (12 V if equipped with overvoltage protection). Check the controller's allowable load resistance and the output voltage. Note that when the controller's allowable load resistance is less than 475  $\Omega$  (600  $\Omega$  if equipped with overvoltage protection), an isolator or similar device should be used.

# 2-4 Cable gland and flameproof universal elbow for TIIS Flameproof apparatus

TIIS Flameproof SVP model is provided with a certified cable gland.

The cable gland seals the cable entering the SVP enclosure to withstand an internal explosion and protects the cable from being damaged mechanically and electrically.

Use the dedicated elbow if it is necessary to change the direction of the cable with these models.

#### **!** Handling Precautions:

If the device is to be used under the authorization other than that for the TIIS Flameproof standards, the wiring of cables must be performed according to local regulations for electrical installations in explosive atmospheres.

#### 1) Structure of the flameproof cable gland

The Flameproof cable gland is shown below in assembled and exploded views.

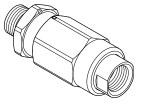


Figure 2-22 Flameproof cable gland

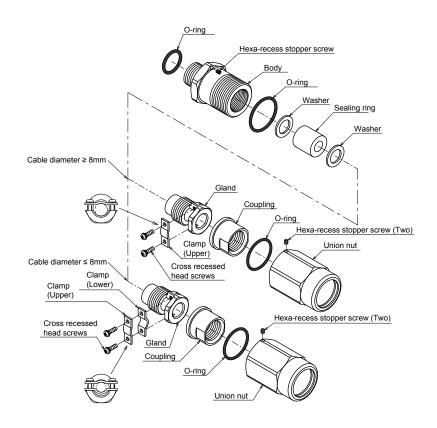
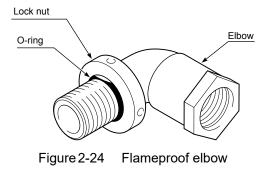


Figure 2-23 Constituent elements of flameproof cable gland

2) Structure of the flameproof universal elbow

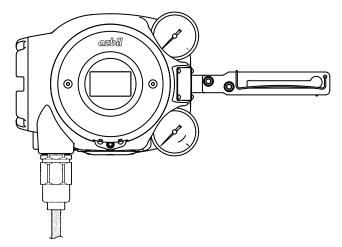
The figure below shows the universal elbow.



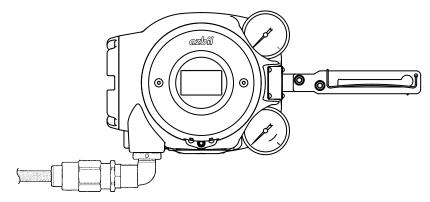
3) Mounting example

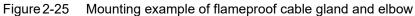
The flameproof cable gland and the universal elbow are used to connect the field wiring cable to the device enclosure, as shown below.

a) Use of flameproof cable gland



b) Use of flameproof cable gland and elbow





## 4) Mounting procedure for flameproof cable gland

| Step   |                         | Procedure  |                                      |                     |
|--|-------------------------|--|--------------------------------------|---------------------|
|  | conduit co<br>flameproc | Securely screw the main unit of the adapter into the conduit connection port of the terminal box or into the flameproof universal elbow, and fasten the hexagon socket bolt. |                                      |                     |
| 1  | Apply<br>recor          | Handling Precautions:<br>Apply adequate waterproofing to these parts. We<br>recommend the use of silicone resin based non-<br>hardening seal materials.                      |                                      |                     |
|  | Refer to the            | ne illustrations a   |                                      | able carefully.     |
|  |                         | <u> </u>   | Warning                              |                     |
|  | a c                     | ot match each c<br>annot be prever<br>nd select a pack<br>iameter matche<br>Cable outer<br>diameter  | nted. Refer to th<br>king adaptor wh | e table below       |
| 2  |                         | (mm)<br>7.0 ~ 8.0  | (mm)<br>8                            | Provided            |
|  |                         | 8.0 ~ 10.0   | 10                                   | Built in            |
|  |                         | 10.0 ~ 12.0  | 10                                   | Provided            |
|  |                         | Lhe cable outer dia<br>land with the clan  |                                      | nax., fix the cable |
|  | Pay a                   |  |                                      |                     |
| Screw the gland into the main unit of the adapter to secure it in place. |                         |  | e adapter to                         |                     |
| 3  |                         |  | Warning                              |                     |
|  |                         | To prevent injuries due to a spark travel, be sure to tighten down the packing adequately.   |                                      |                     |
| 4  |                         | Pass the cable through the body and insert it into the terminal box.   |                                      |                     |
| 5  | securely t              | Screw the union nut onto the body and tighten it down securely to hold it in place. Then, tighten the union nut's recess screw.  |                                      |                     |

The procedure for mounting the flameproof cable gland is shown below.

## 5) Mounting procedure for flameproof universal elbow

| Step | Procedure  |
|------|--|
|      | Align the end surface of the lock nut with the end surface of the O-ring groove as shown below.  |
| 1    | Lock nut<br>Elbow<br>Unit of the surface |
|      | Figure 2-26 Arrangement of lock nut and O-ring   |
| 2    | Screw the flameproof universal elbow into the terminal box<br>conduit connection port until the lock nut end surface hits the<br>connection port end surface.<br>When two elbow are used, at first, screw the first elbow into the<br>terminal box. Next, screw the second elbow into the terminal box   |
|      | in the reverse direction to the first elbow.   |
|      | Handling Precautions:  |
|      | Apply adequate waterproofing to these parts.   |
|      | Turn the flameproof universal elbow to loose in the desired direction.   |
| 3    | I Handling Precautions:  |
|      | Do not loosen it more than 1 turn.   |
| 4    | Lock the flameproof universal elbow in place by tightening down the lock nut using the special tool.   |

The procedure for mounting the flameproof universal elbow is shown below.

# Chapter 3 Operation of the 700 Series

This chapter describes how to start operating the device and adjust the device using the local user interface (LUI). When you purchase the device alone, be sure to read "Installation of the 700 Series" before reading this chapter.

## 3-1 Local User Interface (LUI)

Four push buttons on the LUI (with  $\textcircled{\otimes}$ ,  $\textcircled{\otimes}$ ,  $\textcircled{\otimes}$ ,  $\textcircled{\otimes}$ , and  $\textcircled{\otimes}$  symbols) can be operated by removing two screws ((2.5-mm) hexagonal socket bolts) from the front cover of the device.

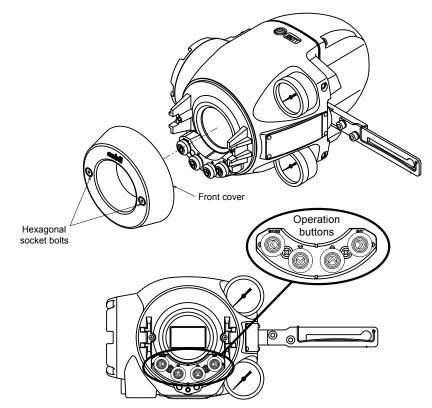


Figure 3-1 LUI Structure with the Front Cover Removed

| Table 3-1 |   |                                    |  |
|-----------|---|------------------------------------|--|
| Key input | Monitor mode                                  | Setup mode                         |  |
|           | Switches between display categories.          | Goes to the next display.          |  |
|           | Selects the next item.                        |                                    |  |
|           | Selects the previous item.                    |                                    |  |
| BODE      | Switches between display categories.          | Goes back to the previous display. |  |
| Hold down | Switches between setup mode and monitor mode. |                                    |  |
| Hold down |   | Executes the function.             |  |

The LUI supports the monitor and setup modes.

In monitor mode, the normal, detailed and status are available. The normal monitor can be used to monitor data such as opening and input signals and it displays alarm information if a self-diagnostic alarm is issued.

To change from monitor mode to setup mode, hold down the button. In setup mode, operations such as auto setup and zero span adjustment can be performed. Figure 3-2 shows a diagram of the LUI screen transition.

The LUI displays the dynamic values in the device and can be used to adjust and set up the following five functions.

- · Auto setup function
- Zero span adjustment
- Supply pressure bypass function
- Specification of control parameters
- · Setup of the control valve system

This section explains adjustment and setup using the LUI.

## **!** Handling Precautions:

- Operations cannot be performed from the host when you are using the LUI to make adjustments or change settings.
- If there is an object near the operation button, remove it before operation.
- Please return display to the nomal monitor when you want to let you display alarm.

Because you can not display alarm when let you display the monitor except the normal monitor.

- Alarm and the present value are displayed at that time of the alarm outbreak in turn.
- If you have made adjustments, make sure to verify them by checking device operation. If you have also modified settings, make sure that they were modified correctly.

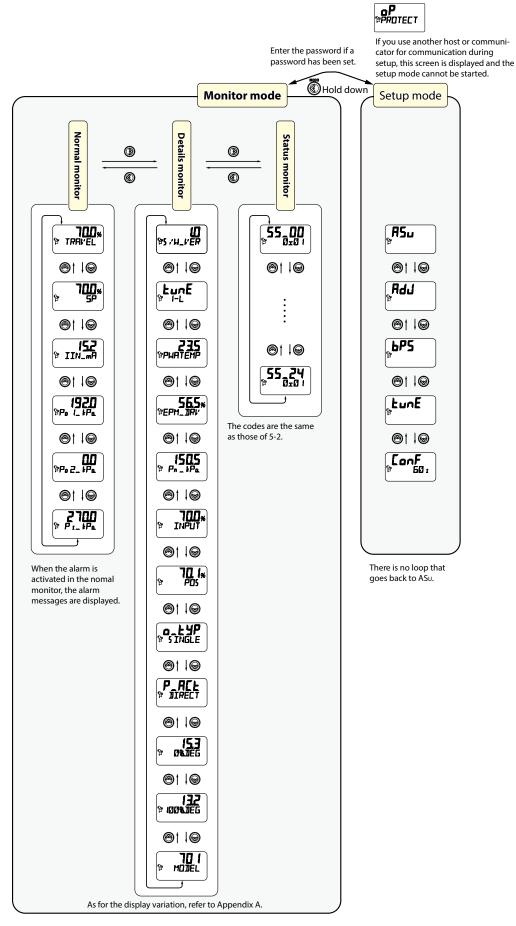


Figure 3-2

## 3-2 Adjustment before Operation

Perform auto setup before using the device. Then, adjust the zero span if necessary. The zero span adjustment function in the device electrically sets the fully closed and fully open positions of the valve independently of each other. Therefore, you can adjust each of these positions without interfering with the other one.

## 3-2-1 Auto Setup

There are two auto setup methods.

- Method using the LUI
- Method through HART communication

This section describes the method using the LUI. For the method through HART communication and the details of auto setup, refer to Chapter 4.

## **!** Handling Precautions:

- •The input signal should be 5 mA or more. If it is less than 5 mA, auto setup may not operate normally.
- •If any of the self-diagnostic messages shown in Table 4-5 in 4-2-20, "Diagnostic Messages" appears, auto setup cannot be executed.
- •Once auto setup and zero span adjustment are completed, always remember to change the input signal and to check the opening, valve travel, and other valve operations.
- •Correctly set the actuator type and feedback lever position when fully closed before starting auto setup.
- In some cases, the dynamic characteristic is not set correctly with the actuator capacity, operation stroke, inner diameter of pneumatic piping and piping length. If this occurs, refer to '4-2-5 Control Configuration' and adjust the dynamic characteristic manually.
- •When the actuator size is Custom, the size is not changed with the Auto setup. When selecting the actuator size with the Auto setup, set the size as below.
  - Param 1 to 6 or
  - Param A to C.
- •In some cases, the initial setting is not same even though the actuator and valve size is same. Please perform the operation check and configuration of the device if necessary.
- •There is a possibility that the forced open value described on page '4-2-7 Travel Cutoff' may change after performing the Auto-setup operation. Please reconfigure the forced open value if necessary.
- •If the booster relay is on, and is operating the Auto-setup function, there might be a possibility of hunting. In this case, adjust the booster's sensitivity, or refer to '4-2-5 Control Configuration and adjust the dynamic characteristic manually.
- •If a speed controller is incorporated, set it to full open and execute auto-setup. Afterwards, adjust the speed with the speed controller.
- •When the device is purchased separately, its initial settings are set to those in the list of default values in '6-7 List of Default Values for Internal Data' of this manual. Because the default actuator direction is reverse, if you mount the device on the direct actuator the device will not work. Please be sure to execute the auto setup program before operation and be sure that appropriate settings are created in the device.

## **≜**Cautions

It is dangerous during auto setup because the fully closed valve moves to fully open. Be prepared in advance to prevent injury and effects on the process when the valve moves.

The Actuator Type is set to Linear and the Valve Closed Position is set to Down when the valve is fully closed at the time of shipment unless there are other shipment setup instructions. If factory setting (initial setup) is requested, check the settings at the time of shipment. Configure settings as needed.

If auto setup fails, refer to 5-1-5, "Auto Setup Failure."

The reverse action actuator fully closes, fully opens, and fully closes the valve when auto setup starts. The direct action actuator fully opens, fully closes, and fully opens the valve. Then, it is opened to between 20% and 25% and between 80% and 85%.

After auto setup, the valve moves to the opening appropriate to the input signal.

Check the following points before starting auto setup.

Actuator Type

|      | Linear (standard):<br>Rotary/90°: | Direct-acting actuator<br>When the distance between the feedback lever of the<br>rotary actuator (90°) and the pin is longer than the<br>distance from the valve shaft |
|------|-----------------------------------|--|
|      | Rotary/Other:                     | When the distance between the feedback lever of the rotary actuator (around $60^{\circ}$ ) and the pin is longer than the distance from the valve shaft                |
|      | Rotary(sub)/90°:                  | When the distance between the feedback lever of the rotary actuator (90°) and the pin is shorter than the distance from the valve shaft                                |
|      | Rotary(sub)/Other:                | When the distance between the feedback lever of the rotary actuator (around 60°) and the pin is shorter than the distance from the valve shaft                         |
| • Va | Ive Closed Position               |  |
|      |                                   |  |

DOWN (standard)

UP

| (1) Procedure for performing | auto setup |
|------------------------------|------------|
|------------------------------|------------|

| (1) 1100000 | Te for performing auto setup  |                     |
|-------------|---|---------------------|
| Step        | Work  | LUI display         |
| 1           | Loosen two (2.5-mm) hexagonal socket bolts and remove<br>the front cover. (A sample initial setup status of the LUI<br>screen is shown.)  | P TRAVEL            |
| 2           | Press and hold the button to enter Settings mode.<br>Enter the password if prompted to do so. For how to set the<br>password, refer to "3-2-5 Password". To change Actuator<br>Type or Valve Closed Position, refer to step (3).                                      | ASu<br>۳            |
| 3           | Wait until the input signal becomes at least 5 mA and press<br>the button once. Check that the screen on the right<br>is displayed and press and hold the button again to<br>perform auto setup.  |                     |
| 4           | The valve, which is initially fully closed, is fully opened and fully closed again. Then, it is opened to between 20% and 25% and between 80% and 85%. After the valve operation ends, the LUI screen changes and the opening appropriate to the input signal is set. | ASu<br>PS UCCES 5   |
| 5           | When you press the 🔘 button, the initial screen of the auto setup is displayed again.   | ASu<br><sup>ه</sup> |

The 'FAIL' signs in the auto setup operation are as follows.

FAIL00: The auto seuup is failed. (The valve does not move, etc.)

FAIL01: The input signal is low level.

FAIL02: A function except for the auto setup is in operation.

FAIL90: The auto setup is forcibly shut down. (Auto setup was stopped from the LUI.)

## For countermeasures for these problems, refer to 5-1-5, "Auto Setup Failure."

#### (2) Procedure for aborting auto setup

| Step | Work  | LUI display     |
|------|---|-----------------|
| 1    | To abort auto setup during execution, press the low button.                                     |                 |
| 2    | Holding down the 🛞 button aborts the execution.<br>If auto setup is aborted, data is not saved. | ASu<br>PFAIL_90 |
| 3    | When you press the 🛞 button, the screen on the right is displayed again.                        | ASu<br>۲        |

## (3) Procedure for specifying Actuator Type and Valve Closed Position

| Step | Work   | LUI display |
|------|--|-------------|
| 1    | Display the screen on the right by repeatedly pressing the<br>and  button.   | EanF        |
| 2    | Press the 🛞 button.  |             |
| 3    | Select an appropriate actuator type with the low and low buttons and press the low button.   |             |
| 4    | Select an appropriate feedback lever position when the valve is fully closed with the (2) and (2) buttons and hold down the (3) button to set that position. |             |
| 5    | The specified actuator type and feedback lever position when<br>the valve is fully closed are displayed. Check the settings.                                 |             |
| 6    | Go back to the desired menu with the low and low buttons.  | Fonf        |

## 3-2-2 Zero Span Adjustment

After auto setup, check the 0% and 100% positions. If adjustment is required, adjust the zero span.

The following two zero span adjustment methods are available.

- · Method using the LUI
- Method using HART communication (This method is further broken down into the following four methods.)
  - Auto Travel Calibration
  - Angle Correction
  - Manual Setting
  - Change Travel Angle

This section describes the method using the LUI. For the method using HART communication, refer to Chapter 4.

## **!** Handling Precautions:

If you adjust the span after auto setup, the forced fully opening value is automatically changed to the value calculated by subtracting 1% from the overstroke percentage.



## **≜**Cautions

Then zero span adjustment is dangerous because of valve action. Take measures in advance to prevent injury to personnel and effects on the process in case the valve operates.

#### (1) Procedure for adjusting the zero span

| Step | Work  | LUI display |
|------|---|-------------|
| 1    | Loosen two hex socket bolts (2.5 mm) to remove the front cover.   | ₽ TRAVEL    |
| 2    | Press and hold the button to enter Settings<br>mode. Enter the password if prompted to do so.<br>For how to enter the password, refer to "3-2-5<br>Password". | ASu<br>۲    |
| 3    | Press the  button to display the screen on the right (ADJ).   | <b>Add</b>  |

| Step | Work   | LUI display                      |
|------|--|----------------------------------|
|      | Press the 🛞 button, select whether to adjust the                                     | FAT 100%                         |
|      | angle for 100% or 0% opening with the 🛞 and  | (100% opening angle adjustment)  |
|      | log buttons, and press the button. (Refer to   |                                  |
|      | "(2) Procedure for adjusting the angle.")  |                                  |
| 4    | To manually adjust each opening rather than  | (0% opening angle adjustment)    |
|      | using the opening adjustment function, select manual adjustment for 100% opening (0% | <b>SE 100</b> %                  |
|      | opening) with the 🛞 and 🎯 buttons and press  | (100% opening manual adjustment) |
|      | the 🛞 button. (Refer to "(3) Procedure for   |                                  |
|      | manual adjustment.")   | (0% opening manual adjustment)   |

## (2) Procedure for adjusting the angle

| Step | Work  | LUI display                           |
|------|---|---------------------------------------|
| 1    | Select the angle (COARSE, MID, FINE) for 100%<br>opening adjustment (0% opening adjustment)<br>with the and and buttons and press the button.<br>(COARSE: Angle 1°<br>MID: Angle 0.1°<br>FINE: Angle 0.01°                    | 日」100%<br>音にOARS E+<br>音にOARS E+      |
| 2    | Adjust the angle by pressing the low button to increase the opening and pressing the low button to decrease the opening.  | ₽ <b>15%</b><br>₽ ₽J 100%<br>₽ ₽J 00% |
| 3    | Pressing the button displays the current<br>opening and output air pressure (Pout1). Check<br>that the angle is properly adjusted.<br>If further adjustment is required, go back to the<br>adjustment screen with the button. | 998%<br>82350 FPa<br>8 400 FPa        |

| Step | Work   | LUI display  |
|------|--|--|
| 1    | Manually specify the desired position for 100% opening (0% opening).   | SE 100%<br>SE 0%   |
| 2    | Press the 🛞 button.  | <b>SE 100%</b><br>SCK7 + 7<br>SE 0%  |
| 3    | Check that the desired position is selected and then hold down the $\rightarrow$ button. This adjusts the 100% opening (0% opening). | <b>5</b><br><b>5</b><br><b>5</b><br><b>5</b><br><b>5</b><br><b>5</b><br><b>5</b><br><b>5</b> |

(3) Procedure for manual adjustment

## 3-2-3 Supply Bypass

Supply bypass allows the valve to be fully closed and opened and enables operation with the regulator.

(For double-acting actuators, the valve can only be fully opened or closed.)

## **≜**Cautions



When the supply bypass operates, it is dangerous because the valve moves. Be prepared in advance to prevent injury and effects on the process when the valve moves.

### (1) Procedure for supply bypass

| Step | Work   | LUI display                                      |
|------|--|--|
| 1    | Loosen two (2.5-mm) hexagonal socket bolts and remove the front cover.   | P TRAVEL   |
| 2    | Hold down to enter setting mode. If a password is required, enter the password.<br>For details on password entry refer to 3-2-5,<br>"Password."  | ASu<br>۲   |
| 3    | Press the  button to display the screen shown on the right.  | <b>bP5</b>                                       |
| 4    | <ul> <li>Press the button to go to the screen shown on the right. To set the output air pressure to 0, hold down the button.</li> <li>(If the output air pressure is already 0 or it is set to the supply air pressure at the supply bypass, go to the screen of step 7 where the supply bypass can be operated.)</li> </ul> | <b>ЪР5</b><br><sup>9</sup> Р_мін+                |
| 5    | To change the output air pressure to the supply<br>air pressure, press the  button to display the<br>screen on the right and hold down the  button.  | 6 <b>P5</b><br>P_MAX++                           |
| 6    | If supply bypass conditions (e.g. the input signal<br>is less than 5 mA) are not satisfied, the screen on<br>the right is displayed.   | BPS<br>PFAIL_0 I                                 |
| 7    | If supply bypass conditions are satisfied, the screen shows that each bypass operates.   | <b>675</b><br>PRUN_MIN<br><b>675</b><br>PRUN_MR× |
| 8    | To clear supply bypass operations, press the Solution to display the screen shown on the right.  | BPS<br>PCLEAR++                                  |
| 9    | Holding down the 🛞 button clears the supply bypass.  | BPS<br>PCLEARED                                  |

The 'FAIL' signs in the supply bypass operation are as follows.

FAIL01: The input signal is low level.

FAIL02: A function except for the supply bypass is in operation.

FAIL90: The auto setup is forcibly shut down.

## **3-2-4 Control Parameters**

V

Control parameters are determined by Actuator Size (Param 1 to 6, A, B, C) and Friction Level (Light(L), Medium(M), Heavy(H)).

| Table 3-2 Actuator size |                 |                |  |
|-------------------------|-----------------|----------------|--|
| Actuator Size           | Stroke Speed[s] | Actuator Model | Actuator<br>Diaphragm<br>capacity[cm³] |
| PARAM C                 | to 0.25         | -              | 200                                    |
| PARAM B                 | to 0.35         | -              | 300                                    |
| PARAM A                 | to 0.45         | -              | 400                                    |
| PARAM 1                 | to 0.85         | PSA1, PSK1     | 600                                    |
| PARAM 2                 | to 2.0          | PSA2, HA2      | 1400                                   |
| PARAM 3                 | to 6.5          | PSA3, HA3      | 2700                                   |
| PARAM 4                 | to 8.15         | PSA4, HA4      | 6600                                   |
| PARAM 5                 | to 12           | PSA6           | 8100                                   |
| PARAM 6                 | to 99           | VA5            | 25300                                  |
| Custom                  | -               | -              | *                                      |

\* Consult an Azbil Corp. service representative.

Table 3-3 Friction Level

| Friction Level | Gland packing material example |
|----------------|--------------------------------|
| HEAVY          | Graphite packing               |
| MEDIUM         | Yarn packing                   |
| LIGHT          | Type V PTFE packing            |

\* This is not decided with the materials in a parameter to be decided by frictional force of the grand packing.



It is dangerous because the valve moves when control parameters are changed. Be prepared in advance to prevent injury and effects on the process when the valve moves.

| Step | Work  | LUI display                    |
|------|---|--------------------------------|
| 1    | Loosen two (2.5-mm) hexagonal socket bolts and remove the front cover.  | ₽ TRAVEL                       |
| 2    | Hold down the start the setup mode.<br>Enter the password if prompted to do so. For how<br>to enter the password, refer to "3-2-5 Password".  | ASu<br>۴                       |
| 3    | Press the  button to display the screen shown on the right (tune).  | Frune                          |
| 4    | Press the 🔊 button to display the screen on<br>the right and select Param 1 to 6, A, B, or C for<br>Actuator Size by operating the 🕞 button, and<br>press the 🔊 button.   | <b>といれて</b><br>学派 <del>、</del> |
| 5    | <ul> <li>Select L (Light), M (Medium), or H (Heavy) for</li> <li>Friction Level and set it by holding down the button.</li> <li>To return the setting to its original value, reset</li> <li>the value with before holding down the button.</li> </ul> | Fune<br>F                      |
| 6    | Check the specification result when it is displayed.  |                                |

## (1) Procedure for specifying control parameters

## 3-2-5 Password

The password consists of four letters. Use alphanumeric characters for the password.

| Step | Work  | LUI display    |
|------|---|----------------|
| 1    | Check that the password screen (screen on<br>the right) is displayed and that the rightmost<br>digit is blinking. Select the alphanumeric<br>character of the specified password with the<br>or or button and press the button. | PASS<br>© 0000 |
| 2    | The second digit from the right starts<br>blinking. Specify all four digits in the same<br>way. To return to and specify a digit to the left<br>of the current digit, use the @button.  | PASS<br>9 0000 |
| 3    | After specifying the fourth digit, press and hold the button.   |                |
| 4    | If the password matches, it changes to<br>Settings mode. If not, the error screen shown<br>on the right is displayed. In this case, enter<br>the password again.  | PASS<br>NG     |

How to enter the password

## 3-3 Starting Operation

## **3-3-1 Preoperation Check**

Check the following points before starting operation.

- The device is properly installed and the feedback lever, feedback pin and other parts are not damaged or fractured.
- The pneumatic piping is completely connected and an appropriate supply air pressure is supplied. (Air is not leaking.)
- Is the input signal (4 to 20 mA DC) being applied.

### 1) Procedure for checking the device operation

The procedure for checking the device operation is shown below.

| Step | Work  |
|------|---|
| 1    | Check that the control valve travel is being changed to suit the preset characteristics by changing the input signal from the controller (constant current source). |
|      | If operation is not normal, refer to "Chapter 5 Troubleshooting."   |
| 2    | After confirming normal operation, tightly secure the terminal cover.   |

# **Chapter 4** Operation with HART Communication

This chapter describes the operations performed using HART communication. For the basic operations, the relationship between the mode and data settings, the specification and modification of data, how to save each type of data, and other descriptions, refer to this chapter.

#### **Operation with HART Communication** 4-1

This section describes the menu configuration and functions for adjustment and setting items using HART communication. The HART communication tool is used to adjust, set, and read data for this device. For details, see the operation manual for the HART communication tool.

#### HART communication tool and wiring

Wire it as shown in the following diagram.

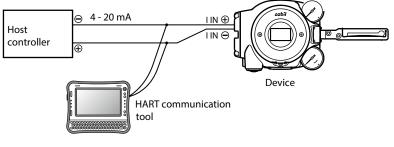


Figure4-1

Before starting HART communication

Check the following before starting communication.

- The wiring connections with this device are completed.
- The input signal (4–20 mA DC) from the controller (constant current source) is correctly applied.

## **!** Handling Precautions:

- If there is no input signal from the controller, connect the constant current source to the input signal terminal (IN). The lines from the controller must be removed in this case.
- Please download the latest DD (Device Description) when using the HART communication tool.

(Download from http://www.azbil.com/products/bi/iap/index.html)

## 4-2 Setup and Adjustment of Device

Set up and adjust the functions required for the device to operate properly.

This section describes the menu of the 475 communicator. To change settings and make adjustments, select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Operator Action Setting]  $\rightarrow$  [Allow operation action].

This allows you to change settings and make adjustments, and also restricts settings changes and adjustments from LUI and the other HART master\*.

\* HART communication master stations are configured for either the primary or secondary. In most cases, the host system is the primary and the 475 communicator is the secondary.

Once the settings and adjustments are complete, select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Operator Action Setting]  $\rightarrow$  [Forbid operation action]. The LUI becomes inoperable if you do not perform this operation. (When there has been no HART communication for more than 10 minutes, this operation will be performed automatically and the LUI becomes operable.)

## 4-2-1 Process Variables

The measurement value data present when the device is operating can be viewed.

Select [Process Variables].

### Checking measured values

Selecting [Process Variables] allows the following items to be checked.

| Item              | Description   |
|-------------------|---|
| Input (mA)        | Displays the current input value.                         |
| Input (%) *1      | Displays the input signal (%).                            |
| Set Point (SP) *2 | Displays the input signal (%) following flow type         |
|                   | conversion.   |
| Travel            | Displays the valve travel (%).                            |
| Position *1       | Displays the valve travel following flow type conversion. |
| Drive Signal      | Displays the EPM (electric-pneumatic converter) drive     |
|                   | signal (%).   |
| Po1               | Displays the output air pressure (OUT1).                  |
| Po2               | Displays the output air pressure (OUT2).                  |
| Ps                | Displays the supply air pressure (SUP).                   |
| Pn                | Displays the nozzle back pressure.                        |
| Temperature       | Displays the temperature inside the positioner.           |

Table 4-1 Description of Each Part

\*1: This is not displayed if flow type conversion was not performed.

\*2: The set point during forced closure is fixed at 0 %.

The set point during forced opening is equal to the travel cutoff high +1 %.

## 4-2-2 Auto Setup

Auto setup is a function that automatically performs basic adjustments and setup after the device is assembled onto the actuator.

```
Select [Device]\rightarrow[Basic Setup]\rightarrow[Auto Setup].
```



## **∕**∆Cautions

It is dangerous during auto setup because the fully closed valve moves to fully open. Be prepared in advance to prevent injury and effects on the process when the valve moves.

## Handling Precautions:

- The input signal should be 5 mA or more. If it is less than 5 mA, auto setup may not operate normally.
- If any of the self-diagnostic messages shown in Table 4-5 in 4-2-20, "Diagnostic Messages" appears, auto setup cannot be executed.
- When auto setup and zero span adjustment are complete, change the input signal and be sure to check valve operations such as opening and shutoff.
- Before the Auto setup operation, set the position of the actuator type and the forced close feedback lever correctly.
- In some cases, the dynamic characteristic is not set correctly with the actuator capacity, operation stroke, inner diameter of pneumatic piping and piping length. If this occurs, refer to '4-2-5 Control Configuration' and adjust the dynamic characteristic manually.
- When the actuator size is Custom, the size is not changed with the Auto setup.
   When selecting the actuator size with the Auto setup, set the size as below.
   Param 1 to 6 or
  - Param A to C.
- In some cases, the initial setting is not same even though the actuator and valve size is same. Please perform the operation check and configuration of the device if necessary.
- There is a possibility that the forced open value described on page '4-2-7 Travel Cutoff' may change after performing the Auto-setup operation. Please reconfigure the forced open value if necessary.
- If the booster relay is on, and is operating the Auto-setup function, there might be a possibility of hunting. In this case, adjust the booster's sensitivity, or refer to '4-2-5 Control Configuration and adjust the dynamic characteristic manually.
- If a speed controller is incorporated, set it to full open and execute auto-setup. Afterwards, adjust the speed with the speed controller.
- When the device is purchased separately, its initial settings are set to those in the list of default values in '6-7 List of Default Values for Internal Data' of this manual. Because the default actuator direction is reverse, if you mount the device on the direct actuator the device will not work. Please be sure to execute the auto setup program before operation and be sure that appropriate settings are created in the device.

Check the Actuator Type and Valve Closed Position before starting auto setup.

The Actuator Type is set to Linear and the Valve Closed Position is set to Down when the valve is fully closed at the time of shipment unless there are other shipment setup instructions. If factory setting (initial setup) is requested, check the settings at the time of shipment. Configure settings as needed. If auto setup fails, refer to 5-1-5, "Auto Setup Failure."

The reverse action actuator fully closes, fully opens, and fully closes the valve when auto setup starts. The direct action actuator fully opens, fully closes, and fully opens the valve. Then, it is opened to between 20% and 25% and between 80% and 85%.

After auto setup, the valve moves to the opening appropriate to the input signal.

The following items are automatically adjusted and set during auto setup.

(1) Zero span adjustment

The zero point is set to the travel when the valve is fully closed. The span point (100 % travel) is set in such a way that the travel when the valve is fully opened is Travel Cutoff High + 1 %. (If Travel Cutoff High is 99 %, the fully opened position is the span point.) If the span is adjusted after auto setup, Travel Cutoff High will be automatically changed and saved.

(2) Input signal range (Input Range), Input Range Low (Close) and Input Range High (Open) settings

The input range settings are changed so that the valve operation direction (close or open) when the input current is lowered from 20 mA to 4 mA is the same as the direction for power-off (input current: 0 mA).

Example: If Valve Closed Position is set to DOWN (normal)

When the actuator action is reversed:

Input Range Low (Close) = 4mA, Input Range High (Open) = 20mA

When the actuator action is forwarded:

Input Range Low (Close) =20mA, Input Range High (Open) = 4mA

(3) Specification of Actuator Size

Select the actuator size from among Param 1 to Param 6, Param A, B, and C.

(4) Specification of Friction Level

Select the friction level of the gland packing from among LIGHT, MEDIUM, and HEAVY.

(5) Specification of Feedback Lever Motion

Specify UP or DOWN as the operation of the feedback lever when output air pressure OUT1 increases.

(6) Specification of Positioner Action

When the input signal is "Disconnected," the positioner operation is forward operation (Direct) if the output air pressure is 0.

When the input signal is "Disconnected," the positioner operation is reverse operation (Reverse) if the output air pressure is the supply air pressure.

(7) Specification of Pilot Relay Type

Select Single Acting or Double Acting as the operation of the actuator.

## 4-2-3 Input Range

Sets the current input value when the valve travel is at 0% (Input Range Low (Close)) and the current input value when the valve travel is at 100% (Input Range High (Open)). An input in the 4–20 mA range can be used.

Select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Input Range].



## **≜**Cautions

Changing the input signal range will move the valve, which is dangerous. Ensure ahead of time that there will be no injuries or effects on the processes if the valve is moved.

Input Range High (Open/100%): Set the input signal at 100% travel.

Input Range Low (Closed/0%): Set the input signal at 0% travel.

## **!** Handling Precautions:

- Set the current input span to not exceed 4 mA for (Input Range High (Open) Input Range Low (Close)). If the current input span is less than 8 mA, the precision will be ±1.5% of full scale.
- Set the value so that the operation direction is the same when the input signal is 0 mA and 4 mA. The following conditions must be satisfied. If the valve is fully closed at power-off :

Input Range High (Open/100%) > Input Range Low (Closed/0%) If the valve is fully open at power-off :

Input Range High (Open/100%) < Input Range Low (Closed/0%)

## 4-2-4 Valve System

Specify the operation of the control valve (actuator and valve) and the positioner. Select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Valve System].



It is dangerous because the valve moves when the settings are changed. Be prepared in advance to prevent injury and effects on the process when the valve moves.

- Actuator Type
  - Linear

Linear motion valve

- Rotary/90°

When the distance between the feedback lever of the rotary actuator (90°) and the pin is longer than the distance from the valve shaft

- Rotary/Other

When the distance between the feedback lever of the rotary actuator (around 60°) and the pin is longer than the distance from the valve shaft

- Rotary sub/90°

When the distance between the feedback lever of the rotary actuator (90°) and the pin is shorter than the distance from the valve shaft

- Rotary sub/Other

When the distance between the feedback lever of the rotary actuator (around 60°) and the pin is shorter than the distance from the valve shaft

Valve Closed Position

Feedback lever position of fully closed

- Down (Standard)
- Up
- Feedback Lever Motion

Specify UP or DOWN as the operation of the feedback lever when output air pressure OUT1 increases. This setting is automatically set by the auto setup.

· Pilot Relay Type

Pilot Relay Type (Single Acting or Double Acting) is indicated. The type is automatically determined by auto setup.

Positioner Action

The EPM moving direction that is automatically determined by auto setup is indicated.

## **!** Handling Precautions:

The positioner operation direction is determined by the hardware of the main unit. This function cannot be used to switch the operation direction. If you want to switch the operation direction, contact one of our service representatives.

· Electrical Fail To

Open or Closed is automatically set as the fail safe direction when the electrical signal is "Disconnected" based on the settings for Valve Closed Position, Feedback Lever Motion, and Positioner Action.

• Air Fail To

Open or Closed is automatically set as the fail safe direction when the supply air pressure is "Disconnected" based on the settings for Valve Closed Position and Feedback Lever Motion.

This item is not displayed when Pilot Relay Type is Double Acting.

### 4-2-5 Control Configuration

Control parameters are PID operation parameters for controlling the control valve and are selected based on Actuator Size and Friction Level.

Select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Control Configuration].

- Actuator Size

Specify Param 1 to 6 or Param A to C depending on the operation speed and capacity of the actuator.

To specify every PID operation parameter, select Custom. (For details, consult with one of our service representatives.)

| Actuator Size | Operating speed | Typical actuator | Actuator capacity                  |
|---------------|-----------------|------------------|------------------------------------|
|               | [s]             | model            | (Typical value) [cm <sup>3</sup> ] |
| PARAM C       | Up to 0.25      | -                | 200                                |
| PARAM B       | Up to 0.35      | -                | 300                                |
| PARAM A       | Up to 0.45      | -                | 400                                |
| PARAM 1       | Up to 0.85      | PSA1, PSK1       | 600                                |
| PARAM 2       | Up to 2.0       | PSA2, HA2        | 1400                               |
| PARAM 3       | Up to 6.5       | PSA3, HA3        | 2700                               |
| PARAM 4       | Up to 8.15      | PSA4, HA4        | 6600                               |
| PARAM 5       | Up to 12        | PSA6             | 8100                               |
| PARAM 6       | Up to 99        | VA5              | 25300                              |

Table 4-2 Actuator Size

#### - Friction Level

Select Heavy, Medium, or Light depending on the gland packing. (It is not necessary to specify this item when Custom is selected for Actuator Size.)

| Friction Level * | Example of gland packing material |
|------------------|-----------------------------------|
| HEAVY            | Graphite packing type             |
| MEDIUM           | Yarn packing type                 |
| LIGHT            | V-type PTFE packing type          |

| Table 4-3 | Friction | Level |
|-----------|----------|-------|
|-----------|----------|-------|

\* This value differs depending on the friction of the gland packing rather than the material.

#### - Control Deadband

Specify the deadband. Although deadband may be effective in preventing hunting, when the friction of the gland packing is especially large, for example, we recommend keeping this value within 1%.

#### - Replace Control Parameters

Replace the PID parameters selected in Actuator Size and Friction Level with the values in Control Parameters. The setting can be changed only if Actuator Size is set to Custom.

- Control Parameters

When Actuator Size is Custom, each PID must be specified individually. The control algorithm employs dual GAP PID control, which switches PID parameters between three levels depending on the control deviation size. There are 11 parameters as shown below. Set a value larger than the dual width to the gap width. The integration operation is disabled when 9999 is set as the value of the integral.

| P Outside of Gap:     | Proportional gain outside the gap width [1/%]     |
|-----------------------|---|
| I Outside of Gap:     | Integral time outside the gap width [s]           |
| D Outside of Gap:     | Differential time outside the gap width [s]       |
| Gap Band:             | Gap width [±%]                                    |
| P Inside Gap:         | Proportional gain within the gap width [1/%]      |
| I Inside Gap:         | Integral time within the gap width [s]            |
| D Inside Gap:         | Differential time within the gap width [s]        |
| Dual Gap Band:        | Dual gap width [±%]                               |
| P Inside of Dual Gap: | Proportional gain within the dual gap width [1/%] |
| I Inside of Dual Gap: | Integral time within the dual gap width [s]       |
| D Inside of Dual Gap: | Differential time within the dual gap width [s]   |

### 4-2-6 Input Characterization

Specify the flow amount characteristic.

Select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Input Characterization]  $\rightarrow$  [InputCharacterization].

- Characterization

Select Linear, Equal Percent, Quick Open, or Custom Curve.

The concept of each characteristic is shown below.

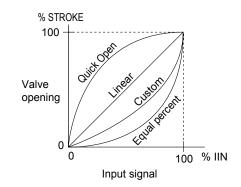


Figure4-2 Concept of Flow Characteristics

- Custom Curve Data

When selecting Custom Curve, individually specify the input signal (Custom Data X1 to 21) and the opening (Custom Data Y1 to 21) to specify a polygonal line consisting of 21 points.

### **!** Handling Precautions:

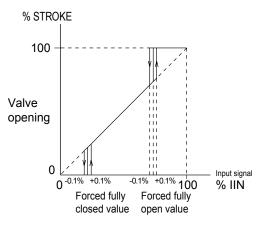
- Specify both Custom Data IN and Custom Data OUT so that they monotonically increase.
- The setting range is between 0% and 100%. The linear characteristic is set from both edges outside this range.

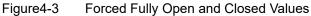
### 4-2-7 Travel Cutoff

Specify the input signal (%) to forcibly fully open or close the valve. The valve is fully closed when the input signal is less than or equal to the forced fully closed value. The valve is fully opened when the input signal is greater than or equal to the forced fully open value. These values can be independently specified.

Select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Travel Cutoff], then set forced fully closed value (TravelCutoff Low) and forced fully open value (Travel Cutoff High).

The concept of input/output characteristics when the forced fully open and closed values are specified is shown below.





## **!** Handling Precautions:

- Specify values such that the forced fully closed value is smaller than the forced fully open value.

If the forced fully closed value is equal to the forced fully open value, the valve performs the ON/OFF operation.

- The settable range is between -200% and 50% for the forced fully closed value and between 50% and 200% for the forced fully open value.
- If you adjust the span after auto setup, the forced fully open value is automatically changed to the value calculated by subtracting 1% from the overstroke percentage.
- The forced fully closed and open values each have a hysteresis difference of 0.1%.
- When the valve is forced fully closed (open), Working Setpoint shows the value for the fully closed (open) status.

## 4-2-8 Units

Specify the units for pressure.

Select [Device]  $\rightarrow$  [Configuration]  $\rightarrow$  [Unit].

Initial setting of SI system unit and non-SI system unit is as follows. You can not change the initial setting.

If the non-SI system unit is needed, order kg/cm<sup>2</sup> or psi at the time of purchase.

SI system: kPa, MPa, Bar

Non-SI system: kPa, MPa, Bar, kg/cm<sup>2</sup>, PSI

This unit setting is invalid in the LUI display. Only the kPa is valid in the LUI display.

## 4-2-9 Travel Calibration

Adjust zero and span of valve opening.

Select [Device]→[Maintenance]→[Travel Calibration].

The following four types of zero span adjustment methods are available.

- (1) Auto Travel Calibration
- (2) Angle Correction
- (3) Manual Setting
- (4) Change Travel Angle

### **!** Handling Precautions:

If you adjust the span after auto setup, the forced fully open value is changed to the value calculated by subtracting 1% from the overstroke percentage.

#### (1) Auto Travel Calibration

When you select  $[Device] \rightarrow [Maintenance] \rightarrow [Travel Calibration] \rightarrow [Auto Travel Calibration], the valve, which is initially fully closed, is fully opened and then fully closed, and the zero point and span point are automatically set.$ 

## **A**Cautions



It is dangerous during automatic opening adjustment because the fully opened valve moves to fully closed. Be prepared in advance to prevent injury and effects on the process when the valve moves.

## **!** Handling Precautions:

- Set the input signal 5 mA min. If the input signal is below 5 mA, the device may not operate properly.
- If any of the self-diagnostic messages shown in Table 4-5 in 4-2-20, "Diagnostic Messages" appears, auto travel calibration cannot be executed.
- After device operation is performed, make sure Travel Cutoff of the valve with changing input signals.

#### (2) Angle Correction

Adjust the angles of the zero and span points.

Select [Device]→[Maintenance]→[Travel Calibration]→[Angle Correction].

- 0% Travel

Set 0% to Final Valve.

Set a value less than 0% to Final Value Lo Cutoff, select the angle increment and decrement values, and adjust the zero point. (To increase the value by 0.01°, select Increment/0.01.)

After adjustment, return Final Value Lo Cutoff to the original value.

- 100% Travel

Set 100% to Final Valve.

If Final Value Hi Cutoff is less than 100%, set a value larger than 100%, select the angle increment and decrement values, and adjust the span point. After adjustment, return Final Value Hi Cutoff to its original value.

## **!** Handling Precautions:

If the angle after adjustment changes by more than  $\pm 30^{\circ}$ , the operation is disabled.

(3) Manual Setting

Manually fix the 0% or 100% opening and set the zero and span points.

Select [Device]→[Maintenance]→[Travel Calibration]→[Manual Setting].

- 0% Travel

Move the valve to the 0% opening position by operating the input signal, actuator pressure, manual handle, or other factor and set the zero point.

- 100% Travel

Move the valve to the 100% opening position by operating the input signal, actuator pressure, manual handle, or other factor and set the span point.

## **!** Handling Precautions:

If the angle after adjustment changes by more than  $\pm 30^{\circ}$ , the operation is disabled.

#### (4) Change Travel Angle

Set the angles of 0% opening and 100% opening.

The angle is 0° when the feedback lever is horizontal. The angle is negative if the lever is lower than the horizontal position. The angle is positive if the lever is higher than the horizontal position.

Select [Device] $\rightarrow$ [Maintenance] $\rightarrow$ [Travel Calibration] $\rightarrow$ [Change Travel Angle].

- 0% Travel Angle

Set the angle of the 0% opening position.

- 100% Travel Angle

Set the angle of the 100% opening position.

## **!** Handling Precautions:

Specify an angle within  $\pm 30^{\circ}$ . Accuracy is guaranteed between  $\pm 4^{\circ}$  and  $\pm 20^{\circ}$ .

## 4-2-10 Input Calibration

Calibrates the input signal (4 mA, 20 mA).

Select [Device]  $\rightarrow$  [Maintenance]  $\rightarrow$  [Input Calibration].

Calibrate the 4 mA signal

Set after making the current input (controller output) 4 mA.

· Calibrate the 20 mA signal

Set after making the current input (controller output) 20 mA.

#### 4-2-11 Pressure Sensor Adjustment

Adjust the zero point of the pressure sensor.

Select [Device]  $\rightarrow$  [Maintenance]  $\rightarrow$  [Pressure Sensor Adjustment]  $\rightarrow$  [ZeroAdjustment].

Shut off the supply air pressure before zero adjustment.

## 4-2-12 Simulation

The following two operations can be changed.

## **!** Handling Precautions:

The input signal should be 5 mA or more. If it is lower than 5 mA, the device does not operate normally.

#### (1) Dummy Input Signal

Specify the pseudo input signal (0% to 100%) and operate the valve. Regardless of the actual input current, the desired input signal can be sent to the device.

Select [Device]  $\rightarrow$  [Maintenance]  $\rightarrow$  [Simulation]  $\rightarrow$  [Dummy Input Signal].

#### (2) Dummy Drive Signal

Specify the pseudo EPM drive signal (0% to 100%). Regardless of the actual input current and travel, the desired EPM drive signal can be output from the device.

Select [Device]  $\rightarrow$  [Maintenance]  $\rightarrow$  [Simulation]  $\rightarrow$  [Dummy Drive Signal].

## **≜**Cautions

0

When a simulation is running, it is dangerous to leave it unused for more than 10 minutes, as this will cancel out the setting, and the valve may start moving. Ensure ahead of time that there will be no injuries or effects on process if the valve is moved.

## 4-2-13 Adjustment of EPM Drive Signal (Pneumatic Modules)

This function is used to adjust the EPM drive signal if the signal has shifted or if Positioner Action has changed.

Select [Device]  $\rightarrow$  [Maintenance]  $\rightarrow$  [Pneumatic Modules]  $\rightarrow$  [EPM Adjustment].

### **!** Handling Precautions:

Ask our service representative for the operation not to damage a device by erroneous operation..

### 4-2-14 Restore factory settings

Restore the data that was set when the device was shipped from the factory.

Select [Device]→[Maintenance]→[Restore factory settings].

(It may be necessary to restart the communication tool after restoring the factory data.)

### **!** Handling Precautions:

This operation does not change the HART communication settings such as Device Tag and Long Tag, diagnostics-related settings, and history information.

#### 4-2-15 Operator Action Records

Save the history of setting modification operations.

The operation item, operation method, and time of the last 10 modifications are saved.

Simulation operations are not saved.

Select [Device]→[Maintenance]→[Operator Action Records].

#### 4-2-16 Real Time Clock

Checks and sets the current time. Select [Device]  $\rightarrow$  [Maintenance]  $\rightarrow$  [Real Time Clock].

### **!** Handling Precautions:

The current time set with this operation is reset when the power is cut.  $(2012/04/01\ 00:000)$ 

#### 4-2-17 Password

Sets whether to use the password function and sets the password. Select [Device]  $\rightarrow$  [Maintenance]  $\rightarrow$  [Password].

### 4-2-18 Device Information

Select [Device]  $\rightarrow$  [Device Information].

The following information can be checked and the settings can be changed.

Manufacturer

Displays Azbil Corporation as the device manufacturer.

Model

Displays AVP700 as the name and model number of the device.

Device ID

Displays the unique ID information of the device.

Device Tag

Displays and changes the Tag No. assigned to the device.

Long Tag

Displays and changes the Tag No. assigned to the device.

Date

Displays and changes specific dates such as the final settings date of the device.

Descriptor

Displays and changes the various information required to manage the device.

Message

Displays and changes the messages registered in the device.Config Change Counter

- Displays and changes the messages registered in the device.
- Serial Number

Displays the unique serial number of the device.

• Final Assembly Number

Displays and changes specific management numbers such as the final settings date for the device and system.

Distributor

Displays the name of the company selling the device.

Config Change Counter

Displays the number of changes made to the set device.

Operating Time

Displays the time the device has been operating.

Polling Address

Displays and changes the device address. Specifies the device address when multiple devices are connected to the same loop (split range, multidrop connection, etc.). • Number of Request Preambles

Displays the number of preambles requested from the device to the host.

• Number of Response Preambles

Displays the number of preambles returned from the device to the host.

Revision Numbers

HART Version:

Displays the revision number of the HART universal command supported by this device.

Device Revision:

Displays the revision number of the device-specific command supported by this device.

Software Revision:

Displays the revision number of the software in a given Device Revision.

Hardware Revision:

Displays the revision number of the hardware for this device.

• Factory Setting Information

Production Number:

Displays the production number.

Model Number:

Displays the model number.

Valve Model Number:

Displays the valve model number.

Factory Setting Date:

Displays the factory shipping date.

## 4-2-19 Option

Additional functions include the following.

### Travel transmission signal output

Selecting [Device]  $\rightarrow$  [Option]  $\rightarrow$  [Travel Transmission (AO)]  $\rightarrow$  [TravelTransmission] allows the travel signal output to be monitored.

Selecting [Device]  $\rightarrow$  [Option]  $\rightarrow$  [Travel Transmission (AO)]  $\rightarrow$  [Dummy TravelTransmission] allows the travel signal output to be changed freely.

Selecting [Device]  $\rightarrow$  [Option]  $\rightarrow$  [Travel Transmission (AO)]  $\rightarrow$  [Fail SafeDirection] allows the failsafe direction (High or Low) for the travel signal to be checked.

This setting is set at the time of factory shipment, and the setting change after the delivery is not possible.

If a self-diagnostic message pertaining to fail-safe operation (Table 4-5 in section 4-2-20) appears, the travel transmission signal is sent according to the specified fail safe direction.

Selecting [Device]  $\rightarrow$  [Option]  $\rightarrow$  [Travel Transmission (AO)]  $\rightarrow$  [D/A Trim] calibrates the travel signal output (4 mA, 20 mA). Connect to an ammeter to calibrate the current value.

## 4-2-20 Diagnostic Messages

The device has a self-diagnostic function.

Select [Device] $\rightarrow$ [Diagnostics] $\rightarrow$ [Diagnostic Status] $\rightarrow$ [Positioner Diagnostic].

### 1) Self-Diagnostic Messages

|                      | Message   |
|----------------------|---|
| Failure              | Valve Travel Detector Failure                   |
|                      | Valve Travel Detector Out of Range              |
|                      | CPU Failure                                     |
|                      | RAM Failure                                     |
|                      | ROM Failure                                     |
|                      | A/D Conversion Module 1 Failure                 |
|                      | A/D Conversion Module 2 Failure                 |
|                      | Non-Volatile Memory Failure                     |
|                      | Po 1 Pressure Sensor Failure                    |
|                      | Po 2 Pressure Sensor Failure                    |
|                      | Ps Pressure Sensor Failure                      |
|                      | Pn Pressure Sensor Failure                      |
|                      | Input Circuit Failure                           |
|                      | Temperature Sensor Failure                      |
|                      | Internal Program Execution Error                |
| Function Check       | In Use by Local User I/F                        |
|                      | Dummy Input Signal simulation is running        |
|                      | Dummy Drive Signal simulation is running        |
|                      | Dummy Travel Transmission simulation is running |
|                      | Auto Setup is running                           |
|                      | Auto Travel Calibration is running              |
|                      | Step Responce Test is running                   |
|                      | Valve Signature is running                      |
| Out of Specification | VTD Angle Span Out of Range                     |
|                      | Input Signal Low                                |
|                      | Insufficient Input Signal Range                 |
|                      | Temperature Out of Range                        |
|                      | Supply Pressure Out of Range                    |
|                      | VTD Temperature Out of Range                    |
|                      | Incorrect Setting of Input Range High/Low       |
| Maintenance Required | Restriction is clogged *                        |
|                      | Deposits on the Nozzle-Flapper *                |
| Information          | Travel Cutoff High                              |
|                      | Travel Cutoff Low                               |
|                      | Factory Settings Restored                       |
|                      | In Use by an Operator                           |
|                      | Local User I/F Abnormal                         |
|                      | Failure Output (AO)                             |
|                      | Local User I/F was used in past 10 min.         |

\* This message can be enabled or disabled by changing the setting of [Diagnostics] → [Diagnostic Setup] → [Positioner Air Circuit] → [Positioner Air Circuit Alarm Enabled]. The factory default setting is "Enabled." ("Enabled" is recommended.) In addition, you can set the threshold value of this message with [Diagnostics] → [Diagnostic Setup] → [Positioner Air Circuit] → [Drive Sig Shift Threshold +] or [Drive Sig Shift Threshold –]. The factory default setting is "±25 %." ("±25 %" is recommended.)

#### Self-diagnostic messages pertaining to fail-safe operation

If the device judges, based on the result of self-diagnosis, that it cannot control the valve properly, the device executes fail-safe operation.

The output air pressure and Travel Transmission during fail-safe operation are as follows.

<Output air pressure>

| Positioner Action | Pilot Relay Type | Output Air Pressure  |
|-------------------|------------------|----------------------|
| Direct action     | single acting    | zero                 |
|                   | double acting    | Po1: zero            |
|                   |                  | Po2: Supply Pressure |
| Reverse action    | single acting    | Supply Pressure      |
|                   | double acting    | double acting        |
|                   |                  | Po1: Supply Pressure |
|                   |                  | Po2: zero            |

<Travel Transmission>

The travel transmission signal is output in accordance with the fail-safe direction (UP or DOWN) specified by a switch. (For how to check the setting, refer to 4-2-19, "Option.")

UP: 21.0 mA minimum DOWN: 3.6 mA maximum

Fail-safe operation is executed if any of the following self-diagnostic messages appear.

Table 4-5 Self-diagnostic messages leading to fail-safe operation

| Message                            |  |  |
|------------------------------------|--|--|
| Valve Travel Detector Failure      |  |  |
| Valve Travel Detector Out of Range |  |  |
| CPU Failure                        |  |  |
| RAM Failure                        |  |  |
| ROM Failure                        |  |  |
| A/D Conversion Module 1 Failure    |  |  |
| Non-Volatile Memory Failure        |  |  |
| Input Circuit Failure              |  |  |

## 4-2-21 Control Valve Diagnostic Messages

The device has a control valve diagnostic function. Select [Device] $\rightarrow$ [Diagnostics] $\rightarrow$ [Diagnostic Status] $\rightarrow$ [Valve Diagnostic].

|                      | Message                    |
|----------------------|----------------------------|
| Out of Specification | Supply Pressure High Alarm |
|                      | Supply Pressure Low Alarm  |
|                      | Temp High Alarm            |
|                      | Temp Low Alarm             |
|                      | Deviation + Alarm          |
|                      | Deviation - Alarm          |
|                      | Zero Travel + Alarm        |
|                      | Zero Travel - Alarm        |
| Maintenance Required | Total Stroke Alarm         |
|                      | Cycle Count Alarm          |
|                      | Shut Count Alarm           |
|                      | Max Tvl Speed + Alarm      |
|                      | Max Tvl Speed - Alarm      |
|                      | Po Validity + Alarm        |
|                      | Po Validity - Alarm        |
|                      | Max Friction Alarm         |
|                      | Stick-Slip High Alarm      |
|                      | Stick-Slip Medium Alarm    |
|                      | Stick-Slip Low Alarm       |

Table 4-6 Control Valve Diagnostic Messages List

# Chapter 5 Troubleshooting

This chapter describes how to address problems in case of troubles.

The following three types of problems may occur when you start up and start operating the device.

- Problems that occur because the specifications of the device are not suitable for the actual use conditions
- · Problems due to setup or operation errors
- Problems due to failure of the device

If a problem occurs, take appropriate actions according to the troubleshooting guidelines described in this chapter.

## 5-1 Troubleshooting

If a problem occurs when operation starts or during operation, address the problem according to the procedure below. If the problem cannot be solved after taking the actions described below, the device may be malfunctioning. Please contact us.

### 5-1-1 The Device Does Not Operate. (There Is No Output Air Pressure.)

- 1. Check that setup has been properly completed (e.g. allowable rotation angle of feedback lever).
- 2. Check that an appropriate supply air pressure is supplied (e.g. air leak).
- 3. Check that an appropriate input signal (power supply) is input (e.g. whether electrical wiring is correct).
- 4. When communication is possible, have the device perform self-diagnostics and take actions according to the displayed messages. Please refer to 5-2, "Description of Messages."
- 5. Check whether the internal data in the device is properly specified.

### 5-1-2 The Control Valve Operates Abnormally (There Is Output Air Pressure.)

- 1. Activate the manual operation status with the A/M switch, adjust air with the regulator, and check that the valve shaft moves smoothly. (Check whether galling or packing solidification has occurred.)
- 2. Check whether the internal data in the device is properly specified (actuator size and hysteresis, among other data).
- 3. If the symptoms of the problem can be found in the table below, take the corresponding actions according to the table.

|                         | · · · · · · · · · · · · · · · · · · ·   |
|-------------------------|---|
| Problem                 | Point to be checked and action  |
|                         | <ul> <li>Check that the allowable rotation angle of the feedback lever<br/>is obeyed.</li> </ul>  |
| Hunting<br>Overshoot    | <ul> <li>Change the friction level from Light to Medium to Heavy. If<br/>this does not solve the problem, change the actuator size</li> </ul> |
|                         | setting to a smaller parameter with the friction level set  |
|                         | to Heavy. (For the work procedure, refer to "Adjustment   |
|                         | Procedure when Hunting Occurs" on the next page.)   |
| The device does not     | - Check that the fully closed and open positions (zero and  |
| complete a full stroke. | span) of the valve are properly adjusted.   |
| The response speed is   |   |
| too slow.               | - Check that the EPM drive signal is within the range of $50 \pm 25\%$ .  |

### 5-1-3 Failure to communicate with the communicator

- 1. Check whether the electrical wiring is correct.
- 2. Check whether the communicator is correctly connected with the device.
- 3. Check whether both input and output devices have power sources.
- 4. Check whether the relationship between the power supply voltage and external load meets the specifications.
- 5. Check whether the wiring is correct for the Models without the motion transmission function (model AVP702) and with the motion transmission function (model AVP701)

## 5-1-4 Adjustment Procedure When Hunting Occurs

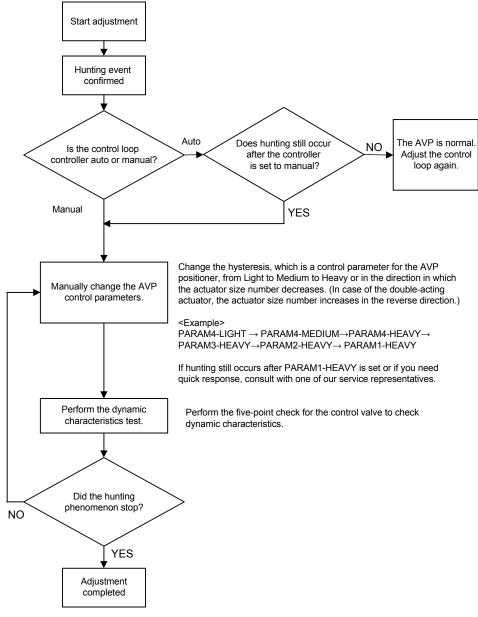


Figure 5.1

### 5-1-5 Auto Setup Failure

Check the following:

- The supply air pressure is appropriate.
- The A/M switch is in the AUTO position.
- The feedback pin and feedback lever are properly connected.
- The output air pressure is properly supplied to the actuator.
- Valve motion is not obstructed by a handle, etc.
- The input signal is 5 mA or more.
- · Valve Signature and Step Response Test are not running.

If there is no problem with the above, there is a possibility that the attached actuator cannot be set up using the auto setup function for some reason. For example, the actuator may take too long before starting to operate. In this case, the user can set up the device manually in order to control valve travel properly. However, some functions will be unavailable.

- Some types of valve diagnosis cannot be used. (For details, contact our service staff.)
- · Deviation diagnosis when the valve is forced to open might not work properly.

#### Settings necessary for travel control

Specify the parameters in the table below, referring to the indicated sections of the manual.

|                               |                       | Reference                          |                       |  |
|-------------------------------|-----------------------|------------------------------------|-----------------------|--|
| Туре                          | Parameter             | LUI                                | HART<br>Communication |  |
|                               | Valve Closed Position | 3-2-1 (3)                          | 4-2-4                 |  |
| Control volvo ovotom pottingo | Actuator Type         | 3-2-1 (3)                          | 4-2-4                 |  |
| Control valve system settings | Feedback Lever Motion | Cannot be specified using the LUI. | 4-2-4                 |  |
| Zero/span adjustment          | Travel Angle 0 %      | 3-2-2 (3)                          | 4-2-9 (3) or          |  |
|                               | Travel Angle 100 %    | 3-2-2 (3)                          | 4-2-9 (4)             |  |
| Control parameter settings    | Actuator Size         | 3-2-4                              | 4-2-5                 |  |
|                               | Fliction Level        | 0-2-4                              | <b>−−∠−</b> 0         |  |
| Input signal range settings*  | Input Range Low       | Cannot be specified                | 4-2-3                 |  |
|                               | Input Range High      | using the LUI.                     | 4-2-0                 |  |

\* These parameters must be changed if their magnitude relationship is not correct.

# 5-2 Description of Messages

|  |                           |               | LUI display                                |   |  |
|--|---------------------------|---------------|--|---|--|
| Message                                  | LUI display<br>example *1 | Upper<br>part | Lower part<br>[*: Optional]                | Description and cause   | Action   |
| ROM Failure                              |                           | AL_00         | 0x01,0x03,0x05,0x07<br>0x09,0x0b,0x0d,0x0F | ROM error.  | Contact Azbil group.   |
| RAM Failure                              |                           | AL_00         | 0x02,0x03,0x06,0x07<br>0x0A,0x0b,0x0E,0x0F | RAM error.  | Contact Azbil group.   |
| Non-Volatile<br>Memory<br>Failure        |                           | AL_00         | 0x04,0x05,0x06,0x07<br>0x0c,0x0d,0x0E,0x0F | Non-volatile memory<br>error.   | Contact Azbil group.   |
| CPU Failure                              |                           | AL_00         | 0x08,0x09,0x0A,0x0b<br>0x0c,0x0d,0x0E,0x0F | CPU error.  | Contact Azbil group.   |
| Valve Travel<br>Detector<br>Failure      |                           | AL_01         | 0x*1,0x*5,0x*9,0x*d                        | <ul> <li>VTD (angle sensor) error.</li> <li>The VTD connector is disconnected.</li> <li>VTD signal line is disconnected or short-circuited.</li> </ul>                                      | Contact Azbil group.   |
| Valve Travel<br>Detector Out<br>of Range |                           | AL_01         | 0x*2,0x*6,0x*A,0x*E                        | <ul> <li>VTD (angle sensor)<br/>output error.</li> <li>The allowable rotation<br/>angle of feedback lever<br/>(±30°) is exceeded.</li> <li>The feedback lever is<br/>disengaged.</li> </ul> | Check that the feedback<br>lever is not disengaged and<br>that the allowable rotation<br>angle (±30°) is obeyed.<br>If the error message does<br>not disappear even after you<br>check these points, contact us. |
| A/D<br>Conversion<br>Module 1<br>Failure |                           | AL_01         | 0x*4,0x*5,0x*6,0x*c<br>0x*d,0x*E           | Error in the AD conversion section (operation part).  | Contact Azbil group.   |
| A/D<br>Conversion<br>Module 2<br>Failure |                           | AL_01         | 0x*8,0x*9,0x*A,0x*c<br>0x*d,0x*E           | Error in the AD<br>conversion section<br>(pressure sensor).   | Contact Azbil group.   |
| Input Circuit<br>Failure                 |                           | AL_14         | 0x*1,0x*3,0x*5,0x*7<br>0x*9,0x*b,0x*d,0x*F | Input Circuit Failure   | Contact Azbil group.   |
| Po 1<br>Pressure<br>Sensor<br>Failure    |                           | AL_01         | 0x1*,0x3*,0x5*,0x7*<br>0x9*,0xb*,0xd*,0xF* | Error in the Po1 pressure sensor.   | Contact Azbil group.   |

|   |                                 |               | LUI display                                |  |   |
|---|---------------------------------|---------------|--|--|---|
| Message   | LUI display<br>example *1       | Upper<br>part | Lower part<br>[*: Optional]                | Description and cause  | Action  |
| Po 2<br>Pressure<br>Sensor<br>Failure             |                                 | AL_01         | 0x2*,0x3*,0x6*,0x7*<br>0xA*,0xb*,0xE*,0xF* | Error in the Po2 pressure sensor.                                | Contact Azbil group.  |
| Ps Pressure<br>Sensor<br>Failure                  | AL 01<br>B 0x40                 | AL_01         | 0x4*,0x5*,0x6*,0x7*<br>0xc*,0xd*,0xE*,0xF* | Error in the Ps pressure sensor.                                 | Contact Azbil group.  |
| Pn Pressure<br>Sensor<br>Failure                  |                                 | AL_01         | 0x8*,0x9*,0xA*,0xb*<br>0xc*,0xd*,0xE*,0xF* | Error in the Pn pressure sensor.                                 | Contact Azbil group.  |
| Temperature<br>Sensor<br>Failure                  |                                 | AL_14         | 0x02,0x03,0x06,0x07<br>0x0A,0x0b,0x0E,0x0F | Temperature sensor<br>error.                                     | Contact Azbil group.  |
| Internal<br>Program<br>Execution<br>Error         |                                 | AL_14         | 0x04,0x05,0x06,0x07<br>0x0c,0x0d,0x0E,0x0F | Program execution error.   | Contact Azbil group.  |
| Local User<br>I/F Active                          | _                               |               | _  | The LUI is operating (in setup mode).                            | Exit the LUI setup mode by holding down   |
| Dummy<br>Drive Signal<br>simulation is<br>running |                                 | AL_02         | 0x*8,0x*9,0x*A,0x*b                        | The device is in the<br>pseudo EPM drive signal<br>output state. | Clear the pseudo EPM<br>drive signal output state.  |
| Auto Setup<br>is running                          | AL 02<br>B 0 10                 | AL_02         | 0x1*                                       | Auto setup is being<br>performed.                                | Wait until execution ends<br>or stop it with the stop<br>command as needed.                           |
| Auto Travel<br>Calibration<br>is running          |                                 | AL_02         | 0x2*                                       | Automatic opening<br>adjustment is being<br>performed.           | Wait until execution ends<br>or stop it with the stop<br>command as needed.                           |
| Step<br>Responce<br>Test is<br>running            | <b>AL 02</b><br><sup>©</sup> 10 | AL_02         | 0x4*                                       | The step response test is being performed.                       | Wait until execution ends<br>or stop it with the stop<br>command as needed.                           |
| Valve<br>Signature is<br>running                  |                                 | AL_02         | 0x8*                                       | Valve signature is being performed.                              | Wait until execution ends<br>or stop it with the stop<br>command as needed.                           |
| VTD Angle<br>Span Out of<br>Range                 |                                 | AL_03         | 0x*1,0x*3,0x*5,0x*7<br>0x*9,0x*b,0x*d,0x*F | The zero and span range is too narrow.                           | Adjust the zero and span<br>so that the angle of the<br>feedback lever has a<br>span of 4° or larger. |

|  |                              |               | LUI display                                |  |  |
|--|------------------------------|---------------|--|--|--|
| Message  | LUI display<br>example *1    | Upper<br>part | Lower part<br>[*: Optional]                | Description and cause  | Action   |
| Input Signal<br>Low                                |                              | AL_03         | 0x*2,0x*3,0x*6,0x*7<br>0x*A,0x*b,0x*E,0x*F | The input current is too<br>low.   | Input at least 3.5mA   |
| Insufficient<br>Input Signal<br>Range              |                              | AL_03         | 0x*4,0x*5,0x*6,0x*7<br>0x*c,0x*d,0x*E,0x*F | The input signal range is too narrow.  | Set the input signal span<br>more than 2mA.  |
| Temperature<br>Out of<br>Range                     |                              | AL_03         | 0x*8,0x*9,0x*A,0x*b<br>0x*c,0x*d,0x*E,0x*F | The temperature in the device is lower than -40° or higher than 80°.                                 | Set the ambient<br>temperature to between<br>-40° and 80° as specified<br>by the usage conditions. If<br>this message is displayed<br>even though this condition<br>is satisfied, a sensor error<br>is suspected. Contact<br>Azbil group.            |
| Supply<br>Pressure<br>Out of<br>Range              | AL 03<br>B <sup>B</sup> 0r 0 | AL_03         | 0x1*,0x5*                                  | The supply air pressure<br>detected in the device<br>is lower than 50 kPa or<br>higher than 715 kPa. | <ul> <li>Check that the supply air pressure is applied.</li> <li>Set the supply air pressure to 715 kPa or lower. If this message is displayed even though this condition is satisfied, a sensor error is suspected. Contact Azbil group.</li> </ul> |
| Incorrect<br>Setting of<br>Input Range<br>High/Low |                              | AL_03         | 0x4*,0x5*                                  | The high and low setting of the input signal range are incorrect.                                    | Make sure the sttings<br>of Input Range High<br>(Open)and Input Range<br>Low (Closed).   |
| Supply<br>Pressure<br>High Alarm                   |                              | AL_16         | 0x01,0x05,0x09                             | The supply air pressure<br>is higher than the<br>specified threshold value.                          | <ul> <li>Check the supply air pressure.</li> <li>Check that the threshold value is appropriate.</li> </ul>   |
| Supply<br>Pressure<br>Low Alarm                    |                              | AL_16         | 0x02,0x06,0x0A                             | The supply air pressure<br>is lower than the<br>specified threshold value.                           |  |
| Temp High<br>Alarm                                 | AL IB<br>B Dr DY             | AL_16         | 0x04,0x05,0x06                             | The internal temperature<br>is higher than the<br>specified threshold value.                         | <ul> <li>Check the ambient<br/>temperature.</li> <li>Check that the threshold<br/>value is appropriate for<br/>the usage environment.</li> </ul>   |

|                                       | LUI display |               | LUI display                 |  |   |
|---------------------------------------|-------------|---------------|-----------------------------|--|---|
| Message                               | example *1  | Upper<br>part | Lower part<br>[*: Optional] | Description and cause  | Action  |
| Temp Low<br>Alarm                     |             | AL_16         | 0x08,0x09,0x0A              | The internal temperature<br>is lower than the<br>specified threshold value.  | <ul> <li>Check the ambient<br/>temperature.</li> <li>Check that the threshold<br/>value is appropriate for<br/>the usage environment.</li> </ul>  |
| Restriction<br>is clogged             |             | AL_04         | 0x01                        | The EPM drive signal<br>has exceeded the normal<br>operation range.<br>- The fixed diaphragm is<br>clogged.<br>- Air is not supplied.<br>- The valve shaft is<br>galled. | <ul> <li>Clean the fixed flow<br/>restriction.</li> <li>Check the supply air<br/>pressure.</li> <li>Check the EPM drive<br/>signal.</li> <li>Change the input signal<br/>to confirm seamless<br/>operation.</li> <li>(- Perform auto setup.)</li> </ul> |
| Deposits on<br>the Nozzle-<br>Flapper |             | AL_04         | 0x02                        | <ul> <li>The EPM drive signal has exceeded the normal operation range.</li> <li>The nozzle is clogged.</li> <li>The A/M switch is in manual mode.</li> </ul>             | <ul> <li>Clean the nozzle.</li> <li>Check that the A/M<br/>switch is in auto mode.</li> <li>Check the EPM drive<br/>signal.</li> <li>Change the input signal<br/>to confirm seamless<br/>operation.</li> </ul>  |
| Total Stroke<br>Alarm                 | _           |               | _                           | The cumulated sliding<br>distance is larger than<br>the threshold value.   | Check the operation of the control valve.   |
| Cycle Count<br>Alarm                  | _           |               | _                           | The number of inversion operations is larger than the threshold value.   | Check the operation of the control valve.   |
| Shut Count<br>Alarm                   | _           |               |                             | The number of fully<br>closing operations is<br>larger than the threshold<br>value.  | Check the operation of the control valve.   |
| Max Tvl<br>Speed +<br>Alarm           | _           |               |                             | The maximum operation<br>speed + is larger than the<br>threshold value.  | Check the operation of the control valve.   |
| Max Tvl<br>Speed -<br>Alarm           | _           |               | _                           | The maximum operation<br>speed - is smaller than<br>the threshold value.   | Check the operation of the control valve.   |

|                                 |                           | LUI display   |                             |   |   |
|---------------------------------|---------------------------|---------------|-----------------------------|---|---|
| Message                         | LUI display<br>example *1 | Upper<br>part | Lower part<br>[*: Optional] | Description and cause   | Action  |
| Po Validity +<br>Alarm          | _                         |               | _                           | The output air pressure validity + is larger than the threshold value.  | Check the operation of the control valve.   |
| Po Validity -<br>Alarm          | —                         |               | _                           | The output air pressure validity - is smaller than the threshold value.   | Check the operation of the control valve.   |
| Max Friction<br>Alarm           | —                         |               | _                           | The maximum friction is larger than the threshold value.  | Check the operation of the control valve.   |
| Stick-Slip<br>High Alarm        | —                         |               | —                           | Stick-slip is larger than the<br>"High" threshold value.  | Check the operation of the control valve.   |
| Stick-Slip<br>Medium<br>Alarm   | _                         |               | _                           | Stick-slip is larger than<br>the "Medium" threshold<br>value.   | Check the operation of the control valve.   |
| Stick-Slip<br>Low Alarm         | _                         |               | —                           | Stick-slip is larger than the "Low" threshold value.  | Check the operation of the control valve.   |
| Deviation +<br>Alarm            | —                         |               | —                           | The deviation + is larger than the threshold value.   | Check the operation of the control valve.   |
| Deviation -<br>Alarm            | _                         |               | _                           | The deviation - is smaller than the threshold value.  | Check the operation of the control valve.   |
| Zero Travel<br>+ Alarm          | _                         | _             |                             | The zero point opening<br>+ is larger than the<br>threshold value.  | Check the operation of the control valve.   |
| Zero Travel -<br>Alarm          | _                         |               | _                           | The zero point opening<br>- is smaller than the<br>threshold value.   | Check the operation of the control valve.   |
| Travel Cutoff<br>High           | _                         |               | _                           | The valve was forcibly fully opened.  | Check the forced fully<br>open and closed values<br>and apply the input signal<br>within the setting range. |
| Travel Cutoff<br>Low            | —                         |               | —                           | The valve was forcibly fully closed.  |   |
| Factory<br>Settings<br>Restored | _                         |               | _                           | The data set when the<br>device was shipped from<br>the factory was restored.<br>The factory data restoration<br>(Restore factory settings)<br>operation was performed. | Perform appropriate adjustment and setup.   |
| In Use by an<br>Operator        | _                         |               | _                           | Settings are being<br>changed through HART<br>communication or with the<br>LUI.   | Check who the operator<br>is that is changing the<br>settings.  |

|   |               | LUI display                 |                       |  |  |
|---|---------------|-----------------------------|-----------------------|--|--|
| Message LUI display<br>example *1                 | Upper<br>part | Lower part<br>[*: Optional] | Description and cause | Action   |  |
| Local User I/<br>F Abnormal                       | _             |                             | _                     | LUI module error.<br>Key input is still<br>recognized as ON.<br>The key is being<br>physically pressed down. | Check the key status.<br>Move the device away<br>from any nearby strong<br>magnetic field. |
| Local User I/<br>F was used<br>in past 10<br>min. | _             |                             | _                     | The LUI key was<br>operated within the past<br>10 minutes.   | There may be someone<br>near the device. Check<br>the safety in the field.                 |

\*1: These alarms are displayed with the nomal monitor. The alarms are not displayed with other monitors.

# Chapter 6 Maintenance

This chapter describes periodic maintenance for the device. You can properly use the device by performing appropriate maintenance. In addition, the limited life parts are listed as resale parts in 6-8. Because the replacement frequencies of resale parts differ depending on the usage environment and usage situation of the device, specify appropriate replacement frequencies.

## Precautions for safe work

# **A**Cautions

If appropriate maintenance is not performed, an unexpected operation may cause the feedback lever to move, causing an injury. Perform maintenance at appropriate times.



Maintenance work is dangerous because the valve moves. Be prepared in advance to prevent injury and effects on the process when the valve moves.

## 6-1 A/M Switch

The maintenance work can be performed by switching between Auto and Manual. The device has a built-in Auto/Manual (A/M) switch.

The A/M switch switches the control method of output air from the positioner between auto operation and manual operation.

#### 1) Auto operation

• The device outputs the output air pressure to control the opening according to the input signal.

### 2) Manual operation

- The positioner directly outputs the supply air pressure.
- Manual operations with the regulator are possible. (The double-acting actuator does not support manual operation.)

**M**Warning



It is dangerous because the valve moves when the A/M switch is operated. Be prepared in advance to prevent injury and effects on the process when the valve moves.

### 3) Structure of A/M switch

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

Remove the pilot relay cover.

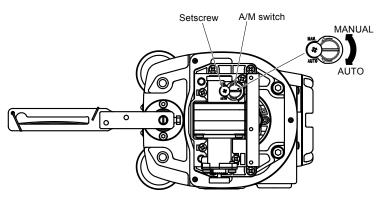


Figure 6-1 Structure of A/M Switch

 Cautions

 Do not loosen the setscrew. If the setscrew is loosened, the A/M switch will pop out due to the air pressure, potentially causing an injury.

4) Procedure for switching from auto operation to manual operation

The procedure for switching from auto operation to manual operation is shown below.

| Step | Work  |
|------|---|
| 1    | Loosen the three screws to remove the pilot relay cover in order to operate the A/M switch.   |
| 2    | Rotate the A/M switch counterclockwise (in the MAN direction)<br>by one revolution using a flat-head screwdriver. (Confirm<br>that operation has switched by using the output air pressure<br>gauge.) |

5) Procedure for switching from manual operation to auto operation

The procedure for switching from auto operation to manual operation is shown below.

| Step | Work   |
|------|--|
| 1    | Securely rotate the A/M switch clockwise (in the AUTO direction) using a flat-head screwdriver until it stops. (Confirm that operation has switched by using the output air pressure gauge.) |
| 2    | Attach the pilot relay cover onto the main unit with the three screws.   |

# 6-2 Replacement of Filter and Maintenance of Flow Restriction

The contamination of the flow restriction section in the device caused by instrumentation air can be removed during maintenance. The replacement and maintenance procedures are described below.

## ! Handling Precautions:

Use clean dry air with solid particles no larger than 3- $\mu$ m as the instrumentation air.

| Step | Work  |
|------|---|
| 1    | Shut off the supply air to the device.  |
| 2    | Loosen the three screws to remove the pilot relay cover and remove the setscrew in the A/M switch section.  |
| 3    | Rotate the A/M switch in the MAN direction to remove.   |
| 4    | Cut the holder with nippers or other tool to remove the old filter.  I Handling Precautions:  |
|      | Properly dispose of the old holder and filter.  |
| 5    | Clean the flow restriction section using a wire (with a diameter<br>of 0.25 mm) or other tool.<br>I Handling Precautions:<br>When cleaning, be careful not to damage the hole of the<br>flow restriction. Do not use an air gun.<br>Be careful not to let oil get on the cleaned flow restriction<br>again. |
| 6    | Wrap a new filter around the A/M switch and hold it with the holder.  |
| 7    | Screw in the A/M switch until it stops.   |
| 8    | Screw the setscrew into the A/M switch section.   |
| 9    | Attach the pilot relay cover with the three screws.   |

# 6-3 Cleaning the Flapper

If the flapper is contaminated by instrumentation air, clean it as described below.

# **≜**Cautions

If air pressure is supplied to the device, the back pressure of the nozzle changes after the flapper is cleaned, and therefore, the valve opening suddenly changes. Perform cleaning under conditions where the sudden move of the valve will not injure people or disturb plant operation.

| Step | Work  |
|------|---|
| 1    | Remove the three screws from the pilot relay cover.   |
| 2    | Prepare a piece of 0.2-mm thick paper. A typical business card is appropriate.                                |
| 3    | Chip dirt that has accumulated in the space between the nozzle<br>and flapper in the EPM away with the paper. |
| 4    | After cleaning, attach the pilot relay cover to the main unit with the three screws.                          |

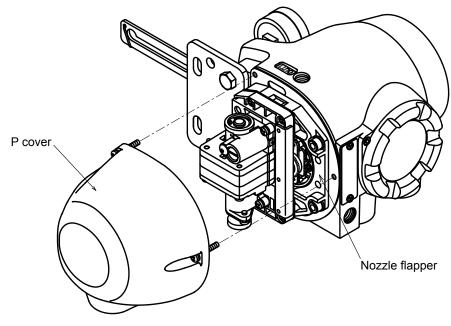


Figure 6-2 Structure

# 6-4 Adjusting the Pilot Relay

The adjustment method for the pilot relay differs depending on whether the single-acting or double-acting actuator is used.

Perform adjustments suitable for the actuator being used by referring to the procedures described below.

**≜**Cautions

| 0 |  |
|---|--|
| 0 |  |

When rotating the pilot relay adjustment screw, be careful not to get your finger caught in the space between it and the adapter.

The adjustment screw may be damaged if you rotate it with excessive force by using a tool.

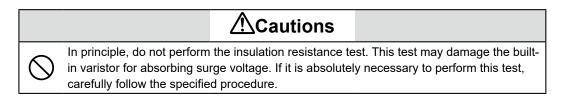
1) Procedure for adjusting the pilot relay for the double-acting actuator (Adjustment from single-acting type to double-acting type)

| Step | Work   |
|------|--|
| 1    | Rotate the pilot relay adjustment screw clockwise (tightening direction) until it stops.   |
| Ι    | The balance pressure of output air pressures Pout1 and Pout2 is used as the supply air pressure.   |
|      | Perform auto setup. (Use the LUI or communication.)  |
|      | Auto setup configures the double-acting settings and roughly adjusts the zero span.  |
| 2    | If auto setup fails, refer to 5-1-5, "Auto Setup Failure" to solve<br>the problem. If there is still a problem and auto setup cannot<br>be completed, Pilot Relay Type will not be changed to Double<br>Acting and the pilot relay cannot be used for a double-acting<br>actuator. In this case please stop adjustment and contact us. |
| 3    | After confirming that auto setup is completed, apply the input signal to make the opening 50%.   |
|      | While checking output air pressure Pout1 or Pout2 with the LUI or pressure gauge, rotate the pilot relay adjustment screw to adjust the output air pressure to $70\% \pm 10\%$ of the supply air pressure.   |
| 4    | Rotating the adjustment screw clockwise increases the balance pressure while rotating it counterclockwise decreases the balance pressure.  |
|      | I Handling Precautions:  |
|      | If the actuator has a large capacity, it takes time for the  |
|      | balance pressure to stabilize. Rotating the adjustment back<br>a bit facilitates stabilization.  |
| 5    | Perform auto setup again.  |
| 5    | The final adjustment value is measured.  |
| 6    | Perform operation checks including a five-point check (0, 25, 50, 75, 100% opening).   |

2) Procedure for adjusting the pilot relay for the single-acting actuator (Adjustment from double-acting type to single-acting type)

| · ·  |  |
|------|--|
| Step | Work   |
| 1    | Rotate the pilot relay adjustment screw counterclockwise (loosening direction) until it stops.   |
|      | Output air pressure Pout2 becomes 0.   |
|      | Perform auto setup.  |
| 2    | If auto setup fails, refer to 5-1-5, "Auto Setup Failure" to solve<br>the problem. If there is still a problem and auto setup cannot<br>be completed, Pilot Relay Type will not be changed to Single<br>Acting and the pilot relay cannot be used for a single-acting<br>actuator. In this case please stop adjustment and contact us. |
| 3    | Perform operation checks including a five-point check (0, 25, 50, 75, 100% opening).   |

## 6-5 Insulation Resistance Test



### 1) Test procedure

- Remove external wiring from the device.
- Short-circuit the FB input signal terminals + and -.
- Perform the test between each of the short-circuited parts and the grounding terminal.
- The applied voltage and evaluation criteria are as shown in the table below.

### **!** Handling Precautions:

Do not apply a voltage equal to or higher than the value below to prevent the instrument from being damaged.

### 2) Evaluation criteria

The evaluation criteria for this test is as shown below.

| Test                  | Evaluation criteria   |
|-----------------------|---|
| Insulation resistance | $2 \times 10^7 \Omega$ or higher at a test voltage of 25 VDC (at 25°C, 60%RH or less) |

# 6-6 Adjustment Procedure When Using the Device with the Booster Relay Attached

When using the device with the booster relay attached, perform adjustment according to the following procedure.

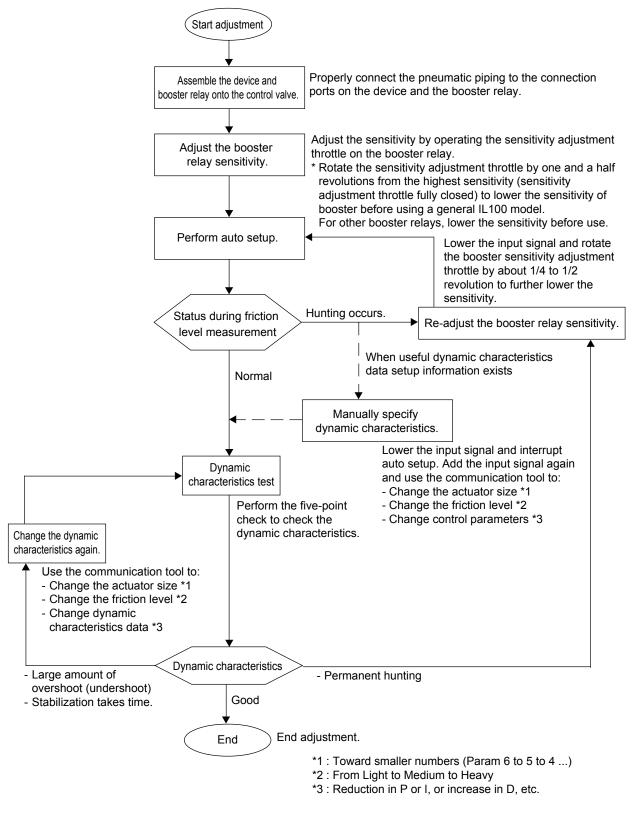


Figure 6-3

# 6-7 List of Default Values for Internal Data

|               | Item                               | Parameter                  | Default                  |
|---------------|------------------------------------|----------------------------|--------------------------|
| Device tag    |                                    | Device Tag                 | XXXXXXXX                 |
| Long tag      |                                    | Long Tag                   | Number of characters: 32 |
| Inpu<br>the v | t value to fully open<br>/alve     | Input Range High<br>(Open) | 20mA                     |
| Inpu<br>the v | t value to fully close<br>/alve    | Input Range Low<br>(Close) | 4mA                      |
| Actu          | ator type                          | Actuator Type              | Linear                   |
|               | tion of valve when<br>closed       | Valve Closed Position      | FeedBack Lever Down      |
| Whe<br>prov   | ther a booster relay is<br>ided    | Booster relay              | Without Booster Relay    |
| Feed          | back lever operation               | Feedback Lever Motion      | UP when Po1 increases    |
| Pilot         | relay type                         | Pilot Relay Type           | Single Acting            |
| Posi          | tioner operation                   | Positioner Action          | Direct                   |
| Elec          | trical fail direction              | Electrical Fail to         | Close                    |
| Actu          | ator size                          | Actuator Size              | Param 1                  |
| Frict         | ion level                          | Friction Level             | Heavy                    |
| Cont          | trol deadband                      | Control Deadband           | 0.05                     |
|               | Proportional gain<br>(beyond GAP1) | P out of GAP1              | 1                        |
|               | Integral time<br>(beyond GAP1)     | I out of GAP1              | 10                       |
|               | Differential time<br>(beyond GAP1) | D out of GAP1              | 0.2                      |
| 0             | GAP width 1                        | GAP1                       | 5                        |
| Controllec    | Proportional gain<br>(within GAP1) | P inside of GAP1           | 0.5                      |
|               | Integral time (within GAP1)        | l inside of GAP1           | 5                        |
| parameter     | Differential time<br>(within GAP1) | D inside of GAP1           | 0.2                      |
| Ÿ             | GAP width 2                        | GAP2                       | 1                        |
|               | Proportional gain<br>(within GAP2) | P inside of GAP2           | 0.2                      |
|               | Integral time (within GAP2)        | I inside of GAP2           | 2                        |
|               | Differential time<br>(within GAP2) | D inside of GAP2           | 0.2                      |
|               | amount<br>acteristic               | Input Characterization     | Linear                   |
| Forc          | ed fully open value                | Travel Cutoff High         | 109                      |
| Forc          | ed fully closed value              | Travel Cutoff Low          | 0.5                      |
| Pres          | sure display unit                  | Unit of Pressure           | kPa                      |

# 6-8 Internal Block Diagram of the 700 Series

1) Internal block diagram of the 700 Series

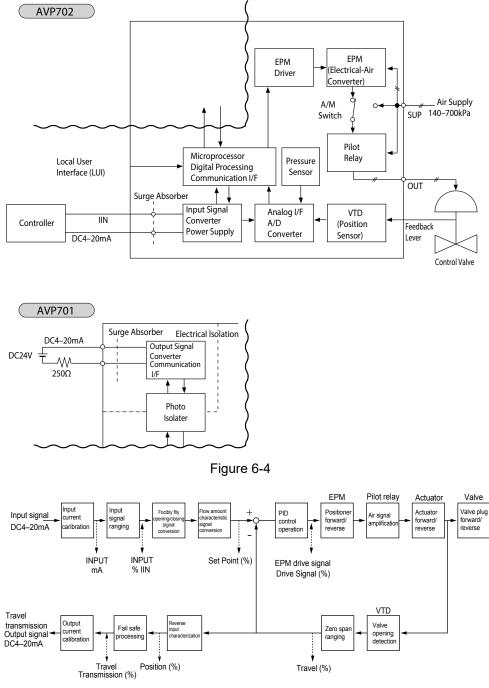


Figure 6-5

# 6-9 Resale Parts

The resale parts for maintenance are listed in the table below. For the position of each part, refer to Figure 6-6.

| No. | Name   | Part no.  | Qty. | Recommended<br>replacement<br>period<br>(year)*1 | Recommended<br>tightening<br>torque<br>N·m |
|-----|--|---|------|--|--|
| 1   | Face cover assembly  | 80388840-101  | 1    | -  | 0.9 ± 0.1                                  |
| 2   | Face cover   | 80388841-001  | 1    | -  | -  |
| 3   | Hexagon socket flush bolt (for face cover, M4×16)  | 80388843-101  | 2    | -  | 0.9 ± 0.1                                  |
| 4   | Screw retainer ring (for face cover)   | 80235519-010  | 2    | -  | -  |
| 5   | Switch block assembly  | 80388910-901  | 1    | 5  | 1.02 ± 0.33                                |
| 6   | S-TITE (for switch block, equivalent to M3×6)  | 80388918-001  | 2    | -  | 1.02 ± 0.33                                |
| 7   | Terminal cover assembly  | 80388820-001 (finish S)<br>80388820-002 (finish B)<br>80388820-003 (finish D) | 1    | 5  | -  |
| 8   | O-ring (AS568-151) (for terminal cover)  | 803888281-151   | 1    | 5  | -  |
| 9   | Hexagon socket bolt (lock screw for terminal cover, M4×8)  | 314-204-080   | 1    | -  | 0.9 ± 0.1                                  |
| 10  | Set of five cross recessed head screws<br>with captive spring washers (terminal<br>screw, M4×8)        | 80277581-001  | 5    | -  | 1.5 ± 0.2                                  |
| 11  | Cross recessed head screws with captive<br>spring washers (external grounding<br>terminal screw, M4×8) | 80277581-001  | 1    | -  | 1.5 ± 0.2                                  |
| 12  | Exhaust cap  | 80388823-001 (finish S)<br>80388823-002 (finish B)<br>80388823-003 (finish D) | 1    | -  | -  |
| 13  | S-TITE (equivalent to M3×6) (for exhaust cap)  | 80388918-001  | 2    | -  | 1.33 ± 0.46                                |
| 14  | P cover assembly (with screw)  | 80388825-001 (finish S)<br>80388825-002 (finish B)<br>80388825-003 (finish D) | 1    | -  | 1.5 ± 0.2                                  |
| 15  | Special cross recessed head screws<br>with captive spring washers (for P cover,<br>M4×16, shank: 9)    | 80388844-001  | 3    | -  | 1.5 ± 0.2                                  |
| 16  | Seal washer (for P cover)  | 80357789-001  | 3    | -  | -  |
| 17  | Pilot relay assembly (including the A/M screw assembly)  | 80388850-001 (single acting)<br>80388850-002 (double acting)                  | 1    | 5  | -  |
| 18  | Cross recessed head screws with captive spring washers (for pilot relay, M4×25)                        | 398-204-250   | 4    | -  | 1.8 ± 0.2                                  |
|     | O-ring (AS568-014) (for pilot relay)   | 80020935-409  | 4    | 5  | -  |
|     | O-ring (S7) (for pilot relay)  | 80020935-323  | 1    | 5  | -  |
|     | A/M screw assembly   | 80388885-001  | 1    | 4  | -  |
| 22  | Filter   | 80377077-001  | 1    | 4  | -  |
| 23  | Holder   | 80377078-001  | 1    | -  | -  |
| 24  | Cross recessed truss head screw (for A/M screw, M4×6)  | 310-240-060   | 1    | -  | 1.5 ± 0.2                                  |
| 25  | O-ring (AS568-007) (for A/M screw)   | 80020935-216  | 1    | 5  | -  |
| 26  | O-ring (AS568-010) (for A/M screw)   | 80020935-324  | 1    | 5  | -  |
| 27  | O-ring (AS568-012) (for A/M screw)   | 80020935-325  | 1    | 5  | -  |

| No. | Name  | Part no.   | Qty.       | Recommended<br>replacement<br>period<br>(year)*1 | Recommended<br>tightening<br>torque<br>N·m |
|-----|---|--|------------|--|--|
| 28  | Feedback lever assembly   | 80377049-001 (without<br>option M6)<br>80377049-002 (with option<br>M6)  | 1          | -  | -  |
| 29  | Feedback lever  | 80377148-001 (with option<br>M6)<br>80377148-002 (without<br>option M6)  | 1          | -  | -  |
| 30  | Arm spring  | 80377149-001 (with option<br>M6)<br>80377149-002 (without<br>option M6)  | 1          | -  | -  |
| 31  | Hexagon socket bolt with captive spring washer (for feedback lever, M5×8) | 80377127-001   | 2<br>(4)*2 | -  | 2.9 ± 0.3                                  |
| 32  | Extension lever   | 80377142-001 (40mm<br>extension, without option<br>M6)<br>80377142-101 (40mm<br>extension, with option M6)<br>80377142-002 (80mm<br>extension, without option<br>M6)<br>80377142-102 (80mm<br>extension, with option M6) | 1          | -  | 2.9 ± 0.3                                  |
| 33  | Blind plug/pressure-resistant explosion-<br>proof plug (G1/2)             | 80377115-001   | 1          | 5  | -  |
|     | Blind plug/plug (for general use, NPT1/2)                                 | 80277971-001   | 1          | -  | -  |
| 35  | Blind plug/plug (for IECEx/ATEX, NPT1/2)                                  | 80372545-001   | 1          | -  | -  |
| 36  | Blind plug/plug (for general use/ATEX,<br>M20)                            | 80377205-001   | 1          | 5  | -  |
| 37  | Blind plug/plug (for IECEx, M20)  | 80372699-001   | 1          | 5  | -  |
| 38  | Flameproof cable gland  | 80388728-002   | 1<br>(2)*3 | 10   | -  |
|     | Flameproof elbow (G1/2)   | 80357206-108   | 1<br>(2)*3 | 10   | -  |
| 100 | LCD cover   | 80384067-001   | 1          | 10   | -  |
| 101 | Pressure gauge elbow  | 80384049-001   | 2<br>(3)*4 | -  | -  |

\*1 The recommended replacement period assumes standard conditions (JIS C 1804, C 1805). The replacement period may be shorter depending on environmental conditions (such as temperature, humidity, vibration, and air quality) and usage conditions (such as operation frequency and ON/OFF operations).

\*2 If the extension lever is required.

\*3 When using two conduit connection ports.

\*4 When Pilot Relay Type is set to Double Acting.

# **≜**Cautions

Do not replace or desorb the parts in the table below, because it causes the device damage. When you replace or desorb it, ask our service representative to replace the parts.

Ask our service representative to replace the parts in the table below. Expertise is required to replace these parts.

| No. | Name   | Part no.   | Qty. | Recommended<br>replacement<br>period<br>(year)*1 | Recommended<br>tightening<br>torque<br>N⋅m |
|-----|--|--|------|--|--|
| 41  | Main cover assembly  | 80388816-001 (finish S,<br>except for structure V)<br>80388816-002 (finish B,<br>except for structure V)<br>80388816-011 (finish S,<br>structure V)<br>80388816-012 (finish B,<br>structure V) | 1    | 5  | -  |
| 42  | O-ring (AS568-154) (for main cover)  | 80388828-154 (except for<br>structure V)<br>80020935-164 (structure<br>V)  | 1    | 5  | -  |
| 44  | Hexagon socket bolt (lock screw for main cover, M4×8)                      | 314-204-080  | 1    | -  | 0.9 ± 0.1                                  |
| 45  | Guide plate  | 80388905-001   | 1    | -  | -  |
| 47  | LCD assembly   | 80388931-001   | 1    | 5  | -  |
| 50  | Adapter assembly   | 80388836-001   | 1    | -  | 0.9 ± 0.1                                  |
| 51  | O-ring (AS568-021) (for adapter)   | 80020935-612   | 1    | 5  | -  |
| 52  | Hexagon socket bolt with captive spring washer (for adapter, M3×6)         | 80377046-001   | 3    | -  | 0.9 ± 0.1                                  |
| 53  | Adapter gasket   | 80388846-001   | 1    | 5  | -  |
| 54  | Filter screen  | 80377087-001   | 4    | -  | -  |
| 55  | Cross recessed head screws with captive spring washer (for adapter, M4×12) | 398-204-120  | 4    | -  | 1.8 ± 0.2                                  |
| 56  | Case packing   | 80388847-001   | 1    | 10   | -  |
| 57  | Magnet unit assembly (EPM)   | 80377010-001 (Forward)<br>80377010-002 (Reverse)   | 1    | -  | -  |
| 58  | O-ring (AS568-007) (for EPM)   | 80020935-216   | 1    | 5  | -  |
| 59  | Hexagon socket bolt with captive spring<br>washer (for EPM, M3×6)          | 80377046-001   | 2    | -  | 0.9 ± 0.1                                  |
| 60  | Sensor board   | <except for="" l,t="" structure=""><br/>80388935-001<br/><structure l,t=""><br/>80384101-001</structure></except>  | 1    | -  | -  |
| 61  | Sensor cable   | 80388944-001   | 1    | -  | -  |
| 62  | O-ring (AS568A-013) (for pressure sensor)                                  | 80388829-013   | 4    | 10   | -  |
| 63  | Hexagon socket bolt with captive spring washer (for sensor cover, M3×8)    | 80377047-001   | 4    | -  | 0.9 ± 0.1                                  |
| 64  | Hexagon socket bolt with captive spring washer (for coil, M3×8)            | 80377047-001   | 2    | -  | 0.9 ± 0.1                                  |

| No. | Name   | Part no.          | Qty. | Recommended<br>replacement<br>period<br>(year)*1 | Recommended<br>tightening<br>torque<br>N·m |
|-----|--|-------------------|------|--|--|
| 65  | Hexagon socket bolt with captive spring washer (M6×16) | 80388845-001      | 4    | -  | 4.4 ± 0.5                                  |
| 66  | VTD assembly (with hexagon socket bolt M4×14)          | 80388909-001, 002 | 1    | -  | 1.5 ± 0.2                                  |

\*1 The recommended replacement period assumes standard conditions (JIS C 1804, C 1805). The replacement period may be shorter depending on environmental conditions (such as temperature, humidity, vibration, and air quality) and usage conditions (such as operation frequency and ON/OFF operations).

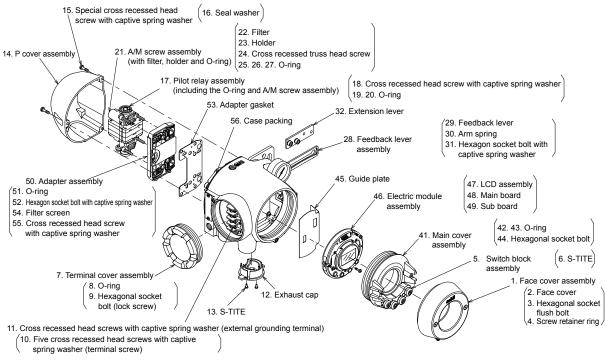
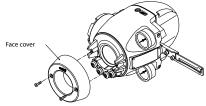


Figure 6-6 Resale Parts

### 6-9-1 Procedure to Change Switch Block

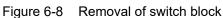
| Step | Procedure   |
|------|---|
| 1    | Loosen two screws with a hexagon socket screw keys and remove the face cover (Figure 6-7) |
| 2    | Loosen two screws and remove the face cover (Figure 6-8)                                  |
| 3    | Tighten a new switch block with two screws.<br>(Torque: 1.02±0.33N • m)                   |
| 4    | Press four buttons and make sure whether the display changes or not.                      |
| 5    | Tighten the face cover with two screws.<br>(Torque: 0.9±0.1N • m)                         |







Removal of face cover



| Step | Procedure   |
|------|---|
| 1    | Loosen three screws and remove the P cover.<br>(Figure 6-9)           |
| 2    | Loosen four screws and remove the pilot relay. (Figure 6-10)          |
| 3    | Tighten a new pilot relay with four screws.<br>(Torque: 1.8±0.2N • m) |
| 4    | Tighten the P cover with three screws.<br>(Torque: 1.5±0.2N • m)      |

### 6-9-2 Procedure to Change Pilot Relay

### **!** Handling Precautions:

Please make sure that the O-ring does not fall off when assembling the pilot relay.

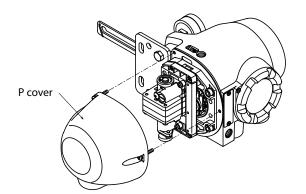


Figure 6-9 Removal of P cover

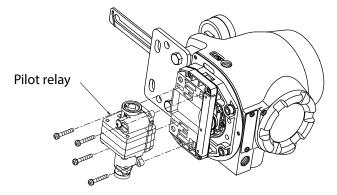


Figure 6-10 Removal of pilot relay

# Chapter 7 Notes on the Explosion-Proof 700 Series

This chapter describes the notes on the explosion-proof 700 Series.

When using the explosion-proof 700 Series, sufficiently understand the notes in this section and use it correctly.

# 7-1 TIIS Flameproof Model

1) Symbol information

## <u>IIC T6</u>

Ambient gas with an ignition point of 85°C or higher Ambient gas with IIC explosion rating

Ambient temperature range: -20°C to +55°C

This pressure-resistant explosion-proof product can be installed in Place types 1 or 2 depending on the target gas. Installation in Place type 0 is not possible.

### 2) Applicable standards

Factory Electrical Facilities Explosion Protection Guidelines (Technical guidelines 2008 that conform to international standards)

### 3) Precautions for safe work

Do not loosen the fixing screws on the cover and angle sensor while the power is applied and within one minute after the power supply is shut off. Doing so may cause an explosion, leading to a severe accident.

|   | <b>≜</b> Cautions  |
|---|--|
| 0 | Be sure to mount the attached (specified) pressure-resistant packing cable adapter<br>onto the signal wiring outlet in the device. Use the attached pressure-resistant elbow if<br>it is necessary to change the orientation of the wiring. To guarantee the explosion-proof<br>specifications, products other than the specified pressure-resistant packing cable adapter<br>and pressure-resistant elbow cannot be used. |
| 0 | Take extra care in handling the device so as not to corrode, deform, or otherwise damage the case or cover. Securely tighten the hexagon socket screws for screw locking on the cover and do not open the cover during use.  |
| 0 | When wiring in an environment similar to the low pressure power distribution work in a Class 1 danger zone, perform work following the "(New) Electrical Facilities Explosion-Proofing Guidelines (Gas Explosion-Proofing 1985)" issued by the Technology Institution of Industrial Safety.  |
| 0 | Apply the correct supply air pressure in acoordance with the Chapter 2<br>Installation of the 700 Series. Incorrect pressure may cause abnormal actions<br>of the control valve or damage to the pressure gauge.   |

## 7-2 IECEx Flameproof and Dust Ignition Protection

### **IECEx Flameproof and Dust Ignition Protection**

#### 1. Marking information

IECEx DEK 12.0025X

Ex d IIC T6 Gb  $-30^{\circ}C \le T_{amb} \le +75^{\circ}C$  IP66

Ex tb IIIC T85°C Db  $-30°C \le T_{amb} \le +75°C$  IP66

#### 2. Applicable standards

- IEC 60079-0:2011
- IEC 60079-1:2007
- IEC 60079-31:2008

#### 3. Special conditions for safe use $\triangle$ Caution

- The gap between the shaft for magnetic pass and the pneumatic module body has 0.065mm max.
- The terminal cover has at least 7.5 engaged threads.
- The gap between the pneumatic module body and the housing has 0.13mm max.
- The electronic cover has at least 6.8 engaged threads.
- The gap between the housing and the feedback sensor has 0.11mm max.
- The gap between the flame arrestor and the pneumatic module body has 0.145mm max.
- The gap between the sensor housing and the outside sleeve has 0.07mm max.
- The gap between the rotary shaft and the inside sleeve has 0.07mm max.
- The screws used to assemble the pneumatic body to the Ex d housing shall be of class A2-70 or A4-70.
- For the use in the area where EPL Db apparatus is required, electrostatic discharge shall be avoided.

### 4. Instruction for safe use 🔥 Caution

- **4.1** Do not open when an explosive atmosphere is present.
- **4.2** Use supply wires suitable for 5°C above surrounding ambient.
- **4.3** When Model No. is given with AVP7xx-xyx-x ... , if y=N, P, U, C, the thread type of the end of all entries is 1/2NPT, or if y=M, the thread type of the end of all entries is M20.
- **4.4** To maintain the degree of protection of at least IP66 in accordance with IEC60529, suitable cable glands, conduit sealing devices or blanking elements must be used and correctly installed.
- **4.5** Cables glands or conduit sealing devices used must be certified for the IECEx protection mentioned above in item 1.
- **4.6** This product is shipped with the IECEx certified blanking element only to avoid ingress of solid foreign objects and water during transportation, the certification of this product does not include the blanking element.

When installed, check the conformity of the blanking element to the relevant standards.

- **4.6** Unused openings must be closed with a blanking element certified for the IECEx protection mentioned above in item 1.
- **4.7** If thread adapters are used these must be certified for the IECEx protection mentioned Above in item 1. Per entry not more than one thread adapter may be used.
- **4.8** This equipment shall be mounted in such a manner that it is not been heated by the process medium.
- **4.9** The cable connection of external grounding terminal shall be used with a cable lug.

\*See the section 2-3 for the connection.

**4.10** This product is shipped with the IECEx certified blanking element only to avoid ingress of solid foreign objects and water during transportation, the certification of this product does not include the blanking element.

When installed, check the conformity of the blanking element to the relevant standards.

# 7-3 FM Explosionproof / Dust Ignition Protection

### Explosionproof

Class I, Division 1, Group B, C and D T6;

## Flameproof

Class I, Zone 1, AEx d IIC T6 Gb

## **Dust ignition**

Class II and III, Division 1, Group E, F, and G T6, Zone 21, AEx tb II C T85 °C Db

Ambient temperature : -30 to +75 °C

Indoor/Outdoor Enclosure IP66

- Install the apparatus only in hazardous (classified) locations for which the apparatus has been approved.
- For division applications:

Factory sealed, conduit seal not required

- Not including gasoline atmospheres
- Do not open the apparatus enclosure when an explosive atmosphere is present.

Use supply wires suitable for 5°C above surrounging ambient.

# 7-4 FM Intrinsically safe (ic) and Nonincendive

### Intrinsically safe(ic)

Class I, Zone 2, AEx ic IIC T4 Entity Parameters: Positioner Circuit: Ui=30V, Ii=100mA, Pi=1W, Ci=24nF, Li=0.22mH Transmitter Circuit (AVP701): Ui=30V, Ii=100mA, Pi=1W, Ci=20nF, Li=0.22mH

### Nonincendive

Class I, Division 2, Group A, B, C and D, T4

Nonincendive Field Wiring Parameters:

Positioner Circuit: Vmax=30V, Imax=100mA, Ci=24nF, Li=0.22mH

Transmitter Circuit (AVP701): Vmax=30V, Imax=100mA, Ci=20nF, Li=0.22mH

### Suitable

Class II and Class III, Division 2, Group E, F and G, T4

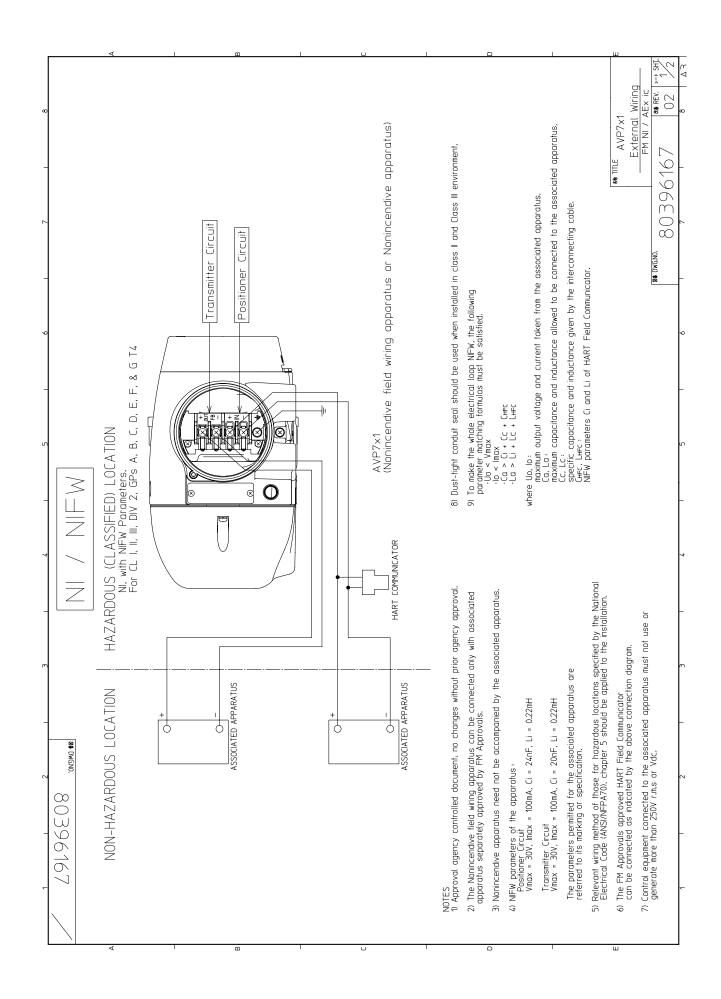
### Indoor/Outdoor Enclosure

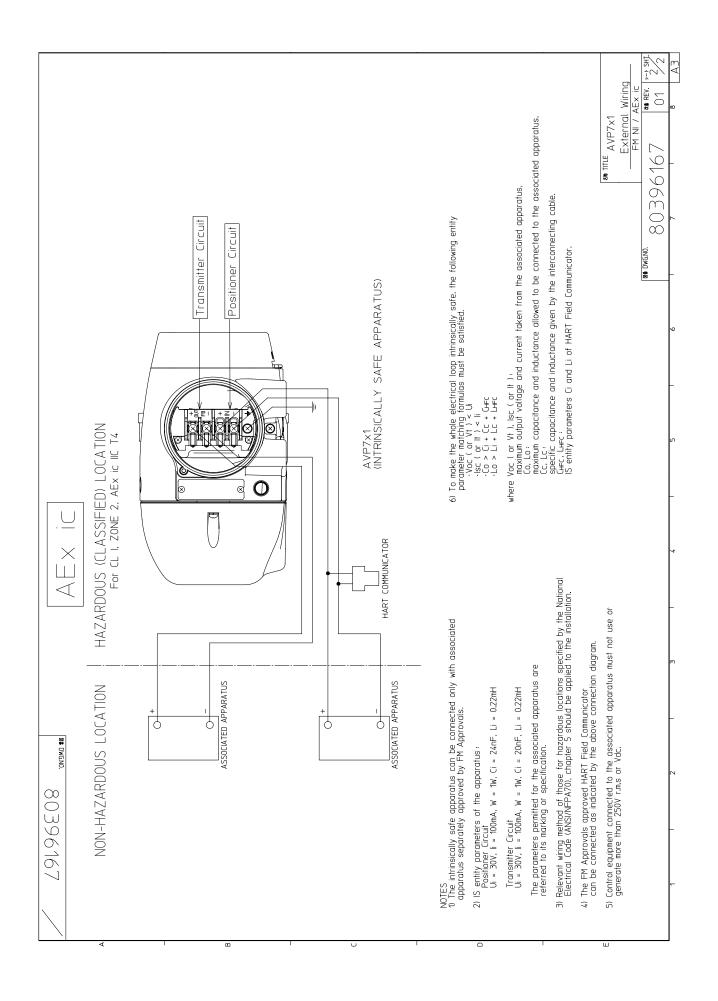
NEMA Type 4X, IP66

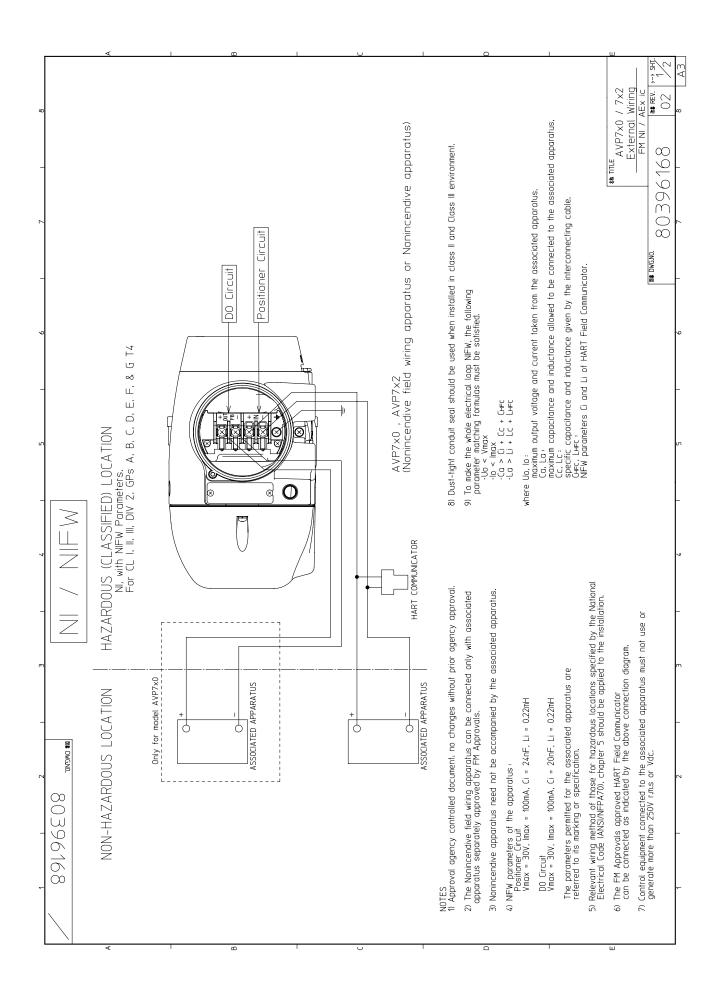
Ambient Temperature:-24 to 75

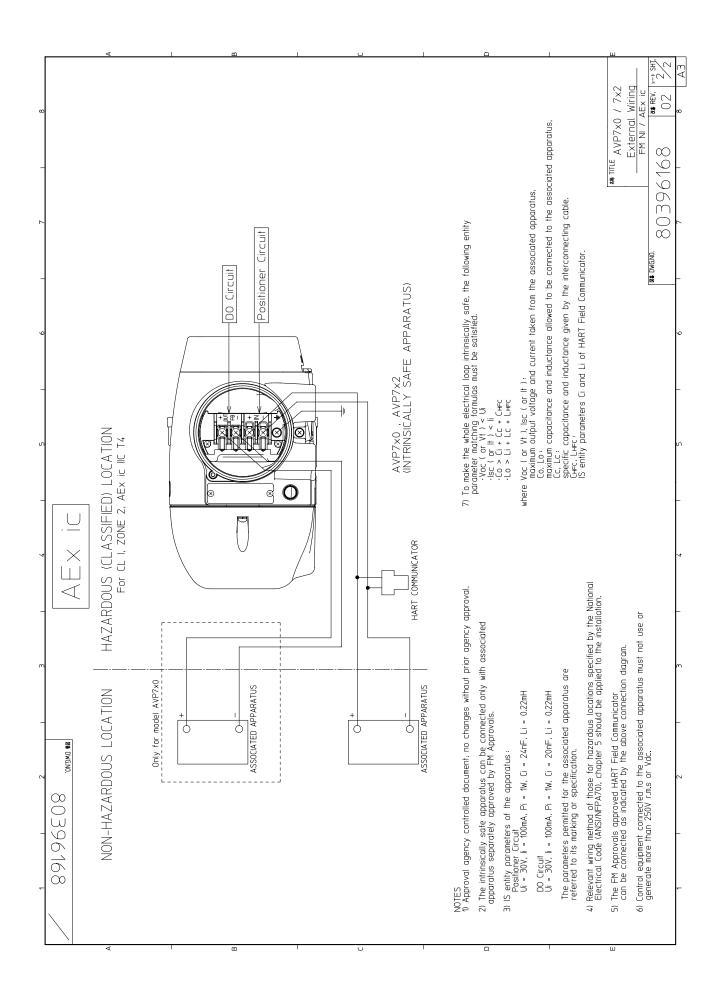
### Instruction for safe use

- Models AVP701/ AVP702 shall be installed in accordance with control drawings 80396167 and 80396168.
- Installations in the US shall comply with the relevant requirements of the National Electrical CodeR (ANSI/NFPA-70 (NECR).
- Tampering and replacement with non-factory components may adversely affect the safe use of the system.
- For guidance on installation in the US, see ANSI/ISA-RP12.06.01, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
- Electrical equipment connected to the Associated Apparatus shall not use or generate more than 250 Volts rms.
- The products discussed in this report were certified by FM Approvals under a Type3 Certification System as identified in ISO Guide 67.









## 7-5 FMC Explosionproof / Dust Ignition Protection

## Explosionproof

Class I, Division 1, Group C and D T6;

## Flameproof

Class I, Zone 1, Ex d IIB T6 Gb

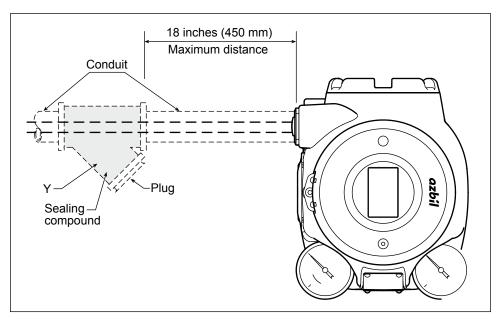
## **Dust ignition**

Class II and III, Division 1, Group E, F, and G T6;

Ambient temperature : -30 to +75 °C

Indoor/Outdoor Enclosure IP66

| WARNING  |
|--|
| • Install the apparatus only in hazardous (classified) locations for which the |
| apparatus has been approved.   |
| For division applications:   |
| Factory sealed, conduit seal not required                                      |
| Not including gasoline atmospheres   |
| For zone applications  |
| Seal all conduits within 450mm (18 INCHES)                                     |
| • Do not open the apparatus enclosure when an explosive atmosphere is present. |



Use supply wires suitable for 5°C above surrounging ambient.

## 7-6 CCC Flameproof / Dust Ignition Protection

## CCC 隔爆

## 1. 防爆标志

Ex db IIC T6 Gb Ex tb IIIC T85°C Db

## 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 3836.2-2021 爆炸性环境 第2 部分:由隔爆外壳 "d"保护的设备 GB/T 3836.31-2021 爆炸性环境 第31 部分:由防粉尘点燃外壳 "t"保护的设备

## 3. 产品安全使用特殊条件

- 3-1. 涉及隔爆接合面的维修须联系产品制造商。
- 3-2. 隔爆结合面用特殊紧固件性能等级为A2-70/A4-70。
- 3-3.产品在爆炸性粉尘环境使用时,应采取措施避免传播型刷型放电产生引燃危险。 仅允许使用湿布擦拭。
- 3-4. 使用环境温度: -30℃~+75℃。

## 4. 产品使用注意事项

- 4-1. 产品设有外接地端子,用户在安装使用时应可靠接地。
- 4-2.产品电缆引入口须配用经国家指定的检验机构认可的、符合国家标准GB/T 3836.1-2021 和GB/T 3836.2-2021 规定的、螺纹规格为M20×1.5 或1/2-14NPT、具有防爆等级为Ex db IIC 的电缆引入装置或封堵件,方可用于爆炸性危险场所。该电缆引入装置或封堵件 的使用必须符合使用说明书的要求。冗余电缆引入口应有效封堵。电缆引入装置或封堵件 安装后,须确保设备整体外壳防护等级不低于IP66。
- 4-3. 现场使用和维护时,必须遵循"存在爆炸性环境时严禁打开"的原则。
- 4-4. 用户不得自行更换该产品的零部件,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。
- 4-5. 用户应当保持产品外壳表面清洁,以防粉尘堆积,但严禁用压缩空气吹扫。
- 4-6. 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 15577-2018 粉尘防爆安全规程

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

#### AVP7xy - 123 - 4567

where:

x=0(Valve positioner)

x=1(Emergency valve shutdown function with Foundation Fieldbus communication)

x=3(valve travel transmitter only)

x=7(Positioner with emergency valve shutdown function @4.48mA)

x=8(Positioner with emergency valve shutdown function @0.5mA)

x=9(Emergency valve shutdown function only)

y=0(Positioner & contact output for alarm)

y=1(Positioner& Valve travel transmitter)

y=2(no output)

Protection

x=3(Foundation Fieldbus communication)

y=4(Positioner & Foundation Fieldbus communication)

With overvoltage protection

AVP7xy 所有组合搭配: AVP700/701/702/703/704/770/771/772/780/781/782/790/791/792/ 713/731

V

|               |                                  |   |                 |                          | Code |
|---------------|----------------------------------|---|-----------------|--------------------------|------|
| ① Structure   | CCC Flameproof is not available) | CCC Flameproof / Dust ignition protection (Electrical connection G1/2 is not available) |                 |                          | Ν    |
|               | CCC Intrinsically                | CC Intrinsically Safe   |                 |                          | R    |
|               | Electrical connection            | Air piping connection   | Mounting thread | Pressure gauge<br>thread |      |
| ② Connection  | M20x1.5                          | 1/4NPT  | M8              | Rc1/8                    | М    |
|               | 1/2NPT                           | 1/4NPT  | M8              | Rc1/8                    | Ν    |
|               | 1/2NPT                           | 1/4NPT  | M8              | 1/8NPT                   | Р    |
|               | 1/2NPT                           | 1/4NPT  | 5/16-18UNC      | Rc1/8                    | U    |
|               | 1/2NPT                           | 1/4NPT  | 5/16-18UNC      | 1/8NPT                   | С    |
|               | G1/2                             | Rc1/4   | M8              | Rc1/8                    | G    |
| ③ Finish      | Standard                         |   |                 |                          | S    |
|               | Corrosion Proof                  |   |                 |                          | В    |
|               | Silver Finish                    |   |                 |                          | D    |
|               |                                  |   |                 |                          |      |
| ④⑤ Display    | Display with push button         |   |                 | DX                       |      |
| ⑥ Diagnostic  | Advanced diagno                  | sis   |                 |                          | А    |
| ⑦ Overvoltage | None                             |   |                 |                          | Х    |

## 7-7 KCs Flameproof

## 1. Marking information

Ex d IIC T6  $-30^{\circ}C < T_{amb} < +75^{\circ}C$ 

## 2. Special conditions for safe use 🛛 🕂 Caution

- The gap between the shaft for magnetic pass and the pneumatic module body has 0.065 mm max.
- The terminal cover has at least 7.5 engaged threads.
- The gap between the pneumatic module body and the housing has 0.13 mm max.
- The electronic cover has at least 6.8 engaged threads.
- The gap between the housing and the feedback sensor has 0.11 mm max.
- The gap between the flame arrestor and the pneumatic module body has 0.145 mm max.
- The gap between the sensor housing and the outside sleeve has 0.07 mm max.
- The gap between the rotary shaft and the inside sleeve has 0.07 mm max.
- The screws used to assemble the pneumatic body to the Ex d housing shall be of class A2-70 or A4-70.

## 3. Instruction for safe use A Caution

- **3.1** Do not open when an explosive atmosphere is present.
- **3.2** Use supply wires suitable for 5°C above surrounding ambient.
- **3.3** When Model No. is given with AVP7xx-xyx-x ... ,

if y=N, P, U, C, the thread type of the end of all entries is 1/2NPT, or

if y=M, the thread type of the end of all entries is M20.

- **3.4** Cables glands or conduit sealing devices used must be certified for the protection mentioned above in item 1.
- **3.5** Unused openings must be closed with a blanking element certified for the protection mentioned above in item 1.
- **3.6** If thread adapters are used these must be certified for the protection mentioned Above in item 1.

Per entry not more than one thread adapter may be used.

- **3.7** This equipment shall be mounted in such a manner that it is not been heated by the process medium.
- **3.8** The cable connection of external grounding terminal shall be used with a cable lug.

\*See the section 2-3-3 for the connection.

# 7-8 INMETRO Flameproof / Dust Ignition Protection

Equipamento à prova de explosão do INMETRO

## Segurança

## Sobre este manual

Este manual contém informações e advertências que devem ser observadas para manter posicionador de válvula smart o AVP7XX que opera seguramente. Instalação correta, operação correta e manutenção regular são essenciais para assegurar segurança enquanto usando este dispositivo.

Para o uso correto e seguro deste dispositivo é essencial que ambos que operam e pessoal de serviço segue procedimentos de segurança geralmente aceitos além das precauções de segurança especificadas neste manual.

Os símbolos seguintes são usados neste manual para alertar a possíveis perigos:

## Advertência

Denota um potencialmente situação perigosa que, se não evitou, poderia resultar em morte ou dano sério.

## Precaução

Denota uma situação potencialmente situação perigosa que, se não evitar, poderá resultar em um dano secundário ao operador ou poderá danificar o dispositivo.

~ Informação de nota que pode ser útil ao usuário.

## Precauções de segurança

ADVERTINDO

- PERIGO DE CHOQUE ELÉTRICO! Desligue antes de executar qualquer instalação elétrica.
- NUNCA abra a tampa do invólucro do terminal enquanto o AVP7XX está energizado em um ambiente de atmosfera explosiva.
- Não toque o AVP7XX desnecessariamente enquanto estiver em operação.A superfície pode estar muito quente ou muito fria, enquanto dependendo do ambiente operacional.

## PRECAUÇÃO

Não pisar, apoiar-se ou subir noAVP7XX. Você pode danificar o aparelho.

1. Marcação conforme a Portaria 179 do INMETRO:

Azbil Corporation Tipo:AVP 7XX Ex db llC T6 Gb Ex tb IIIC T85 °C Db -30 °C  $\leq$  Ta  $\leq$  +75 °C Número de série: ... NCC 14.3175 X

ATENÇÃO – NÃO ABRA QUANDO UMA ATMOSFERA EXPLOSIVA PUDER ESTAR PRESENTE

2. Normas conforme a Portaria 179 do INMETRO:

ABNT NBR IEC 60079–0:2013 ABNT NBR IEC 60079–1:2009 ABNT NBR IEC 60079–31:2011

## 3. Condições especiais para uso seguro:

- As dimensões das juntas à prova de explosão estão detalhadas nos documentos do fabricante.
- Os parafusos usados para montar o corpo pneumático do invólucro 'Ex d' devem ser de classes A2-70 ou A4-70.
- Quando usado em área onde são exigidos equipamentos com nível de proteção EPL Db, deve ser evitada descarga eletrostática.

## 4. Instruções para o uso seguro

Este produto é expedido com o elemento de vedação certificado por IECEx apenas para evitar a entrada de objetos estranhos sólidos e água durante o transporte.

A certificação deste produto não inclui o elemento de vedação.

Ao instalar, verifique a conformidade do elemento de vedação com os padrões pertinentes.

# 7-9 EAC Flameproof

Взрывозащищенное исполнение в соответствии с техническим регламентом ТР ТС 012/2011 «О безопасности оборудования для работы во взрывоопасных средах»

## 1. Маркировка

EAЭC RU C-JP.EX01.B.00075/19 1Ex d IIC T6 Gb X -30 °C ≤ Ta ≤ +75 °C IP66 Ex tb IIIC T85°C Db X -30 °C ≤ Ta ≤ +75 °C IP66

## 2. Применяемые стандарты

- FOCT 31610.0-2014 (IEC 60079-0:2011)
- FOCT IEC 60079-1-2011
- FOCT IEC 60079-31-2013

## 3. Специальные условия применения

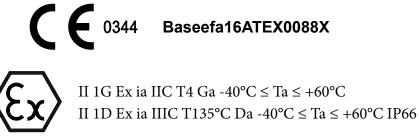
- Зазор между валом магнитного блока и корпусом пневматического модуля должен быть не больше 0,065 мм.
- Крышка клеммной коробки должна быть закручена по резьбе как минимум на 7,5 оборотов.
- Зазор между корпусом пневматического модуля и оболочкой изделия должен быть не больше 0,13 мм.
- Крышка электроники должна быть закручена по резьбе как минимум на 6,8 оборотов.
- Зазор между корпусом изделия и датчиком обратной связи должен быть не больше 0,11 мм.
- Зазор между пламегасителем и корпусом пневматического модуля должен быть не больше 0,145 мм.
- Зазор между корпусом датчика и наружным рукавом должен быть не больше 0,07 мм.
- Зазор между вращающимся валом и внутренним рукавом должен быть не больше 0,07 мм.
- Для крепления пневматического модуля к оболочке Ex d следует использовать винты класса А2-70 или А4-70.
- Корпуса позиционеров способны накапливать электростатический заряд, поэтому они должны устанавливаться в местах, где риск электростатического разряда сведен к минимуму.
- Ремонт взрывонепроницаемых соединений позиционеров допускается, если он произведен изготовителем или его уполномоченным представителем.

## 4. Инструкции для безопасной эксплуатации

- 4.1 Не открывайте корпус при наличии взрывоопасной атмосферы.
- 4.2 Используйте подходящие кабели и кабельные вводы с температурным диапазоном на 5°С выше температуры окружающей среды.
- **4.3** Чтобы обеспечить степень защиты не ниже IP66 в соответствии со стандартом IEC 60529, необходимо использовать и правильно устанавливать подходящие кабельные вводы, уплотнения кабелепроводов и заглушки.
- 4.4 Используемые кабельные вводы и уплотнения кабелепроводов должны иметь соответствующий сертификат взрывозащиты.
- **4.5** Неиспользуемые отверстия должны быть закрыты заглушками, имеющими соответствующий сертификат взрывозащиты.
- **4.6** Если используются резьбовые переходники, они должны иметь сертификат соответствующий сертификат взрывозащиты. Можно использовать не более одного переходника на каждый ввод.
- **4.7** Данное оборудование следует устанавливать так, чтобы оно не нагревалось за счет технологической среды.
- 4.8 Соединительный кабель внешнего заземления должен быть оснащен кабельным наконечником.
  - \* Описание подключения см. в разделе 2-3.
- **4.9** Данное изделие комплектуется заглушкой с сертификатом IECEx лишь для предотвращения попадания внутрь посторонних предметов и воды во время транспортировки, и эта заглушка не включается в сертификацию изделия. Во время установки убедитесь, что заглушка соответствует надлежащим стандартам.

# 7-10 ATEX Intrinsic Safety and Dust Ignition Protection

1. Marking information



+/-IN Ui = 30V, Ii = 93mA, Pi = 0.9W, Ci = 4nF, Li = 220μH +/-OUT(AVP7x0/AVP7x1) Ui = 30V, Ii = 93mA, Pi = 0.9W, Ci = 22nF, Li = 220μH

## 2. Applicable standards

- EN IEC 60079-0: 2018
- EN 60079-11: 2012

# 3. Special conditions for safe use 🕂 Caution

- **3.1** For Group III, the enclosure must be mounted in a location where the risk of electrostatic discharge is minimised.
- **3.2** The enclosure of the product is made of aluminium, if it is mounted in an area where the use of EPL Ga apparatus is required, it must be installed such that, even in the event of rare incidents, ignition sources due to impact or friction sparks are excluded.
- **3.3** The equipment is not capable of passing a 500V dielectric strength test between the power and signal connections and the housing. This shall be taken into account during installation.

# 4. Instruction for safe use A Caution

- **4.1** To maintain the degree of protection of IP66 in accordance with IEC 60529, suitable cable glands, conduit sealing devices or blanking elements must be used and correctly installed.
- **4.2** The equipment is to be connected with power supplies through a safety barrier suitable for the terminal parameters of the equipment.

# 7-11 IECEx Intrinsic Safety and Dust Ignition Protection

## 1. Marking information

IECEx BAS 16.0069X Ex ia IIC T4 Ga -40°C  $\leq$  Ta  $\leq$  +60°C Ex ia IIIC T135°C Da -40°C  $\leq$  Ta  $\leq$  +60°C IP66 +/-IN Ui = 30V, Ii = 93mA, Pi = 0.9W, Ci = 4nF, Li = 220µH +/-OUT(AVP7x0/AVP7x1) Ui = 30V, Ii = 93mA, Pi = 0.9W, Ci = 22nF, Li = 220µH

## 2. Applicable standards

- IEC 60079-0 : 2017
- IEC 60079-11 : 2011

# 3. Special conditions for safe use 🕂 Caution

- **3.1** For Group III, the enclosure must be mounted in a location where the risk of electrostatic discharge is minimised.
- **3.2** The enclosure of the product is made of aluminium, if it is mounted in an area where the use of EPL Ga apparatus is required, it must be installed such that, even in the event of rare incidents, ignition sources due to impact or friction sparks are excluded.
- **3.3** The equipment is not capable of passing a 500V dielectric strength test between the power and signal connections and the housing. This shall be taken into account during installation.

# 4. Instruction for safe use $\bigwedge$ Caution

**4.1** To maintain the degree of protection of IP66 in accordance with IEC 60529, suitable cable glands, conduit sealing devices or blanking elements must be used and correctly installed.

## 7-12 CCC Intrinsic Safety and Dust Ignition Protection

## CCC 本安防爆

## 1. 防爆标志

Ex ia IIC T4 Ga Ex ia IIIC T<sub>200</sub>135℃ Da

## 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

- 3-1. 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。
- 3-2. 产品在爆炸性粉尘环境使用时,应采取措施避免传播型刷型放电产生引燃危险。仅允许使 用湿布擦拭。
- 3-3. 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。
- 3-4. 使用环境温度: -40℃~+60℃。

## 4. 产品使用注意事项

- 4-1. 产品使用环境温度范围: -40℃~+60℃。
- 4-2. 产品必须与经防爆检验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该产品和所配关联设备的使用说明 书要求,接线端子不得接错。产品本安电气参数见下表:

4.2.1 AVP7a 0 AVP7a 1 AVP7a 2

#### 输入信号端子:

| 最高输入电压             | 最大输入电流              | 最大输入功率                             | 最大内部                | 等效参数                |
|--------------------|---------------------|------------------------------------|---------------------|---------------------|
| U <sub>i</sub> (V) | l <sub>i</sub> (mA) | <b>P</b> <sub>i</sub> ( <b>W</b> ) | C <sub>i</sub> (nF) | L <sub>i</sub> (µH) |
| 30                 | 93                  | 0.9                                | 4                   | 220                 |

#### 输出信号端子:

| 最高输出电压             | 最大输入电流  | 最大输入功率             | 最大内部    | 等效参数    |
|--------------------|---------|--------------------|---------|---------|
| U <sub>0</sub> (V) | l₀ (mA) | P <sub>0</sub> (W) | C₀ (nF) | L₀ (µH) |
| 30                 | 93      | 0.9                | 22      | 220     |

#### 4-2.2 AVP703型用户端子

| 最高输入电压             | 最大输入电流  | 最大输入功率             | 最大内部                | 等效参数    |
|--------------------|---------|--------------------|---------------------|---------|
| U <sub>i</sub> (V) | li (mA) | P <sub>i</sub> (W) | C <sub>i</sub> (nF) | Li (µH) |
| 17.5               | 380     | 5.32               | 2                   | 近似为0    |

- 4-3. 用户不得自行更换该产品的零部件, 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。
- 4-4. 用户应当保持产品外壳表面清洁,以防粉尘堆积,但严禁用压缩空气吹扫。
- 4-5.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 15577-2018 粉尘防爆安全规程

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

#### AVP7xy - 123 - 4567

where:

x=0(Valve positioner)

x=1(Emergency valve shutdown function with Foundation Fieldbus communication)

x=3(valve travel transmitter only)

x=7(Positioner with emergency valve shutdown function @4.48mA)

x=8(Positioner with emergency valve shutdown function @0.5mA)

x=9(Emergency valve shutdown function only)

y=0(Positioner & contact output for alarm)

y=1(Positioner& Valve travel transmitter)

y=2(no output)

x=3(Foundation Fieldbus communication)

y=4(Positioner & Foundation Fieldbus communication)

With overvoltage protection

AVP7xy 所有组合搭配: AVP700/701/702/703/704/770/771/772/780/781/782/790/791/792/ 713/731

|                |                                  |                       |                      |                          | Code |
|----------------|----------------------------------|-----------------------|----------------------|--------------------------|------|
| 1) Structure   | CCC Flameproof is not available) | / Dust ignition pr    | otection (Electrical | connection G1/2          | N    |
|                | CCC Intrinsically                | Safe                  |                      |                          | R    |
|                | Electrical connection            | Air piping connection | Mounting thread      | Pressure gauge<br>thread |      |
| ② Connection   | M20x1.5                          | 1/4NPT                | M8                   | Rc1/8                    | М    |
|                | 1/2NPT                           | 1/4NPT                | M8                   | Rc1/8                    | Ν    |
|                | 1/2NPT                           | 1/4NPT                | M8                   | 1/8NPT                   | Р    |
|                | 1/2NPT                           | 1/4NPT                | 5/16-18UNC           | Rc1/8                    | U    |
|                | 1/2NPT                           | 1/4NPT                | 5/16-18UNC           | 1/8NPT                   | С    |
|                | G1/2                             | Rc1/4                 | M8                   | Rc1/8                    | G    |
| ③ Finish       | Standard                         | ·                     |                      |                          | S    |
|                | Corrosion Proof                  |                       |                      |                          | В    |
|                | Silver Finish                    |                       |                      |                          | D    |
| (4)(5) Display | Display with push button         |                       |                      | DX                       |      |
| 6 Diagnostic   | Advanced diagno                  | Advanced diagnosis    |                      |                          | Α    |
| ⑦ Overvoltage  | None                             |                       |                      |                          | Х    |
| Protection     | With overvoltage                 | protection            |                      |                          | V    |

# Appendix A LUI Display Example

#### Normal monitor

| Guide<br>number | Display               | Reading | Item          | Remarks                                |
|-----------------|-----------------------|---------|---------------|--|
| 1-1             |                       | 70.0    | Opening       | Displays the item value in percentage. |
| 1-1             | P TRAVEL              | TRAVEL  | Opening       | Valve opening                          |
| 1-2             |                       | 70.0    | Input signal  | Displays the item value in percentage. |
| 1-2             | SP<br>SP              | SP      | Input signal  | SetPoint                               |
| 1-3             |                       | -       |               | -                                      |
| 1-3             | -                     | -       | -             | -                                      |
|                 |                       | 192.0   | Output air    | Displays the item value in kPa.        |
| 1-4             | <sup>10</sup> 1− 1 Pa | Po1_kPa | pressure OUT1 | Pressure OUT1<br>(kPa)                 |
| 4.5             |                       | 0.0     | Output air    | Displays the item value in kPa.        |
| 1-5             | °°₽₀ 2_ ⊧₽₅           | Po2_kPa | pressure OUT2 | Pressure OUT2<br>(kPa)                 |
| 1.0             |                       | 270.0   | Supply air    | Displays the item value in kPa.        |
| 1-6             |                       | Ps_kPa  | pressure Ps   | Pressure Supply<br>(kPa)               |

## Details monitor

| Guide<br>number | Display           | Reading | Item                             | Remarks   |
|-----------------|-------------------|---------|----------------------------------|---|
| 2-1             | 1 <b>1</b>        | 1.0     | Software version                 | Displays the item value.<br>(The initial setting is the same as<br>that on the seal affixed on the case.) |
|                 |                   | S/W_VER |                                  | Software Version  |
|                 | LunE              | TUNE    | Control                          | Tuning Parameter  |
| 2-2             |                   | 1-L     | Control<br>parameters            | Left: Actuator Size<br>Right: Friction Level<br>(Initial setting value: 2-L)                              |
| 2-3             | PHATEMP           | 23.5    | Electronic                       | Displays the item value in degrees.   |
| 2-3             | BHMH I FUID       |         | temperature                      | Substrate temperature   |
|                 | 555               | 56.5    | Electropneumatic<br>transduction | Displays the item value in percentage.  |
| 2-4             | 56.5%<br>PEPM_JRV | EPM_DRV | module<br>Driving current        | EPM Drive Signal<br>(EPM: Electropneumatic<br>transduction module)  |
| 2-5             | <b>1505</b>       | 150.5   | Electropneumatic<br>transduction | Displays the item value in kPa.   |
| 2-3             |                   | Pn_kPa  | module<br>Output air pressure    | Pressure Nozzle back in EPM<br>(kPa)  |

| Guide<br>number | Display  | Reading  | Item   | Remarks   |                       |
|-----------------|--|--|--|---|-----------------------|
| 2-6             |  | 70.0   | Input %  | Displays the item value in percentage.  |                       |
| 2-0             |  | INPUT  |  | Input Signal  |                       |
| 2-7             |  | 70.1   | Opening<br>(Reverse transduction   | Displays the item value in percentage.  |                       |
| 2-1             |  | POS  | of flow amount<br>characteristic)  | Position  |                       |
|                 |  | O_TYP  |  | Output Type   |                       |
| 2-8             | ₽ SINGLE   | SINGLE (single-<br>acting)<br>DOUBLE (double-<br>acting) | Single-acting/<br>double-acting  | SINGLE: Single-acting<br>DOUBLE: Double-acting<br>Set during auto setup.<br>(Initial setting: SINGLE) |                       |
|                 |  | P_ACT  |  | Positioner Action   |                       |
| 2-9             | PACE<br>DIRECT (forward)<br>REVERSE<br>(reverse) | Forward/reverse  | DIRECT: Forward<br>REVERSE: Reverse<br>Set during auto setup.<br>(Initial setting: DIRECT) |   |                       |
| 2-10            | [[5]]  | 15.3   | Angle when the   | Displays the item value in degrees.   |                       |
| 2-10            | ° <b>0%.DE</b> G                                 | 0%.DEG   | valve opening is 0%  | 0% angle (Degree)   |                       |
| 2-11            |  | 13.2   | Angle when the   | Displays the item value in degrees.   |                       |
| 2-11            | ° 100% JËG                                       | 100%.DEG   | valve opening is 0%  | 100% angle (Degree)   |                       |
| 2 4 2           |  | 10 <b>1</b> 701  | 701  | Basic model   | of basic model number |
| 2-12            |  | MODEL  | number   | Basic model number  |                       |

#### Status monitor

| Guide<br>number | Display | Reading | ltem  | Remarks  |
|-----------------|---------|---------|---|--|
|                 | SS_00   | 0. /    | SS: StatusSummary<br>Numerical value: Status category |  |
| 3-1             | 3-1     | 0x01    | Status  | 0x: Hexadecimal format<br>Numerical value: Details of status |

## Setup mode

## Auto setup

| Guide<br>number | Display                     | Reading                        | Item                      | Remarks  |
|-----------------|-----------------------------|--------------------------------|---------------------------|--|
|                 |                             | ASU                            |                           | Auto SetUp   |
| 7-1             | ₽ <b>50</b> 1               | 60s                            | ASU initial screen        | Time until the setup mode<br>automatically ends<br>(Not displayed if the time is<br>longer than 60 seconds.) |
|                 |                             | ASU                            | Moiting for ASL           | Auto SetUp   |
| 7-2             | <b>85u</b><br>95 tart++     | START→→                        | Waiting for ASU execution | To perform auto setup, hold down the 🛞 button.   |
| 7.0             | ASu<br>PRUMNING             | ASU                            | ASU is being              | Auto SetUp   |
| 7-3             | <sup>₽</sup> ₽UNNING        | RUNNING                        | performed.                | Flashes.   |
|                 |                             | ASU                            |                           | Auto SetUp   |
| 7-4             | 850<br>8500 + +             | $STOP \rightarrow \rightarrow$ | Waiting until ASU stops.  | To abort auto setup, hold down the 🛞 button.   |
|                 | <b>80.5</b> %<br>≌2085 ⊧P₄  | 80.5                           |                           | Valve opening (%)  |
| 7-5             | °2085 ⊧P⊾                   | 208.5kPa                       | ASU monitor               | Output air pressure OUT1   |
| 7.0             | ASu                         | ASU                            | ASU successfully          | Auto SetUp   |
| 7-6             |                             | SUCCESS                        | completed                 |  |
|                 | 7-7 <b>ASu</b><br>PFAIL_0 ( | ASU                            |                           | Auto SetUp   |
| 7-7             | FAIL_01                     | FAIL_01                        | ASU failed                | The numerical value is an error code.  |

## Zero span adjustment

| Guide<br>number | Display        | Reading         | ltem                                | Remarks   |
|-----------------|----------------|-----------------|-------------------------------------|---|
| 8-1             |                | ADJ             | ADJ initial screen                  | Angle Adjustment<br>Time until the setup mode<br>automatically ends |
|                 |                | 60s             |                                     | (Not displayed if the time is longer than 60 seconds.)              |
|                 | <b>AJ 100%</b> | AJ100<br>(AJ 0) |                                     | AJ100 : Adjust 100% Angle<br>(AJ 0 : Adjust 0% Angle)               |
| 8-2             |                | $\rightarrow$   | ADJ adjustment<br>opening selection |   |

| Guide<br>number | Display   | Reading   | Item   | Remarks   |
|-----------------|---|---|--|---|
|                 | <b>RJ 100%</b><br>PCDAPS E*   | AJ100<br>(AJ 0)                                       |  | AJ100 : Adjust 100% Angle<br>(AJ 0 : Adjust 0% Angle)                                       |
| 8-3             |   | $COARSE \rightarrow MID \rightarrow FINE \rightarrow$ | ADJ adjustment<br>angle selection                  | Angle adjusted by operating<br>the button once<br>COARSE : 1°<br>MID : 0.1°<br>FINE : 0.01° |
|                 | 975%<br>Pri 100%  | 97.5  |  | Valve opening (%)   |
| 8-4             | р на юра<br>(р Ал 0%)   | AJ100%<br>(AJ 0%)                                     | ADJ is being<br>adjusted                           | AJ100% : Adjust 100% Angle<br>(AJ 0% : Adjust 0% Angle)                                     |
| 8-5             | 998%  | 99.8  | ADJ monitor  | Valve opening (%)   |
| 0-0             | °2350 FP  | 235.0kPa  |  | Output air pressure OUT1  |
| 8-6             | <b>SE 100%</b>  | ST 0<br>ST100   | ADJ Manual<br>Setting                              | ST 0 :Set 0% angle<br>ST100 : Set 100% angle  |
| 0-0             |   | $\rightarrow$   | adjustment<br>opening selection                    |   |
|                 | SE 100%   | ST 0<br>ST100   | Waiting until ADJ                                  | ST 0 :Set 0% angle<br>ST100 : Set 100% angle  |
| 8-7             | $\begin{array}{ccc} & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & &$ | Manual Setting is<br>performed                        | To perform manual setting, hold down the 🛞 button. |   |
| 0.0             | <u>51</u>   | ST 0<br>ST100   | ADJ Manual   | ST 0 : Set 0% angle<br>ST100 : Set 100% angle   |
| 8-8             |   | SUCCESS   | Setting completed                                  |   |

## Supply bypass

| Guide<br>number | Display                | Reading   | ltem                      | Remarks  |
|-----------------|------------------------|---|---------------------------|--|
|                 |                        | BPS   |                           | Supply Bypass  |
| 9-1             | 60 r                   | 60s   | BPS initial screen        | Time until the setup mode<br>automatically ends<br>(Not displayed if the time is<br>longer than 60 seconds.) |
|                 |                        | BPS   |                           | Supply Bypass  |
| 9-2             | <b>675</b><br>₽₽_min++ | $: P_MIN \rightarrow \rightarrow$ $: P_MAX \rightarrow \rightarrow$ | BPS pressure<br>selection | To perform the selected supply bypass, hold down the button.   |
| 0.2             | <b>BP5</b>             | BPS   | PDC evenution             | Supply Bypass  |
| 9-3             | PRUN_MIN               | : RUN_MIN<br>: RUN_MAX  | BPS execution             | Flashes.   |

| Guide<br>number | Display                | Reading                         | Item          | Remarks   |
|-----------------|------------------------|---------------------------------|---------------|---|
|                 | <b>BP5</b><br>≌CLEAR++ | BPS                             | BPS stop      | Supply Bypass                                       |
| 9-4             | PELEAR+ +              | $CLEAR \rightarrow \rightarrow$ | selection     | To abort the supply bypass, hold down the 🛞 button. |
| 9-5             | LP5                    | BPS                             | BPS stop      | Supply Bypass                                       |
| 9-0             |                        | completed                       |               |   |
| 0.6             | <u>6</u> <b>P</b> 5    | BPS                             | BPS execution | Supply Bypass                                       |
| 9-6             | °FAIL_0 (              | FAIL_01                         | impossible    | The numerical value is an error code.               |

## **Control parameters**

| Guide<br>number | Display                      | Reading                     | Item  | Remarks  |
|-----------------|------------------------------|-----------------------------|---|--|
|                 |                              | TUNE                        |   | Tuning Parameter   |
| 11-1            |                              | 60s                         | Control parameter<br>initial screen                       | Changes depending on the<br>time until the setup mode<br>automatically ends<br>[Longer than 60 seconds]<br>Current control parameter<br>[60 seconds or less]<br>Time until the setup mode<br>automatically ends (in seconds) |
|                 |                              | TUNE                        |   | Tuning Parameter   |
| 11-2            | Control paramet<br>selection | Control parameter selection | To change control<br>parameters, hold down the<br>button. |  |
| 11-3            |                              | TUNE                        | Control parameter<br>check                                | Tuning Parameter   |
|                 |                              | 1-L                         |   |  |

## Configuration

| Guide<br>number | Display                  | Reading                                      | Item   | Remarks  |
|-----------------|--------------------------|--|--|--|
|                 |                          | CONF   | and Valve  | Valve Configuration  |
| 12-1            | 60 r                     | 60s  | Closed Position<br>specification initial<br>screen | Lower section: Time until the<br>setup mode automatically ends<br>(Not displayed if the time is<br>longer than 60 seconds.)  |
|                 |                          | A_TYPE                                       |  | Actuator Type  |
| 12-2            | <b>A_LYP</b><br>≌ LINEAR | LINEAR<br>R 90<br>R OTH<br>R_S 90<br>R_S OTH | Actuator Type<br>specification<br>screen           | Flashes.<br>LINEAR: Linear valve<br>R 90:<br>Rotary valve with an<br>operating angle of 90°<br>R OTH:<br>Rotary valve with an<br>operating angle other than<br>90°<br>R_S 90:<br>Rotary sub valve with an<br>operating angle of 90°<br>R_S OTH:<br>Rotary sub valve with an<br>operating angle other than<br>90° |
| 12-3            |                          | CLS_P<br>UP                                  | Valve Closed<br>Position<br>specification          | Valve Closed Position  |
|                 |                          | DOWN   | screen   | Flashes.   |
|                 |                          | A_TYPE                                       |  | Actuator Type  |
| 12-4 PLINERP    | ALYP<br>B LINEAR         | LINEAR<br>R 90<br>R OTH<br>R_S 90<br>R_S OTH | Actuator Type<br>confirmation<br>screen            | Same as 12-2.<br>(Does not flash.)   |
| 12-5            |                          | CLS_P  | Valve Closed<br>Position                           | Valve Closed Position  |
| 12-3            |                          | UP<br>DOWN                                   | confirmation<br>screen                             |  |

# Appendix B Menu List

#### Menu List

|                      |                | Menu                                     |                                  |                       |
|----------------------|----------------|--|----------------------------------|-----------------------|
| Process Varia        | bles           | i  |                                  | 1                     |
| Process<br>Variables |                |  |                                  |                       |
| Valiables            | Input (mA)     |  |                                  |                       |
|                      | Input (%) *1   |  |                                  |                       |
|                      | Set Point (SP) |  |                                  |                       |
|                      | Travel         |  |                                  |                       |
|                      | Position *1    |  |                                  |                       |
|                      | Drive Signal   |  |                                  |                       |
|                      | Po 1           |  |                                  |                       |
|                      | Po 2 *2        |  |                                  |                       |
|                      | Ps             |  |                                  |                       |
|                      | Pn             |  |                                  |                       |
|                      | Temperature    |  |                                  |                       |
| Device               |                |  |                                  |                       |
|                      | Basic Setup    |  |                                  |                       |
|                      |                | Auto Setup                               |                                  |                       |
|                      |                | Travel Angle 100%                        |                                  |                       |
|                      |                | Travel Angle 0%                          |                                  |                       |
|                      |                | Stroke Time Open                         |                                  |                       |
|                      |                | Stroke Time Closed                       |                                  |                       |
|                      |                | Stroke Time Average                      |                                  |                       |
|                      |                | Friction Index                           |                                  |                       |
|                      |                | Initial Supply Pressure                  |                                  |                       |
|                      |                | Spring Range High                        |                                  |                       |
|                      |                | Spring Range Low<br>Drive Sig Range High |                                  |                       |
|                      |                | Drive Sig Range Low                      |                                  |                       |
|                      | +              | Drive Sig-Pn Gain                        |                                  |                       |
|                      |                | Drive Sig-Pn Intercept                   |                                  |                       |
|                      | Configuration  |  |                                  |                       |
|                      |                | Operator Action Setting                  |                                  |                       |
|                      |                | 5  | Using Operator                   |                       |
|                      |                |  | Allow operator action            |                       |
|                      |                |  | Forbid operator action           |                       |
|                      |                | Input Range                              |                                  |                       |
|                      |                |  | Input Range High                 |                       |
|                      |                |  | (Open/100%)                      |                       |
|                      |                |  | Input Range Low<br>(Closed/0%)   |                       |
|                      |                | Valve System                             | (0)                              |                       |
|                      |                | ,  | Actuator Type                    |                       |
|                      |                |  | Valve Closed Position            |                       |
|                      |                |  | Feedback Lever Motion            |                       |
|                      |                |  | Pilot Relay Type                 |                       |
|                      |                |  | Positioner Action                |                       |
|                      |                |  | Electrical Fail To               |                       |
|                      |                |  | Air Fail To                      |                       |
|                      |                | Control Configuration                    |                                  |                       |
|                      |                |  | Actuator Size                    |                       |
|                      |                |  | Friction Level *4                |                       |
|                      |                |  | Control Deadband                 |                       |
|                      |                |  | Replace Control<br>Parameters *5 |                       |
|                      |                |  | Control Parameters *5            |                       |
|                      |                |  | 2 Sharr and motors o             | P Outside of GAP1 *5  |
|                      |                |  |                                  | I Outside of GAP1 *5  |
|                      | 1              |  |                                  | D Outside of GAP1 *5  |
|                      |                |  |                                  | GAP1 *5               |
|                      |                |  |                                  | P Inside of GAP1 *6   |
|                      | 1              |  |                                  | I Inside of GAP1 *6   |
|                      |                |  |                                  | D Inside of GAP1 *6   |
|                      |                |  |                                  | GAP2 *6               |
|                      |                |  |                                  | P Inside of GAP2 *7   |
|                      |                |  |                                  | I Inside of GAP2 *7   |
|                      |                |  |                                  | D Inside of GAP2 *7   |
|                      |                | Input Characterization                   |                                  |                       |
|                      |                |  | Input Characterization           |                       |
|                      |                |  | Custom Curve Data *8             |                       |
|                      |                |  |                                  | Custom Data IN 1 *8   |
|                      |                |  |                                  |                       |
|                      |                |  |                                  | Custom Data IN 21 *8  |
|                      |                |  |                                  | Custom Data OUT 1 *8  |
|                      |                |  |                                  | 1                     |
|                      | -              |  |                                  | Custom Data OUT 21 *8 |
|                      |                | Travel Cutoff                            |                                  |                       |
|                      |                |  | Travel Cutoff High               |                       |
|                      |                |  | Travel Cutoff Low                |                       |
|                      |                | Unit                                     |                                  |                       |

|             |                       |                                 | Change Unit of Pressure                     |                                  |
|-------------|-----------------------|---------------------------------|---|----------------------------------|
|             | Maintenance           |                                 |   |                                  |
|             |                       | Travel Calibration              |   |                                  |
|             |                       |                                 | Auto Travel Calibration                     |                                  |
|             |                       |                                 | Angle Correction<br>Manual Setting          |                                  |
|             |                       |                                 | Change Travel Angle                         |                                  |
|             |                       | Input Calibration               |   |                                  |
|             |                       |                                 | Calibrate 4 mA signal                       |                                  |
|             |                       |                                 | Calibrate 20 mA signal                      |                                  |
|             |                       | Pressure Sensor                 |   |                                  |
|             |                       | Adjustment                      | Zero Adjustment                             |                                  |
|             |                       | Simulation                      | Loro rajustitorit                           |                                  |
|             |                       |                                 | Dummy Input Signal                          |                                  |
|             |                       |                                 | Dummy Drive Signal                          |                                  |
|             |                       | Pneumatic Modules               |   |                                  |
|             |                       |                                 | Pilot Adjustment *2                         |                                  |
|             |                       |                                 | EPM Adjustment *10                          |                                  |
|             |                       | Restore factory settings        | Destass fasters settings                    |                                  |
|             |                       | Operator Action Records         | Restore factory settings                    |                                  |
|             |                       | Operator Action Records         | Operator Action Records                     |                                  |
|             |                       | Real Time Clock                 |   |                                  |
|             | 1                     |                                 | Current Date (MM/DD/                        | Note 3                           |
|             |                       |                                 | YYYY)                                       | 11010 0                          |
|             |                       |                                 | Current Time<br>Set Real Time Clock         |                                  |
|             |                       | Password                        | Set rear Time Clock                         |                                  |
|             |                       | 1 4550014                       | Password Use                                |                                  |
|             |                       |                                 | Change password use                         |                                  |
|             |                       |                                 | setting                                     |                                  |
|             | Device                |                                 | Change Password *11                         |                                  |
|             | Device<br>Information |                                 |   |                                  |
|             |                       | Manufacturer                    |   |                                  |
|             |                       | Model                           |   |                                  |
|             |                       | Device ID                       |   |                                  |
|             |                       | Device Tag                      |   |                                  |
|             |                       | Long Tag                        |   | Note 3                           |
|             |                       | Date (MM/DD/YYYY)<br>Descriptor |   | Note 5                           |
|             |                       | Message                         |   |                                  |
|             |                       | Serial Number                   |   |                                  |
|             |                       | Final Assembly Number           |   |                                  |
|             |                       | Distributor                     |   |                                  |
|             |                       | Config Change Counter           |   |                                  |
|             |                       | Operating Time                  |   |                                  |
|             |                       | Polling Address                 |   |                                  |
|             |                       | Number of Request<br>Preambles  |   |                                  |
|             |                       | Number of Response              |   |                                  |
|             |                       | Preambles                       |   |                                  |
|             |                       | Revision Numbers                | HART Version                                |                                  |
|             |                       |                                 | Device Revision                             |                                  |
|             |                       |                                 | Software Revision                           |                                  |
|             |                       |                                 | Hardware Revision                           |                                  |
|             |                       | Factory Setting                 |   |                                  |
|             |                       | Information                     | Droduction Number                           |                                  |
|             |                       |                                 | Production Number<br>Model Number           |                                  |
|             |                       |                                 | Valve Model Number                          |                                  |
|             |                       |                                 | Factory Setting Date                        | Note 3                           |
|             |                       |                                 | (MM/DD/YYYY)                                | Note 3                           |
|             | Option                | Travel Transmission             |   |                                  |
|             |                       | (AO) *12                        |   |                                  |
|             |                       |                                 | Travel Transmission *12                     |                                  |
|             |                       |                                 | Dummy Travel                                |                                  |
|             |                       |                                 | Transmission *12<br>Fail Safe Direction *12 |                                  |
|             |                       |                                 | D/A Trim *12                                |                                  |
|             | Review                |                                 |   |                                  |
|             |                       | * Refer to "1) MENU             |   |                                  |
| Dia and th  |                       | (Review)".                      |   |                                  |
| Diagnostics | Diagnostic            |                                 |   |                                  |
|             | Status                |                                 |   |                                  |
|             |                       | Positioner Diagnostic           |   |                                  |
|             |                       |                                 | Failure                                     |                                  |
|             |                       |                                 |   | Valve Travel Detector<br>Failure |
|             |                       |                                 |   | Valve Travel Detector Out        |
|             |                       |                                 |   | of Range                         |
|             |                       |                                 |   | Po 1 Pressure Sensor<br>Failure  |
|             |                       |                                 |   | Po 2 Pressure Sensor             |
|             |                       |                                 |   | Failure                          |
|             |                       |                                 |   | Ps Pressure Sensor<br>Failure    |
|             |                       |                                 |   |                                  |

|                                 |                        |                       | Temperature Sensor                    |
|---------------------------------|------------------------|-----------------------|---------------------------------------|
|                                 |                        |                       | Failure                               |
|                                 |                        |                       | CPU Failure                           |
|                                 |                        |                       | RAM Failure<br>ROM Failure            |
|                                 |                        |                       | A/D Conversion Module 1               |
|                                 |                        |                       | Failure                               |
|                                 |                        |                       | A/D Conversion Module 2<br>Failure    |
|                                 |                        |                       | Non-Volatile Memory                   |
|                                 |                        |                       | Failure                               |
|                                 |                        |                       | Input Circuit Failure                 |
|                                 |                        |                       | Internal Program<br>Execution Error   |
|                                 |                        | Function Check        | Execution Entri                       |
|                                 |                        |                       | Local User I/F Active                 |
|                                 |                        |                       | Dummy Input Signal is                 |
|                                 |                        |                       | running                               |
|                                 |                        |                       | Dummy Drive Signal is<br>running      |
|                                 |                        |                       | Dummy Travel                          |
|                                 |                        |                       | Transmission is running<br>*12        |
| <br>                            |                        |                       | Auto Setup is running                 |
|                                 |                        |                       | Auto Travel Calibration is            |
|                                 |                        |                       | running                               |
|                                 |                        |                       | Step Responce Test is<br>running      |
|                                 |                        |                       | Valve Signature is                    |
|                                 |                        |                       | running                               |
|                                 |                        | Out of Specification  |                                       |
|                                 |                        |                       | VTD Angle Span Out of<br>Range        |
|                                 |                        |                       | Supply Pressure Out of                |
|                                 |                        |                       | Range                                 |
|                                 |                        |                       | Temperature Out of<br>Range           |
|                                 | 1                      |                       | Input Signal Low                      |
|                                 |                        |                       | Insufficient Input Signal             |
|                                 |                        |                       | Range                                 |
|                                 |                        |                       | Incorrect Setting of Input<br>Range   |
|                                 |                        | Maintenance Required  |                                       |
|                                 |                        |                       | Restriction is clogged                |
|                                 |                        |                       | Deposits on the Nozzle-               |
|                                 |                        | Information           | Flapper                               |
|                                 |                        | mormation             | Travel Cutoff High                    |
|                                 |                        |                       | Travel Cutoff High                    |
|                                 |                        |                       | Factory Settings Restored             |
|                                 |                        |                       | In Use by an Operator                 |
|                                 |                        |                       | Local User I/F Abnormal               |
|                                 |                        |                       | Local User I/F was used               |
|                                 |                        |                       | in past 10 min.                       |
| <br>                            | Valva Diaggarti        |                       | Failure Output (AO) *12               |
|                                 | Valve Diagnostic       | Out of Specification  |                                       |
|                                 |                        |                       | Supply Pressure High                  |
|                                 |                        |                       | Alarm                                 |
|                                 |                        |                       | Supply Pressure Low<br>Alarm          |
| <br>                            |                        |                       | Temp High Alarm                       |
|                                 |                        |                       | Temp Low Alarm                        |
|                                 |                        | Maintenance Required  |                                       |
|                                 |                        |                       | Stick-Slip High Alarm                 |
|                                 |                        |                       | Stick-Slip Medium Alarm               |
|                                 |                        |                       | Stick-Slip Low Alarm                  |
|                                 |                        |                       | Zero Travel + Alarm                   |
|                                 |                        |                       | Zero Travel - Alarm                   |
|                                 |                        |                       | Deviation + Alarm                     |
|                                 |                        |                       | Deviation - Alarm                     |
|                                 |                        |                       | Po Validity + Alarm                   |
|                                 |                        |                       | Po Validity - Alarm                   |
|                                 |                        |                       | Max Friction Alarm Total Stroke Alarm |
|                                 |                        |                       | Cycle Count Alarm                     |
|                                 |                        |                       | Shut Count Alarm                      |
|                                 |                        |                       | Max Tvl Speed + Alarm                 |
|                                 |                        |                       | Max Tvl Speed - Alarm                 |
| Diagnostic<br>Status<br>Records |                        |                       |                                       |
| Records                         | Positioner Diagnostic  |                       |                                       |
| <br>                            | Valve Diagnostic       |                       |                                       |
| Diagnostic                      |                        |                       |                                       |
| Setup                           |                        |                       |                                       |
|                                 | Positioner Air Circuit |                       |                                       |
|                                 |                        | Drive Sig Max Shift + |                                       |
|                                 |                        | Drive Sig Max Shift - |                                       |
|                                 |                        | Update Drive Sig Max  | 1                                     |
|                                 |                        | Shift                 |                                       |

| Image: Control of the second secon                |  | 1               | Drive Sig Shift Threehold      |
|--|--|-----------------|--------------------------------|
| Dres Spikit Treshold           Conduct value 250           Conduct 250 <t< td=""><td></td><td></td><td>Drive Sig Shift Threshold<br/>+</td></t<>   |  |                 | Drive Sig Shift Threshold<br>+ |
| Image: State   |  |                 |                                |
| Image: Construction of the sign shale in the sign shale of an international of the sign shale of a sign shale s  |  |                 | -                              |
| Image: Construction of the second   |  |                 |                                |
| Image: Second  |  |                 |                                |
| Image: Second  |  |                 | Pn Stable Threshold            |
| Image: Second  |  |                 |                                |
| Image: Control of the second secon  |  |                 |                                |
| Pointore Ar Circuit<br>Alam Enable<br>(Genet the alam enable<br>of metricols in ite include)<br>and "Deposite on the<br>Nozafe-Tapper)           Stick-Slip         Include<br>Stick-Slip V           Image: Stick-Slip V         Image: Slip V           Image: Slip V         Image: Slip V  |  |                 |                                |
| Image: Solution of the stame number of all solution is decigned in the stame number of all solution is decigned in the stame number of the stame numb  |  |                 | Positioner Air Circuit         |
| a     Stack-Stip       Image: Stack Stip X     Stack-Stip X       Image: Stack Stip X     Stack-Stip X       Image: Stack Stip X     Stack Stip X  |  |                 |                                |
| Image: Stark-Stip     Stark-Stip       Image: Stark-Stip     Stark-Stip X       Image: Stark-Stip X     Stark-Stip X       Image: Stark-Stip X     Stark-Stip Validity       Image: Stark-Stip Validity     Stark-Stip Transhot       Image: Stark-Stip Validity     Stark-Stip Validity       Image: Stark-Stip Validity     Stark-Stip Transhot       Image: Stark-Stip Validity     Stark-Stip Validity       Image: Stark-Stip Validity     Stark-Stip Validity<  |  |                 | or alarm disable of            |
| Image: Stark-Stip         Image: Stark-Stip X           Image: Stark-Stip X         Stark-Stip X           Image: Stark-Stip X         Stark-Stip X           Image: Stark-Stip Valuety         Stark-Stip Y           Image: Stark-Stip Valuety         Stark-Stip Valuety           Image: Stark-Stip Treshold Stark         Stark-Stip Treshold Stark   |  |                 |                                |
| Image: Start         |  |                 |                                |
| Image: Section of the sectio        |  | Stick-Slip      |                                |
| Image: Stack-Sip Validity           Image: Stack-Sip Validity <td></td> <td></td> <td></td>  |  |                 |                                |
| Sila-Silo Updated Date<br>(MMODYYY)         Image: Silo Silo Updated Time         Image: Silo Silo Updated Time         Image: Silo Silo Updated Time         Image: Silo Silo Silo Silo Markator         Silo-Silo Modum Alarm<br>Count         Image: Silo Silo Silo Markator         Image: Silo Silo Silo Markator         Image: Silo Silo Silo Thereshold High<br>(Default value 10)         Image: Silo Silo Silo Silo Silo Silo Silo Silo  |  |                 |                                |
| Image: Construct State                 |  |                 |                                |
| Image: Side Sign Age       Image: Side Sign High Alarm       Stack-Sign High Alarm       Count       Stack-Sign Modum Alarm       Count       Stack-Sign Thereshold High       Update Side-Sign Threshold High       Chart Values 5(5)       Stack-Sign Threshold High       Chart Values 5(5)       Stack-Sign Threshold High       Chart Values 5(5)       Stack-Sign Threshold Low       Chart Values 5(5)       Stack-Sign Threshold Low       Chart Values 5(5)       Stack-Sign Alarm Enabled       Zero Travel       Zero Travel       Zero Travel Max       Zero Travel Max       Min       Stack-Sign Alarm Enabled       Zero Travel Max       Min       Zero Travel Max       Min       Zero Travel Max       Min       Stack-Sign Alarm Alarm       Common Status Alarm Count       Update Zero Travel Mark       Common Status Alarm Count       Common Status Alarm Count       Common Status Alarm Count       Update Zero Travel Alarm Count   |  |                 |                                |
| Sile-Silp High Atem<br>Count       Sile-Silp Holm Atem<br>Count         Sile-Silp Count Atem<br>Count       Sile-Silp Low Atem<br>Count         Sile-Silp Count Atem<br>Count       Update Side-Silp Atem<br>Count         Sile-Silp Thershold High<br>(Default value 50)       Sile-Silp Thershold Low<br>(Default value 50)         Sile-Silp Thershold Low<br>(Default value 5)       Sile-Silp Thershold Low<br>(Default value 5)         Sile-Silp Thershold Low<br>(Default value 5)       Sile-Silp Thershold Low<br>(Default value 5)         Zero Travel       Sile-Silp Thershold Low<br>(Default value 5)         Sile-Silp Thershold Low<br>(Default value 5)       Sile-Silp Atem<br>Enabled         Zero Travel       Zero Travel Max         Zero Travel Max       Zero Travel Max         Min       Zero Travel Max         Zero Travel Static Travel Static Travel Max/<br>Min       Zero Travel Static Travel Max/<br>Min         Zero Travel Static Travel Static Travel Static Travel<br>Zero Travel Static Travel Static Travel<br>Zero Travel Static Travel Max/<br>Zero Travel Atem<br>Cont         Zero Travel Static Travel Max/<br>Zero Travel Maxing<br>Travel Maxing<br>Travel Maxing<br>Travel Maxing<br>Travel Maxing<br>Travel Maxing         Zero Travel Atem<br>Cont       Zero Travel Maxing<br>Travel Maxing<br>Travel Maxing         Zero Travel Atem<br>Cont       Zero Travel Maxing<br>Travel Maxing         Zero Travel Atem<br>Cont       Zero Travel Maxing<br>Travel Maxing         Zero Travel Atem<br>Cont       Zero Travel Atem<br>Cont     <   |  |                 | Stick-Slip Updated Time        |
| Image: Count       Stack-Sign Medium Alarm Count         Stack-Sign Medium Alarm Count       Update Stack-Sign Jarm Count         Image: Count of the Stack-Sign Threshold High (Default value 5.5)       Stack-Sign Threshold Indiana (Default value 5.5)         Image: Count of the Stack-Sign Threshold Low (Default value 5.5)       Stack-Sign Threshold Low (Default value 5.5)         Image: Count of the Stack-Sign Threshold Low (Default value 5.5)       Stack-Sign Threshold Low (Default value 5.5)         Image: Count of the Stack-Sign Threshold Low (Default value 5.5)       Stack-Sign Alarm Enabled         Image: Count of the Stack Sign Alarm Enabled       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Alarm Enabled       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Alarm Enabled       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Alarm Enabled       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Count of the Stack Sign Alarm Enabled       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Alarm Enabled       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Threshold - (Default value 30)       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Alarm Enabled       Image: Count of the Stack Sign Alarm Enabled         Image: Count of the Stack Sign Alarm Enab  |  |                 |                                |
| Stick-Sign Medium Alarm         Count         Stick-Sign Low Alarm         Count         Update Stick-Sign Low Alarm         Count         Stick-Sign Threshold High<br>(Default value 5.0)         Stick-Sign Threshold Low<br>(Default value 5.1)         Stick-Sign Threshold Low<br>(Default value 3.1)         Stick-Sign Threshold Low<br>(Default value 3.1)         Stick-Sign Threshold Low<br>(Default value 3.1)         Stick-Sign Threshold Max/<br>Min         Image: Stick-Sign Threshold Low<br>(Default value 3.1)         Stick-Sign Threshold Max/<br>Min         Image: Stick-Sign Threshold Max/<br>(Default value 5.9)         Image: Stick-Sign Threshold Max/<br>(Default value 5.9)         Image: Stick-Sign Threshold Max/<br>(Default value 5.9)         Image: Stick-Sign Threshold Max/<br>(Default value 4.9)         Imag  |  |                 |                                |
| Stick-Sip Low Alarm         Count         Update Stick-Sip Alarm         Count         Stick-Sip Threshold High<br>(Default value 5.)         Stick-Sip Threshold Low<br>(Default value 3)         Stick-Sip Carmon Enabled         Zero Travel         Zero Travel Max         Num         Stick-Sip Carmon Max/<br>Min         Stick-Sip Carmon Max/<br>Min         Zero Travel Static Time         Zero Travel High         Zero Travel Alarm  |  | 1               | Stick-Slip Medium Alarm        |
| Image: Count       Update Stick-Sip Parm (South Fight (Default value 10))         Stock-Sip Threshold High (Default value 5))       Stock-Sip Threshold Iow (Default value 5))         Image: Count of the stock Sign Threshold Low (Default value 5))       Stock-Sip Threshold Low (Default value 5))         Image: Count of the stock Sign Threshold Low (Default value 5))       Stock-Sip Threshold Low (Default value 5))         Image: Count of the stock Sign Threshold Low (Default value 5))       Stock-Sip Threshold Low (Default value 5))         Image: Count of the stock Sign Threshold Low (Default value 5))       Image: Count Sign Alam Enabled         Image: Count of the stock Sign Threshold Low (Default value 5))       Image: Count Sign Alam Enabled         Image: Count of the stock Sign Threshold Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled         Image: Count Sign Alam Enabled       Image: Count Sign Alam Enabled <td></td> <td></td> <td></td>  |  |                 |                                |
| Update Site/Site/Site/Alarm         Count         Stock-Site/Threshold High<br>(Default value 5)         Stock-Site/Threshold Low<br>(Default value 5)         Stock-Site/Threshold Low<br>(Default value 3)         Zero Travel         Zero Travel Max         Zero Travel State         Zero Travel State Travel         Zero Travel State         Zero Travel State         Zero Travel State Travel         Zero Travel State         Zero Travel State         Zero Travel State Travel         Zero Travel State Travel         Zero Travel State Travel         Zero Travel Alarm         Zero Travel Alarm         Zero Travel Alarm Count         Zero Travel Alarm Count         Zero Travel Alarm         Zero Travel Alarm Count         Zero Travel Alarm Count         Zero Travel Alarm         Zero Travel Alarm Count         Zero Travel Alarm Count         Zero Travel Alarm Count         Zero Tra   |  |                 |                                |
| Image: Court     Court       Stock-Stp Threshold High<br>(Oefault value 5.5)       Stock-Stp Threshold<br>Medium<br>(Oefault value 5.5)       Stock-Stp Threshold Low<br>(Oefault value 5.5)       Stock-Stp Threshold Low<br>(Oefault value 5.5)       Stock-Stp Threshold Low<br>(Oefault value 5.7)       Stock-Stp Threshold Low<br>(Oefault value 5.7)       Image: Constraint of the state of the   |  | 1               | Update Stick-Slip Alarm        |
| Image: Construct of the second state state of the second state of the second state of the secon                |  |                 | Count                          |
| Stick-Sip Threshold<br>Medium<br>(Default value 5-5)         Image: Stick-Sip Threshold Low<br>(Default value 3)         Image: Stick-Sip Threshold Low<br>(Default value 4)         Image: Stick-Sip Threshol   |  |                 |                                |
| Image: Constraint of the second constraint of the seco  |  |                 | Stick-Slip Threshold           |
| Stick-Sip Treshol Low<br>((Defaul value 3)         Zero Travel         Zero Travel Max         Zero Travel Max         Update Zero Travel Max         Min         Reset Zero Travel Max/<br>Min         Zero Travel Stable<br>Threshold         Zero Travel Threshold +<br>(Defaul value 105)         Zero Travel Threshold +<br>(Defaul value 105)         Zero Travel Threshold +<br>(Defaul value 105)         Zero Travel Valing Thre<br>(Defaul value 405)         Zero Travel Valing Thre<br>(Defaul value 405)         Zero Travel Alarm<br>Count         Zero Travel  |  |                 |                                |
| Image: Constraint of the second state of the second sta                |  |                 |                                |
| Zero Travel     Zero Travel Max       Zero Travel Min     Update Zero Travel Max/<br>Min       Reset Zero Travel Stable     Travel Stable       Threshold     Zero Travel Stable       Zero Travel Stable     Travel Stable       Threshold     Zero Travel Stable       Zero Travel Stable     Travel Stable       Threshold     Zero Travel Stable       Zero Travel Stable     Travel Stable       Threshold     (Defaul value 10s)       Zero Travel Threshold +     (Defaul value 10s)       Zero Travel Threshold -     (Defaul value 10s)       Zero Travel Marm     Zero Travel Marm       Zero Travel Atarm     Zero Travel Atarm       Zero Travel Atarm     Zero Travel Atarm<  |  |                 | (Default value 3)              |
| Zero Travel Max       Zero Travel Min       Update Zero Travel Max/<br>Min       Reset Zero Travel Max/<br>Min       Zero Travel Stable       Threshold       Zero Travel Stable       Threshold +       (Default value 10s)       Zero Travel Ming Time       (Default value 10s)       Zero Travel Variting Time       (Default value 40s)       Zero Travel Variting Time       Update Zero Travel Alarm       Count       Zero Travel Variting Time       Update Deviation Time Max +       Deviation       Max       Reset Deviation Time Max       Update Deviation Time Max       Update Deviation Time Max       Update Deviation Time Max       Deviation Variting Time       (Default value 5%)       Deviation Alaram Count   |  |                 | Stick-Slip Alarm Enabled       |
| Zero Travel Min     Update Zero Travel Max/<br>Min       Reset Zero Travel Max/<br>Min     Reset Zero Travel Stable       Threshold     Zero Travel Stable       Contravel Threshold -     (Default value 3%)       Zero Travel Threshold -     (Default value - 3%)       Zero Travel Valing Time     (Default value - 3%)       Zero Travel Valing Time     (Default value - 3%)       Zero Travel Alarm Count     Update Zero Travel Alarm       Count     Zero Travel Alarm       Count     Zero Travel Alarm       Zero Travel Alarm     Zero Travel Alarm       Count     Update Zero Travel Alarm       Quotato Time Max +     Deviation Time Max +       Deviation     Deviation Time Max +       Quotato Deviation Time Max     Deviation Time Max -       Quo  |  | Zero Travel     |                                |
| Update Zero Travel Max/<br>Min     Reset Zero Travel Max/<br>Min       Zero Travel Stable     Threshold       Threshold     Zero Travel Stable       Threshold     Zero Travel Stable       Time     (Default value 10s)       Zero Travel Threshold +<br>(Default value 1%)       Zero Travel Threshold +<br>(Default value 1%)       Zero Travel Threshold +<br>(Default value 3%)       Zero Travel Waiting Time<br>(Default value 3%)       Zero Travel Value 3%)       Zero Travel Alarm Count       Update Zero Travel Alarm<br>Count       Zero Travel Alarm       Zero Travel Ala  |  |                 |                                |
| Image: Subset of the set of  |  |                 |                                |
| Image: Supply Pressure       Min         Zero Travel Stable       Threshold         Zero Travel Stable       Zero Travel Stable         Time       Zero Travel Stable         Image: Construct Stable       Zero Travel Threshold +         (Default value 10s)       Zero Travel Threshold +         Zero Travel Threshold +       (Default value 40s)         Zero Travel Threshold -       (Default value 40s)         Zero Travel Waiting Time       (Default value 40s)         Zero Travel Value 40s)       Zero Travel Value 70s)         Zero Travel Value 40s)       Zero Travel Value 70s)         Zero Travel Alarm Count       Update Zero Travel Alarm Count         Update Zero Travel Alarm Count       Zero Travel Alarm Enabled         Deviation       Zero Travel Alarm Enabled         Deviation       Deviation Time Max +         Deviation       Deviation Time Max +         Deviation       Reset Deviation Time Max         Deviation Threshold +       (Default value 5%)         Deviation Time Max       Deviation Time Max         Deviation Threshold +       (Default value 5%)   |  |                 |                                |
| Zero Travel Stable       Threshold       Zero Travel Error Walting       Time       Qefault value 10s)       Zero Travel Travel Nationg       Time       Qefault value 10s)       Zero Travel Travel Nationg       Qefault value 10s)       Zero Travel Mating Time       Qefault value 40s)       Zero Travel Walting Time       Qefault value 40s)       Zero Travel Value 7%0       Zero Travel Value       Quedate Zero Travel Alarm       Count       Zero Travel Alarm       Count       Zero Travel Alarm       Quedate Zero Travel Alarm       Count       Zero Travel Alarm       Deviation       Update Zero Travel Alarm       Quedate Zero Travel Alarm       Quedate Zero Travel Alarm       Quedate Zero Travel Alarm       Deviation       Max       Quedate Zero Travel Alarm       Deviation Time Max -       Quedate Zero Trave  |  |                 |                                |
| Image: Supply Pressure       Threshold         Image: Supply Pressure       Zero Travel Static Time         Zero Travel Travel Corror Waiting Time (Default value 1%)       Zero Travel Threshold + (Default value 1%)         Zero Travel Threshold - (Default value 40s)       Zero Travel Threshold - (Default value 40s)         Zero Travel Threshold - (Default value 40s)       Zero Travel Vaiting Time (Default value 40s)         Zero Travel Threshold - (Default value 40s)       Zero Travel Alarm Count         Count       Zero Travel Alarm Count         Update Zero Travel Alarm Enabled       Zero Travel Alarm Enabled         Deviation       Zero Travel Alarm Enabled         Reset Deviation Time Max +       Deviation Time Max -         Update Deviation Time Max -       Update Deviation Time Max -         Update Deviation Time Max -       Update Deviation Time Max -         Update Deviation Time Max -       Update Deviation Time Max -         Update Deviation Time Max -       Update Deviation Time Max -         Update Deviation Time Max -       Deviation Time Max -         Update Deviation Time Max -       Update Deviation Time Max -         Update Deviation Time Max -       Deviation Time Max -         Update Deviation Time Max -       Deviation Time Max -         Update Deviation Time Max -       Deviation Time Max -         Deviation   |  |                 |                                |
| Zero Travel Error Waiting<br>Time       (Default value 10s)       Zero Travel Threshold +<br>(Default value -3%)       Zero Travel Threshold -<br>(Default value -3%)       Zero Travel TravelNoting Time<br>(Default value 40s)       Zero Travel Alarm<br>Count       Update Zero Travel Alarm<br>Count       Deviation       Deviation       Deviation Time Max +       Deviation Time Max +       Update Deviation Time Max +       Deviation Time Max       Update Deviation Time Max +       Deviation Time Max       Update Deviation Time Max +       Deviation Time Max       Update Deviation Time Max       Deviation Threshold +<br>(Default value 5%)       Deviation Threshold -<br>(Default value 5%)       Deviation Alarm Count       Deviation Plate Deviation Alarm   |  |                 |                                |
| Imme       (Default value 10s)         Zero Travel Threshold +       (Default value 1%)         Zero Travel Waiting Time       Zero Travel Waiting Time         (Default value 40s)       Zero Travel Value -3%)         Zero Travel Value -3%)       Zero Travel Alarm         Count       Deviation         Max       Deviation Time Max +         Deviation Time Max       Deviation Time Max         Max       Reset Deviation Time Max         Max       Deviation Threshold +         Deviation Threshold +       (Default value 5%)         Deviation Threshold +       Deviation Threshold -         Deviation Alarm Count       Deviation Ala   |  |                 |                                |
| Image: Supplementation of the state of                 |  |                 |                                |
| Image: State of the state                 |  |                 |                                |
| Zero Travel Threshold -<br>(Default value -3%)         Zero Travel Waiting Time<br>(Default value 40s)         Zero Travel + Alarm<br>Count         Zero Travel + Alarm<br>Count         Update Zero Travel Alarm<br>Count         Deviation         Zero Travel Alarm<br>Count         Deviation         Zero Travel Alarm<br>Count         Deviation         Deviation Time Max +         Deviation Time Max -         Update Deviation Time<br>Max         Reset Deviation Time<br>Max         Deviation Threshold +<br>(Default value 5%)         Deviation Threshold -<br>(Default value 5%)         Deviation Alarm Count         Deviation Alarm Enabled         SupPress Max   |  |                 |                                |
| Image: Construct of the second state of the second stat                |  |                 |                                |
| Image: Constant of the second seco                |  |                 |                                |
| Zero Travel + Alarm<br>Count       Zero Travel - Alarm Count         Update Zero Travel Alarm<br>Count       Update Zero Travel Alarm<br>Count         Zero Travel Alarm       Enabled         Deviation       Zero Travel Alarm         Deviation       Deviation Time Max +         Deviation       Deviation Time Max -         Update Deviation Time Max -       Update Deviation Time Max -         Update Deviation Time Max       Max         Deviation       Reset Deviation Time Max -         Update Deviation Time Max       Deviation Time Max -         Update Deviation Time Max       Deviation Time Max         Deviation Threshold +       Update Deviation Time Max         Deviation Threshold +       Deviation Threshold +         Update Deviation Threshold -       Update S%)         Deviation Alarm Count       Deviation + Alarm Count         Deviation Alarm Count       Deviation Alarm Count         Update Deviation Alarm Enabled       Deviation Alarm Enabled         Deviation Alarm Enabled       Sup Press Max         Sup Press Min       Update Sup Press Max/Min  |  |                 |                                |
| Image: set of the |  |                 |                                |
| Update Zero Travel Alarm<br>Count       Zero Travel Alarm<br>Enabled       Deviation       Deviation       Deviation       Deviation Time Max +       Deviation Time Max -       Update Deviation Time Max       Reset Deviation Time Max       Max       Deviation Threshold +       Deviation Threshold +       Deviation Threshold -       Deviation Alarm Count       Deviation - Alarm Count       Deviation Alarm       Count       Deviation Alarm Enabled       Deviation Press Max       Min  |  |                 | Count                          |
| Image: Count Coun                |  |                 |                                |
| Zero Travel Alarm<br>Enabled       Deviation       Deviation       Update Deviation Time Max -       Update Deviation Time Max       Reset Deviation Time Max       Deviation Time Max       Reset Deviation Time Max       Deviation Threshold +<br>(Default value 5%)       Deviation Threshold -<br>(Default value 5%)       Deviation Wating Time<br>(Default value 10s)       Deviation Alarm Count       Deviation Alarm Count       Deviation Alarm Count       Deviation Alarm Enabled       Supply Pressure       Sup Press Max       Sup Press Max       Min   |  |                 |                                |
| Image: Constraint of the second se  |  |                 |                                |
| Image: Constraint of the second se  |  |                 |                                |
| Image: Constraint of the second se  |  | Deviation       |                                |
| Image: Supply Pressure     Update Deviation Time Max       Image: Supply Press Max     Reset Deviation Timeshold + (Default value 5%)       Image: Supply Press Max     Deviation Threshold - (Default value 5%)       Image: Supply Pressure     Image: Supply Press Max       Image: Supply Press Max     Image: Supply Press Max       Image: Supply Press Max     Image: Supply Press Max       Image: Supply Press Max     Image: Supply Press Max/Min  |  |                 |                                |
| Max       Reset Deviation Time<br>Max       Deviation Threshold +<br>(Default value 5%)       Deviation Threshold -<br>(Default value 5%)       Deviation Alarm Count       Deviation - Alarm Count       Update Deviation Alarm<br>Count       Deviation Alarm Enabled       Supply Pressure       Sup Press Max       Sup Press Max       Update Sup Press Max/<br>Min       Reset Sup Press Max/Min   |  |                 |                                |
| Max       Image: Constraint of the state of                         |  |                 |                                |
| Deviation Threshold +<br>(Default value 5%)       Deviation Threshold -<br>(Default value 5%)       Deviation Threshold -<br>(Default value 5%)       Deviation Waiting Time<br>(Default value 10s)       Deviation + Alarm Count       Deviation - Alarm Count       Deviation - Alarm Count       Deviation Alarm Count       Deviation Alarm Enabled       Supply Pressure       Sup Press Max       Sup Press Max       Min       Reset Sup Press Max/Min  |  |                 |                                |
| Image: Constraint of the second se  |  |                 |                                |
| Image: Constraint of the second se  |  |                 |                                |
| Deviation Waiting Time<br>(Default value 10s)       Deviation + Alarm Count       Deviation - Alarm Count       Update Deviation Alarm<br>Count       Deviation Alarm Enabled       Supply Pressure       Sup Press Max       Sup Press Min       Update Sup Press Max/<br>Min       Reset Sup Press Max/Min   |  |                 |                                |
| Image: Constraint of the second se  |  |                 |                                |
| Image: Constraint of the second se  |  |                 | (Default value 10s)            |
| Update Deviation Alarm<br>Count       Deviation Alarm Enabled       Supply Pressure       Sup Press Max       Update Sup Press Max/<br>Min       Reset Sup Press Max/Min   |  |                 |                                |
| Count       Count       Deviation Alarm Enabled       Supply Pressure       Sup Press Max       Sup Press Max       Update Sup Press Max/<br>Min       Reset Sup Press Max/Min   |  |                 |                                |
| Deviation Alarm Enabled       Supply Pressure       Sup Press Max       Sup Press Min       Update Sup Press Max/<br>Min       Reset Sup Press Max/Min   |  |                 |                                |
| Supply Pressure     Sup Press Max       Sup Press Max     Sup Press Max       Update Sup Press Max/<br>Min     Press Max/<br>Reset Sup Press Max/Min   |  |                 |                                |
| Sup Press Max Sup Press Min Update Sup Press Max/ Min Reset Sup Press Max/Min  |  | Supply Pressure |                                |
| Update Sup Press Max/<br>Min<br>Reset Sup Press Max/Min  |  |                 | Sup Press Max                  |
| Min           Reset Sup Press Max/Min  |  |                 |                                |
| Reset Sup Press Max/Min  |  |                 |                                |
|  |  |                 |                                |
| I Sub Press Infeshold I  |  | 1               | Sup Press Threshold            |
| High Note 1  |  |                 | High Note 1                    |
| Sup Press Threshold Low<br>Note 1  |  |                 |                                |

|   |                                    | Sup Travel Stable<br>Threshold   |  |
|---|------------------------------------|--|--|
|   |                                    | Sup Travel Stable Time   |  |
|   |                                    | Sup Press High Alarm   |  |
|   |                                    | Count  |  |
|   |                                    | Sup Press Low Alarm  |  |
|   |                                    | Count  |  |
|   |                                    | Update Sup Press Alarm<br>Count  |  |
|   |                                    | Sup Press Alarm Enabled  |  |
|   | Tananatan                          | Sup Press Alarm Enabled  |  |
|   | Temperature                        | There Man  |  |
|   |                                    | Temp Max   |  |
|   |                                    | Temp Min   |  |
|   |                                    | UpdateTemp Max/Min   |  |
|   |                                    | Reset Temp Max/Min   |  |
|   |                                    | Temp Threshold High<br>(Default value 80 degrees   |  |
|   |                                    | C)   |  |
|   |                                    | Temp Threshold Low   |  |
|   |                                    | (Default value -40   |  |
|   |                                    | degrees C)<br>Temp High Alarm Count  |  |
|   |                                    |  |  |
|   |                                    | Temp Low Alarm Count   |  |
|   |                                    | UpdateTemp Alarm Count   |  |
|   |                                    | Temp Alarm Enabled   |  |
|   | Force Balance                      |  |  |
|   |                                    | Po Validity  |  |
|   |                                    |  | Po Validity +                                |
|   |                                    |  | Po Validity -                                |
|   |                                    |  | Unbalance Force Seg 1                        |
|   |                                    |  |  |
|   |                                    |  | Unbalance Force Seg 26                       |
|   |                                    |  | Update Unbalance Force                       |
|   |                                    |  | Po Validity Threshold +                      |
|   |                                    |  | Note 1                                       |
|   |                                    |  | Po Validity Threshold -<br>Note 1            |
|   |                                    |  | Po Validity Alarm Enabled                    |
|   |                                    | Max Friction   |  |
|   |                                    | Wax I IIGUUII  | Max Friction                                 |
|   |                                    |  |  |
|   |                                    |  | Friction Seg 1                               |
|   |                                    |  |  |
|   |                                    |  | Friction Seg 26                              |
|   |                                    |  | Update Friction                              |
|   |                                    |  | Max Friction Threshold<br>Note 1             |
|   |                                    |  | Max Friction Alarm                           |
|   |                                    |  | Enabled                                      |
|   |                                    | Common Parameters  |  |
|   |                                    |  | Po Max Seg 1                                 |
|   |                                    |  |  |
|   |                                    |  | Po Max Seg 26                                |
|   |                                    |  | Po Min Seg 1                                 |
|   |                                    |  |  |
|   |                                    |  | Po Min Seg 26                                |
|   |                                    |  | Update Po Max/Min                            |
|   |                                    |  | Travel Seg Divider 1                         |
|   |                                    |  |  |
|   |                                    |  |  |
|   |                                    |  | Travel Seg Divider 25<br>Po Stable Threshold |
|   |                                    |  | Travel Stable Threshold                      |
|   |                                    |  |  |
|   |                                    |  | Travel Upper Limit                           |
|   |                                    | Durine Di  | Travel Lower Limit                           |
|   |                                    | Reset Force Balance  |  |
|   | Total Stroke                       |  |  |
| 1 |                                    | Tatal Otralia  | 1  |
|   |                                    | Total Stroke   |  |
|   |                                    | Update Total Stroke  |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band  |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold  |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value  |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold  |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)   |  |
|   | Cycle Count                        | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm   |  |
|   | Cycle Count                        | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm   |  |
|   | Cycle Count                        | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled  |  |
|   | Cycle Count                        | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count   |  |
|   | Cycle Count                        | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count<br>Update Cycle Count<br>Cycle Count Dead Band<br>High  |  |
|   | Cycle Count                        | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count<br>Update Cycle Count<br>Cycle Count Dead Band<br>High<br>Cycle Count Dead Band   |  |
|   | Cycle Count                        | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count High Cycle Count Dead Band High Cycle Count Dead Band Low  |  |
|   | Cycle Count                        | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count<br>Update Cycle Count<br>Cycle Count Dead Band<br>High<br>Cycle Count Dead Band<br>Low<br>Cycle Count Threshold   |  |
|   | Cycle Count                        | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count Cycle Count Dead Band High Cycle Count Threshold (Default value 10000) Cycle Count Alarm   |  |
|   | Cycle Count                        | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count Cycle Count Dead Band High Cycle Count Dead Band Low Cycle Count Threshold (Default value 100000)  |  |
|   | Cycle Count Cycle Count Shut Count | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count Cycle Count Dead Band High Cycle Count Threshold (Default value 10000) Cycle Count Alarm   |  |
|   |                                    | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count Cycle Count Dead Band High Cycle Count Threshold (Default value 10000) Cycle Count Alarm   |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count<br>Update Cycle Count<br>Cycle Count Dead Band<br>High<br>Cycle Count Dead Band<br>Low<br>Cycle Count Threshold<br>(Default value 100000)<br>Cycle Count Alarm<br>Enabled   |  |
|   |                                    | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count Dead Band High Cycle Count Dead Band Low Cycle Count Threshold (Default value 100000) Cycle Count Alarm Enabled Shut Count Update Shut Count Cunt Shut Count Shut Count Cunt Cunt Cunt Cunt Cunt Cunt Cunt C  |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count<br>Update Cycle Count<br>Update Cycle Count<br>Cycle Count Dead Band<br>Low<br>Cycle Count Dread Band<br>Low<br>Cycle Count Threshold<br>(Default value 100000)<br>Cycle Count Alarm<br>Enabled<br>Shut Count<br>Update Shut Count<br>Update Shut Count<br>Shut Shut Count<br>Shut Count<br>Shut Count<br>Shut Count<br>Shut Count<br>Shut Count<br>Shut Shut Shut Shut<br>Shut Shut Shut<br>Shut Shut<br>Shut Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Sh |  |
|   |                                    | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count Cycle Count Dead Band High Cycle Count Dead Band Low Cycle Count Threshold (Default value 100000) Cycle Count Alarm Enabled Shut Count Update Shut Count Shut Count Shut Count Alarm   |  |
|   | Shut Count                         | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count<br>Update Cycle Count<br>Update Cycle Count<br>Cycle Count Dead Band<br>Low<br>Cycle Count Dread Band<br>Low<br>Cycle Count Threshold<br>(Default value 100000)<br>Cycle Count Alarm<br>Enabled<br>Shut Count<br>Update Shut Count<br>Update Shut Count<br>Shut Shut Count<br>Shut Count<br>Shut Count<br>Shut Count<br>Shut Count<br>Shut Count<br>Shut Shut Shut Shut<br>Shut Shut Shut<br>Shut Shut<br>Shut Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Shut<br>Sh |  |
|   |                                    | Update Total Stroke<br>Total Stroke Dead Band<br>Total Stroke Threshold<br>(Default value<br>2000000%)<br>Total Stroke Alarm<br>Enabled<br>Cycle Count<br>Update Cycle Count<br>Update Cycle Count<br>Cycle Count Dead Band<br>High<br>Cycle Count Dead Band<br>Low<br>Cycle Count Threshold<br>(Default value 100000)<br>Cycle Count Alarm<br>Enabled<br>Shut Count<br>Update Shut Count<br>Shut Count Threshold<br>(Default value 100000)<br>Shut Count Alarm<br>Enabled   |  |
|   | Shut Count                         | Update Total Stroke Total Stroke Dead Band Total Stroke Threshold (Default value 2000000%) Total Stroke Alarm Enabled Cycle Count Update Cycle Count Update Cycle Count Cycle Count Dead Band High Cycle Count Dead Band Low Cycle Count Threshold (Default value 100000) Cycle Count Alarm Enabled Shut Count Update Shut Count Shut Count Shut Count Alarm   |  |

| 1                |                          |                         |
|------------------|--------------------------|-------------------------|
|                  | Reset Max Tvl Speed      |                         |
|                  | Max Tvl Speed Threshold  |                         |
|                  | +                        |                         |
|                  | (Default value +1000%/s) |                         |
|                  | Max Tvl Speed Threshold  |                         |
|                  | -                        |                         |
|                  | (Default value -1000%/s) |                         |
|                  | Max Tvl Speed Alarm      |                         |
|                  | Enabled                  |                         |
| Travel Histogram |                          |                         |
|                  | Travel Histogram         |                         |
|                  |                          | Travel Histogram 1      |
|                  |                          |                         |
|                  |                          | Travel Histogram 26     |
|                  |                          | Update Travel Histogram |
|                  |                          | Reset Travel Histogram  |
|                  | Travel Segmentation      |                         |
|                  |                          | Travel Seg Divider 1    |
|                  |                          |                         |
|                  |                          | Travel Seg Divider 25   |

Note 1: These parameters are updated when the auto setup is carried out.

Note 2: When '1.\$', '<<<', '>>>' or '1.#INF' is displayed, the value is non-numeric character or infinite.

- Note 3: The order of 'MM/DD/YYYY' can be changed with the host or PC configuration.
- \*1. Display except for "Linear" of Input Characterization
- \*2. Display in case of "Double Acting" of Pilot Relay Type
- \*4. Display in case of Param 1, 2 3, 4, 5, or 6 of Actuator Size
- \*5. Display in case of "Custom" of Actuator Size
- \*6. Display in case of "Custom" or "GAP1≠0.00" of Actuator Size
- \*7. Display in case of "Custom", "GAP1≠0.00" or "GAP1≠0.00"of Actuator Size
- \*8. Display in case of "Custom Curve" of Input Characterization
- \*10. Please ask our service engineer to carry out this operation.
- \*11. Display in case of "Enabled" of Password Use
- \*12. Display in case of AVP701
- \*13. Display in case of only EDD
- \*14. Display in case of only DD

# 1) MENU (Review)

Displayed parameters and their order are as shown below.

| Manufacturer                                 |
|--|
| Model  |
| Device ID                                    |
| Device Tag                                   |
| Long Tag                                     |
| Date   |
| Descriptor                                   |
| Message                                      |
| Serial Number                                |
| Final Assembly Number                        |
| Distributor                                  |
| Config Change Counter                        |
| Operating Time Polling Address               |
| Number of Request Preambles                  |
| Number of Response Preambles                 |
| HART Version                                 |
| Device Revision                              |
| Software Revision                            |
| Hardware Revision                            |
| Production Number                            |
| Model Number                                 |
| Valve Model Number                           |
| Factory Setting Date                         |
| Input (mA)                                   |
| Input (%) *1                                 |
| Set Point (SP)                               |
| Travel                                       |
| Position *1                                  |
| Drive Signal                                 |
| Po 1   |
| Po 2 *2                                      |
| Ps   |
| Pn   |
| Temperature                                  |
| VTD Angle                                    |
| Travel Angle 100%                            |
| Travel Angle 0%                              |
| Stroke Time Open                             |
| Stroke Time Closed                           |
| Stroke Time Average                          |
| Friction Index                               |
| Initial Supply Pressure                      |
| Spring Range High                            |
| Spring Range Low                             |
| Drive Sig Range High                         |
| Drive Sig Range Low                          |
| Drive Sig-Pn Gain                            |
| Drive Sig-Pn Intercept                       |
| Input Range High (Open/100%)                 |
| Input Range Low (Closed/0%)                  |
| Actuator Type                                |
| Valve Closed Position                        |
| Feedback Lever Motion                        |
| Pilot Relay Type                             |
| Positioner Action                            |
| Electrical Fail To                           |
| Air Fail To                                  |
| Actuator Size                                |
| Friction Level *4                            |
| Control Deadband                             |
| P Outside of GAP1 *5                         |
| I Outside of GAP1 *5<br>D Outside of GAP1 *5 |
|  |
|  |
| GAP1 *5                                      |
|  |

| D Inside of GAP1 *6     |
|-------------------------|
| GAP2 *6                 |
| P Inside of GAP2 *7     |
| I Inside of GAP2 *7     |
| D Inside of GAP2 *7     |
| Input Characterization  |
| Custom Data IN 1 *8     |
|                         |
| Custom Data IN 21 *8    |
| Custom Data OUT 1 *8    |
|                         |
| Custom Data OUT 21 *8   |
| Travel Cutoff High      |
| Travel Cutoff Low       |
| Unit of Pressure        |
| Password Use            |
| Travel Transmission *12 |
| Fail Safe Direction *12 |
|                         |

- \*1. Display except for "Linear" of Input Characterization
- \*2. Display in case of "Double Acting" of Pilot Relay Type
- \*4. Display in case of Param 1, 2 3, 4, 5, or 6 of Actuator Size
- \*5. Display in case of "Custom" of Actuator Size
- \*6. Display in case of "Custom" or "GAP1≠0.00" of Actuator Size
- \*7. Display in case of "Custom", "GAP1≠0.00" or "GAP1≠0.00" of Actuator Size
- \*8. Display in case of "Custom Curve" of Input Characterization
- \*12. Display in case of AVP701

# Appendix C Specification

#### LIST OF FEATURES

| ltem                         | Function   |
|------------------------------|--|
| Desired input signal range   | Any split-range value can be specified.  |
| Forced fully open/closed     | The control valve can be fully closed or opened securely when the desired percentage of input signal is reached.   |
| Desired flow characteristics | The relationship between input signal and valve travel that is appropriate for the process can be defined by using |
|                              | a 21-point line graph.   |
| Travel transmission (option) | Valve motion can be reliably monitored by transmitting the valve travel.   |

#### FUNCTIONAL SPECIFICATIONS

| ltem             |                                   | Specification  |  |  |  |  |
|------------------|-----------------------------------|--|--|--|--|--|
| Applicable       | actuator                          | Pneumatic single and double acting, linear and rotary motion actuator  |  |  |  |  |
| Input signa      | 1                                 | 4 to 20 mA DC (Configurable to any required range for split range: minimum span 4 mA DC)<br>Minimum driving current: 3.84 mA   |  |  |  |  |
| Output sign      | nal                               | 4 to 20 mA DC (Travel transmission)  |  |  |  |  |
| Input resist     | ance                              | 475 Ω typically / 20 mA DC (Without the overvoltage protection)<br>600 Ω typically / 20 mA DC (With the overvoltage protection)  |  |  |  |  |
| Lightning p      | protection                        | Peak value of voltage surge: 12 kV<br>Peak value of current surge: 1000 A  |  |  |  |  |
| Flow chara       | cteristics                        | Linear, Equal percentage, Quick opening<br>Custom user characteristics (21 points)   |  |  |  |  |
| Manual op        | eration                           | Auto/Manual external switch or LUI (Local User Interface) (Not available double acting actuator)   |  |  |  |  |
| Supply air p     | upply air pressure 140 to 700 kPa |  |  |  |  |  |
| Air consum       | nption                            | for single acting actuator<br>3.2 L/min [N] or less: with steady supply air pressure of 140 kPa {1.4 kgf/cm <sup>2</sup> } and output of 50 %<br>4.0 L/min [N] or less: with steady supply air pressure of 280 kPa {2.8 kgf/cm <sup>2</sup> } and output of 50 %<br>4.8 L/min [N] or less: with steady supply air pressure of 500 kPa {5.0 kgf/cm <sup>2</sup> } and output of 50 %<br>for double acting actuator<br>8 L/min (N) or less: at air pressure of 400 kPa {4.0 kgf/cm <sup>2</sup> } and balanced output pressures at a steady 70 %<br>of the supply air pressure |  |  |  |  |
| Maximum          | air deliver flowrate              | 110 L/min (N) at 140 kPa {1.4 kgf/cm <sup>2</sup> }  |  |  |  |  |
| Air connec       | tions                             | Rc1/4 or 1/4NPT internal thread  |  |  |  |  |
| Electrical c     | onnections                        | G1/2, 1/2NPT or M20 $\times$ 1.5 internal thread   |  |  |  |  |
|                  |                                   | TIIS Flameproof: -20 to +55 °C<br>FM/FMC/IECEx/CCC/KCs Explosion protection: -30 to +75 °C<br>FM Intrinsically safe (ic) and Nonincendive: -24 to + 75 °C<br>ATEX/IECEx Intrinsically safe: -40 to + 60 °C<br>LCD operating limit: 0 to +50 °C   |  |  |  |  |
| Ambient hu       | umidity limits                    | 5 to 100 %RH   |  |  |  |  |
|                  | haracteristics                    | 20 m/s <sup>2</sup> , 5 to 400 Hz (with standard mounting kit on Azbil Corporation's HA actuator)  |  |  |  |  |
| Color            |                                   | Silver   |  |  |  |  |
| Material         |                                   | Cast aluminum  |  |  |  |  |
| Weight           |                                   | Without Pressure regulator with filter: 4.2 kg<br>With Pressure regulator with filter model RA1B: 4.7 kg<br>With Pressure regulator with filter model KZ03: 4.9 kg   |  |  |  |  |
| Perfor-<br>mance | Accuracy                          | $\pm 1.0\%$ F.S.<br>But: $\pm 3.0\%$ FS if the feedback lever angle is outside the $\pm 4^{\circ}$ to $\pm 20^{\circ}$ range (see Table 1)<br>There is an additional 0.5% FS (input error) if 4 mA $\leq$ input signal span $< 8$ mA   |  |  |  |  |
|                  | Travel transmis-<br>sion accuracy | ±1.0 %F.S.*1   |  |  |  |  |
|                  | Stroke coverage                   | 14.3 to 100 mm Stroke (Feedback Lever Angle ±4° to ±20°)   |  |  |  |  |
| Structure        |                                   | TIIS Flameproof Ex d IIC T6 X  |  |  |  |  |
|                  |                                   | <ul> <li>FM Explosionproof/Dust Ignition Protection</li> <li>Explosionproof (Division system):Class I, Division 1, Group B, C, D T6 <ul> <li>Factory sealed, conduit seal not required</li> <li>Not including gasoline atmospheres</li> <li>Flameproof (Zone system): Class I, Zone 1, AEx d IIC T6 Gb</li> <li>Dust ignition protection (Division system): Class II, III, Division 1, Group E, F, G T6</li> <li>Dust ignition protection (Zone system): Zone 21 AEx tb IIIC T85 °C Db</li> <li>Enclosure classification: IP66</li> </ul> </li> </ul>                        |  |  |  |  |

\*1. This applies only to positioners with travel transmission (model AVP701). In this case, a power supply circuit for travel transmission is required.

| Item      | Specification  |
|-----------|--|
| Structure | FM Intrinsically safe (ic) and Nonincendive         Intrinsically safe (ic) (Zone system)         Class I, Zone 2, AEx ic IIC T4         Entity Parameters:         Positioner Circuit: Ui=30 V, Ii=100 mA, Pi=1 W, Ci=24 nF, Li=0.22 mH         Transmitter Circuit (AVP701): Ui=30 V, Ii=100 mA, Pi=1 W, Ci=20 nF, Li=0.22 mH         Nonincendive (Division system)         Class I, Division 2, Group A, B, C and D, T4         Nonincendive Field Wiring Parameters:         Positioner Circuit (AVP701): Vmax=30 V, Imax=100 mA, Ci=24 nF, Li=0.22 mH         Transmitter Circuit (AVP701): Vmax=30 V, Imax=100 mA, Ci=20 nF, Li=0.22 mH         Suitable         Class II and Class III, Division 2, Group E, F and G, T4                               |
|           | Indoor/Outdoor Enclosure: NEMA Type 4X, IP66<br>FMC Explosionproof/Dust Ignition Protection<br>Explosionproof (Division system): Class I, Division 1, Group C, D T6<br>• Factory sealed, conduit seal not required<br>• Not including gasoline atmospheres<br>Flameproof (Zone system): Class I, Zone 1, Ex d IIB T6<br>• Seal all conduits within 450 mm (18 inches)<br>Dust ignition protection (Division system): Class II, III, Division 1, Group E, F, G T6<br>Enclosure classification: IP66<br>• The wiring conduit cable gland and electrical wiring must be compliant with the<br>National Electrical Code (NEC).   |
|           | ATEX Intrinsically safe/Dust Ignition Protection<br>Intrinsically safe: II 1 G Ex ia IIC T4 Ga<br>Dust ignition protection: II 1 D Ex ia IIIC T135°C Da<br>Enclosure classification: IP66<br>The barriers should be ATEX certified types and comply with the following conditions:<br>Input Signal Terminals (+/-IN):<br>Ui=30 V, Ii=93 mA, Pi=0.9 W, Ci=4 nF, Li=220 μH<br>Output Signal Terminals (+/-OUT):<br>(AVP701) Ui=30 V, Ii=93 mA, Pi=0.9 W, Ci=22 nF, Li=220  |
|           | <ul> <li>IECEx Flameproof/Dust Ignition Protection</li> <li>Flameproof: Ex d IIC T6 Gb</li> <li>Dust ignition protection: Ex tb IIIC T85 °C Db</li> <li>Enclosure classification: IP66</li> <li>Please use IECEx Ex d IIC-approved products as the cable gland for connecting it to the electrical connection port.</li> <li>However, please use IP66-approved products when using it in an environment that requires IP66.</li> <li>IECEx Intrinsically safe/Dust Ignition Protection</li> <li>Intrinsically safe: Ex ia IIC T4 Ga</li> <li>Dust ignition protection: Ex ia IIIC T135°C Da</li> <li>Enclosure classification: IP66</li> <li>The barriers should be IECEx certified types and comply with the following conditions:</li> </ul>                 |
|           | Input Signal Terminals (+/-IN):<br>Ui=30 V, Ii=93 mA, Pi=0.9 W, Ci=4 nF, Li=220 μH<br>Output Signal Terminals (+/-OUT):<br>(AVP701) Ui=30 V, Ii=93 mA, Pi=0.9 W, Ci=22 nF, Li=220 μHCCC Flameproof / Dust Ignition Protection<br>Flameproof: Ex db IIC T6 Gb -30°C≤T <sub>amb</sub> ≤+75°C IP66<br>Dust ignition protection: Ex tb IIIC T85°C Db<br>Enclosure classification: IP66<br>For the cable gland connected to the electrical connection nort, use products<br>with CCC Ex d IIC or Ex tD A21 explosion-proof certification.<br>Please use IP66-approved products in an environment that requires IP66.KCs FlameproofEx d IIC T6<br>Please use KCs Ex d IIC-approved products as the cable gland to be connected to<br>the electrical connection port. |

| ltem          | Specification  |
|---------------|--|
| CE conformity | Electromagnetic compatibility EN61326-1: 2013 (CE Marking)   |
|               | The device is intended for use in industrial locations defined in CE marking directive (EN 61326-1). |

Note: Depending on the inner diameter and length of the air pipe, automatic setup might not be sufficient to realize the optimum operation. In such a case, please specify the relevant parameters.

## Conditions of supply air (JIS C1805-1 (2001))

| ltem                       | Specification  |
|----------------------------|--|
| Particles                  | Maximum diameter 3 µmm   |
| Oil mist                   | Less than 1 ppm at mass  |
| Humidity of the air supply | The dew point should be at least 10°C lower than the temperature of this device. |

To meet the above specifications for instrument air, install the air purification devices listed below properly in the specified installation location.

#### Examples of air purification devices

| Installation         | Air purification device | SMC corporation       | CKD corporation |
|----------------------|-------------------------|-----------------------|-----------------|
| Compressor outlet or | Line filter             | AFF series            | AF series       |
| main line            | Mist separator          | AM series             |                 |
| Terminal device      | Mist separator          | AM150 or AM250 series | M3000S type     |

#### Table 1. Standard travel range and accuracy

| Actuator       | Travel (mm)           | Accuracy [% F.S.] |
|----------------|-----------------------|-------------------|
| PSA1, 2        | 14.3, 20, 25          | 1.0               |
| PSA3, 4        | 20, 38                | 1.0               |
| HA1            | 6, 8, 10              | 3.0               |
|                | 14.3, 25              | 1.0               |
| HA2            | 10                    | 3.0               |
|                | 14.3, 25, 38          | 1.0               |
| HA3            | 14.3                  | 3.0               |
|                | 25, 38, 50            | 1.0               |
| HA4            | 14.3                  | 3.0               |
|                | 25, 38, 50, 75        | 1.0               |
| VA5            | 25, 37.5, 50, 75, 100 | 1.0               |
| VA6            | 14.3                  | 3.0               |
| PSA6, 7        | 25, 37.5, 50, 75, 100 | 1.0               |
| HK1            | 10                    | 3.0               |
| PSK1           | 19                    | 1.0               |
| DAP560, 1000   | 14.3                  | 3.0               |
| 1000X          | 25~100                | 1.0               |
| DAP1500, 1500X | 14.3, 25              | 3.0               |
|                | 38~100                | 1.0               |

# **Appendix D Model Selection**

## **MODEL SELECTION**

#### **Basic model number**

| AVP701                        | Analog signal (4 to 20<br>munication Protocol  | mA DC) with Travel Tran  | smission and HAR   | Г com                  | (1)      | (2)     | (3)     | -      | (4)    | (5) | (6) | (7) | - | (8)  | (9)  |
|-------------------------------|--|--|--|------------------------|----------|---------|---------|--------|--------|-----|-----|-----|---|--|--|
| AVP702                        | Analog signal (4 to 20   | mA DC) with HART com   | munication Protoco   | ol                     |          |         |         |        |        |     |     |     |   |  |  |
|                               | X47.4 C  |  |  |                        | v        |         |         |        |        |     |     |     |   |  |  |
|                               | Water-proof  |  | 1  | 1 4 1                  | X        | ł       |         |        |        |     |     |     |   |  |  |
|                               | -  | ctrical connection G1/2 or   |  |                        | E        | ł       |         |        |        |     |     |     |   |  |  |
|                               |  | st ignition protection (Electri  | ical connection G1/21  | s not available.)      | F        | -       |         |        |        |     |     |     |   |  |  |
|                               | FM Intrinsically safe (  |  |  |                        | V        | ł       |         |        |        |     |     |     |   |  |  |
|                               |  | oust ignition protection (Elec   | trical connection G1/2   | 2 is not available.)   | A        | ł       |         |        |        |     |     |     |   |  |  |
| (1) Structure                 |  | /Dust Ignition Protection  |  |                        | L        | -       |         |        |        |     |     |     |   |  |  |
| . ,                           |  | t ignition protection (Electric  | cal connection G1/2 is   | not available.)        | D        | -       |         |        |        |     |     |     |   |  |  |
|                               | , ,  | Dust Ignition Protection   |  |                        | Т        | ł       |         |        |        |     |     |     |   |  |  |
|                               |  | ignition protection (Electrica   |  | not available.)        | N        | -       |         |        |        |     |     |     |   |  |  |
|                               | KCs Flameproof (Elec   | trical connection G1/2 is  | not available.)  |                        | K        |         |         |        |        |     |     |     |   |  |  |
|                               | Electrical connection  | Air piping connection  | Mounting thread  | Pressure gauge         | thread   |         |         |        |        |     |     |     |   |  |  |
| ( <b>a</b> ) Commention       | G1/2   | Rc1/4  | M8   | Rc1/8                  |          | G       |         |        |        |     |     |     |   |  |  |
| (2) Connection                | 1/2NPT   | 1/4NPT   | M8   | Rc1/8                  |          | Ν       |         |        |        |     |     |     |   |  |  |
|                               | M20×1.5  | 1/4NPT   | M8   | Rc1/8                  |          | М       |         |        |        |     |     |     |   |  |  |
|                               | Standard (Baked acryl  | lic)   |  |                        |          |         | S       | ĺ      |        |     |     |     |   |  |  |
| (3) Finish                    | Corrosion proof (Bake  | ed urethane)   |  |                        |          |         | В       |        |        |     |     |     |   |  |  |
|                               |  |  |  |                        |          |         |         | J      |        |     |     |     |   |  |  |
| (4) (5) Display               | Display with push but  | ton  |  |                        |          |         |         |        | D      | Х   | 1   |     |   |  |  |
| (6) Diagnostic                | Advanced Diag (with  |  |  |                        |          |         |         |        | 2      |     | A   |     |   |  |  |
|                               | None   | iour pressure sensors)   |  |                        |          |         |         |        |        |     |     | Х   |   |  |  |
| (7) Overvoltage<br>protection |  | n (Input impedance +125  | )  |                        |          |         |         |        |        |     |     | V   |   |  |  |
| protection                    | Overvoltage protection   | in (input impedance +125   | /  |                        |          |         |         |        |        |     |     | v   |   |  |  |
|                               | None   |  |  |                        |          |         |         |        |        |     |     |     |   | Х  | X  |
|                               |  | ersal elbow (SUS304 G1/2   | ) (1)  |                        |          |         |         |        |        |     |     |     |   | A  | A  |
|                               |  | ersal elbow (SUS304 G1/2   |  |                        |          |         |         |        |        |     |     |     |   | A  | C  |
|                               | · · ·  | e regulator with filter (Mo  |  | r)*2                   |          |         |         |        |        |     |     |     |   | М  | 7  |
|                               | · · · ·  | e regulator with filter (wit   |  |                        |          |         |         |        |        |     |     |     |   | М  | 8  |
|                               |  | e regulator with filter (wit   |  |                        | horizo   | ntal-ir | nstalle | ed act | uator) | )   |     |     |   | М  | 9  |
|                               | -  | regulator with filter (Mo  |  |                        |          |         |         |        |        |     |     |     |   | М  | 1  |
|                               | ^  | regulator with filter (wit   |  |                        |          |         |         |        |        |     |     |     |   | М  | 2  |
|                               | Model KZ03 pressure  | regulator with filter (with  | n bracket for separate   | ed mount onto he       | orizonta | l-insta | lled a  | ctuato | r)     |     |     |     |   | М  | 3  |
|                               | Extension lever (In cas  | se of without mounting b   | acket)   |                        |          |         |         |        |        |     |     |     |   | М  | L  |
|                               | Seal tape prohibited   |  |  |                        |          |         |         |        |        |     |     | М   | J |  |  |
|                               |  |  |  |                        |          |         |         |        |        |     |     |     |   |  |  |
|                               |  | terial SUS316 <sup>*3</sup>  |  |                        |          |         |         |        |        |     |     |     |   | М  | 6  |
|                               |  |  |  |                        |          |         |         |        |        |     |     |     |   | M<br>Y   | -  |
|                               | Mounting bracket mat<br>Mounting bracket (PS   |  | ced after 2000), VA1   | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y   | S  |
|                               | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS   | A,1,2,PSK1)<br>ew model PSA3, 4 (produc<br>A6, VA4 to 6(produced af  |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y  | S<br>Q<br>L  |
|                               | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PS   | A,1,2,PSK1)<br>ew model PSA3, 4 (produc<br>A6, VA4 to 6(produced af<br>A7)   |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y   | S<br>C<br>L<br>8   |
|                               | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (HA   | GA,1,2,PSK1)<br>ew model PSA3, 4 (produce<br>GA6, VA4 to 6(produced af<br>GA7)<br>A1)  |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y  | S<br>C<br>I<br>8<br>A  |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (HA<br>Mounting bracket (HA   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)  |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y   | S<br>C<br>I<br>8<br>A<br>T   |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (HA<br>Mounting bracket (HA   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)  |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y  | S<br>C<br>I<br>8<br>A<br>T<br>C  |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (HA<br>Mounting bracket (HA   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)  |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y  | S<br>C<br>I<br>8<br>A<br>T<br>C<br>N   |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting bracket (VH   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)   |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y  | S<br>C<br>L<br>8<br>A<br>T<br>C<br>C<br>N<br>V   |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting Bracket (VH<br>Mounting Bracket (VH   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)   |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y                                    | S<br>C<br>R<br>S<br>C<br>S<br>C<br>C<br>N<br>V<br>C<br>R   |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting Bracket (VH<br>Mounting Bracket (VH<br>Mounting Bracket (VH   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)   |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y                                    | S<br>C<br>I<br>I<br>8<br>8<br>A<br>T<br>C<br>C<br>N<br>V<br>W<br>R<br>6                                    |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting Bracket (VI<br>Mounting Bracket (VI<br>Mounting Bracket (VI<br>Mounting Bracket (VI<br>Mounting Bracket (NE)  | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)<br>SA1)   |  | to 3(produced a        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y                          | S<br>C<br>I<br>I<br>S<br>A<br>T<br>C<br>C<br>N<br>V<br>R<br>R<br>6<br>6<br>F                               |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting bracket (HA<br>Mounting Bracket (VI<br>Mounting Bracket (VI<br>Mounting Bracket (VI<br>Mounting Bracket (RS<br>Mounting Bracket (RS   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)<br>SA1)<br>SA2)   | ter May. '83))   |                        | fter Ma  | y. '83) | )       |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y                     | S<br>C<br>B<br>B<br>A<br>T<br>C<br>C<br>N<br>V<br>R<br>G<br>G<br>F<br>F<br>U                               |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (Ne<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (RS<br>Mounting Bracket (RS<br>Mounting Bracket (Off  | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)<br>SA1)<br>SA1)<br>SA2)<br>d model PSA3, 4 (those pr                                  | ter May. '83))<br>roduced before 1999                          | )))                    |          |         |         |        |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y                     | S<br>C<br>I<br>I<br>8<br>A<br>A<br>T<br>C<br>C<br>N<br>V<br>V<br>V<br>R<br>6<br>6<br>F<br>F<br>U<br>U<br>Y |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (NS<br>Mounting Bracket (RS<br>Mounting Bracket (NS   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)<br>6A1)<br>6A2)<br>d model PSA3, 4 (those pr<br>A1 to 3 (produced before <i>A</i>     | ter May. '83))<br>oduced before 1999<br>Apr. '83, former moc   | )))<br>del Motion Conr | ector),  | 800-1   | , 2, 3) | *4     |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y           | S<br>C<br>R<br>A<br>A<br>T<br>C<br>N<br>V<br>V<br>R<br>R<br>6<br>6<br>F<br>F<br>U<br>U<br>Y                |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (NS<br>Mounting Bracket (NS<br>Mounting Bracket (NA<br>Mounting Bracket (NA<br>Mounting Bracket (NA   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)<br>6A1)<br>6A2)<br>d model PSA3, 4 (those pr<br>A1 to 3 (produced before Apr          | ter May. '83))<br>oduced before 1999<br>Apr. '83, former moc   | )))<br>del Motion Conr | ector),  | 800-1   | , 2, 3) | *4     |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y      | S<br>C<br>R<br>A<br>C<br>N<br>V<br>V<br>R<br>R<br>G<br>G<br>F<br>F<br>U<br>U<br>Y<br>Y<br>W<br>J           |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (NS<br>Mounting Bracket (VA<br>Mounting Bracket (VA<br>Mounting Bracket (VA<br>Mounting Bracket (VA<br>Mounting Bracket (VA   | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)<br>6A1)<br>6A2)<br>d model PSA3, 4 (those pr<br>A1 to 3 (produced before Apr<br>P5,6) | ter May. '83))<br>oduced before 1999<br>Apr. '83, former moc   | )))<br>del Motion Conr | ector),  | 800-1   | , 2, 3) | **4    |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y | 6<br>S<br>Q<br>L<br>8<br>A<br>T<br>C<br>N<br>V<br>R<br>6<br>F<br>F<br>U<br>U<br>Y<br>W<br>J<br>1<br>1      |
| (8) (9) Option                | Mounting bracket mat<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PS<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting bracket (PA<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (VF<br>Mounting Bracket (VA<br>Mounting Bracket (VA | 6A,1,2,PSK1)<br>ew model PSA3, 4 (produced af<br>6A6, VA4 to 6(produced af<br>6A7)<br>A1)<br>A2, HL2)<br>A3, HL3)<br>A4, HL4)<br>R1)<br>R2, 3)<br>R3H)<br>6A1)<br>6A2)<br>d model PSA3, 4 (those pr<br>A1 to 3 (produced before Apr<br>P5,6) | ter May. '83))<br>oduced before 1999<br>Apr. '83, former model | )))<br>del Motion Conr | ector),  | 800-1   | , 2, 3) | *4     |        |     |     |     |   | Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y<br>Y      | S<br>C<br>R<br>A<br>C<br>N<br>V<br>V<br>R<br>R<br>G<br>G<br>F<br>F<br>U<br>U<br>Y<br>Y<br>W<br>J           |

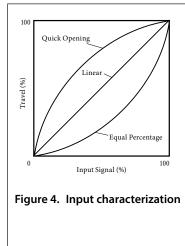
\*1. One set of TIIS Flameproof cable gland shall be attached for model AVP702. Two sets are for model AVP701.

\*2. Select the code "M7" or "M1" only when the direction of drain of the pressure regulator with filter on the control valve is downward (ground). \*3. Material of mounting bracket when you don't select code "M6" is SUS304.
\*4. Consult with sales representative in case of no mounting hole on the side of valve yoke.

#### Individual specifications

| Device TAG No. (8 characters)          | Be sure to configure the data.  |
|--|---|
| Long TAG No. (max 32 characters)       | Configure the data if necessary.  |
| Input range                            | 4 to 20 mA DC Note: Minimum span 4mA                                      |
| Input characterization*1               | L: Linear   |
|  | EQ%: Equal percentage   |
|  | QO: Quick opening   |
|  | USER: User-defined  |
| Positioner action*2                    | D: Direct for single acting actuator                                      |
|  | R: Reverse for single acting actuator                                     |
|  | W: For double acting actuator   |
| Supply pressure classification         | 1: 140≤Ps≤150 kPa   |
|  | 2: 150 <ps≤300 kpa<="" td=""></ps≤300>                                    |
|  | 3: 300 <ps≤400 kpa<="" td=""></ps≤400>                                    |
|  | 4: 400 <ps≤450 kpa<="" td=""></ps≤450>                                    |
|  | 5: 450 <ps≤700 kpa<="" td=""></ps≤700>                                    |
| Unit of pressure gauge                 | A: kPa  |
|  | B: kgf/cm <sup>2</sup>  |
|  | C: MPa  |
|  | D: bar  |
|  | E: psi  |
| Valve closed position                  | DOWN, UP  |
| Actuator type                          | L: Linear   |
|  | R90: Rotary 90°   |
|  | R60: Rotary 60°   |
|  | RS90: Rotary sub 90°  |
|  | RS60: Rotary sub 60°  |
| Travel transmitter fail safe direction | DOWN, UP  |
| (Model AVP701 only)                    | The setting of failure output direction cannot be changed after delivery. |
| LCD facing upwards                     | X: No optional parts  |
|  | A: LCD cover and Pressure gages jointed to elbows                         |
|  | B: LCD cover  |
|  | C: Pressure gages jointed to elbows                                       |

\*1. Refer to following when selecting the input/ output characteristics.



#### Selection of input characterization

The flow characteristic of a control valve is set by selecting the valve plug characteristic, and the input-output characteristics of the positioner must be specified as linear. However, if the valve plug flow characteristic, which depends on the control valve's shape and structure, does not meet requirements, you can correct the overall flow characteristic of the control valve by specifying "equal percentage" or "quick opening" for the input-output characteristics of the positioner, as shown in Table 2.

#### Table 2. Control valve flow characteristics correction by the positioner

| Characteristic of valve plug | Input characterization of | Overall flow characteristic of |
|------------------------------|---------------------------|--------------------------------|
|                              | positioner                | control valve                  |
| Linear                       | Quick opening             | Quick opening                  |
| Linear                       | EQ%                       | EQ%                            |
| EQ%                          | Quick opening             | Linear                         |

Note: If the valve plug characteristic is "quick opening," the overall flow characteristic of the control valve cannot be linear even if "equal percentage" is set for the positioner's input-output characteristics. (This is because when the valve plug characteristic is "quick opening," the control valve works as an ON/OFF valve and it is difficult to correct its characteristics by changing the setting of the positioner.)

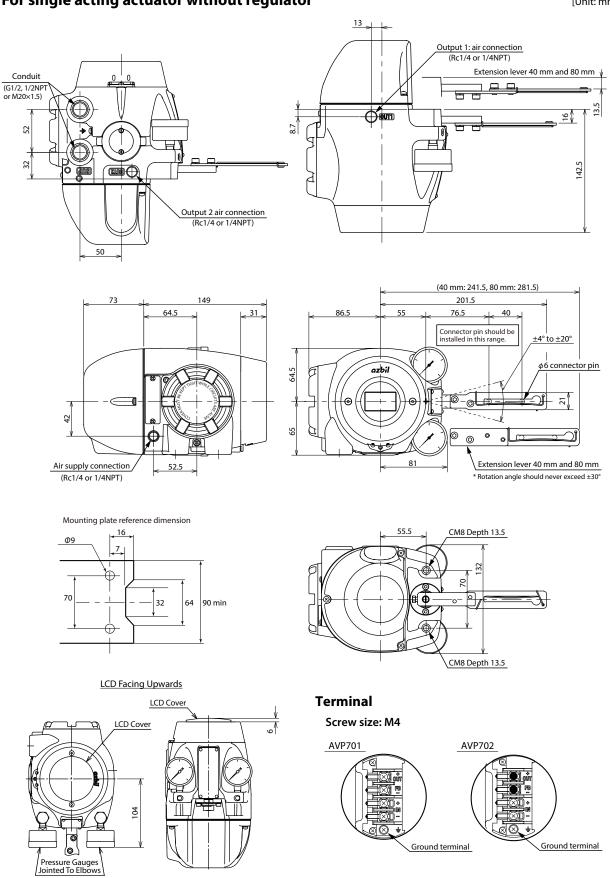
\*2. When the power is shut off, select D (Direct for single acting actuator) to make the output air pressure of this device zero, and R (Reverse for single acting actuator) to make the output at the maximum air pressure (supply air pressure). Positioner action differs from actuator and control valve action, so be careful in selecting the positioner's action.

# Appendix E Outline Dimensional Drawing

## DIMENSIONS

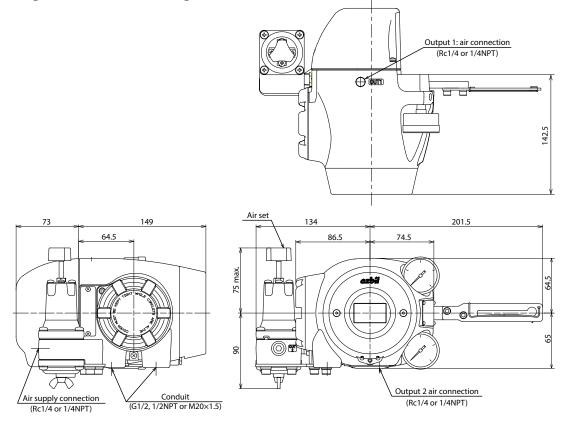
### For single acting actuator without regulator

[Unit: mm]



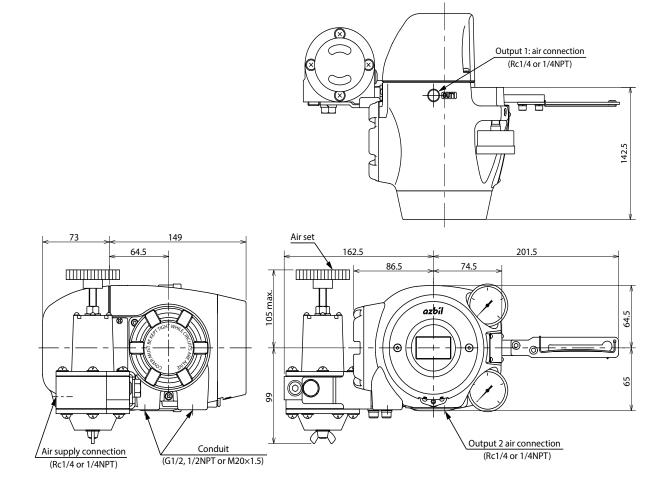
## For single acting actuator with RA1B regulator

[Unit: mm]



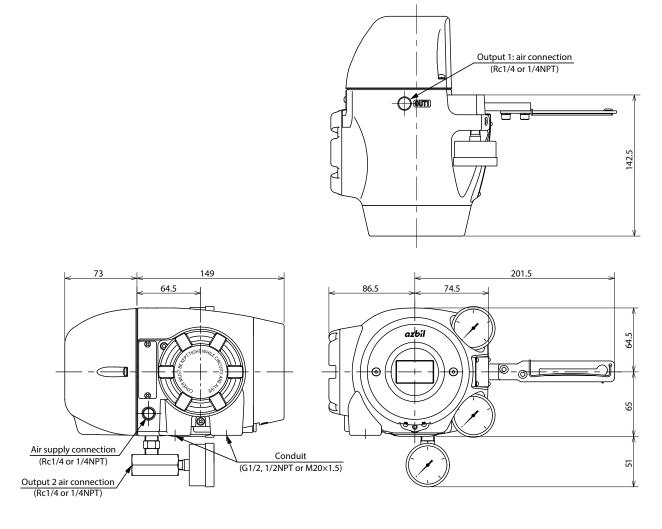
## For single acting actuator with KZ03 regulator

[Unit: mm]

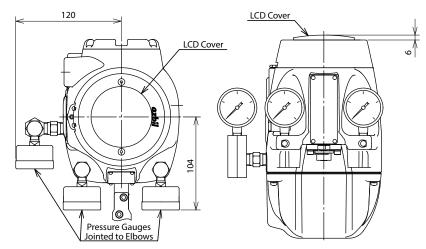


## For double acting actuator without regulator

[Unit: mm]

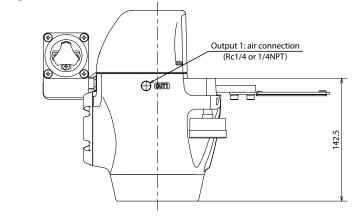


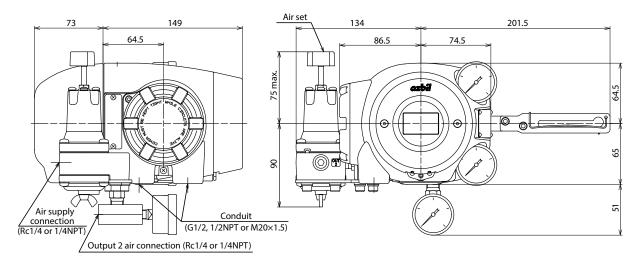
LCD Facing Upwards



# For double acting actuator with RA1B regulator

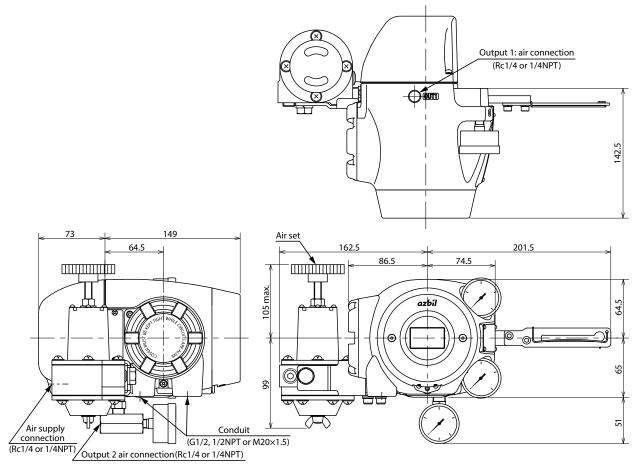
[Unit: mm]





For double acting actuator with KZ03 regulator

[Unit: mm]



# **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,<sup>\*1</sup> and fail-safe design<sup>\*2</sup> (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,<sup>\*3</sup> fault tolerance,<sup>\*4</sup> 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, antiflame 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.

|                   | CM2-AVP702-2001<br>Smart Valve Positioner<br>700 Series with HART Communication Protocol<br>Model AVP701/702<br>User's Manual |
|-------------------|---|
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| Issued/Edited by: | Azbil Corporation   |

**Azbil Corporation**