

# Smart ESD Device 700 Series for Safety Instrumented Systems (SIS) Model AVP77\_/78\_/79\_

## Overview

Model AVP 77\_/78\_/79\_ is a Smart ESD (Emergency Shut Down) Device that is compatible with the Safety Instrumented Systems (SIS) and the functional safety standard, IEC 61508.

It is not only compatible with the discrete 0/24 V DC signal that is used in the safety instrumented systems, but also with 4-20 mA DC and 0-20 mA DC instrumentations.

Furthermore, it is equipped with the Partial Stroke Test (PST) by default, and can be utilized with LUI (Local User Interface). Adjustments and settings such as auto setup and zero/span adjustment can also be easily done with the LUI.

## Features

### 1. Safety Instrumented Systems (SIS)

The device is certified by exida to SIL2 or SIL3 of IEC 61508.

### 2. Standard Features of PST and FST

It is equipped by default with a PST function and Full Stroke Test (FST) feature, and the PST can be automatically implemented based on the equipment's internal scheduler function.

In addition, it can also be operated and the results verified via the LUI (PST only) or HART communication tool.

- PST/FST Configuration  
Field communication software(Model CFS100), PLUG-IN Valstaff and HART communication tool
- PST/FST Execution  
PST can be automatically activated (setting the schedule, etc., are done with the HART communication tool) based on the equipment's internal scheduler function.  
LUI (PST only), Field communication software(Model CFS100), PLUG-IN Valstaff and HART communication tool
- PST Data Storage  
Alarm history is saved in non-volatile memory.

### 3. Notification of SIS Diagnosis Results

Self-diagnosis results related to SIF (Safety Instrumented function) and PST results can be notified via an output signal. Notifications are sent out via failure output, analog signal (travel transmission signal), or the contact output signal. (The travel transmission signal and the contact output signal correspond to Model AVP 7\_1 and Model AVP 7\_0, respectively)



### 4. Flexible Control Mode (for Model AVP 77\_/78\_ only)

With the SIS positioner mode, you can select either the ON/OFF mode, which fully opens or closes the valve, or the positioning mode, which controls the valve.

### 5. Ease of Adjustment and Setting

The following adjustments and settings can be easily accomplished by controlling the LUI, which is composed of an LCD (liquid crystal display) and an operation button. In addition, it can be used in hazardous location, as the operation button and the interior are isolated.

- Auto Setup (automatic adjustment)
- Zero/span adjustment
- Supply bypass switch
- PST
- Modification of the control parameter configuration

## Product Usage Precautions

- This product is intended for the general industrial market.
- This product is not subject to the regulations pursuant to the Chinese electronic information product pollution control laws. However, if the product is used for semiconductor manufacturing equipment, special-purpose equipment for electronic devices, etc., it may in some cases be necessary to include documentation and mark the product in accordance with the Chinese electronic information product pollution control laws. If necessary, please indicate this in advance to our sales department.

## List of Features

Item	Feature
Emergency operation	This function sets the output air pressure to zero when there is emergency signal input.
PST	This function partially moves the valve to diagnose it.
FST	This function fully opens and then closes the valve to diagnose it.
Forced full closure / full throttle	You can fully close or open the valve with accuracy by means of a percentage (%) input signal. (When the SIS positioner mode is in positioning mode)
Flow characteristics	You can define the relationship between the input signal and throttle level that suits a particular process by using a polygonal line with 21 dots. (When the SIS positioner mode is in positioning mode)
Travel transmission (optional) Model AVP7_1 only	By transmitting the valve's position, it can accurately monitor the valve's behavior, and can give notice of any abnormalities in the self diagnosis result or the PST result using failure output.
Contact output (optional) Model AVP7_0 only	Notifies abnormalities of self diagnosis result or PST result via the failure output.

## Composition of Basic Model No.

Model AVP 77\_ Analog Signal 4-20 mA DC HART Communication

Model AVP 78\_ Analog Signal 0-20 mA DC HART Communication

Model AVP 79\_ Discrete Signal 0/24 V DC HART Communication

\_0: Contact Output

1: Analog Output

2: No output

## Input Signal Specification

When used for an emergency shut down valve (or the emergency open valve) (when the SIS positioner mode is set to ON/OFF mode)

Basic Model No.	Input Specification	Emergency Operation		Normal Operation		PST Execution (Feasibility)
		Input Signal	Output Air Pressure	Input Signal	Output Air Pressure	
Model AVP 77_	4-20 mA DC	3.84-4.48 mA DC	0 <sup>*1</sup>	12-20 mA DC	Maximum Pressure	PST Executable
Model AVP 78_	0-20 mA DC	Less than 0.5 mA DC				
Model AVP 79_	0/24 V DC	Less than 0.5 V DC		24±4.8 V DC		

If used for a control valve (When the SIS positioner mode is in positioning mode)

Basic Model No.	Input Specification	Emergency Operation		Normal Operation		PST Execution (Feasibility)
		Input Signal	Output Air Pressure	Input Signal	Output Air Pressure	
Model AVP 77_	4-20 mA DC	3.84-4.48 mA DC	0 <sup>*1</sup>	5.6-20 mA DC	Control Pressure	PST Not executable
Model AVP 78_	0-20 mA DC	Less than 0.5 mA DC		4-20 mA DC		

<sup>\*1</sup> For double-acting units, OUT1's pressure will be at 0, and OUT2's will be at supplied air pressure.

## Standard Specifications

Item	Specifications
Applicable actuator type	Pneumatic single and double acting, linear and rotary motion actuator
Input signal	4-20 mA DC, 0-20 mA DC, 0/24 V DC
Input resistance	600 Ω typically / 20 mA DC
Output signal	Travel Transmission Signal 4-20 mA DC <sup>*1</sup> , (failure output Hi: 21mA min. Lo: 3.6mA max.) Contact Output (contact volume: 30 V DC max, 100 mA DC max, saturation voltage: 5 V DC max except for structure L, T / 30V DC max, 93 mA DC max, saturation voltage: 5 V DC max for structure L, T) <sup>*2</sup>
Lightning protection	Peak value of voltage surge: 12 kV; peak value of current surge: 1000 A
Flow characteristics	Linear, equal percentage, quick opening, user-defined optional characteristics (can set a maximum of 21 points) (When the SIS positioner mode is in ON/OFF mode, you can only select "linear")
Manual operation	Possible with the A/M switch or LUI operation
Supply air pressure	140 kPa-700 kPa
Air consumption	3.2 l/min [N] or less: with steady supply air pressure of 140 kPa and output of 50% 4.0 l/min [N] or less: with steady supply air pressure of 280 kPa and output of 50% 4.8 l/min [N] or less: with steady supply air pressure of 500 kPa and output of 50% 8 l/min [N] or less: with double-acting reversing relay and steady supply air pressure of 400 kPa
Maximum air deliver flow rate	110 l/min [N]: if the supply air pressure is 140 kPa
Air pipe connection	Rc1/4, 1/4NPT
Electrical wiring connection	G1/2, 1/2NPT, M20×1.5

Item		Specifications
Ambient temperature limits		General model: -40 to +80 °C TIIIS Flameproof: -20 to +55 °C FM/FMC/IECEX/NEPSI/KOSHA/INMETRO Explosion Proof: -30 to +75 °C FM intrinsically safe (ic) and Nonincendive: -24 to +75 °C ATEX/IECEX Intrinsically safe: -40 to +60 °C However, the LCD usage range is 0 to 50 °C
Ambient humidity limits		5-100% RH
Vibration Characteristics		20 m/s <sup>2</sup> (5-400 Hz) (vibration within the positioner main unit)
Finish and color		Finish: baked acrylic; color: silver
Material		Aluminum alloy
Weight		4.2 kg (4.9 kg with regulator with filter [Model KZ03] attached)
Performance	Accuracy	±1.0% FS But: ±3.0 % FS if the feedback lever angle is outside the ±4° to ±20° range (see Table 1) There is an additional 0.5 % FS (input error) if 4 mA ≤ input signal span < 8 mA
	Travel transmission accuracy	±1.0% FS <sup>*1</sup>
	Stroke coverage	14.3 to 100 mm (when the feedback lever rotation angle is between ±4° to ±20°)

\*1. Only applies when the travel transmission is provided (Model AVP 7\_1). In such a case, a power supply circuit for travel transmission is necessary.

\*2. Only applies when the contact output is provided (Model AVP 7\_0). In such a case, a power supply circuit for contact output is necessary.

Note: Depending on the inside diameter and length of the air pipes, optimal operation may not be possible using auto-setup alone. In such cases, please set the control parameters.

Structure	<p>Waterproof JIS C0920 TIIIS Flameproof: Ex d IIC T6 FM Explosionproof / Dust Ignition Protection:</p> <ul style="list-style-type: none"> <li>Explosionproof (Division System): Class I, Division 1, Group B, C, D T6 <ul style="list-style-type: none"> <li>Cannot be used in an environment with gasoline.</li> <li>Electrical conduit sealing fitting is unnecessary.</li> </ul> </li> <li>Explosionproof (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>Container protection grade: IP66</li> </ul> <p>FM Intrinsically Safe (ic) and Nonincendive Intrinsically safe (ic) (Zone System) Class I, Zone 2, AEx ic IIC T4 Entity Parameters: Input Circuit Side: <math>U_i=30\text{ V}</math>, <math>I_i=100\text{ mA}</math>, <math>P_i=1\text{ W}</math>, <math>C_i=24\text{ nF}</math>, <math>L_i=0.22\text{ mH}</math> Travel Transmission Circuit (Model AVP 7_1): <math>U_i=30\text{ V}</math>, <math>I_i=100\text{ mA}</math>, <math>P_i=1\text{ W}</math>, <math>C_i=20\text{ nF}</math>, <math>L_i=0.22\text{ mH}</math> Contact output circuit (Model AVP 7_0): <math>U_i=30\text{ V}</math>, <math>I_i=100\text{ mA}</math>, <math>P_i=1\text{ W}</math>, <math>C_i=20\text{ nF}</math>, <math>L_i=0.22\text{ mH}</math></p> <p>Nonincendive (Division System) Class I, Division 2, Group A, B, C and D, T4 Nonincendive Field Wiring Parameters: Input Circuit Side: <math>V_{\text{max}}=30\text{ V}</math>, <math>I_{\text{max}}=100\text{ mA}</math>, <math>C_i=24\text{ nF}</math>, <math>L_i=0.22\text{ mH}</math> Travel Transmission Circuit (Model AVP 7_1): <math>V_{\text{max}}=30\text{ V}</math>, <math>I_{\text{max}}=100\text{ mA}</math>, <math>C_i=20\text{ nF}</math>, <math>L_i=0.22\text{ mH}</math> Contact output circuit (Model AVP 7_): <math>V_{\text{max}}=30\text{ V}</math>, <math>I_{\text{max}}=100\text{ mA}</math>, <math>C_i=20\text{ nF}</math>, <math>L_i=0.22\text{ mH}</math></p> <p>Suitable Class II and Class III, Division 2, Group E, F and G, T4 Container Protection Grade: NEMA Type 4X, IP66</p> <p>FMC Explosionproof / Dust Ignition Protection</p> <ul style="list-style-type: none"> <li>Explosionproof (Division System): Class I, Division 1, Group C, D T6 <ul style="list-style-type: none"> <li>Cannot be used in an environment with gasoline.</li> <li>It is unnecessary to seal-fetch the conduit pipe.</li> </ul> </li> <li>Explosionproof (Zone System): Class I, Zone 1, Ex d IIB T6 <ul style="list-style-type: none"> <li>For connection with a conduit pipe, seal it within 450 mm (18 in).</li> </ul> </li> <li>Explosionproof (Division System): Class II, III, Division 1, Group E, F, G T6</li> <li>Container protection grade: IP66</li> </ul> <p>ATEX Intrinsically safe/Dust Ignition Protection Intrinsically safe: II 1 G Ex ia IIC T4 Ga Dust ignition protection: II 1 D Ex ia IIIC T135°C Da Enclosure classification: IP66 The barriers should be ATEX certified types and comply with the following conditions: Input Signal Terminals (+/- IN): <math>U_i=30\text{ V}</math>, <math>I_i=93\text{ mA}</math>, <math>P_i=0.9\text{ W}</math>, <math>C_i=4\text{ nF}</math>, <math>L_i=220\text{ }\mu\text{H}</math> Output Signal Terminals (+/- OUT): (AVP7_0/7_1) <math>U_i=30\text{ V}</math>, <math>I_i=93\text{ mA}</math>, <math>P_i=0.9\text{ W}</math>, <math>C_i=22\text{ nF}</math>, <math>L_i=220\text{ }\mu\text{H}</math></p>
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Structure	<p>IECEX Flameproof / Dust Ignition Protection  Flameproof: Ex d IIC T6 Gb  Dust Ignition Protection: Ex tb IIIC T85 °C Db  Container Protection Grade: IP66  Please use IECEx Ex d IIC-approved products as the cable gland for connecting it to the electrical connection port.  However, please use IP66-approved products when using it in an environment that requires IP66.</p> <p>IECEX Intrinsically safe/Dust Ignition Protection  Intrinsically safe: Ex ia IIC T4 Ga  Dust ignition protection: Ex ia IIIC T135°C Da  Enclosure classification: IP66  The barriers should be IECEx certified types and comply with the following conditions:  Input Signal Terminals (+/- IN):  <math>U_i=30\text{ V}</math>, <math>I_i=93\text{ mA}</math>, <math>P_i=0.9\text{ W}</math>, <math>C_i=4\text{ nF}</math>, <math>L_i=220\text{ }\mu\text{H}</math>  Output Signal Terminals (+/- OUT):  (AVP7_0/7_1) <math>U_i=30\text{ V}</math>, <math>I_i=93\text{ mA}</math>, <math>P_i=0.9\text{ W}</math>, <math>C_i=22\text{ nF}</math>, <math>L_i=220\text{ }\mu\text{H}</math></p> <p>NEPSI Flameproof / Dust Ignition Protection  Flameproof: Ex d IIC T6 Gb  Dust Ignition Protection: Ex tD A21 IP66 T85°C  Container Protection Grade: IP66  Please use Ex d IIC or Ex tD A21-approved products as the cable gland to be connected to the electrical connection port.  Please use IP66-approved products in an environment that requires IP66.</p> <p>KOSHA Flameproof: Ex d IIC T6  Please use Ex d IIC-approved products as the cable gland to be connected to the electrical connection port.</p> <p>INMETRO Flameproof / Dust Ignition Protection  Flameproof: Ex d IIC T6 Gb  Dust Ignition Protection: Ex tb IIIC T85 °C Db  Container Protection Grade: IP66  Please use INMETRO or IECEx Ex d IIC and Ex td IIIC-approved products as the cable gland to be connected to the electrical connection port.  Please use IP66-approved products in an environment that requires IP66.</p>
Electrical standard	CE Marking (EN61326-1: 2013)
Related devices	Field Communication Software (Model CFS100)

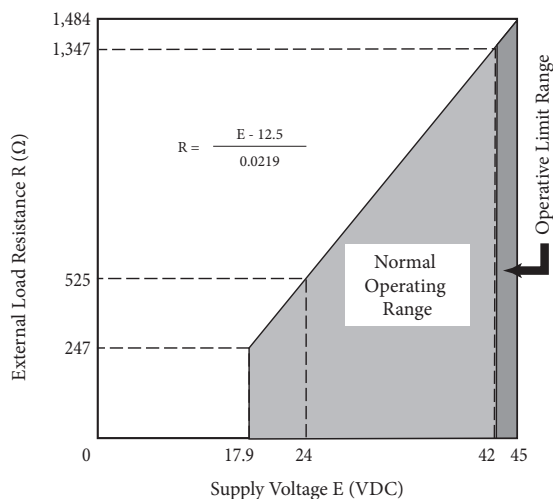


Figure 1. Supply Voltage and External Load Resistance of the Travel Transmission

Table 1 - Stroke and Accuracy of the Standard Operating Unit

Actuator	Stroke [mm]	Accuracy [%FS]
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

## Air Specifications of Applicable Instruments (according to JIS C1805-1 (2001))

Item	Specifications
Solid particles	There must be no particles with diameter that exceeds 3 μm.
Oil content	The mass must be less than 1 ppm
Supply air temperature	Dew point temperature must be at least 10 °C lower than temperature of the main unit

Please appropriately install the following air cleaner at each of the installation locations to satisfy the above instrumentation air specification.

## Examples of Air Cleaners

Installation Locations	Air Cleaners	SMC Inc.	CKD Inc.
Compressor outlet or mainline	Line Filter	AFF Series	AF Series
	Mist separator	AM series	
For terminals	Mist separator	AM150 or AM250 series	M3000S Type

## System Configuration

The wire connection method for this equipment differs depending on the input and output signals, so please reference the following system configurations.

The next section explains the following three working examples as examples of instrumentation.

- 1) PST device along with solenoid valve: Case 1
- 2) ESD control device with PST function: Case 2
- 3) Smart Valve Positioner with ESD function: Case 3

### 1) Case 1 (PST device with solenoid valve)

#### 1-1) System Configuration without Output Signals (Model AVP 7\_2)

1-1-1) Analog current (4-20 mA) signal input

System configuration for Model AVP 772.

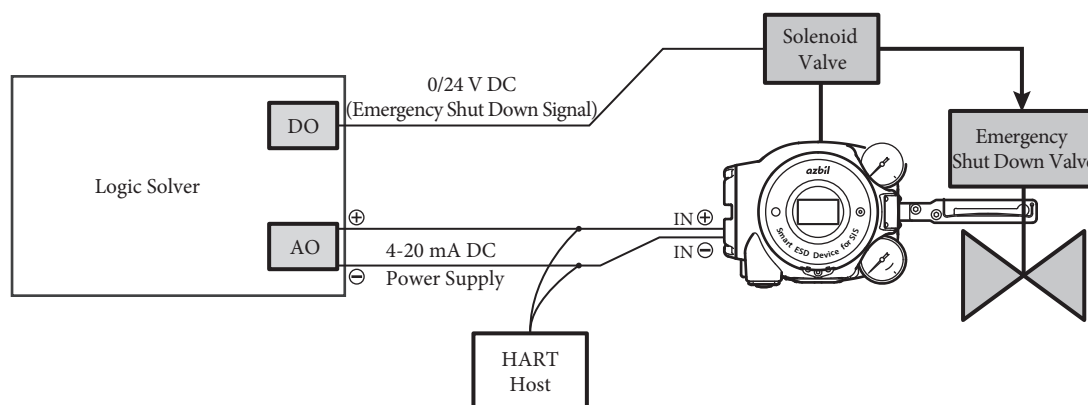


Figure 2. System Configuration for Model AVP 772 with Solenoid Valve

1-1-2) Discrete voltage signal (0/24 V DC) inputs

System configuration for Model AVP 792.

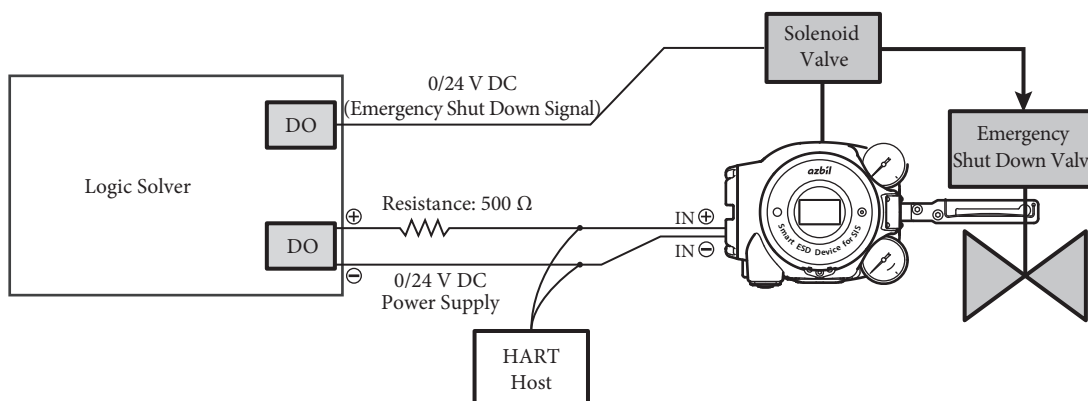


Figure 3. System Configuration for Model AVP 792 with Solenoid Valve

## 1-2) System Configuration for Analog Output (Models AVP 7\_1)

Model AVP 7\_1 has a function for analog output of the valve's position.

This signal will indicate failure output if abnormalities are detected with the self diagnosis (during serious failures) or PST.

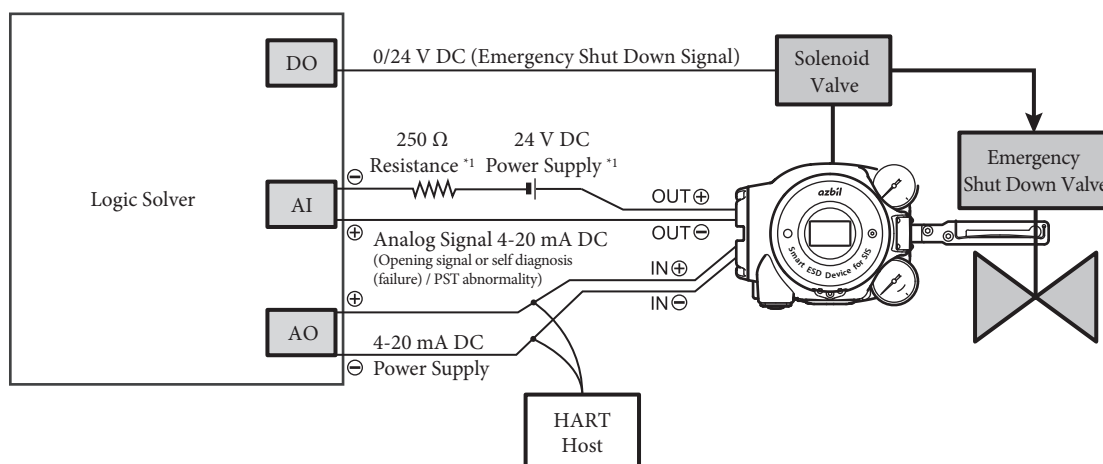
To output the position signal to the host monitoring device using analog values, configure a system that supports analog signals.

The output of position of 0% will be 4 mA, and output of position of 100% will be 20 mA.

With this system configuration, the analog signal from the instrument is directly output to the host monitoring system.

### 1-2-1) If implementing the current signal input

System configuration for Model AVP 771.

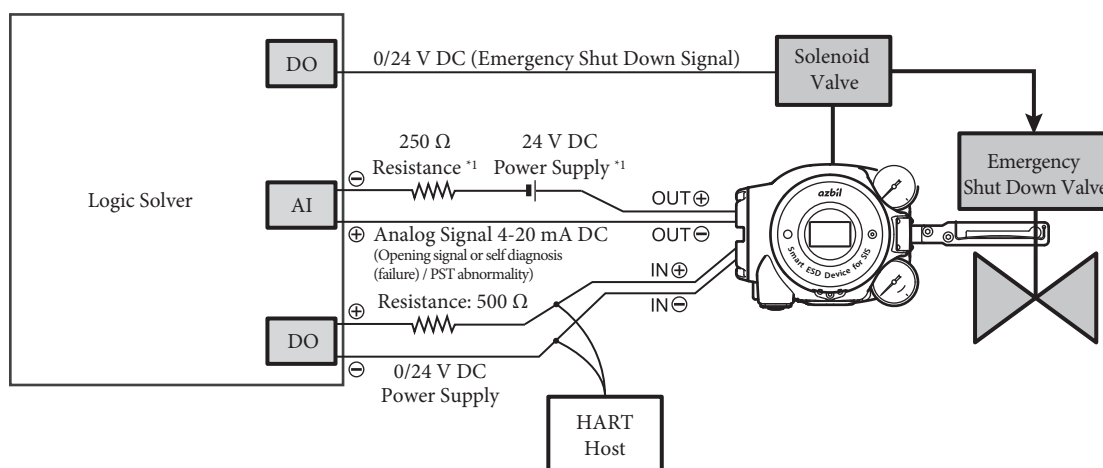


\*1. The external load resistance will be the sum of the host logic solver's input resistance and the two resistances.

Figure 4. System Configuration for Model AVP 771 Used Jointly with Solenoid Valve

### 1-2-2) For voltage signal (0/24 V DC) inputs

System configuration for Model AVP 791.



\*1. The external load resistance will be the sum of the host logic solver's input resistance and the two resistances. please refer to Figure 1 for details regarding the power supply and resistance.

Figure 5. System Configuration for Model AVP 791 Used Jointly with Solenoid Valve

### 1-3) System Configuration with Contact Output (Model AVP 7\_0)

Model AVP 7\_0 has a function of transmitting a contact output signal.

Failure output will be sent out via this contact output regardless of the valve position whenever an abnormality in the self diagnosis (during serious failure) or PST is detected.

With this system configuration, the contact output from the instrument is output to the host monitoring system.

#### 1-3-1) When using current signal input

System configuration for Model AVP 770.

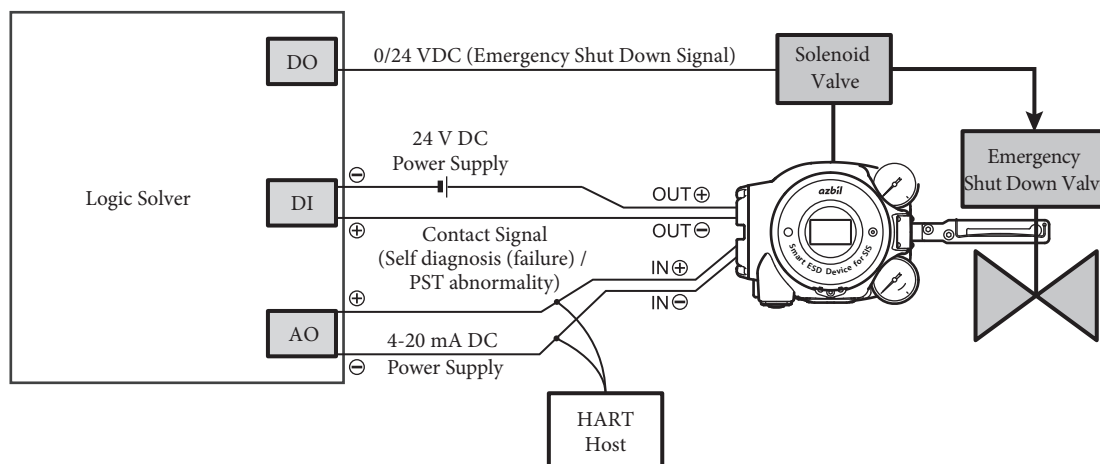


Figure 6. System Configuration for Model AVP 770 Used Jointly with Solenoid Valve

#### 1-3-2) When using voltage signal (0/24 V DC) input

System configuration for Model AVP 790.

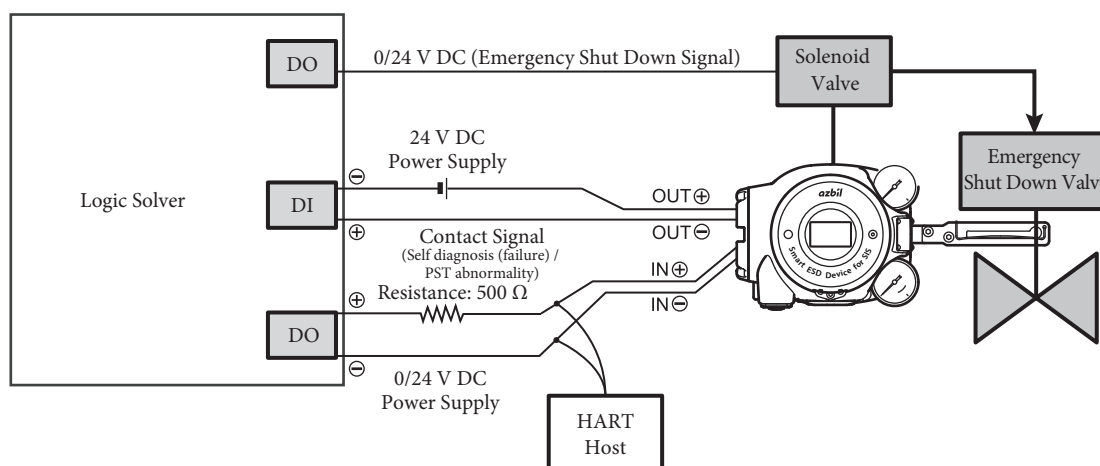


Figure 7. System Configuration for Model AVP 790 Used Jointly with Solenoid Valve



## 2) Case 2 (ESD control device with PST function)

### 2-1) System Configuration without Output Signals (Model AVP 7\_2)

2-1-1) Analog current (4-20 mA) signal input

System configuration for Model AVP772.

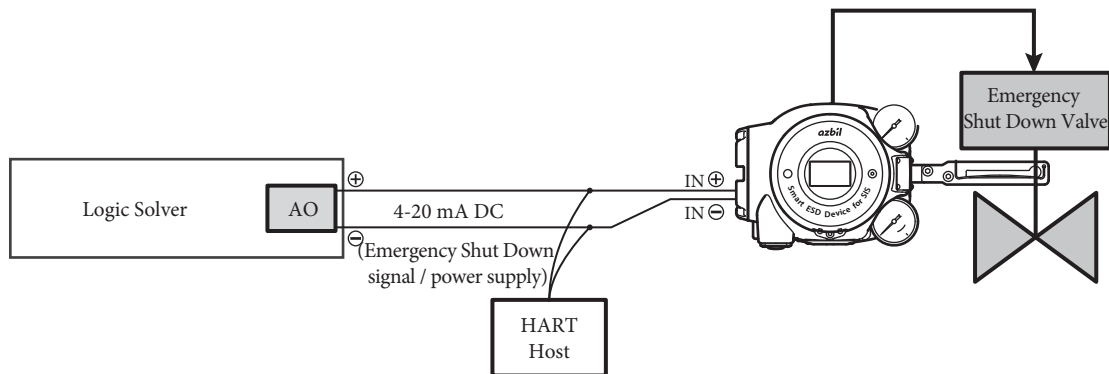


Figure 8. System Configuration for Model AVP 772 Used as ESD Device

2-1-2) Discrete voltage signal (0/24 V DC) inputs

System configuration for Model AVP 792.

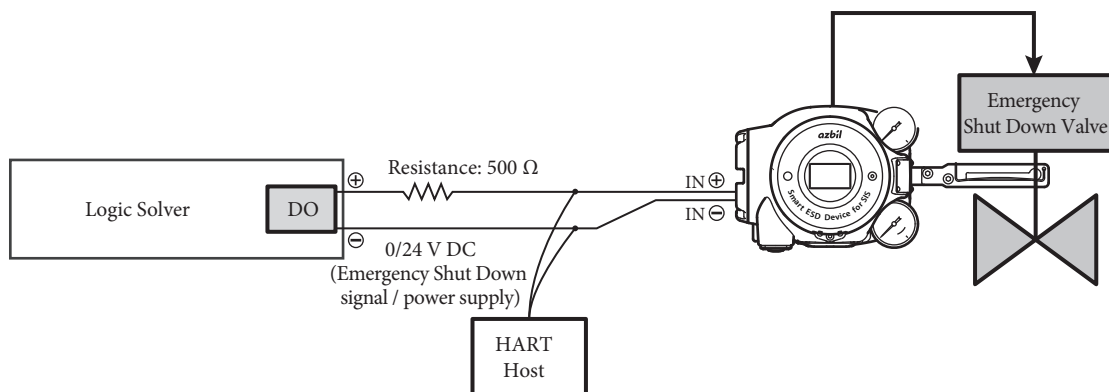


Figure 9. System Configuration for Model AVP 792 Used as ESD Device



## 2-2) System Configuration with Analog Output (Model AVP 7\_1)

Model AVP 7\_1 has an analog output function for the valve's position.

This signal will indicate failure output if abnormalities are detected with the self diagnosis (during serious failures) or PST.

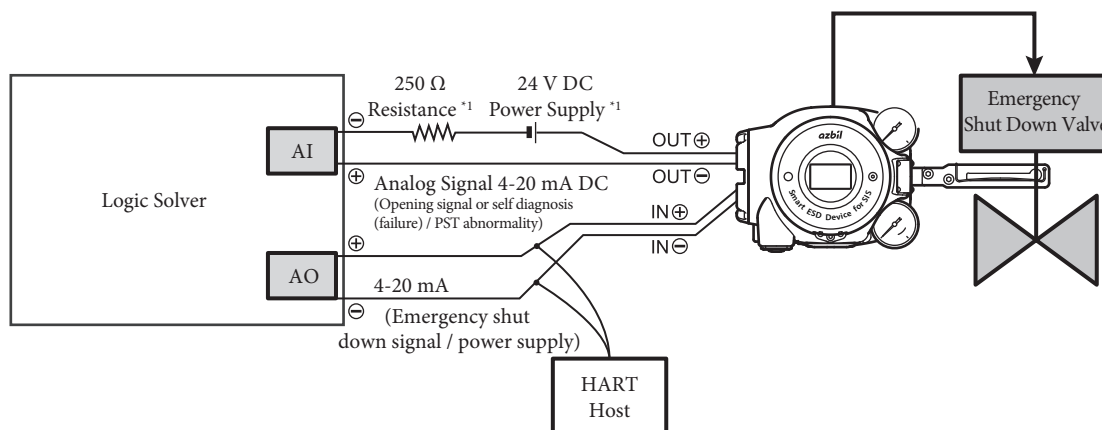
To output the position signal to the host monitoring device using analog values, configure a system that supports analog signals.

The output of position of 0% will be 4 mA, and output of position of 100% will be 20 mA.

With this system configuration, the analog signal from the instrument is directly output to the host monitoring system.

### 2-2-1) Analog current (4-20 mA) signal input

System configuration for Model AVP 771.

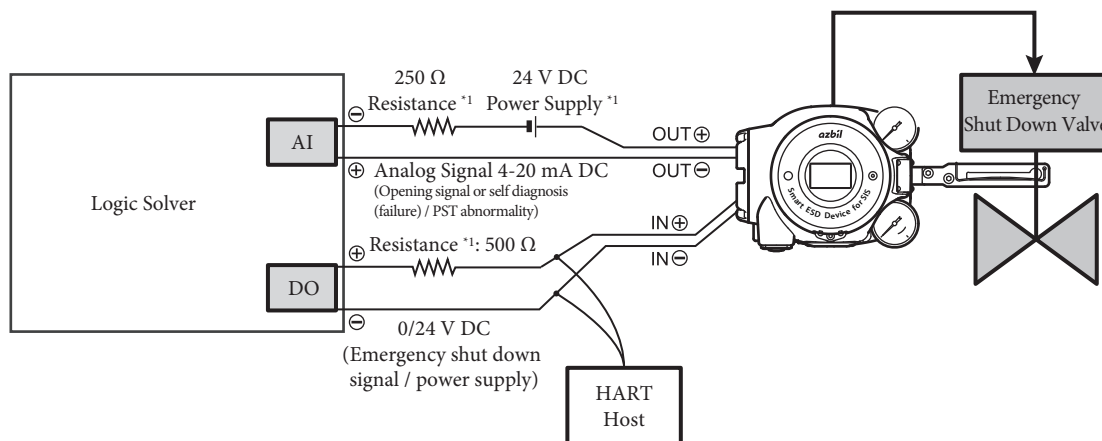


\*1. The external load resistance will be the sum of the host logic solver's input resistance and the two resistances.

Figure 10. System Configuration for Model AVP 771 Used as ESD Device

### 2-2-2) Discrete voltage signal (0/24 V DC) inputs

System configuration for Model AVP 791.



\*1. The external load resistance will be the sum of the host logic solver's input resistance and the two resistances. please refer to Figure 1 for details regarding the power supply and resistance.

Figure 11. System Configuration for Model AVP 791 Used as ESD Device

## 2-3) System Configuration with Contact Output (Model AVP 7\_0)

Model AVP 7\_0 has a function of transmitting a contact output signal.

This contact output will be sent out via failure output regardless of the valve position whenever an abnormality in the self diagnosis (during serious failure) or PST is detected.

With this system configuration, the contact output from the instrument is output to the host monitoring system.

### 2-3-1) Analog current signal input

System configuration for Model AVP 770.

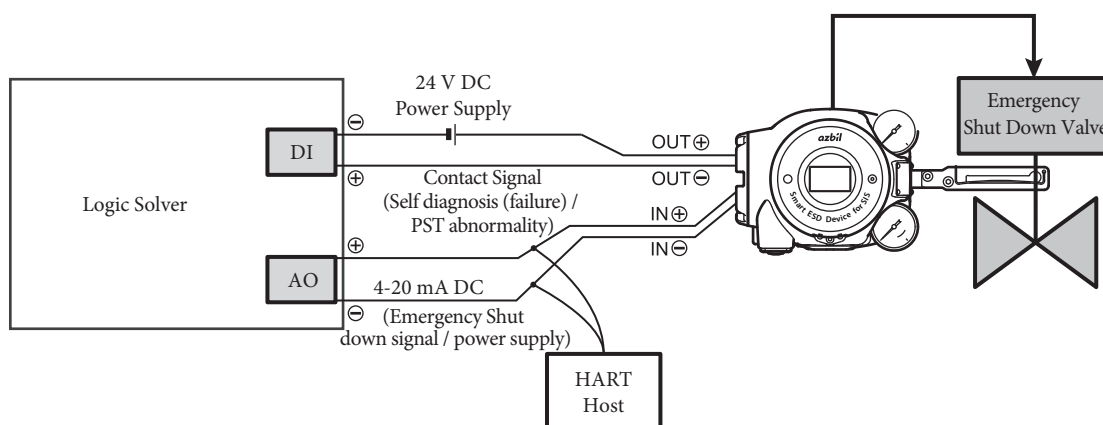


Figure 12. System Configuration for Model AVP 770 Used as ESD Device

### 2-3-2) Discrete voltage signal (0/24 V DC) inputs

System configuration for Model AVP 790.

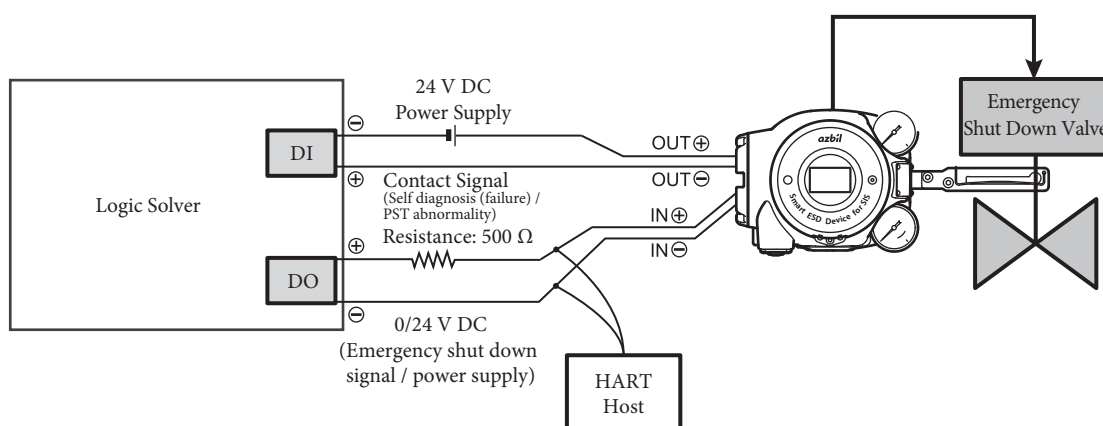


Figure 13. System Configuration for Model AVP 790 Used as ESD Device

### 3) Case 3 (Smart Valve Positioner with ESD function)

#### 3-1) System Configuration without Output Signals (Model AVP 782)

System configuration for Model AVP 782.

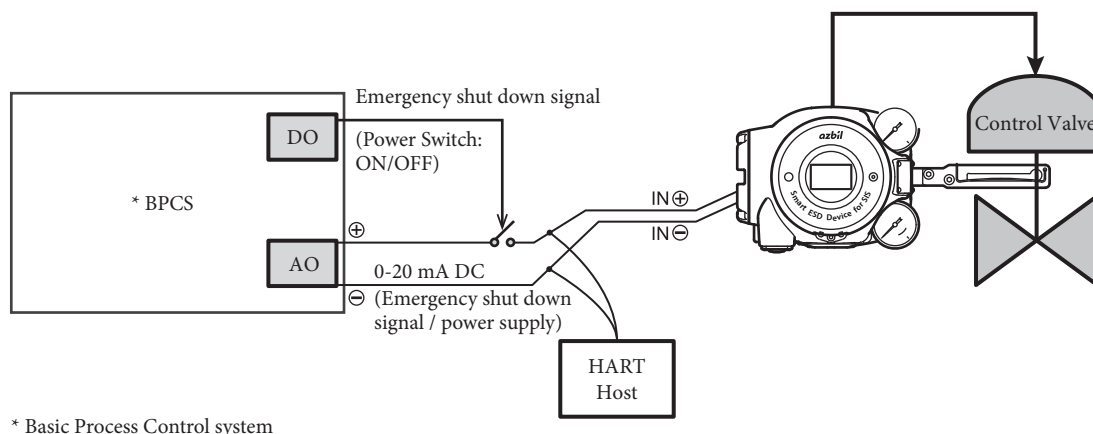


Figure 14. System Configuration for Model AVP 782 Used as ESD Device

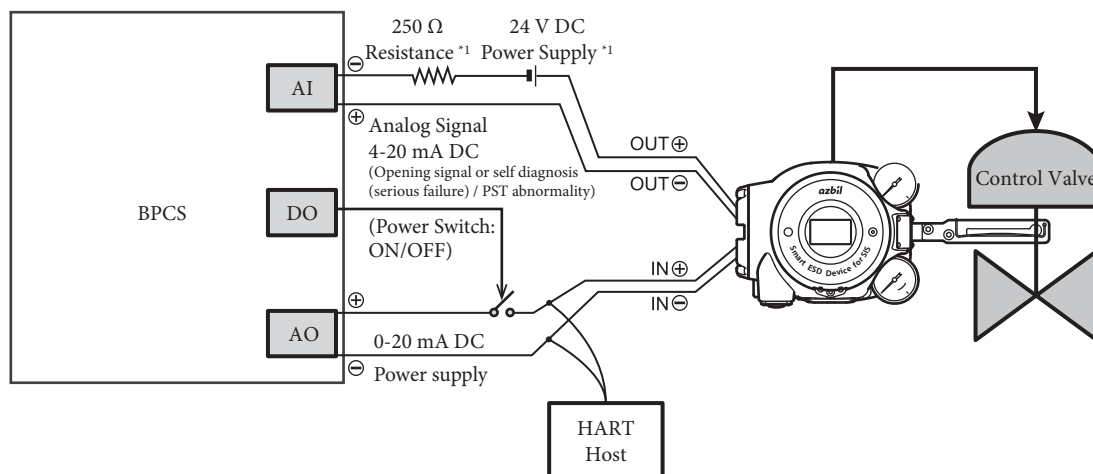
#### 3-2) System Configuration with Analog Output (Model AVP 781)

Model AVP 781 has a function for analog output of the valve's position.

This signal will indicate failure output if abnormalities are detected with the self diagnosis (during serious failures) or PST. To output the travel signal to the host monitoring device using analog values, configure the system with travel transmission. Usually, the output of 0% position will be 4 mA, and the output of 100% position will be 20 mA.

With this system configuration, the analog signal from the instrument is directly output to the host monitoring system.

System configuration for Model AVP 781.



\*1. The external load resistance is the sum of the BPCS's input resistance and the two resistances. Please reference Figure 1 for the details regarding the power supply and resistance.

Figure 15. System Configuration for Model AVP 781 Used as ESD Device

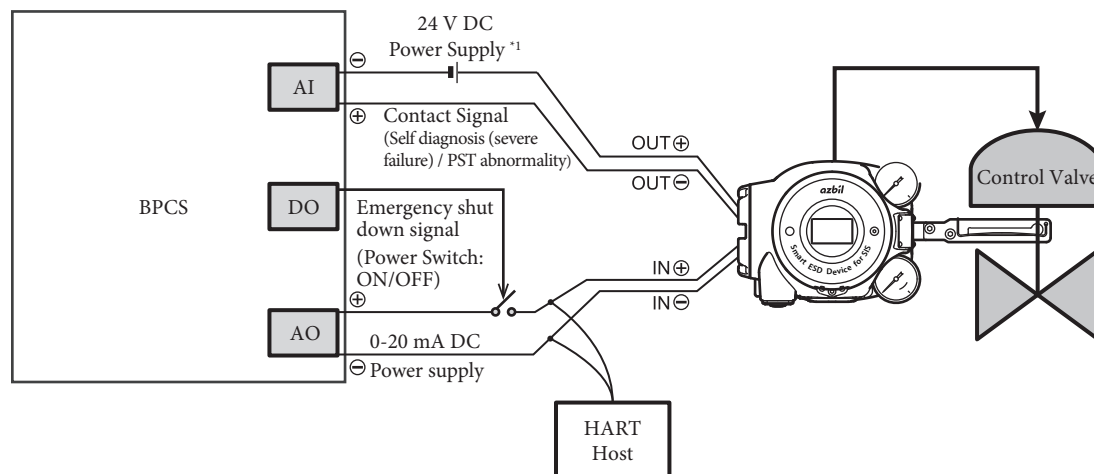
### 3-3) System Configuration with Contact Output (Model AVP 780)

Model AVP 780 has a function of transmitting a contact output signal.

This contact output will be sent out via failure output regardless of the valve position whenever an abnormality in the self diagnosis (during serious failure) or PST is detected.

With this system configuration, the contact output from the instrument is output to the host monitoring system.

System configuration for Model AVP 780.



\*1. The external load resistance is the sum of the BPCS's input resistance and the resistance.

Figure 16. System Configuration for Model AVP 780 Used as ESD Device




## Safety Precautions

In order to promote safe use of the product, this manual uses the following symbols.





 **Warning** If misuse could lead to death or severe injury.













 **Caution** If misuse could lead to light injury or material damage.

## Visual Indicators




	These indicate that the user should take "caution" during usage.
	These indicators indicate "prohibited" actions.
	These indicate "instructions" that should always be followed.

## Cautions to ensure safe operation

 <b>Warning</b>	
	Do not perform wiring work, turn on the electricity, etc., when your hands are wet. There is a risk of electric shock. Perform this work with the power supply turned off, and with dry or gloved hands.
	When working in a hazardous area, perform installation and deployment according to the construction methods prescribed by the guidelines for the hazardous area.
	If it is flame-proof explosion-proof, do not under any circumstances open the cover during operation (when powered up).

 <b>Caution</b>	
	After installing the device, do not place your body weight on it, use it as a scaffold, etc. There is a risk that it could fall over.
	Do not touch the device unnecessarily while it is in operation. Depending on the environment in which the device is used, there is a danger that the surface of the device may be very hot or very cold.
	When opening the cover of the terminal box, be careful of the edges of the cover, the threads of the screws on the main unit, etc. There is a possibility of injury.
	Use a DC power supply that has overload protection. An overload can cause the emission of smoke and fire.
	Bringing tools and the like into contact with the glass portion of the display can cause damage or injury. Exercise sufficient caution. In addition, be sure to wear safety glasses.
	As this product is extremely heavy, watch your footing, and be sure to wear safety shoes.
	When the device is in operation, do not touch moving parts such as the feedback lever. Your hand may become caught, resulting in injury.
	Supply power correctly based on the specifications. An incorrect power input can damage the instrument.
	When working in a high-temperature or low-temperature environment, wear gloves and other protective equipment.
	Do not bring magnets or magnetic screwdrivers near the device. There is a possibility that the control valve will move in response.
	Apply the correct supply air pressure based on the specification. Applying large pressure will possibly result in abnormal behaviors of the control valve, damages to the pressure gauge, etc.

## Installation Precautions

 <b>Caution</b>	
	During installation, be careful to avoid injury from edges on the main unit and actuator, sharp corners on the threads of screws, etc. The type of mounting plate and the mounting method and procedure differ depending of the type of actuator to which the AVP is attached.
	If installation is not performed correctly, it will not be possible to realize the potential performance of the AVP, and damage to or failure of the AVP may result. Be careful of the following. <ul style="list-style-type: none"> <li>• The mounting plate and accompanying accessories differ depending on the specifications (actuator type). Be sure to use those that are appropriate for the actuator to be installed.</li> <li>• When installing the control valve, leave as much space as possible in its surrounding area, taking ease of maintenance into consideration (piping, wiring, adjustment, etc.), and so that the device is oriented properly.</li> <li>• To the extent possible, transport the AVP to the installation location in its packaged state.</li> <li>• During installation, do not apply excessive force to the feedback lever.</li> <li>• Do not bend the feedback pin.</li> <li>• Tighten bolts securely.</li> </ul>

## Model Number Configuration Table

### Basic Model No.

AVP770	Analog Signal (4-20 mA DC) HART communication with contact output	-	(1)	(2)	(3)	-	(4)	(5)	(6)	(7)	-	(8)	(9)
AVP771	Analog Signal (4-20 mA DC) HART communication with travel transmission output												
AVP772	Analog Signal (4-20 mA DC) HART communication without output signal												
AVP780	Analog Signal (0-20 mA DC) HART communication with contact output												
AVP781	Analog Signal (0-20 mA DC) HART communication with travel transmission output												
AVP782	Analog Signal (0-20 mA DC) HART communication without output signal												
AVP790	Discrete Signal (0/24 V DC) HART communication with contact output												
AVP791	Discrete Signal (0/24 V DC) HART communication with travel transmission output												
AVP792	Discrete Signal (0/24 V DC) HART communication without output signal												
(1) Structure	Waterproof	X											
	TIIS Flameproof G1/2 electrical conduit only, with flameproof packing cable adapter [Note 1]	E											
	FM Explosionproof/Dust ignition protection (G1/2 electrical conduit cannot be selected.)	F											
	FM Intrinsically safe (ic) and Nonincendive	V											
	FMC Explosionproof/Dust ignition protection (G1/2 electrical conduit cannot be selected.)	A											
	ATEX Intrinsically safe/Dust Ignition Protection	L											
	IECEx Flameproof/Dust ignition protection (G1/2 electrical conduit cannot be selected.)	D											
	IECEx Intrinsically safe/Dust Ignition Protection	T											
	NEPSI Flameproof/Dust ignition protection (G1/2 electrical conduit cannot be selected.)	N											
	KOSHA Flameproof (G1/2 electrical conduit cannot be selected.)	K											
	INMETRO Flameproof/Dust ignition protection (G1/2 electrical conduit cannot be selected.)	B											
(2) Connection	Electrical conduit connection	Air Pipe Connection	Mounting Bracket Screw	Pressure Gauge Screw									
	G1/2	Rc1/4	M8	Rc1/8	G								
	1/2 NPT	1/4 NPT	M8	Rc1/8	N								
	M20×1.5	1/4 NPT	M8	Rc1/8	M								
(3) Finish	Standard finish (baked acrylic)				S								
	Corrosion-Resistant Finish (baked urethane)				B								
(4)(5) Display	Display (LCD) with push button						D	X					
(6) Diagnostic	Advanced Diagnosis (with 4 pressure sensors)								A				
(7) Overvoltage protection	With over-voltage protection									V			

(8)(9) Optional	None	X	X
	Flameproof Universal Elbow (G1/2) 1 Piece	A	A
	Flameproof Universal Elbow (G1/2) 2 Pieces	A	C
	Model KZ03 pressure regulator with stainless steel filter (mounted on positioner) <sup>*2</sup>	M	1
	Model KZ03 pressure regulator with stainless steel filter (with bracket for separated mount)	M	2
	Model KZ03 pressure regulator with filter(with bracket for separated mount onto horizontal-installed actuator)	M	3
	Extension lever (only in case of mounting without mounting bracket)	M	L
	Sealing tape prohibited	M	J
	Mounting Bracket Material SUS316 (only in case of mounting with mounting bracket) <sup>*3</sup>	M	6
	With mounting bracket (PSA1,2,PSK1)	Y	S
	With mounting bracket (New model PSA3, 4 (produced after 2000),VA1 to 3(produced after May.'83))	Y	Q
	With mounting bracket (PSA6, VA4 to 6(produced after May. '83))	Y	L
	With mounting bracket (PSA7)	Y	8
	With mounting bracket (HA1)	Y	A
	With mounting bracket (HA2, HL2)	Y	T
	With mounting bracket (HA3, HL3)	Y	C
	With mounting bracket (HA4, HL4)	Y	N
	With mounting bracket (VR1)	Y	V
	With mounting bracket (VR2, 3)	Y	R
	With mounting bracket (VR3H)	Y	6
	With mounting bracket (RSA1)	Y	F
	With mounting bracket (RSA2)	Y	U
	With mounting brackets (Previous model of PSA3, 4 [Those manufactured before 1999])	Y	Y
	With mounting brackets (VA1 to 3 (produced before Apr. '83) [motion connector (previous model)], 800-1, 2, 3) <sup>*4</sup>	Y	W
	With mounting brackets (VA4,5(produced before Apr. '83) [motion connector (previous model)], 800-4, 5) <sup>*4</sup>	Y	J
	With mounting bracket (VP5, 6)	Y	1
	With mounting bracket (VP7)	Y	7
	With mounting bracket (DAP560, 1000, 1000X (until 100 mm stroke))	Y	4
	With mounting bracket (DAP1500, 1500X (until 100 mm stroke))	Y	5

\*1. One or two pressure-resistant packing cable adapter(s) are included with Model AVP 7\_2 and Model AVP 7\_0/7\_1, respectively.

\*2. Select the code "M1" only when the direction of drain of the pressure regulator with filter on the control valve is downward(ground).  
Not available code "M1" when AVP is installed with the LCD facing upwards.

\*3. SUS304 is the material used for the mounting bracket when code "M6" is not selected.

\*4. Consult with sales representative in case of no mounting hole on the side of valve yoke.



## Setting Data

Device tag (maximum of 8 characters)	Must be set.
Long tag (maximum of 32 characters)	Set if necessary.
Input characterization <sup>*1</sup>	L (Linear: standard), EQ% (equal percentage), QO (quick opening) and USER (custom setting)
Positioner action	D (Single acting increasing-output: standard; cannot select decreasing-output), W (double-acting)
Supply pressure classification	1 (140≤Ps≤150 kPa) 2 (150<Ps≤300 kPa: standard) 3 (300<Ps≤400 kPa) 4 (400<Ps≤450 kPa) 5 (450<Ps≤700 kPa)
Unit of pressure gauge	A (kPa: standard) B (kgf/cm <sup>2</sup> )* C (MPa) D (bar) E (psi)* * No domestic sales in Japan due to Non-SI unit.
Valve closed position	DOWN (standard), UP
Actuator Type	L (Linear motion: standard) R90 (90° rotation) R60 (60° rotation) RS90 (90° rotation sub) RS60 (60° rotation sub)
SIS Positioner Mode	ESD: ON/OFF mode CTL: Positioning mode (Only Model AVP77_ /78_)
Travel transmission fail safe direction (Only Model AVP 7_1)	DOWN (standard), UP You cannot change the setting after the delivery of the failure output direction
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. When the SIS positioner mode is in "ESD: ON/OFF mode", you can only select "L (linear)"

Refer to following when selecting the input/output characteristics.

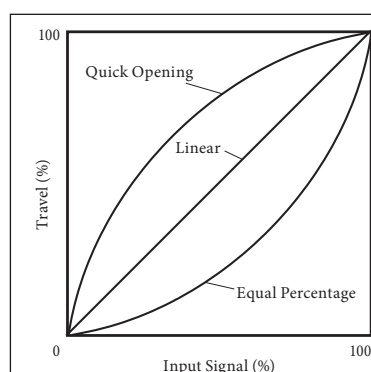


Figure 17. Input-Output Characteristics

### Selection of Input-Output Characteristics

The flow rate characteristics of the valve are set by selecting the valve plug characteristics, so "linear" is selected as the input-output characteristics of the positioner. However, the valve plug flow rate characteristics are determined based on the relationship between the shape, structure, etc., of the valve, and if these do not fit the requirements, the positioner can be used to compensate for the total flow rate characteristics of the valve by selecting "equal percentage" or "quick opening" as shown in Table 2.

Valve Plug Characteristics	Positioner I/O Characteristics	Valve Total Flow Characteristics
Linear	Quick Opening	Quick Opening
Linear	Equal Percentage	Equal Percentage
Equal Percentage	Quick Opening	Linear

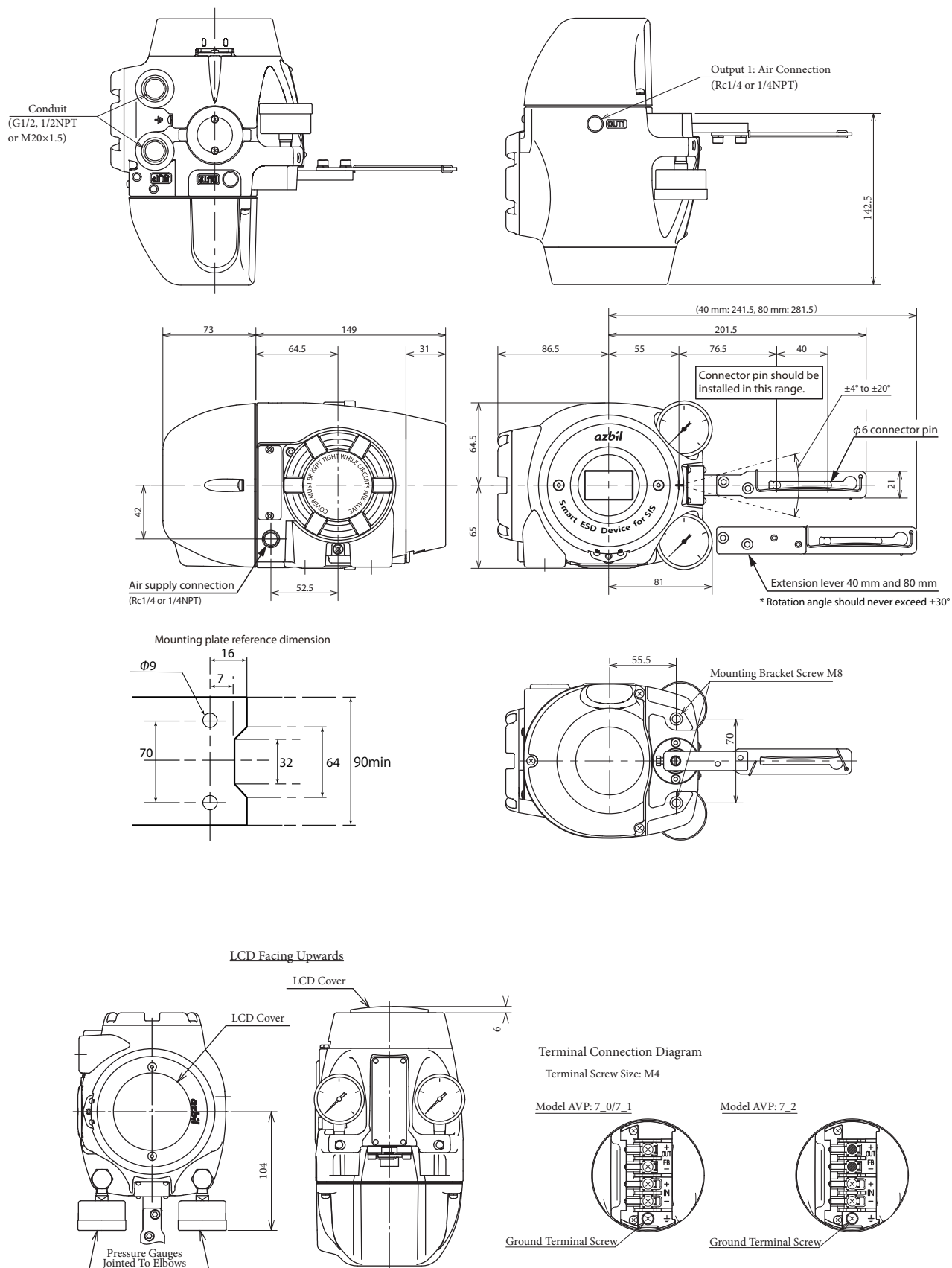
Table 2. Compensation of Valve Flow Rate Characteristics using Positioner

Caution: If the valve plug has a quick-opening characteristic, the total flow rate will not be linear even if "equal percentage" is set as the input-output characteristics of the positioner. (This is due to the fact that, if quick opening is set as the valve plug's characteristic, it becomes the equivalent of an on/off valve, and compensation using a positioner will be difficult.)

## External Dimensions Diagram

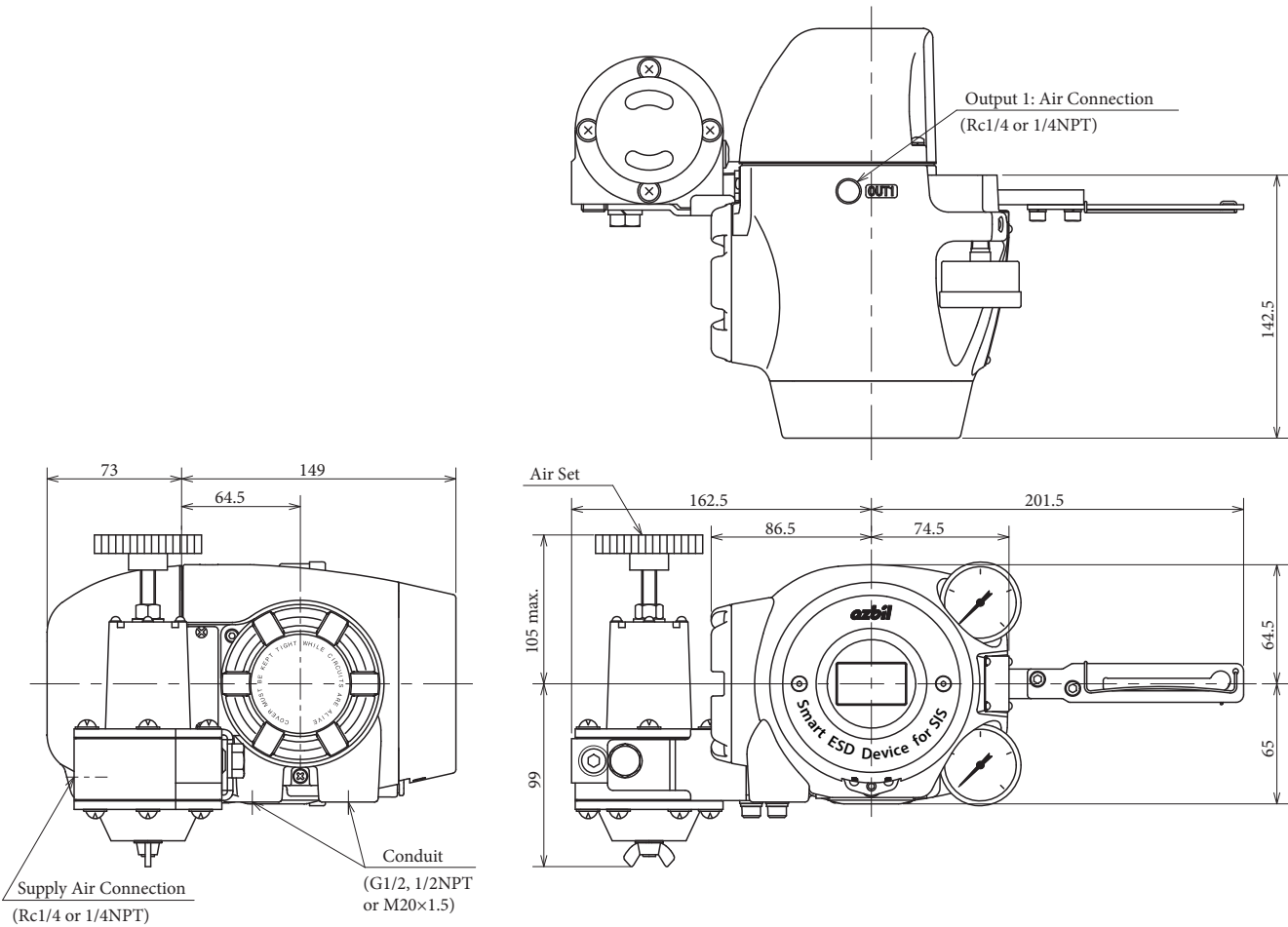
For single-acting actuator without KZ03 regulator

[Units: mm]



For single-acting actuator with KZ03 regulator

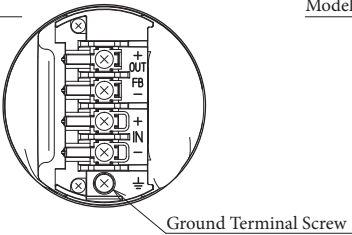
[Units: mm]



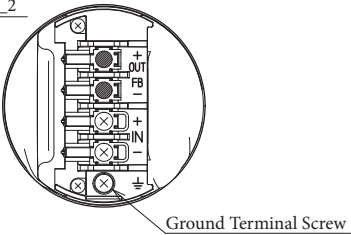
Terminal Connection Diagram

Terminal Screw Size: M4

Model AVP: 7\_0/7\_1

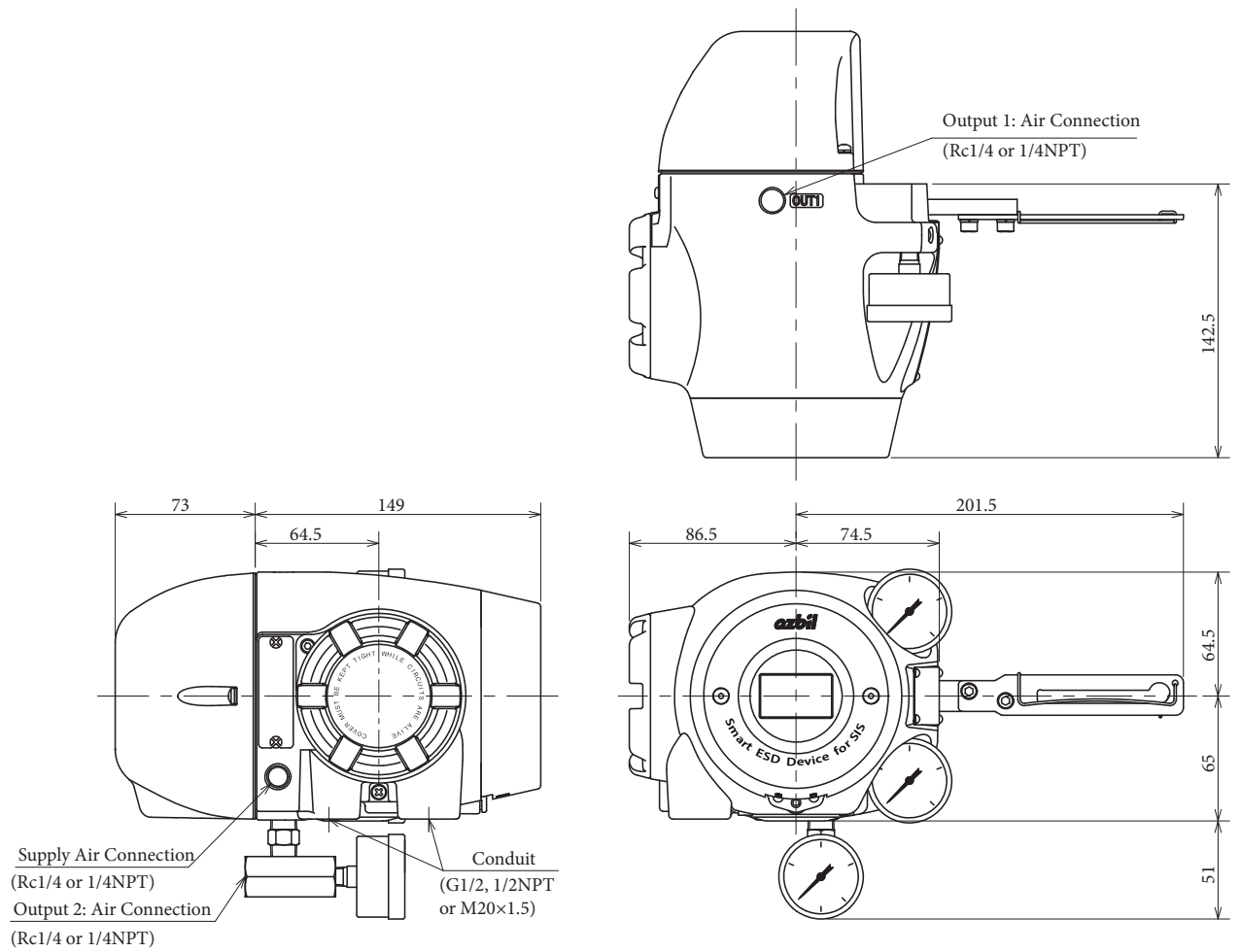


Model AVP: 7\_2



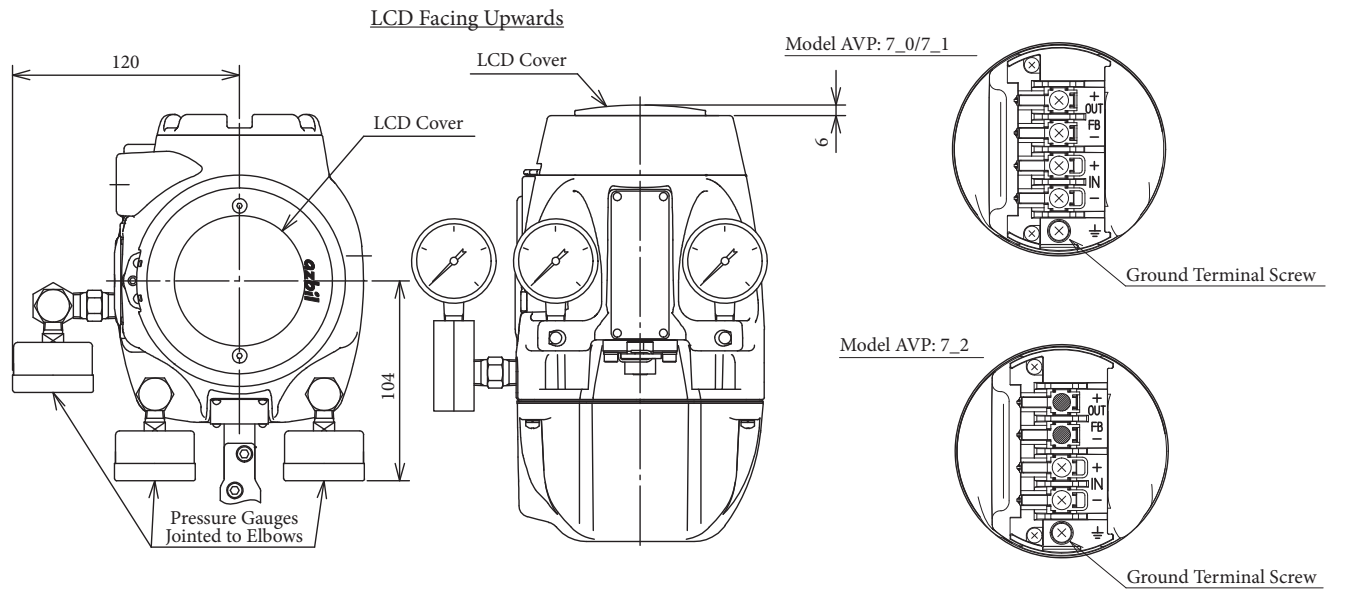
For double-acting actuator without KZ03 regulator

[Units: mm]



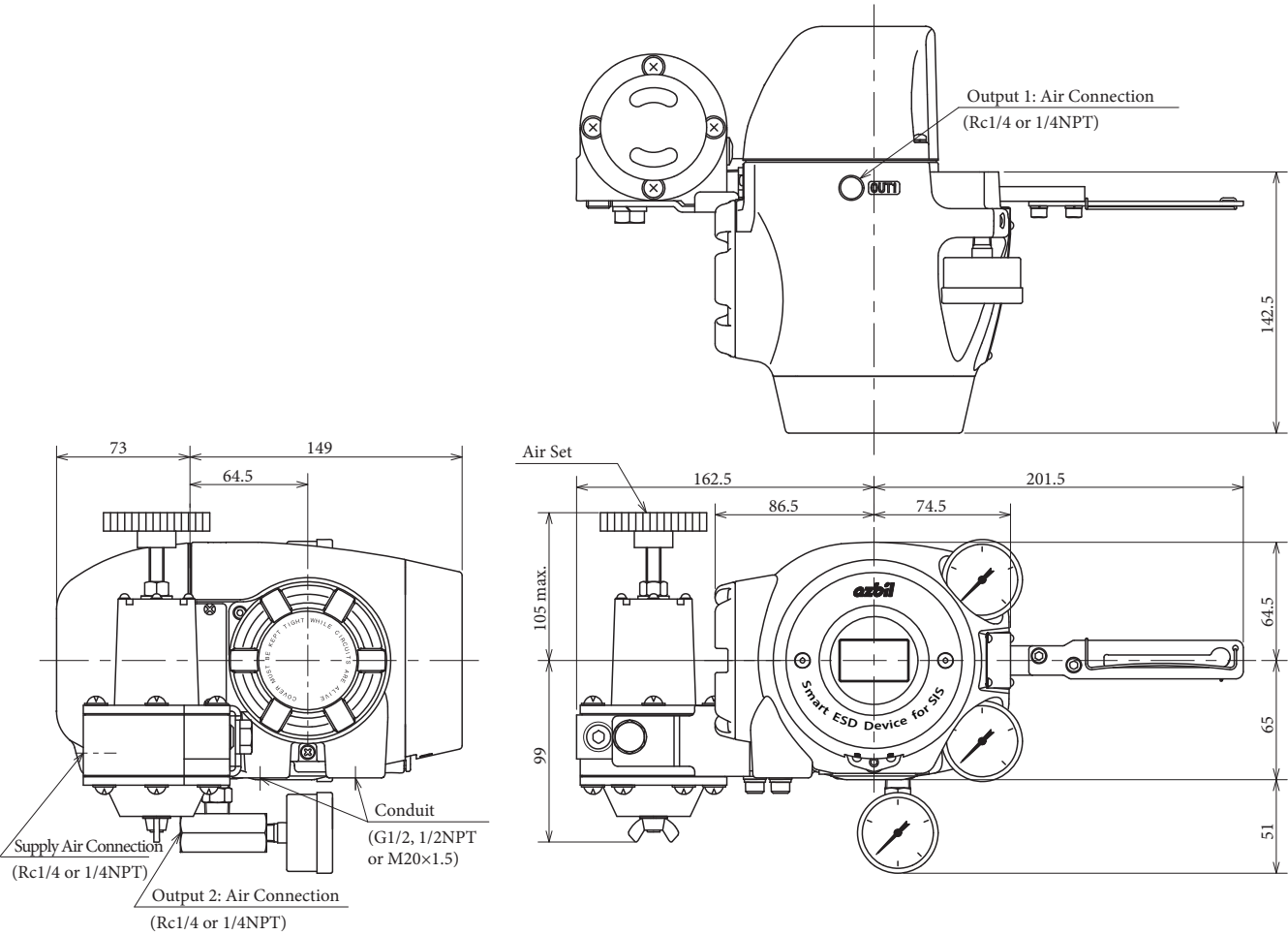
Terminal Connection Diagram

Terminal Screw Size: M4



For double-acting actuator with KZ03 regulator

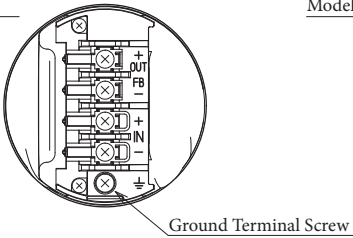
[Units: mm]



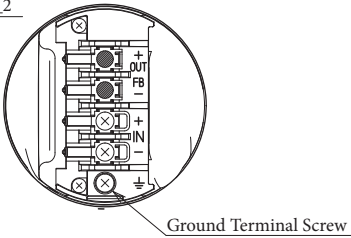
Terminal Connection Diagram

Terminal Screw Size: M4

Model AVP: 7\_0/7\_1



Model AVP: 7\_2











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