Smart Valve Positioner 700 Series with HART® Communication Protocol

Model AVP701/702

OVERVIEW

The model AVP70* is a current-pneumatic smart valve positioner.
The model AVP70* receives a DC current signal from control devices and controls pneumatic valves. In addition to this basic function, the model AVP70* has communication capabilities, an automatic configuration program and self-diagnostics functions that will greatly increase productivity and the efficiency of plant operation.
Calibration, configuration and self-diagnostics can be performed by using a HART communicator.

FEATURES

Easy to use

1. Improved valve diagnosis

Because the pressure sensor measures positioner output air pressure, the following valve diagnostic functions have been improved.

- Detection of abnormalities associated with valve closing, the actuator, and friction.
- Valve Signature (based on the relationship between the valve travel and pressure of the actuator)
- Positioner air circuit diagnosis

2. Easy adjustment and setup

The following can be easily adjusted or set up using the local user interface (LUI), which consists of an LCD and operation buttons. Since the operation buttons are isolated from the positioner, the positioner can be used in an explosive atmosphere.

- Auto-setup (auto-adjustment)
- Zero/span adjustment
- Supply bypass switching
- Control parameter configuration

3. Single model for multiple specifications

The model AVP702 settings can be changed without any replacement of changing of parts. A single model can be modified to suit any application without any parts change.

- Flow characteristic: Linear, EQ%, Quick opening or user customized characteristics
- Actuator type: Double or single acting actuator

4. Easy maintenance

Because the electric circuits are completely separated from the pneumatic circuit, maintenance work on the pneumatic circuit at the work site is easy.
In addition, the pilot component has an auto/manual switch. Thus, even if there is no electrical signal, a valve operation check can be conducted.
(However, in the case of a double-acting actuator, the switch cannot be used.)

5. Valve travel output function

In the case of (4–20 mA DC) valve travel output models in the AVP701 series, valve operation can be monitored from the control room.
(Note that because a power supply circuit for travel output is required in addition to the input signal line, 4-wire instrumentation is needed.)

China RoHS

This device is used in the Oil & Gas, Petrochemical, Chemical, Pulp & Paper, Food & Beverage, Machinery, Steel/Metal & Mining, and Automobile industries and therefore does not fall under the China RoHS Legislation.
If this device is used in semiconductor manufacturing equipment, labeling on the device and documents for the China RoHS may be required. If such documents are required, consult an Azbil Corp. representative.

FUNCTIONAL SPECIFICATIONS

Applicable actuator

- Single and double acting actuator
- Linear and rotary motion actuator

Approvals

TIIS Flameproof

Ex d IIC T6

FM Explosionproof / Dust Ignition Protection

Explosionproof (Division system):Class I, Division 1, Group B, C, D T6
- Factory sealed, conduit seal not required
- Not including gasoline atmospheres

Flameproof (Zone system): Class I, Zone 1, AEx d IIC T6 Gb
Dust ignition protection (Division system): ClassII, III, Division 1, Group E, F , G T6
Dust ignition protection (Zone system): Zone21 AEx tb IIIC T85 °C Db
Enclosure classification:IP66

FM Intrinsically safe (ic) and Nonincendive

Intrinsically safe (ic) (Zone system)
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 (Division system)
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

FMC Explosionproof / Dust Ignition Protection

Explosionproof (Division system): ClassI, Division1, Group C, D T6
- Factory sealed, conduit seal not required
- Not including gasoline atmospheres

Flameproof (Zone system): Class I, Zone 1, Ex d IIB T6
Seal all conduits within 450 mm (18 inches)
Dust ignition protection (Division system): Class II, III, Division 1, Group E, F, G T6
Enclosure classification: IP66

ATEX Flameproof / Dust Ignition Protection

Flameproof: II 2 G Ex d IIC T6 Gb
Dust ignition protection: II 2 D Ex tb IIIC T85 °C Db
Enclosure classification: IP66
Cables glands or conduit sealing devices used must be sertified for the Ex d IIC protection.
Use the product with the degree of protection IP66 under the IP66 required environment.

IECEx Flameproof / Dust Ignition Protection

Flameproof: Ex d IIC T6 Gb
Dust ignition protection: Ex tb IIIC T85 °C Db
Enclosure classification: IP66
Cables glands or conduit sealing devices used must be sertified for the IECEx Ex d IIC protection.
Use the product with the degree of protection IP66 under the IP66 required environment.

NEPSI Flameproof / Dust Ignition Protection

Flameproof: Ex d IIC T6 Gb
Dust ignition protection: DIP A21 TA 85 °C
Enclosure classification: IP66
Cables glands or conduit sealing devices used must be sertified for the Ex d IIC or DIP A21 protection.
Use the product with the degree of protection IP66 under the IP66 required environment.

KOSHA Flameproof

Ex d IIC T6
Cable glands or conduit sealing devices used must be certified for the Ex d IIC protection.

EAC Flameproof

Flameproof: 1Ex d IIC T6 X
Enclosure classification: IP66
Cables glands or conduit sealing devices used must be sertified for the EAC 1Ex d IIC or IECEx Ex d IIC protection
Use the product with the degree of protection IP66 under the IP66 required environment.

INMETRO Flameproof / Dust Ignition Protection

Flameproof: Ex d IIC T6 Gb
Dust ignition protection: Ex tb IIIC T85 °C Db
Enclosure classification: IP66
Cables glands or conduit sealing devices used must be sertified for the INMETRO or IECEx Ex d IIC or Ex td IIIC protection.
Use the product with the degree of protection IP66 under the IP66 required environment.

Control signal input

4–20 mA DC (Configurable to any required range for split range.)
Minimum driving current: 3.84 mA

Input resistance
475 Ω typically / 20 mA DC (Without the overvoltage protection)
600 Ω typically / 20 mA DC (With the overvoltage protection)

Output signal
4–20 mA DC (Travel transmission)

Output characteristics
- Linear, Equal percentage, Quick opening
- Custom user characteristics (21 points)

Stem travel range
14.3 to 100 mm Stroke (Feedback Lever Angle ± 4° to ± 20°)

Bypass operation
Auto/Manual external switch or LUI (Local User Interface) (For single acting actuator only)

Air supply pressure
140 to 700 kPa {1.4 to 7.0 kgf/cm²}

Air consumption
3.2 ℓ/min (N) maximum: normal condition of 50% output at 140 kPa {1.4 kgf/cm²}
4.0 ℓ/min (N) maximum: normal condition of 50% output at 280 kPa {2.8 kgf/cm²}
4.8 ℓ/min (N) maximum: normal condition of 50% output at 500 kPa {5.0 kgf/cm²)}
8.0 ℓ/min (N) maximum: normal condition of 50% output at 400 kPa {4.0 kgf/cm²}
for double acting actuator

Maximum air deliver flowrate
110 ℓ/min (N) at 140 kPa {1.4 kgf/cm²}

Lightning protection
Peak value of voltage surge: 12 kV
Peak value of current surge: 1000 A

Vibration tolerance
20 m/s^2, 5 to 400 Hz
(with standard mounting kit on Azbil Corporation's HA actuator)

Ambient temperature limits
-40°C to +80°C for general model
TIIS Flameproof: -20°C to +55°C
FM/FMC/ATEX/IECEx/NEPSI/KOSHA/EAC/ INMETRO Explosion protection: -30°C to +75°C
FM Intrinsically safe (ic) and Nonincendive: -24°C to +75°C
LCD operating limit: 0°C to +50°C

Ambient humidity limits
5% to 100% RH

CE conformity
Electromagnetic compatibility
EN61326-1: 2013 (CE Marking)

PERFORMANCE SPECIFICATIONS

Accuracy *1
For 8 mA ≤ input signal span < 16 mA
±1% F.S. (±2.5% with output characteristics modification)
For 4 mA ≤ input signal span < 8 mA
±1.5% F.S.

*Note)*1: Refer to Table 1. Because accuracy varies depending on the combination of actuator size and travel.*

Travel transmission accuracy
±1% F.S. (±2.5% with output characteristics modification)

PHYSICAL SPECIFICATIONS

Enclosure classification
JIS C0920 watertight, NEMA type 4X, IEC529 IP66

Finish
Baked acrylic

Color
Silver

Material
Cast aluminum

Weight
Without Pressure regulator with filter: 4.2 kg
With Pressure regulator with filter: 4.9 kg

INSTALLATION

Air connections
Rc1/4 or 1/4NPT internal thread

Electrical connections
G1/2, 1/2NPT or M20 × 1.5 internal thread

Conditions of supply air (JIS C1805-1 (2001))
Particles
Maximum diameter 3 μm

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.

Typical installation

Figure 1 shows wiring for the model AVP702 (Smart positioner without travel transmission). In this case, you can connect a SVP to its terminal for communications.
Figure 2 shows wiring for the model AVP701 (Smart positioner with travel transmission). In this case, you can connect a SVP anywhere along the travel transmission wiring for communications.

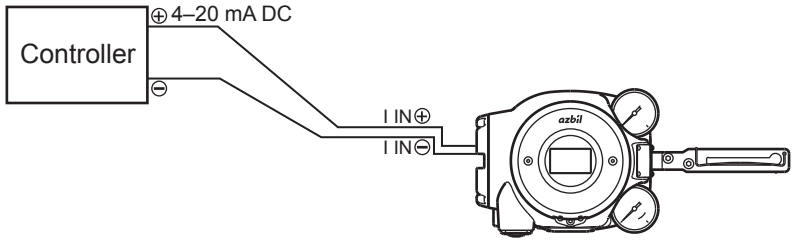


Figure 1 Wiring for model AVP702

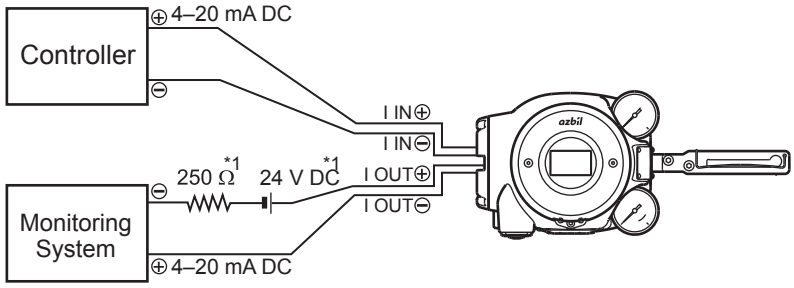


Figure 2 Wiring for model AVP701

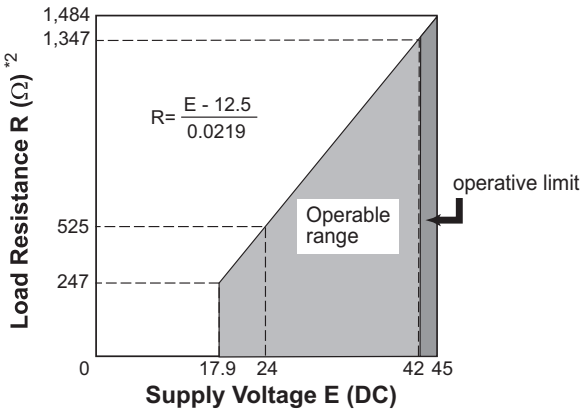


Figure 3 Supply voltage for travel transmission vs. load resistance characteristic

*Note) *1: For load resistance, refer to Figure 3.*

**2. Load resistance = Resistance for Monitoring system + 250 Ω[*1] + Resistance of supply voltage[*1]*

Table 1 Standard travel range and accuracy

Actuator	Travel (mm)	Accuracy [% F.S.]
PSA1, 2	14.3, 20, 25	1
PSA3, 4	20, 38	1
HA1	6, 8, 10	3
	14.3, 25	1
HA2	10	3
	14.3, 25, 38	1
HA3	14.3	3
	25, 38, 50	1
HA4	14.3	3
	25, 38, 50, 75	1
VA5	25, 37.5, 50, 75, 100	1
VA6 PSA6, 7	14.3	3
	25, 37.5, 50, 75, 100	1
HK1 PSK1	10	3
	19	1
DAP560 1000,1000X	14.3	3
	25–100	1
DAP1500 1500X	14.3, 25	3
	38–100	1

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.

⚠**CAUTION** 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.
	This symbol indicates “prohibited” actions that must not be taken.
	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 when performing the power distribution work in an explosion-proof area.
	For devices equipped with the pressure-resistant, explosion-proof specifications, do not open the cover during operation (while the power is on).

⚠CAUTION	
	Do not get on the installed device or use it as a step stool. This is dangerous because the device may tip over.
	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.
	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.
	Use a DC power supply with overload protection. Overload may cause smoke or fire.
	If a tool or other item touches the glass part of the display, it may break, leading to an injury. Be careful. Wear safety glasses during work.
	This product is heavy. Be careful where you step and wear safety shoes during work.
	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.
	Properly use the power supply based on the specifications. Inputting a different power supply may damage the device.
	Use gloves and other protective equipment during work in a hot, cold, or other severe environent.
	Do not move the device close to a magnet or magnetic driver. The control valve may operate.
	Apply the correct supply air pressure in accordance with the specification of the device. The overpressure may cause abnormal actions of the control valve or damage to the pressure gauge.

Precautions for installation

⚠CAUTION	
	Be careful not to get injured by sharp parts such as the edge of the main unit or actuator or screw threads during mounting. The type of mounting plate, mounting method, and mounting procedure differ depending on the actuator model to be mounted in the device.
	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. - The mounting plate and its accessories differ depending on the specifications (actuator model). Be sure to use the appropriate mounting plate and accessories for the actuator to be mounted. - When installing the control valve, ensure as much surrounding space as possible and put the device in the correct orientation taking maintainability (such as piping, wiring, and adjustment) into consideration. - Deliver the device to the installation location in the packaged state if possible. - Do not apply excessive force to the feedback lever during mounting. - Do not bend the feedback pin. - Securely tighten bolts.

MODEL SELECTION

			(1)	(2)	(3)		(4)	(5)	(6)	(7)		(8)	(9)
AVP701	Analog signal (4 to 20 mAdc) with Travel Transmission and HART communication Protocol	-				-					-		
AVP702	Analog signal (4 to 20 mAdc) with HART communication Protocol												

(1) Structure	Watwe-proof					**X**
	TIIS Flameproof (Electrical connection G1/2 only) with cable gland *1					**E**
	FM Explosionproof/Dust ignition protection (Electrical connection G1/2 is not available)					**F**
	FM Intrinsically safe (ic) and Nonincendive					**V**
	FMC Explosionproof/Dust ignition protection (Electrical connection G1/2 is not available)					**A**
	ATEX Flameproof/Dust ignition protection (Electrical connection G1/2 is not available)					**C**
	IECEX Flameproof/Dust ignition protection (Electrical connection G1/2 is not available)					**D**
	NEPSI Flameproof/Dust ignition protection (Electrical connection G1/2 is not available)					**N**
	KOSHA Flameproof					**K**
	EAC Flameproof (Electrical connection G1/2 is not available)					**G**
	INMET RO Flameproof/Dust ignition protection (Electrical connection G1/2 is not available)					**B**
(2) Connection	Electrical connection	Air piping connection	Mounting thread	Pressure gauge thread		
	G1/2	Rc1/4	M8	Rc1/8	**G**	
	1/2NPT	1/4NPT	M8	Rc1/8	**N**	
	M20 × 1.5	1/4NPT	M8	Rc1/8	**M**	
(3) Finish	Standard (Baked acrylic)				**S**	
	Corrosion proof (Baked urethane)				**B**	

(4) (5) Display	Display with push button	**D**	**X**	
(6) Diagnostic	Advanced Diag (with four pressure sensors)			**A**
(7) Overvoltage protection	None			**X**
	Overvoltage protection (Input impedance +125 Ω)			**V**

(8) (9) Option	None	**X**	**X**
	Model KZ03 pressure regulator with filter (Mounted on Positioner)	**M**	**1**
	Model KZ03 pressure regulator with filter (with bracket for separated mount)	**M**	**2**
	Extention lever (In case of without mounting bracket)	**M**	**L**
	Seal tape prohibited	**M**	**J**
	Mounting bracket material SUS316 (In case of with mounting bracket)	**M**	**6**
	Mounting bracket (PSA1, 2)	**Y**	**S**
	Mounting bracket (New model PSA3, 4 produced after 2000)	**Y**	**Q**
	Mounting bracket (PSA6, VA4 to 6)	**Y**	**L**
	Mounting bracket (PSA7)	**Y**	**8**
	Mounting bracket (HA1)	**Y**	**A**
	Mounting bracket (HA2, HL2)	**Y**	**T**
	Mounting bracket (HA3, HL3)	**Y**	**C**
	Mounting bracket (HA4, HL4)	**Y**	**N**
	Mounting Bracket (VR1)	**Y**	**V**
	Mounting Bracket (VR2,3)	**Y**	**R**
	Mounting Bracket (VR3H)	**Y**	**6**
	Mounting Bracket (RSA1)	**Y**	**F**
	Mounting Bracket (RSA2)	**Y**	**U**
	Mounting Bracket (old model PSA3, 4 (those produced before 1999))	**Y**	**Y**
	Mounting Bracket (VA1 to 3 (former model Motion Connector), 800-1, 2, 3)	**Y**	**W**
	Mounting Bracket (VA4, 5 (former model Motion Connector), 800-4, 5)	**Y**	**J**
	Mounting Bracket (VP5,6)	**Y**	**1**
	Mounting Bracket (VP7)	**Y**	**7**
	Mounting bracket (DAP560, 1000, 1000X (stroke: 100mm max.))	**Y**	**4**
	Mounting bracket (DAP1500, 1500X (stroke: 100mm max.))	**Y**	**5**

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

Individual specifications

- Device TAG No. (8 character):
- Long TAG No.(max 32 character):
- Input Range : 4 to 20mA (Standard)
  _ _._ _ to _ _._ _mA Note: Minimum span 4mA
- Input Characterization:
  Linear(Standard), Equal persentage, Quick opening, User-defined
- Positioner action:
  Direct(Single acting actuator), Reverse (Single acting actuator), Double acting actuator
- Supply pressure classification
  150 < Ps ≤ 300kPa (Standard)
  140 ≤ Ps ≤ 150kPa, 300 < Ps ≤ 400kPa, 400 < Ps ≤ 450kPa, 450 < Ps ≤ 700kPa
- Unit of pressure gauge
  kPa (Standard), MPa, bar, psi, kgf/cm2
- Valve closed position
  DOWN(Standard), UP
- Actuator type
  Linear (Standard)
  Rotary 90, Rotary 60, Rotary sub90, Rotary sub60
- Travel Transmitter fail safe derection (Model AVP701 only)
  DOWN(Standard), UP

DIMENSIONS

For single acting actuator without KZ03 regulator

[Unit: mm]

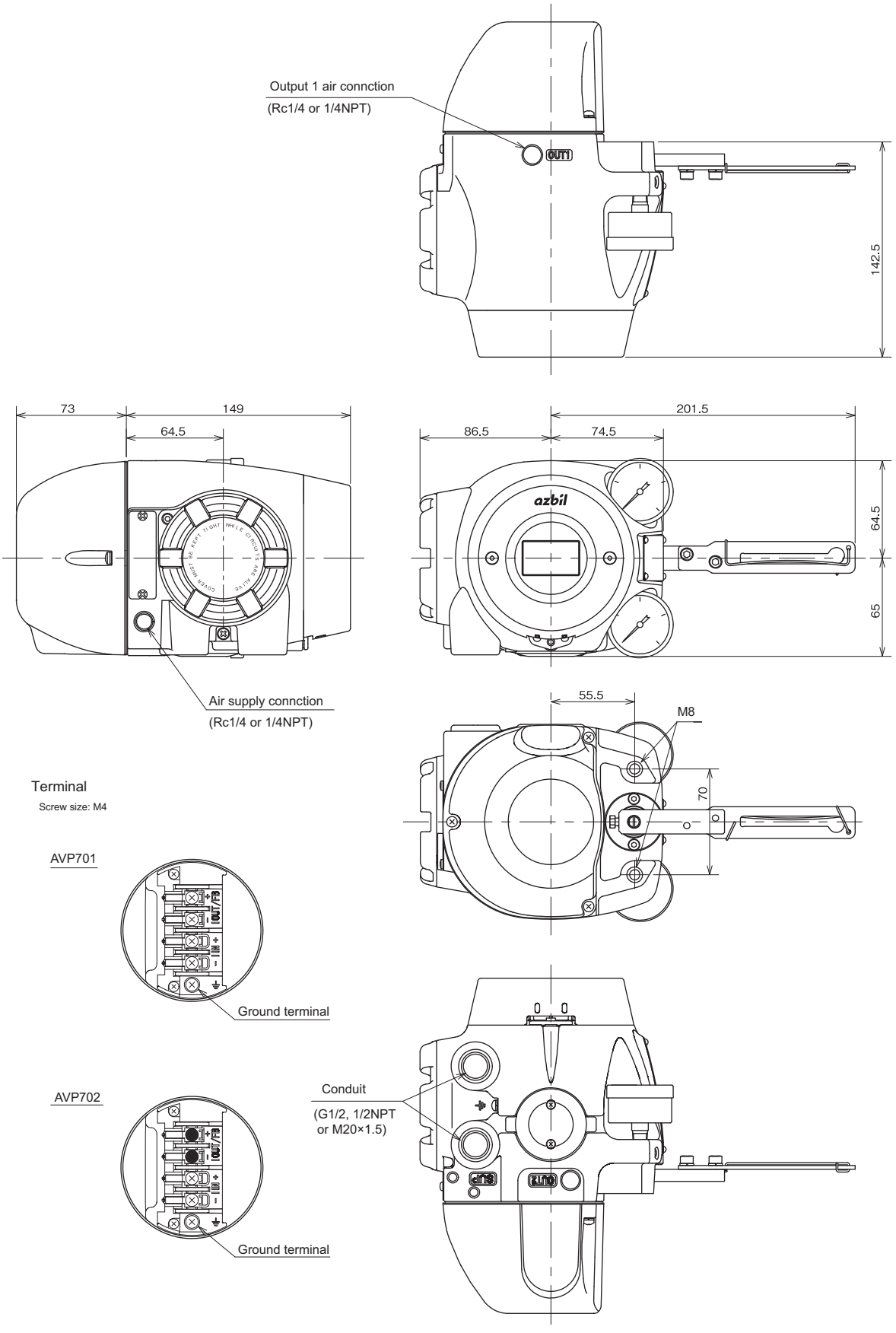
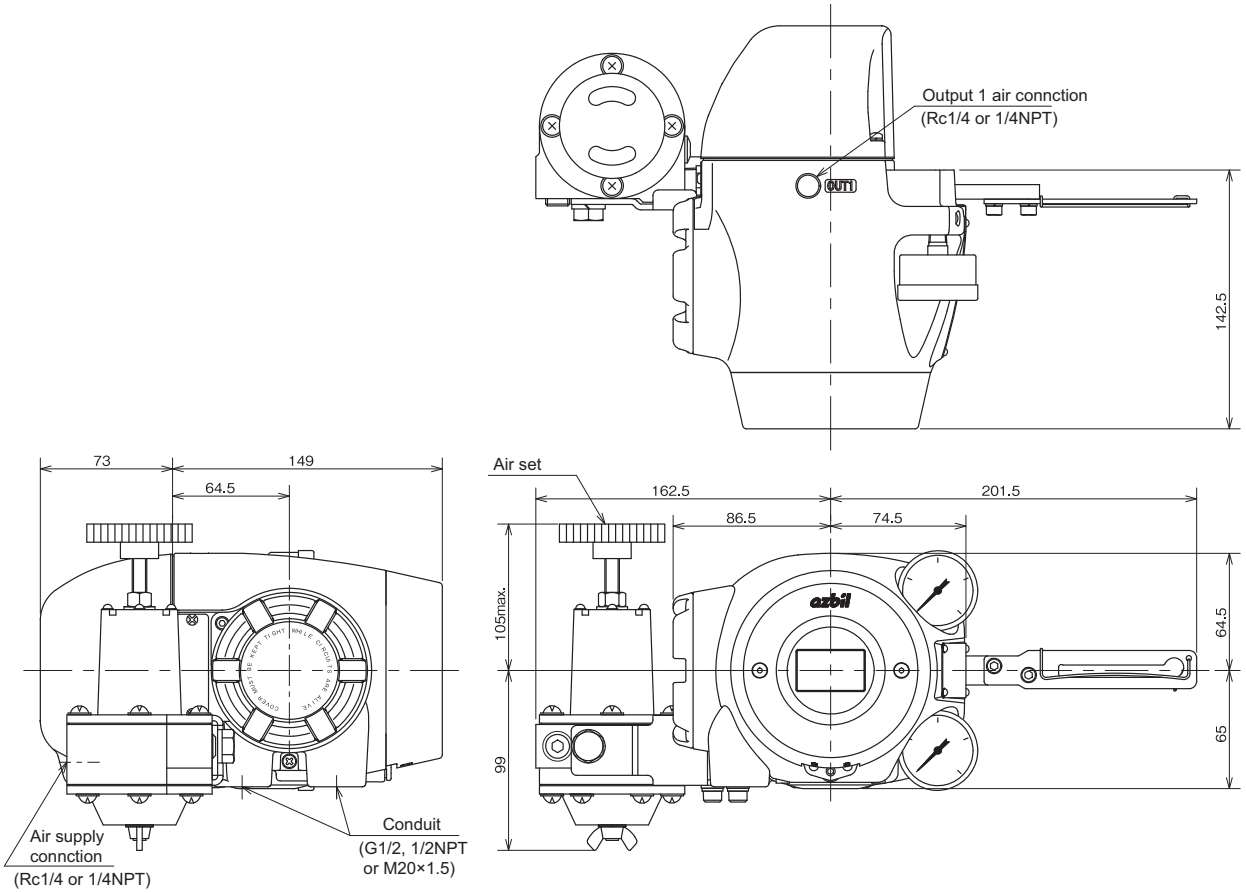


Figure 4 Dimension of the model AVP701/702

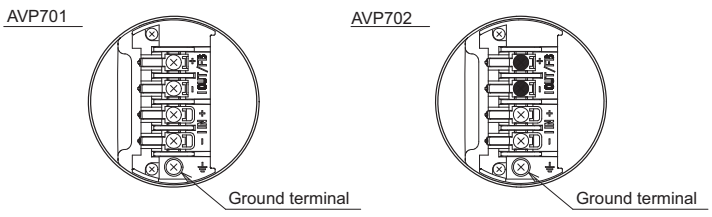
For single acting actuator with KZ03 regulator

[Unit: mm]



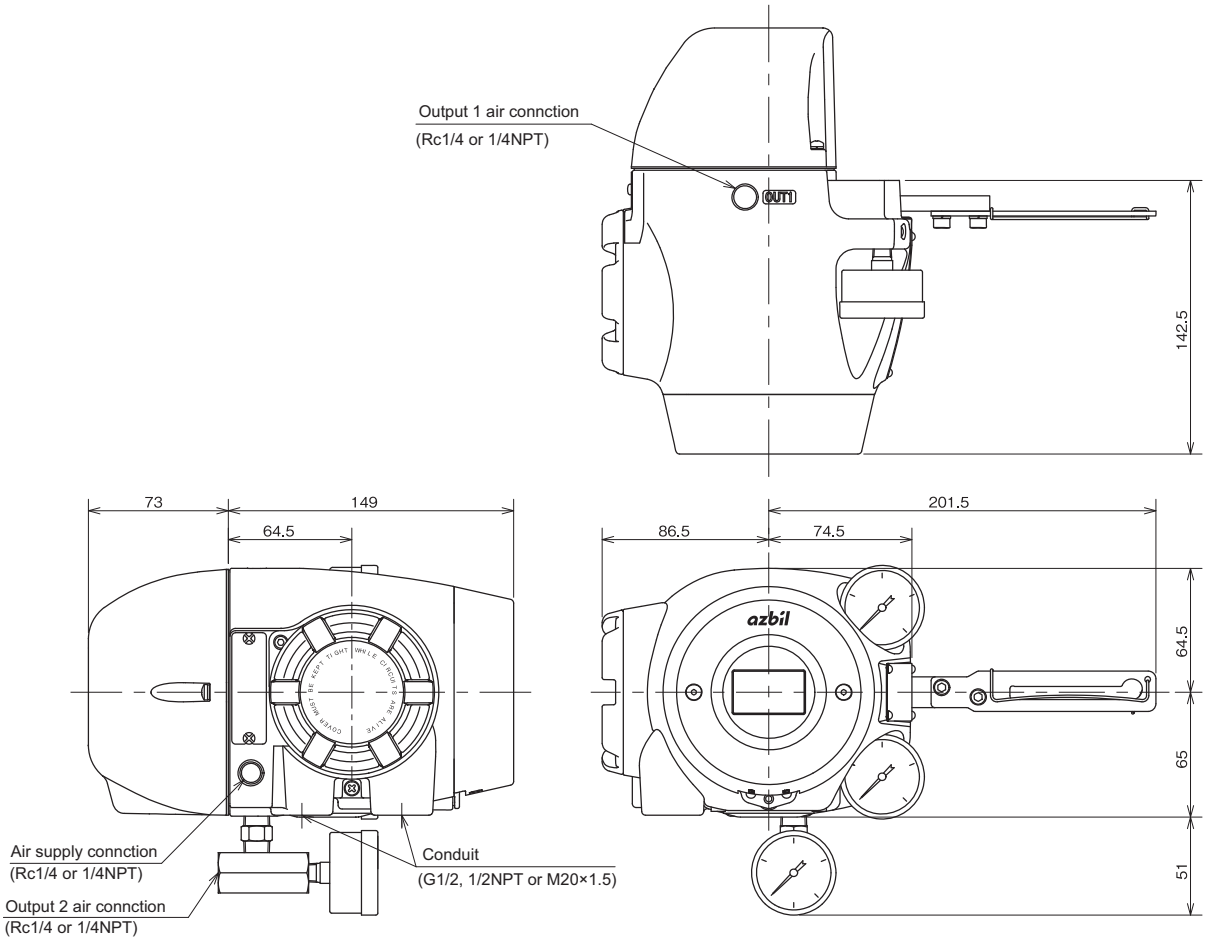
Terminal

Screw size: M4



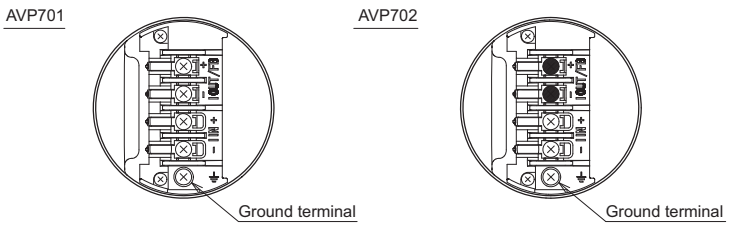
l**For double acting actuator without KZ03 regulator**

[Unit: mm]



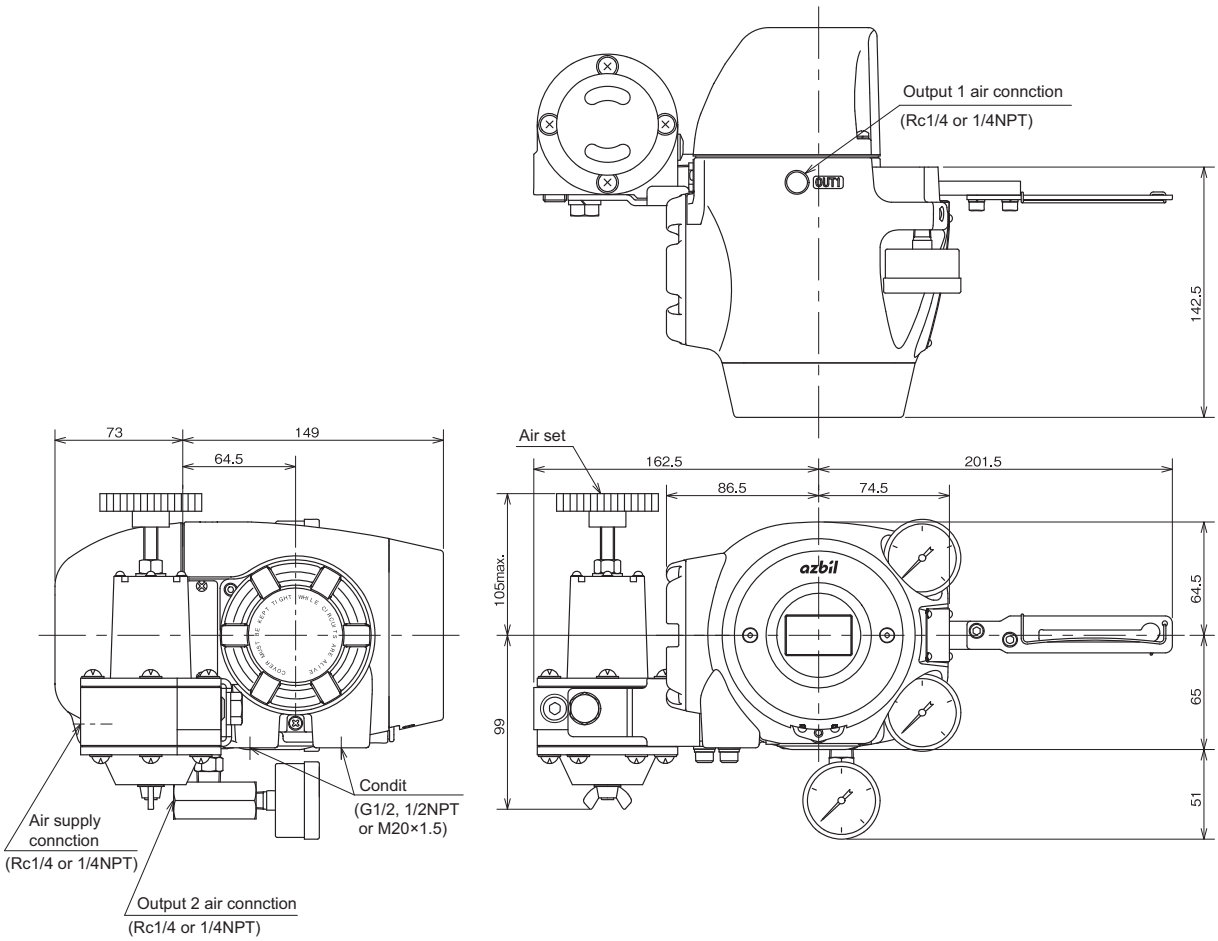
Terminal

Screw size: M4



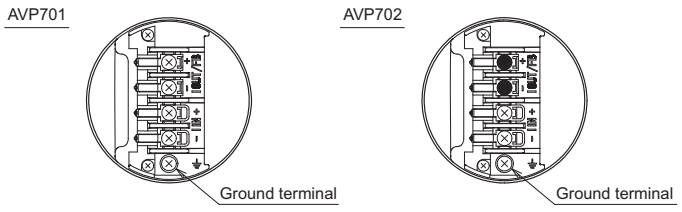
For double acting actuator with KZ03 regulator

[Unit: mm]



Terminal

Screw size: M4



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Azbil Corporation
Advanced Automation Company

1-12-2 Kawana, Fujisawa
Kanagawa 251-8522 Japan
URL: http://www.azbil.com/

1st edition: Apr. 2014
3rd edition: Feb. 2016

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