



Intelligent Valve Positioner IP6000 Series User's Manual

(Please read the instruction manual carefully before installation and use)



Contents

1. Overview	1
2. One-key automatic initialization	1
3. Selection and ordering data	3
4. Technical data	4
5. Connection description	5
6. Dimension	7
6.1. Mechanical dimension	7
6.2. Mounting bracket dimension	8
6.3. Dimension of linear stroke feedback lever	12
6.3.1. Feedback lever A (with driving pin)	12
6.3.2. Feedback lever B (without driving pin)	12
6.4. Sensor dimension for separate type	13
6.5. Sensor dimension for remote type	14
7. Installation.....	15
7.1. Linear stroke (normal type or remote type)	15
7.1.1. Installation of general piping connections	15
7.1.2. Installation of no piping connections	26
7.2. Rotary stroke (normal type or remote type).....	27
7.3. Separate type	34
7.4. Position feedback module	38
8. Operation.....	40
8.1. Interface description.....	40
8.2. Display and operation of main interface	41
8.3. Menu and functions.....	42
8.3.1. Display and operation of menu	42
8.3.2. Functions description and operation	43
8.3.2.1. TYPE.....	43
8.3.2.2. INITA	43
8.3.2.3. INITM	43
8.3.2.4. CAL.....	44
8.3.2.5. SDIR.....	44
8.3.2.6. CHAR.....	45
8.3.2.7. FREE	46
8.3.2.8. DB	47
8.3.2.9. LIM	48
8.3.2.10. YDIR.....	48
8.3.2.11. CUT.....	49
8.3.2.12. POS	50

8.3.2.13.	FACT.....	51
8.3.2.14.	WP.....	51
8.3.2.15.	ACT.....	51
8.3.2.16.	REF	51
8.3.2.17.	REC.....	51
8.3.2.18.	LCD.....	52
8.3.2.19.	DIAG.....	52
8.3.2.19.1.	PST.....	52
8.3.2.20.	SPLIT	53
8.3.2.21.	EXT	54
8.3.3.	Error message during initialization	54
8.3.4.	Tips of menu option or function cannot access.....	55
8.3.5.	Menu function options summary description.....	55
8.4.	HART DD file and DTM file description	57
8.4.1.	Device dynamic variable description	57
8.4.2.	Device custom function description.....	57
8.5.	Feedback signal.....	60
8.6.	Adjust air flow	60
9.	Limit switch adjustment and wiring.....	62
9.1.	Mechanical limit switch	62
9.1.1.	Mechanical limit switch cam adjustment.....	62
9.1.2.	Wiring for mechanical limit switch	63
9.2.	Intrinsic safety limit switch.....	64
9.2.1.	Intrinsic safety limit switch cam adjustment.....	64
9.2.2.	Wiring for intrinsic safety limit switch	65
10.	Trouble shooting	66
11.	Warranty terms.....	67

1. Overview

IP6000 series intelligent valve positioner is mounted on pneumatic actuators. It's used to control air intake and exhaust of the pneumatic actuators to drive the valve position to the set point by calculating both data from 4-20 mA DC signal and feedback position.

2. One-key automatic initialization

1. Please read the installation instructions in **chapter 7** before installing the positioner. Install the positioner according to the installation requirements described. Please pay attention to some installation points. For example, confirm the initial position of the feedback axis of the positioner or remote sensor before installation. Do not turn the feedback axis 360° during installation. For the positioner of normal linear type, make the upper plane of the positioner housing at a right angle to the main stem of the valve. Within the valve stroke range, the rotation angle of the positioner feedback lever meets the installation requirements.
2. After installing the positioner on the valve, connect the air source and electrical cables. Ensure that the air source pressure can fully open the valve. Power on the positioner by inputting a 4-20mA signal.
3. After the positioner is powered on, Positioner is in the uninitialized state before initialization. When LCD displays the sign **NOINI**, interface displays percentage value of sensor in the top line. As shown below.



In this state, pressing   buttons can open and close valve. Open and close valve fully, and observe the percentage value of sensor displayed on the interface. For non-separate type, ensure that within the entire valve stroke range, the minimum sensor percentage value $\geq 2\%$, and the maximum sensor percentage value $\leq 98\%$. Otherwise, it is necessary to re-adjust the installation position to make the linear stroke feedback lever or the angle stroke adapter move within the effective range. For separate type, ensure that within the valve stroke range of 5-25mm, the minimum sensor percentage value $\geq 12\%$, and the maximum sensor percentage value $\leq 92\%$; within the valve stroke range of 25-50mm, the minimum sensor percentage value $\geq 2\%$, and the maximum sensor percentage value $\leq 97\%$. Otherwise, the D value of the sensor needs to be adjusted. In addition, the minimum and maximum percentage difference of the sensor is required to be greater than 16% (non-separate type) or 8% (separate type).

4. The actuator type has been set before the positioner leaves the factory. The user only needs one-key operation to execute the automatic initialization (**INITA**) function to complete the matching of the valve. In the initial interface (**NOINI**) or manual / automatic mode interface, press and hold  button for approx. 3s to run the automatic initialization. After the initialization is completed, **FINSH** is displayed on the LCD, press  button to exit. After exiting, the system enters the manual mode interface, press  button again to switch to the automatic mode. At this time, the user can control the valve position through the 4-20mA signal. For some reasons, the system will display an error message in the function option line during the automatic initialization process and the automatic initialization will be interrupted. Descriptions of error messages and solutions are showed in chapter 8.3.3.

3. Selection and ordering data

L Normal linear FL Remote linear R Normal rotary FR Remote rotary S Separate *	Stroke type
S Single acting D Double acting	Acting mode
n No explosion i Ex ia IIC T4/T6 Ga ; Ex ia IIIC T200 135°C/T200 85°C Da k Ex ia I Ma	Explosion signs
0 no 1 yes	Feedback signal
0 no 1 yes	HART
0 no 1 Linear Bracket 2 Rotary Bracket	Mounting Bracket
0 no 1 yes	Pressure gauge
S Safe F Freeze	Power off state
N -20°C L -40°C	Lowest ambient temperature
J	Sales area (optional), composed of 3 characters, can be empty, this code is not related to explosion-proof performance

IP6000	-	L	-	S	-	n	-	0	-	0	-	0	-	0	-	S	-	N	-	J
--------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Remarks:

In **Stroke type** options, the option **S**(Separate) marked with * does not support **Lowest ambient temperature** option **L**(-40℃).

4. Technical data

Shell material	Aluminum(Ex ia IIC T4/T6 Ga; Ex ia IIIC T200 135℃/ T200 85℃ Da) 316L(Ex ia I Ma)
Set-point signal	4-20mA DC, no-load voltage: 15-24V DC
Minimum working current	3.8mA
Input resistance	120Ω
Ambient temperature	Normal version for non-explosion-proof: -20℃ ~ +80℃ Optional version for non-explosion-proof: -40℃ ~ +80℃ Normal version for explosion-proof: -20℃ ~ +80℃ (T4), -20℃ ~ +40℃ (T6) Optional version for explosion-proof: -40℃ ~ +80℃ (T4), -40℃ ~ +40℃ (T6) The device display will be dull or not displayed below -20℃.
Gas source requirement	ISO 8573-1 ● Solid particle size and density Class 3 ● Dew point Class 3 ● Oil content Class 3
Vibration resistance	0.15mm,10Hz-60Hz,20 cycle/axis 20m/ s ² ,60Hz-500Hz,20 cycle/axis Recommended range for control valve ≤ 20 m/s ² , no resonance peak
Supply pressure	0.14~0.7MPa
Flow	● Input air 2 bar 4.8 Nm³/h 4 bar 8.0 Nm³/h 6 bar 11.2 Nm³/h ● Exhaust air(Safe) 2 bar 5.9 Nm³/h 4 bar 9.8 Nm³/h 6 bar 13.7 Nm³/h ● Exhaust air (Freeze)

	2 bar 6.6 Nm ³ /h 4 bar 11.1 Nm ³ /h 6 bar 15.6 Nm ³ /h
Steady state air consumption	≤0.4 L/min
Basic error	≤0.5%
Hysteresis error	≤0.5%
Electrical connection	1/2NPT (default) or M20x1.5, please contact with sales for other thread specifications
Pneumatic connection	1/4NPT (default) or G1/4, please contact sales for other thread specifications
Weight	2.0 kg
Protection class	IP69K
Explosion signs	Ex ia IIC T4/T6 Ga; Ex ia IIIC T200 135°C / T200 85°C Da; Ex ia I Ma

5. Connection description

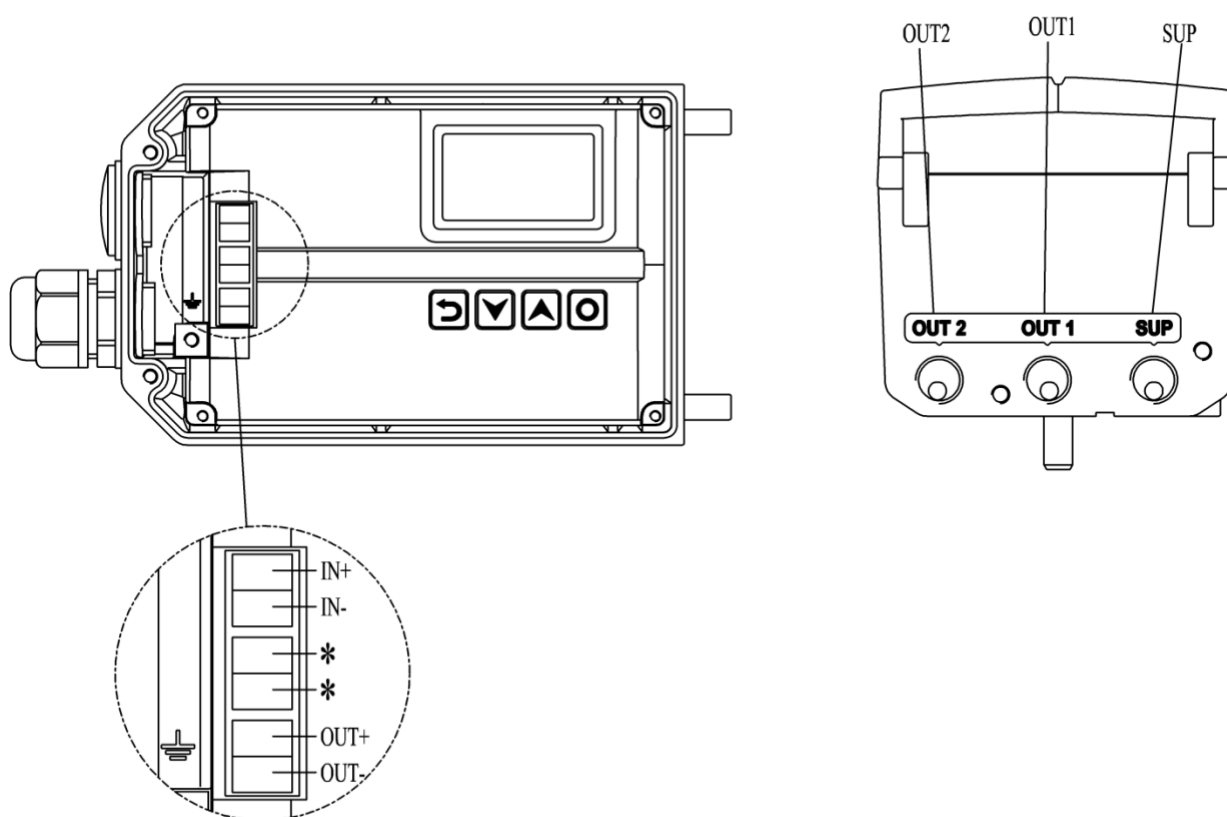


Figure 1. Connection description

Electrical Connection	Description
IN+	4-20 mA set-point signal +
IN-	4-20 mA set-point signal -
OUT+	Feedback signal module 18-30 V DC +
OUT-	Feedback signal module 4-20 mA output
*	The two interfaces are connected with each other, and the device is in low impedance mode. (In low impedance mode, the HART communication function will be disabled.)

Pneumatic Connection	Description
SUP	Air supply enter
OUT1	Pilot air outlet 1
OUT2	Pilot air outlet 2, used for double acting type.

Remarks: For the separate type of the positioner, OUT1 and OUT2 are blocked and not used.

NOTES:

- Electrical cables must use shielded twisted pair or shielded wires. Connect one end of the cable shielding layer to the $\perp$ screw inside the casing, and the other end to the ground. So that the device is effectively grounded to prevent electromagnetic interference.
- Keep electrical cables away from strong magnetic fields.
- Must install or remove the electrical cable when the device is powered off.
- If the input signal has attenuation and the user does not require HART communication function, try to set to low impedance mode. Connect the two undefined electrical interfaces marked with * in Figure 1 to each other through one wire to make the positioner in low impedance mode.
- If the split range control function of the positioner is to be used, a DC signal isolator must be used to convert one 4-20mA setting signal into two 4-20mA setting signals, and then connect them to two positioners respectively. Set the positioner to low impedance mode.

HART communication wiring:

Connect the two signal wires of the HART modem or HART communicator to the positive and negative poles of the 4-20 mA setting signal.

6.2. Mounting bracket dimension

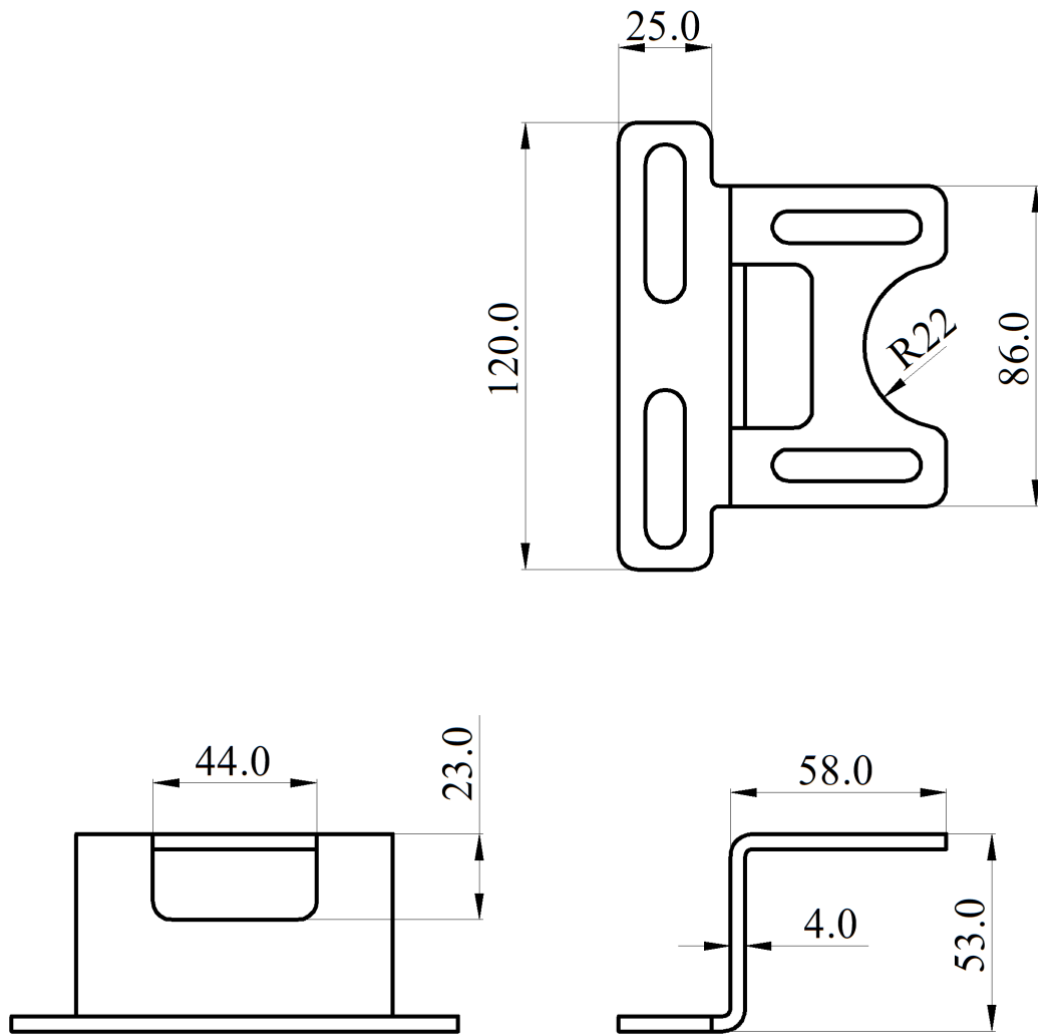


Figure 3. Normal linear mounting bracket

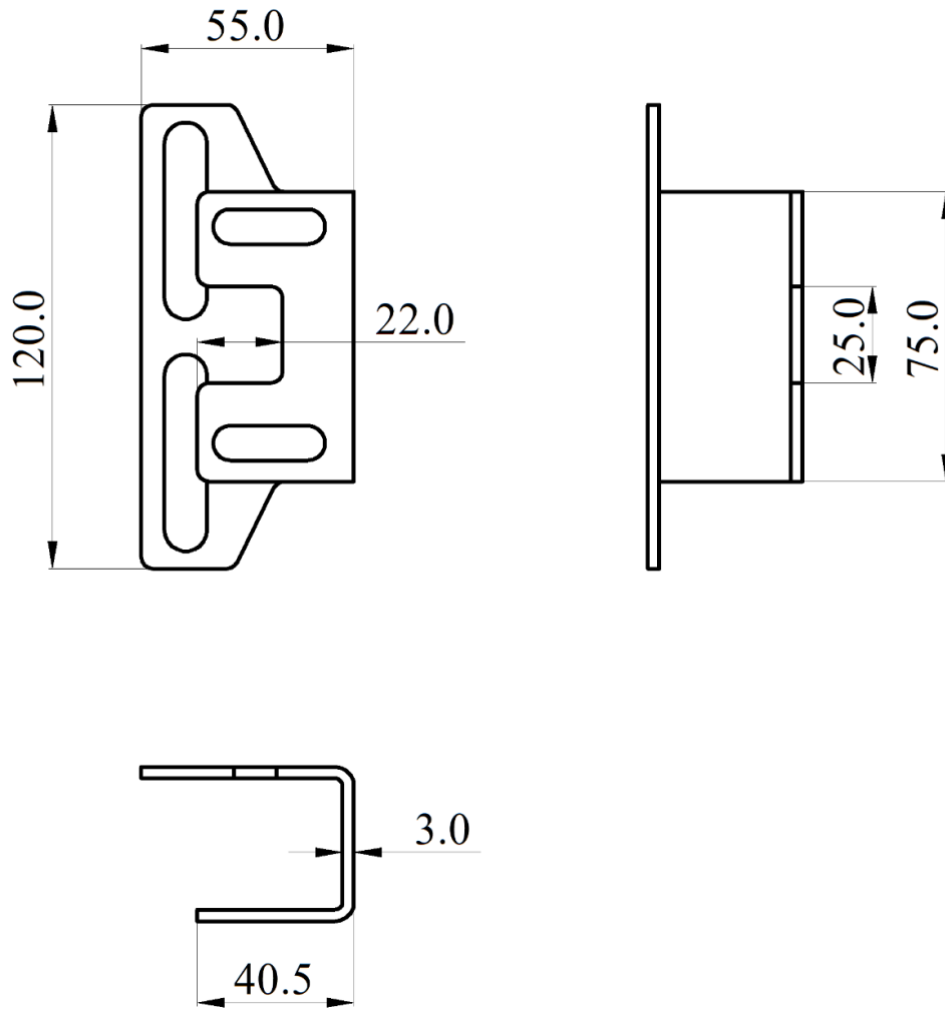


Figure 4. Remote linear mounting bracket

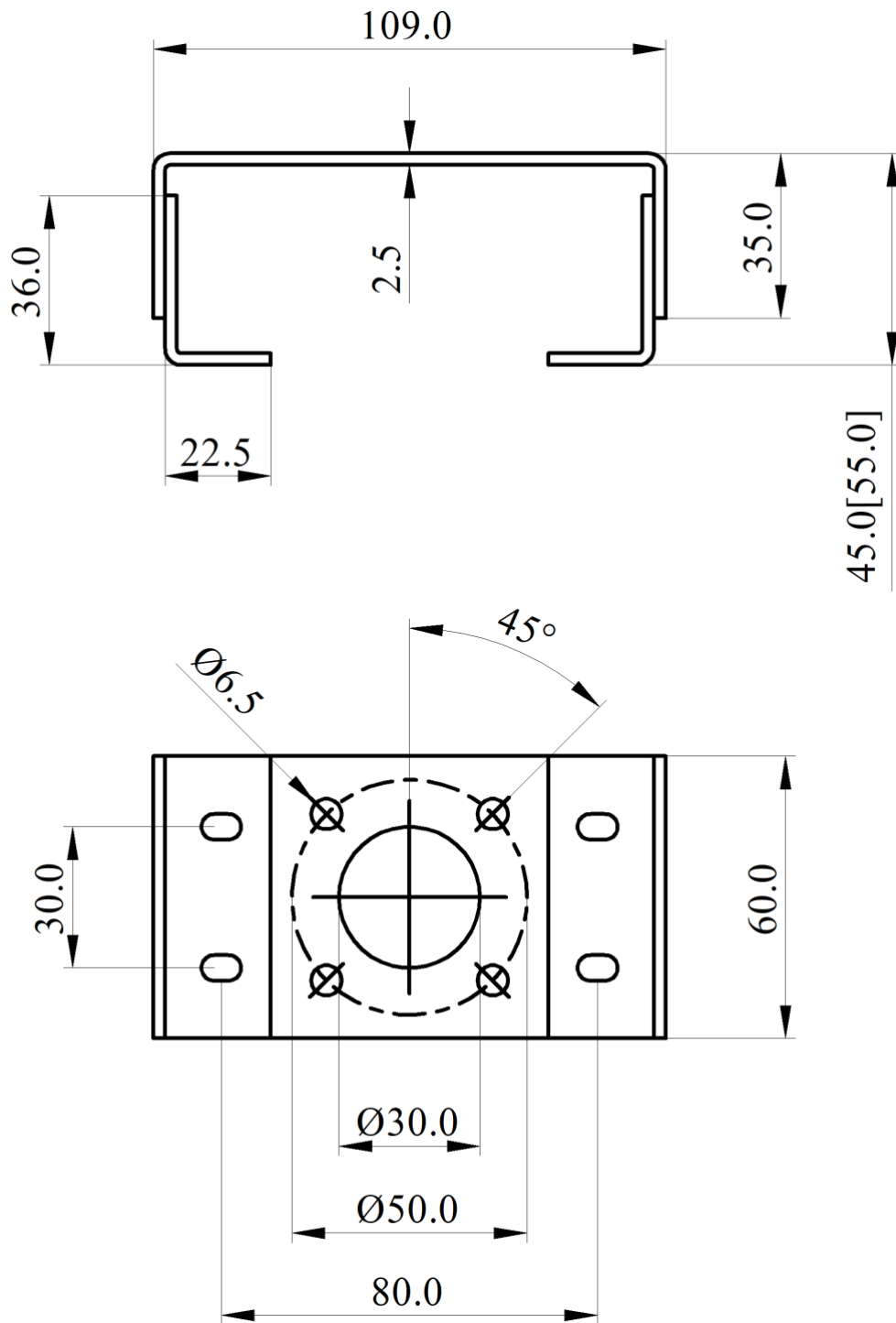


Figure 5. Rotary mounting bracket (Type A)

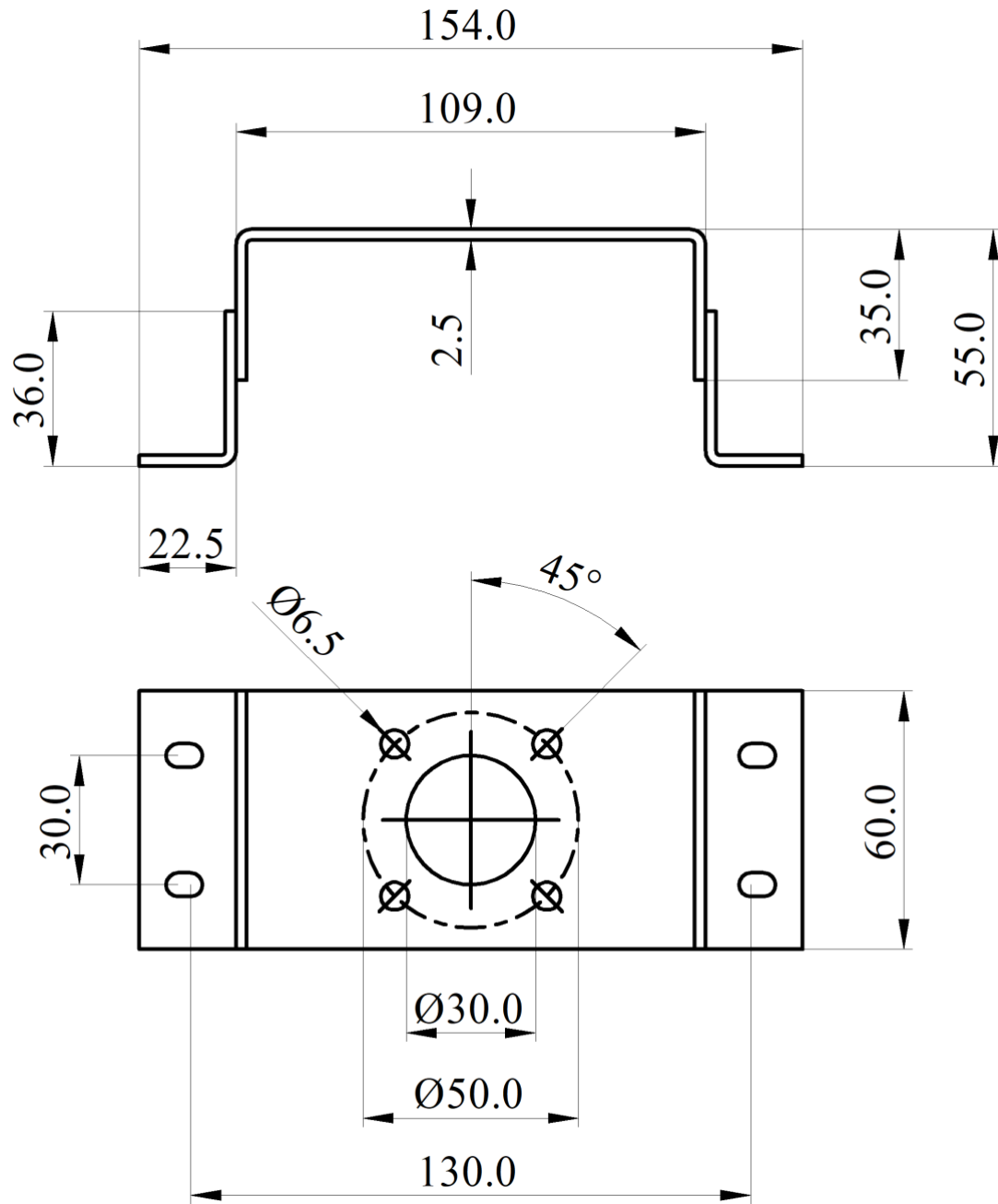


Figure 6. Rotary mounting bracket (Type B)

6.3. Dimension of linear stroke feedback lever

6.3.1. Feedback lever A (with driving pin)

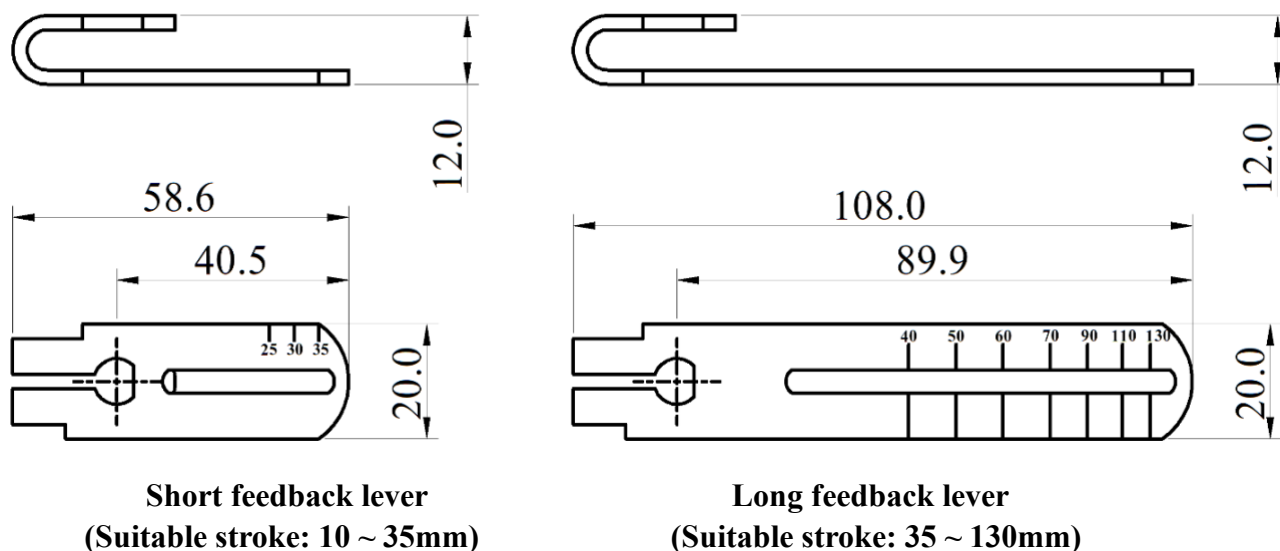


Figure 7. Dimension of feedback lever A

6.3.2. Feedback lever B (without driving pin)

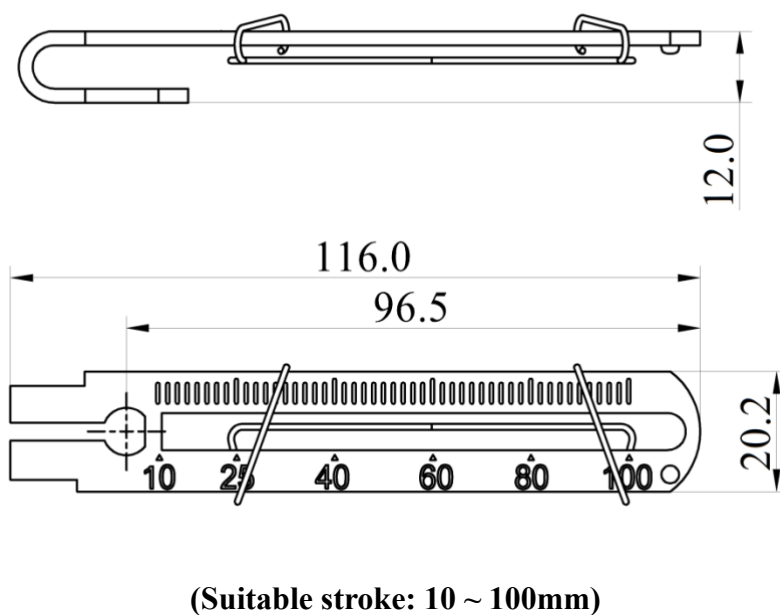


Figure 8. Dimension of feedback lever B

6.4. Sensor dimension for separate type

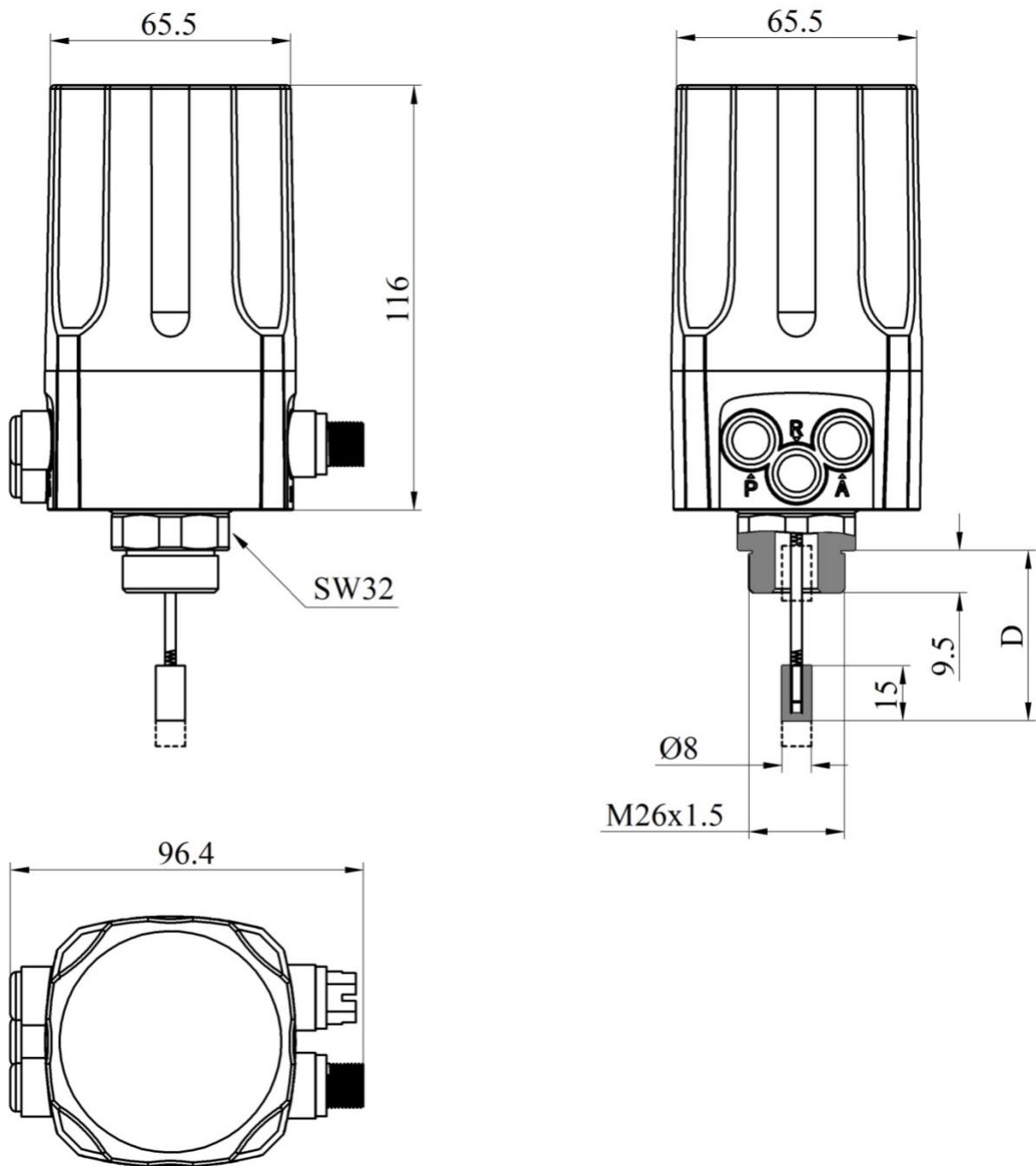


Figure 9. Sensor dimension for separate type

6.5. Sensor dimension for remote type

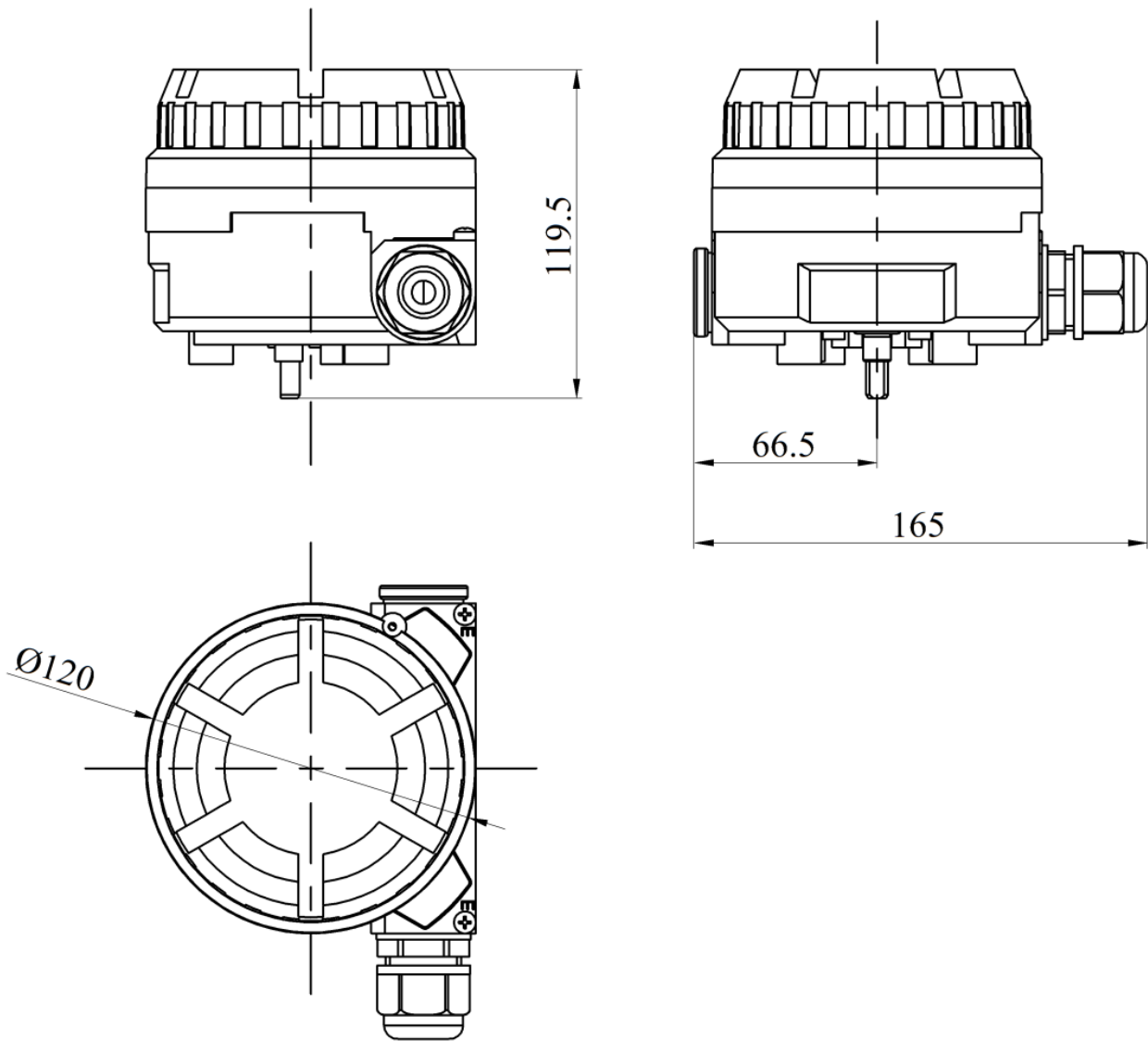


Figure 10. Sensor dimension for remote type

7. Installation

7.1. Linear stroke (normal type or remote type)

Linear actuator mounting components			
No.	Name	Amount	Note
①	U-shaped rod	1	Rotate the feedback lever in the working process
②	Clamping assembly	1	Mount U-shaped rod to actuator
③	M6 hexagon socket screw	2	M6×25
④	M6 spring washer	2	Prevent screw loosening
⑤	feedback lever	1	Mounted on the main stem of the positioner
⑥	M6 hexagon socket bolt	1	M6×20, match with square nut
⑦	Linear stroke mounting bracket	1	Connect positioner and actuator
⑧	M8 hexagon head bolts	2	M8×10
⑨	M8 spring washer	2	Prevent bolts loosening
⑩	M8 flat washer	2	Protect contact surface
⑪	Driving pin for feedback lever B	1	Mounted on the main stem of the valve

7.1.1. Installation of general piping connections

1. Confirm the initial position of the feedback axis of the positioner or the remote sensor

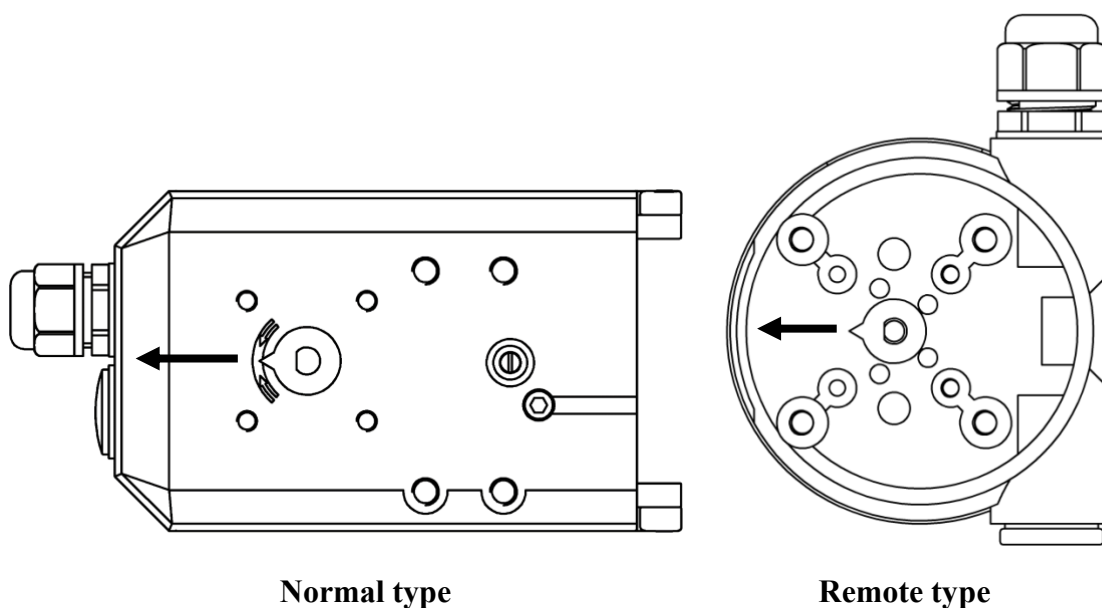


Figure 11. Initial position of the feedback axis

Rotate the feedback axis and point the pointer on the feedback axis in the direction of arrow in Figure 11. The direction of arrow is defined as the initial position. Power on the positioner,

observe the percentage value of the sensor on the initial interface (**NOINI**), and confirm that the value is between 40-60%. If not, turn the feedback axis 360° and confirm again. After confirmation, power off the positioner.

2. Install the U-shaped rod that matches the feedback lever A or the driving pin that matches the feedback lever B to the actuator.

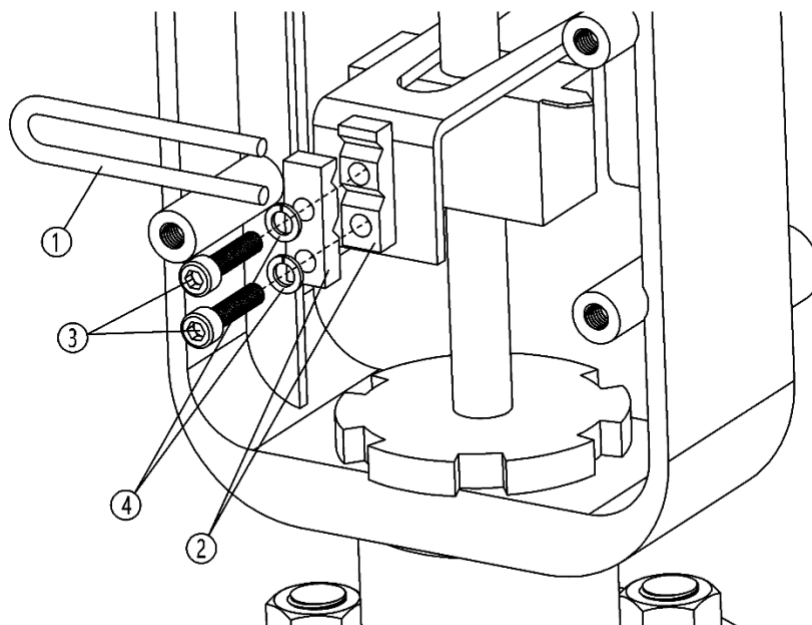


Figure 12. U-shaped rod installation

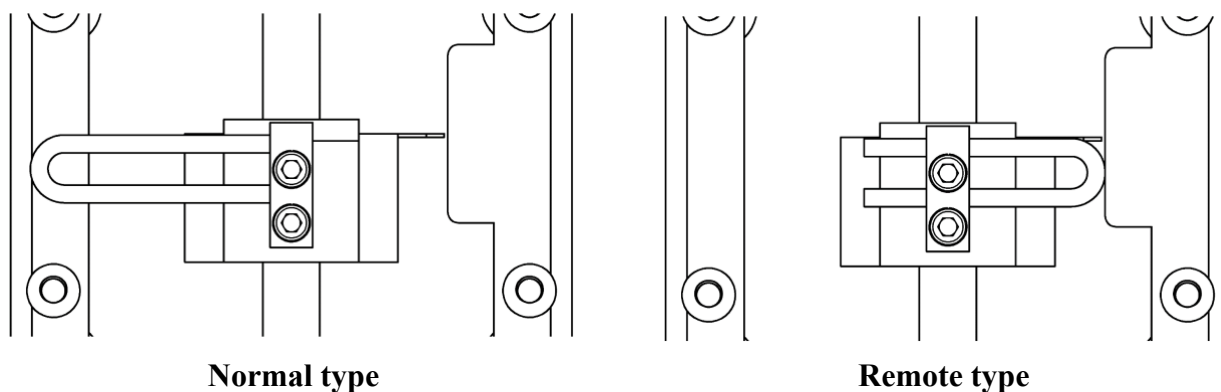


Figure 13. U-shaped rod direction

Fix U-shaped rod① and Clamping assembly② on the actuator center spindle with M6 hexagon socket screw③ and M6 spring washer④, and tighten screws with a hexagon socket wrench.

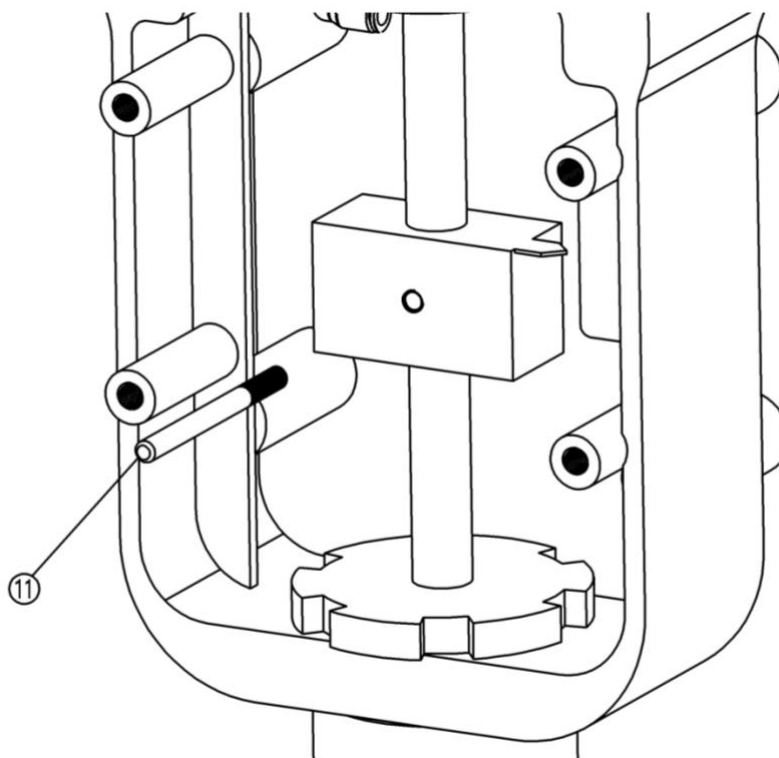


Figure 14. Driving pin installation

Install the driving pin ⑪ on the main stem of the valve. The slot height of the feedback lever B is 6.2 mm. Therefore, if the user does not use the provided driving pin, it should be noted that the diameter of the driving pin used is 6 mm, and the thread size of the driving pin and the main stem of the valve must be the same.

3. Install the driving pin that matches the feedback lever A.

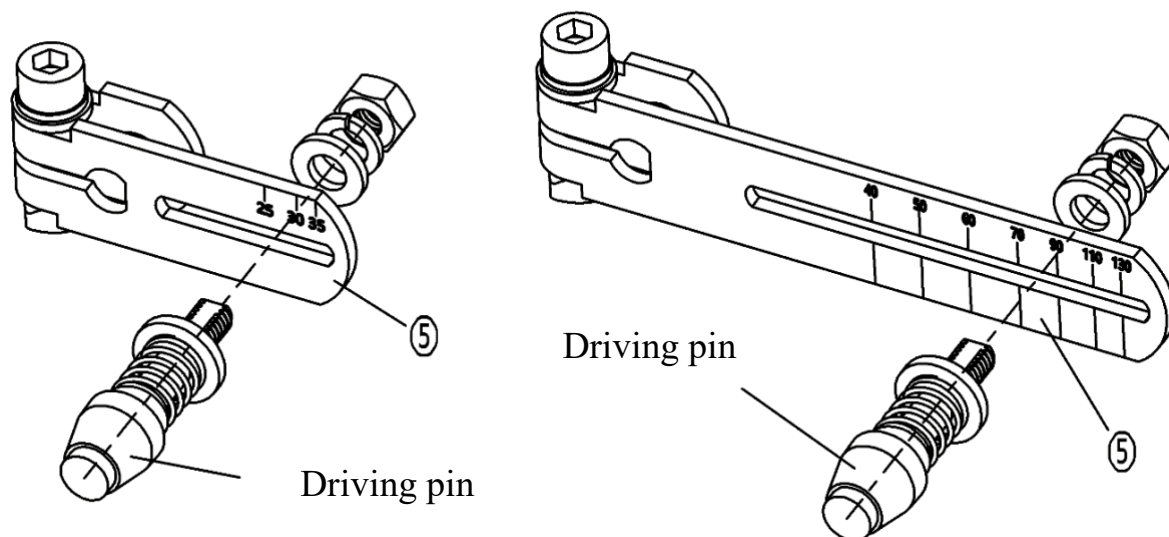


Figure 15. Driving pin that matches the feedback lever A installation

Select the feedback lever corresponding to the figure above according to valve actual stroke. The pin must be mounted at the corresponding stroke scaling value at the feedback lever, if it's not, the lever may be damaged when the valve is activated. For example, mounting driving pin at value 40 position for a valve with 100mm stroke, the feedback lever may be deformed when the valve is activated. If the valve stroke is out of the range of feedback lever A, please consult

the manufacturer.

4. Mount feedback lever and linear mounting bracket to the positioner or the remote sensor.

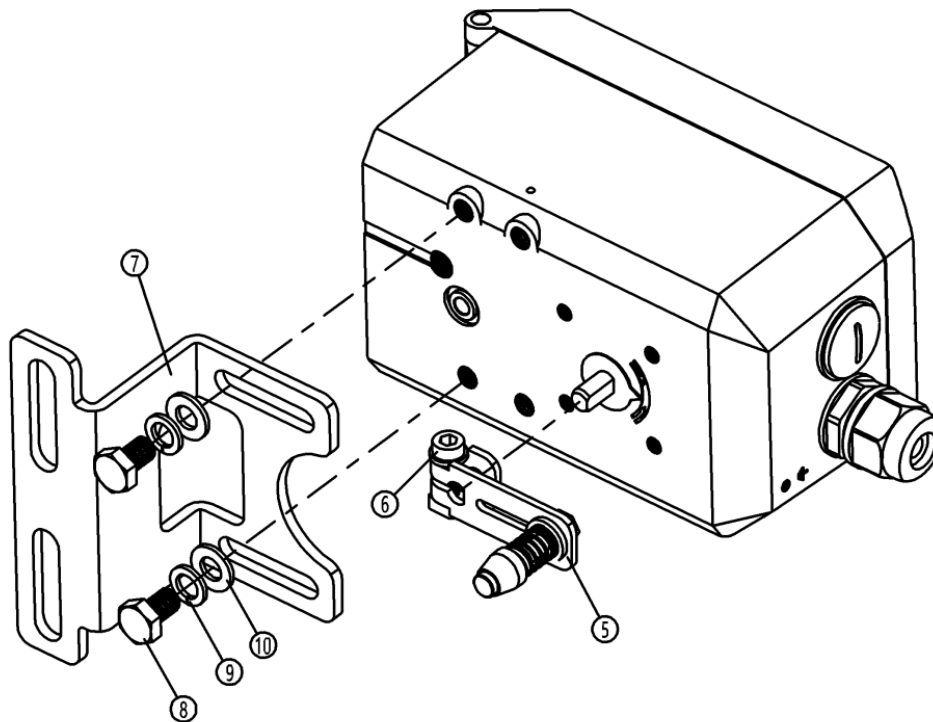


Figure 16. Feedback lever A and mounting bracket installation (normal type)

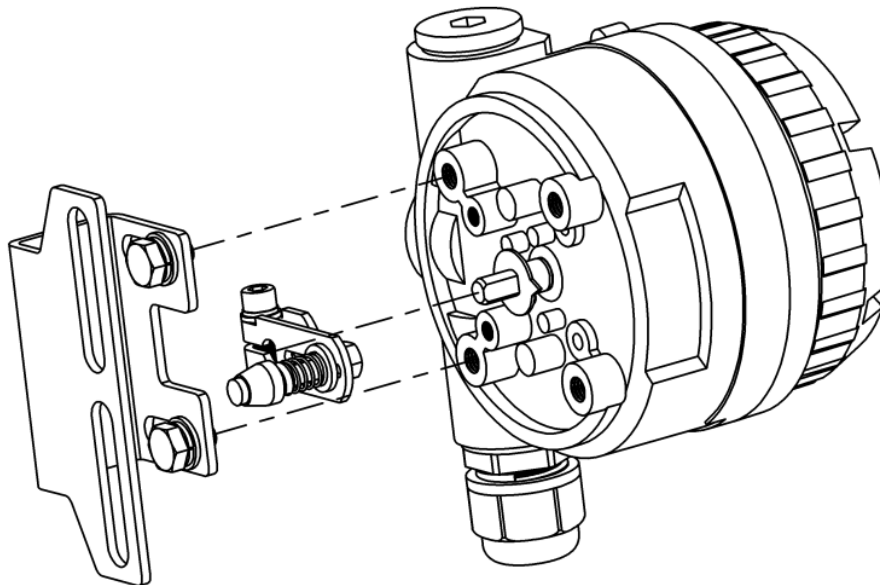


Figure 17. Feedback lever A and mounting bracket installation (remote type)

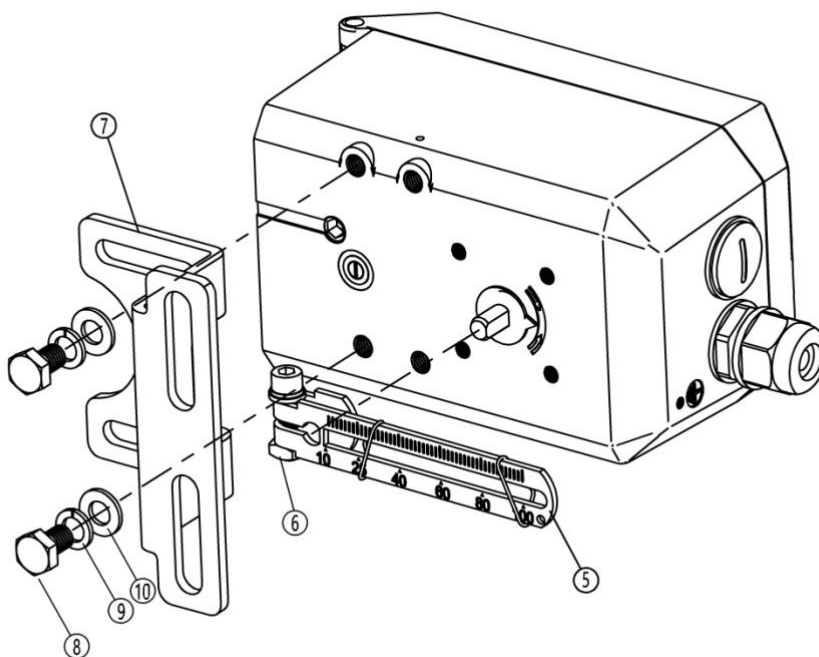


Figure 18. Feedback lever B and mounting bracket installation (normal type)

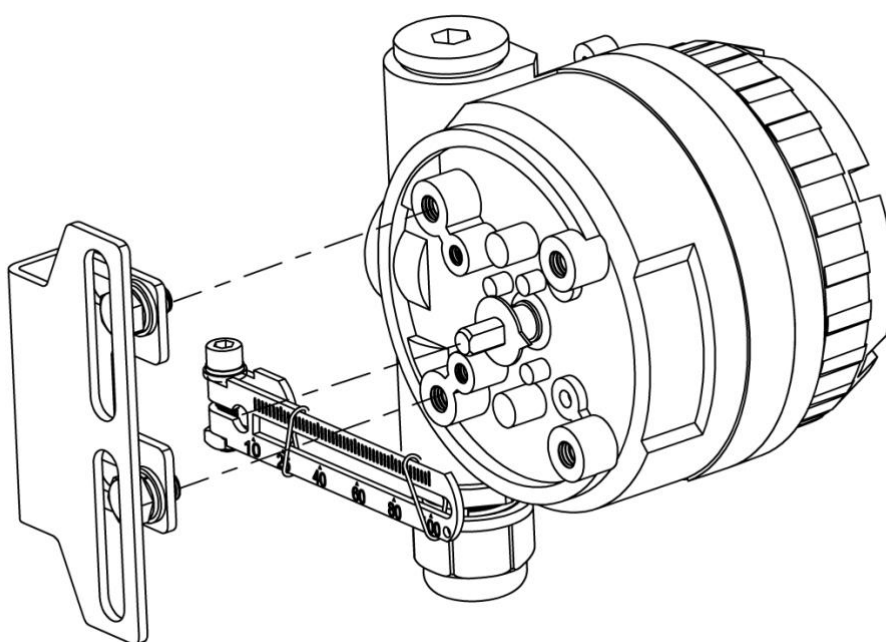


Figure 19. Feedback lever B and mounting bracket installation (remote type)

- Mount the feedback lever A or B ⑤ to the feedback axis on the rear of the positioner or the remote sensor.
 - Check whether the NUMAR lever stroke is within the operational range regarding to the arrow mark.
 - Fix the hexagon socket bolt⑥ with hexagon socket wrench.
 - Pre-fasten the mounting bracket⑦ to the positioner or the remote sensor with hexagon head bolts⑧, spring washer⑨ and flat washer⑩.
5. Fix linear mounting bracket to the actuator.

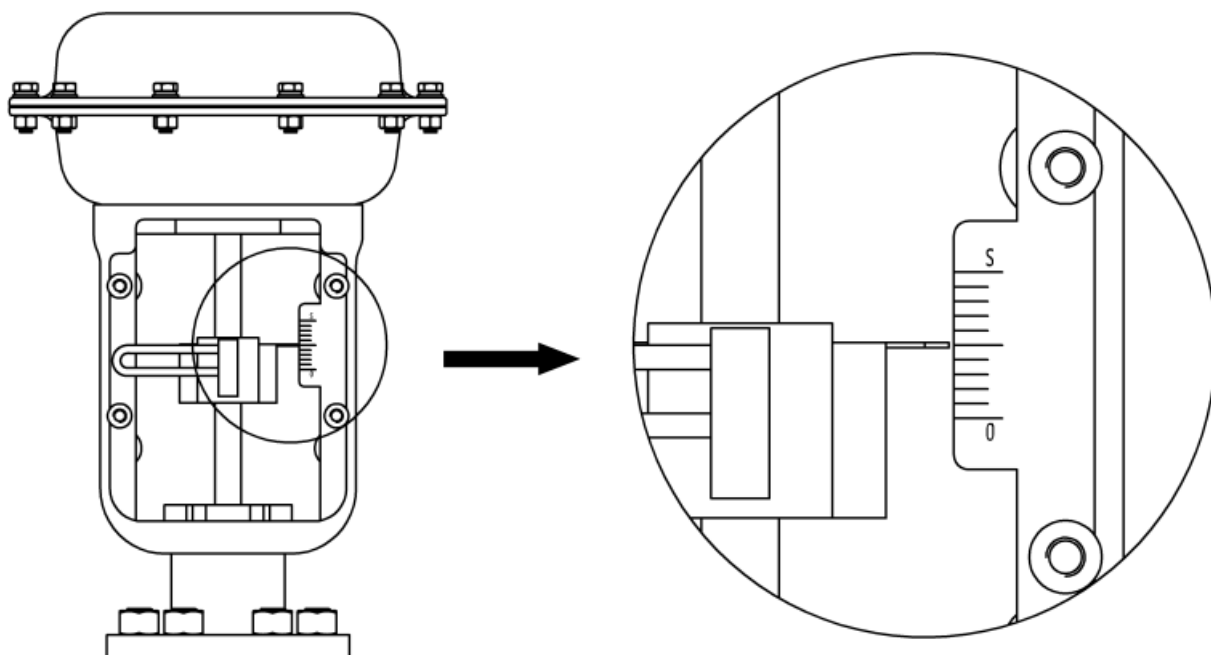


Figure 20. Valve mid-stroke point

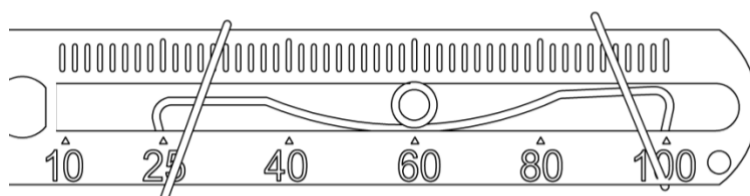


Figure 21. Feedback lever B and driving pin connection

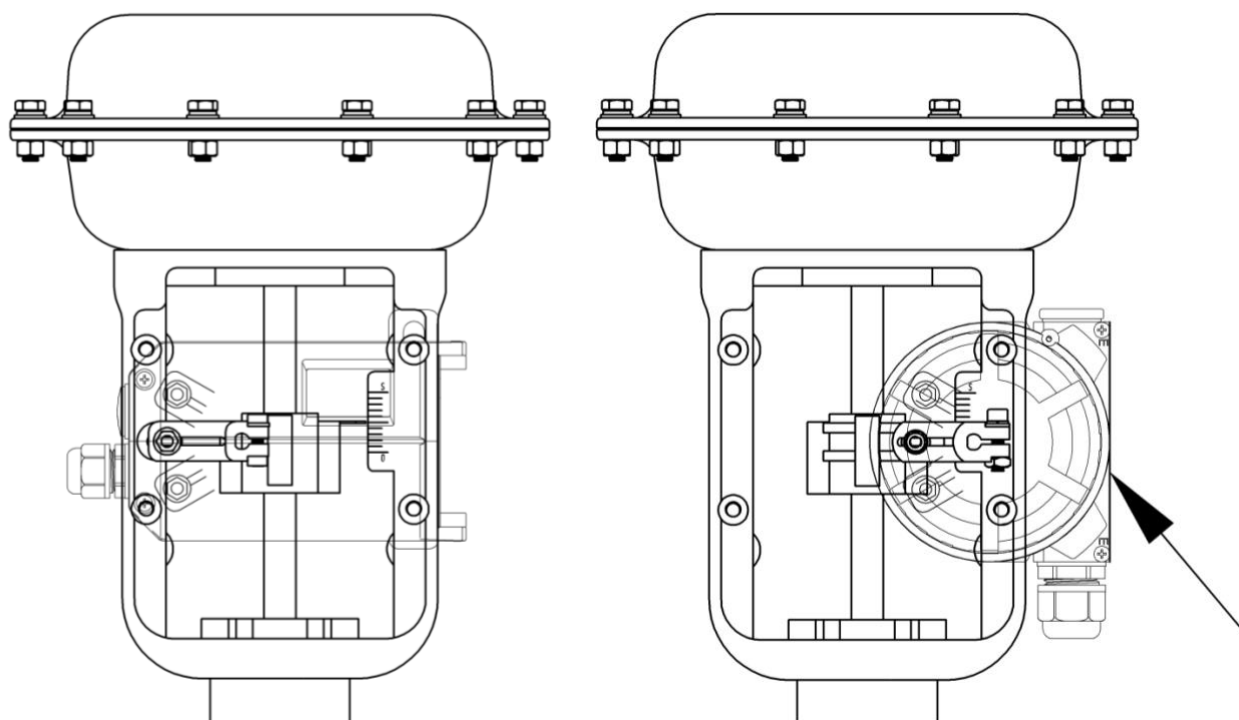


Figure 22. Installation with actuator (Feedback lever A)

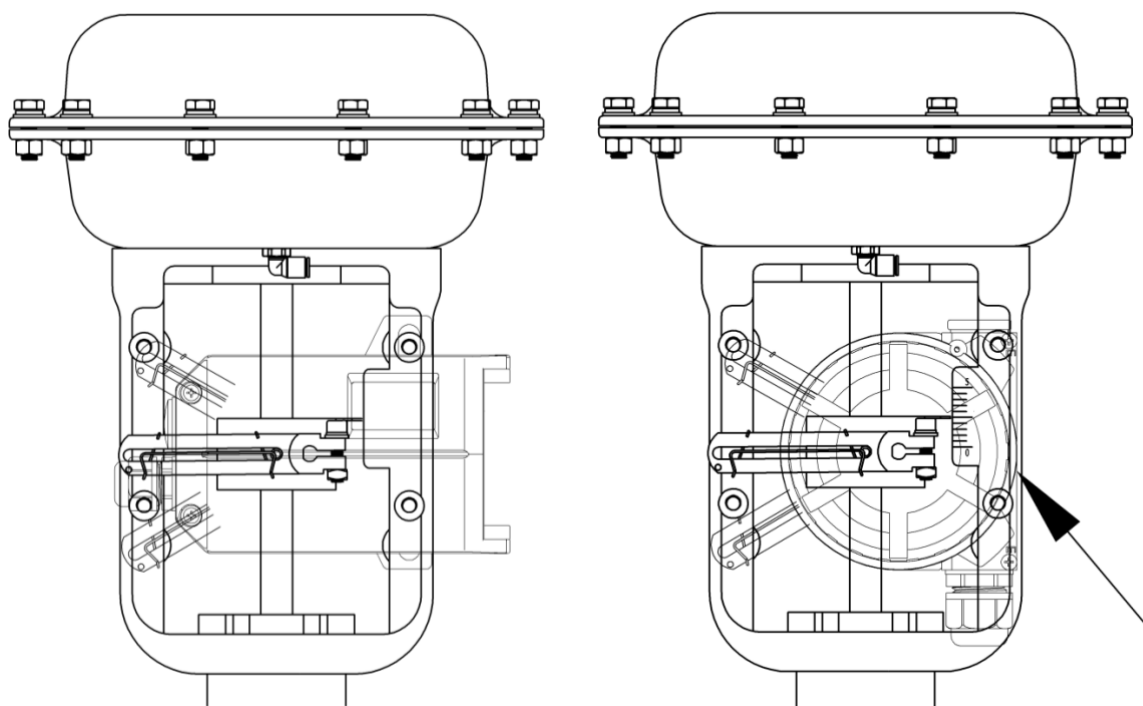


Figure 23. Installation with actuator (Feedback lever B)

- Input air to the valve cylinder, adjust the valve position to the mid-stroke point according to the stroke ruler on the valve, as shown in Figure 20.
- For feedback lever A, hold the linear stroke mounting bracket⑦ against the actuator. Plug the head of feedback lever⑤ into the U-shaped rod①. For feedback lever B, insert the driving pin⑪ into the fixed spring in the slot of the feedback lever B, as shown in Figure 21. Make the valve main stem and feedback lever are at right angle. If it cannot be at right angle, install according to the actual situation.
- The whole rotary angle is recommended to be between 40°~90°. User can adjust the distance (Angle rotation radius) between the driving pin and the rotation shaft of the positioner or the remote sensor to change the angle.
- For the positioner of normal linear type, make the upper plane of the positioner housing at a right angle to the main stem of the valve. For the positioner of remote linear type, make the plane indicated by the arrow (on the right side of Figure 22 and Figure 23) on the sensor housing and the main stem of the valve are parallel to each other. Otherwise it will affect the control accuracy. Finally, tighten the bracket with bolts.

6. Overall schematic diagram.

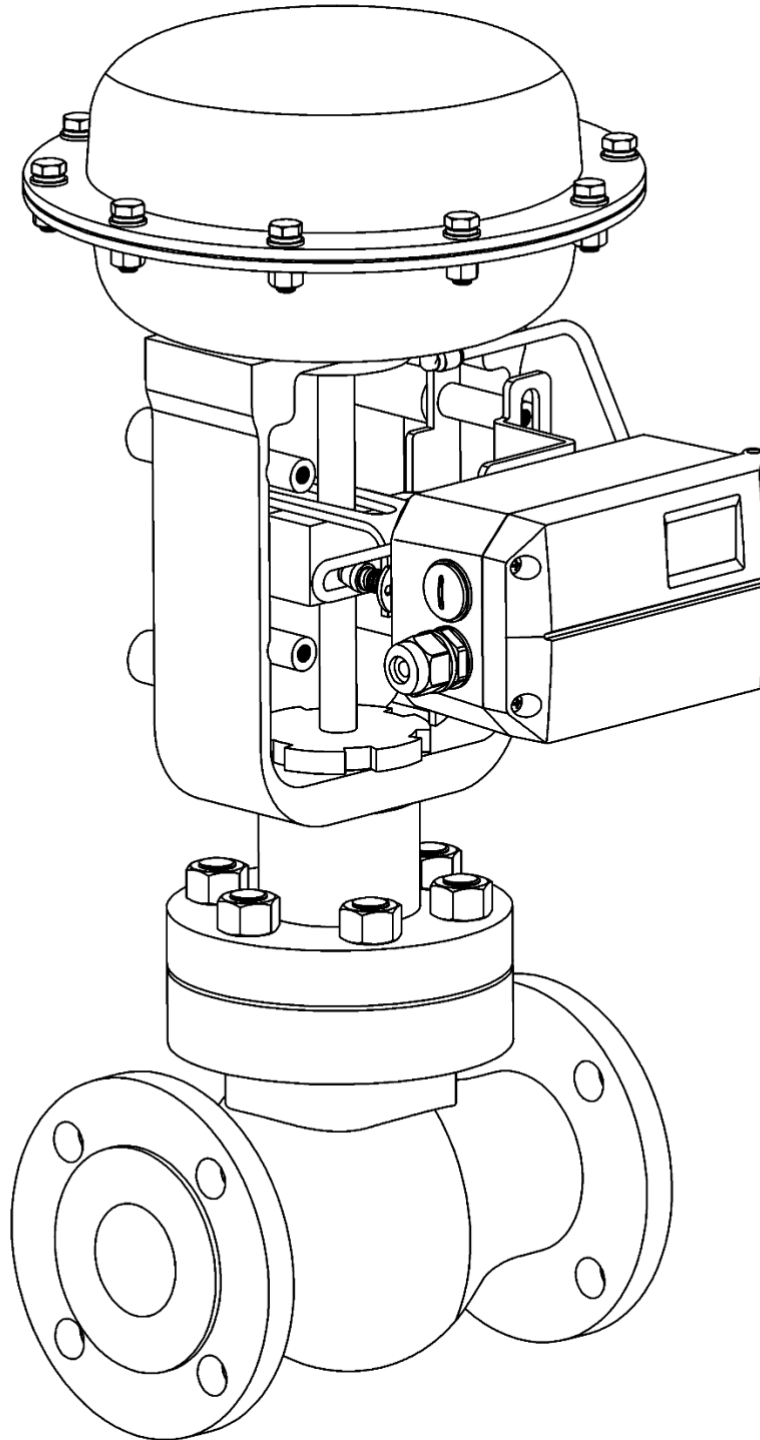


Figure 24. Linear stroke for normal type (Feedback lever A)

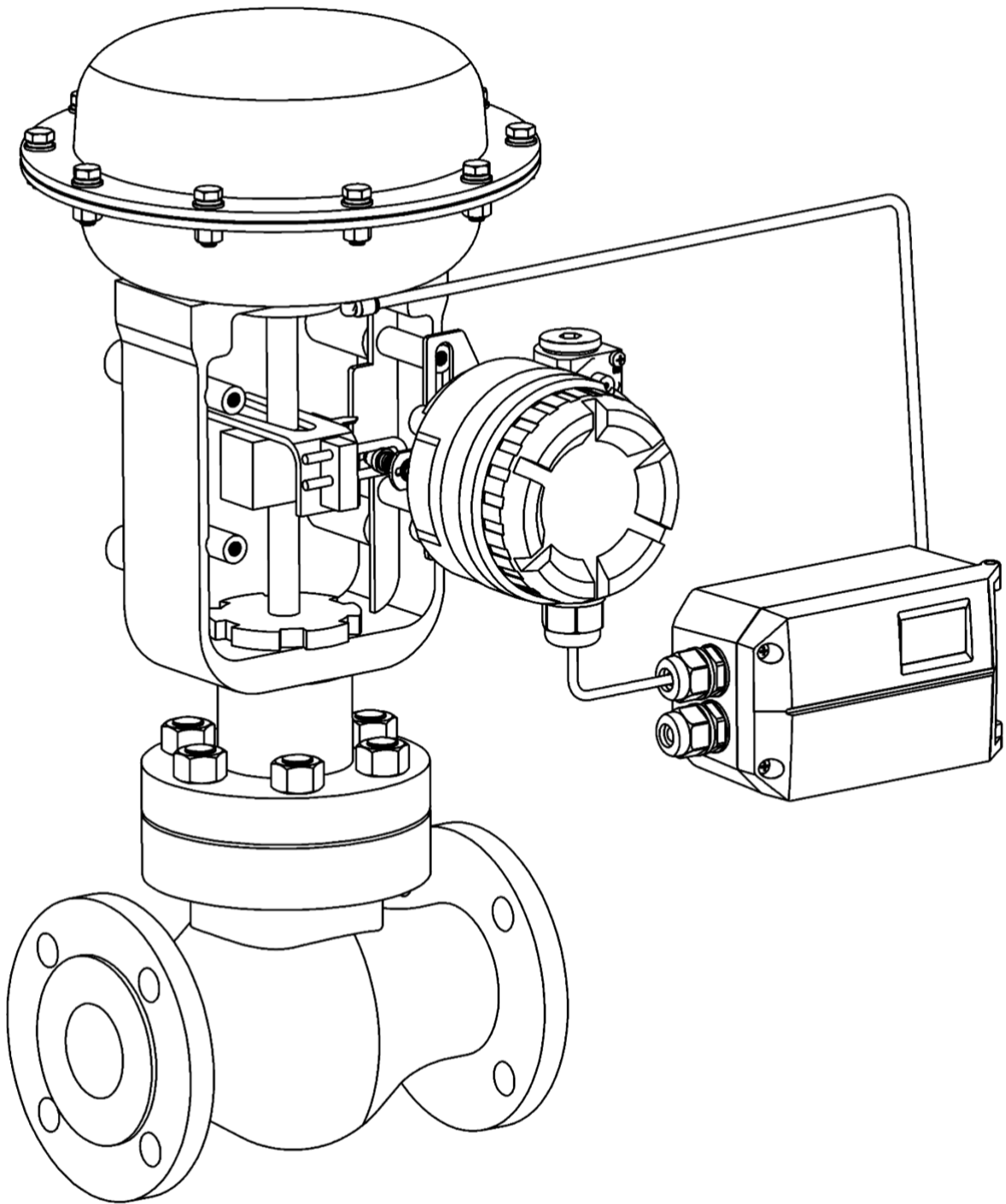


Figure 25. Linear stroke for remote type (Feedback lever A)

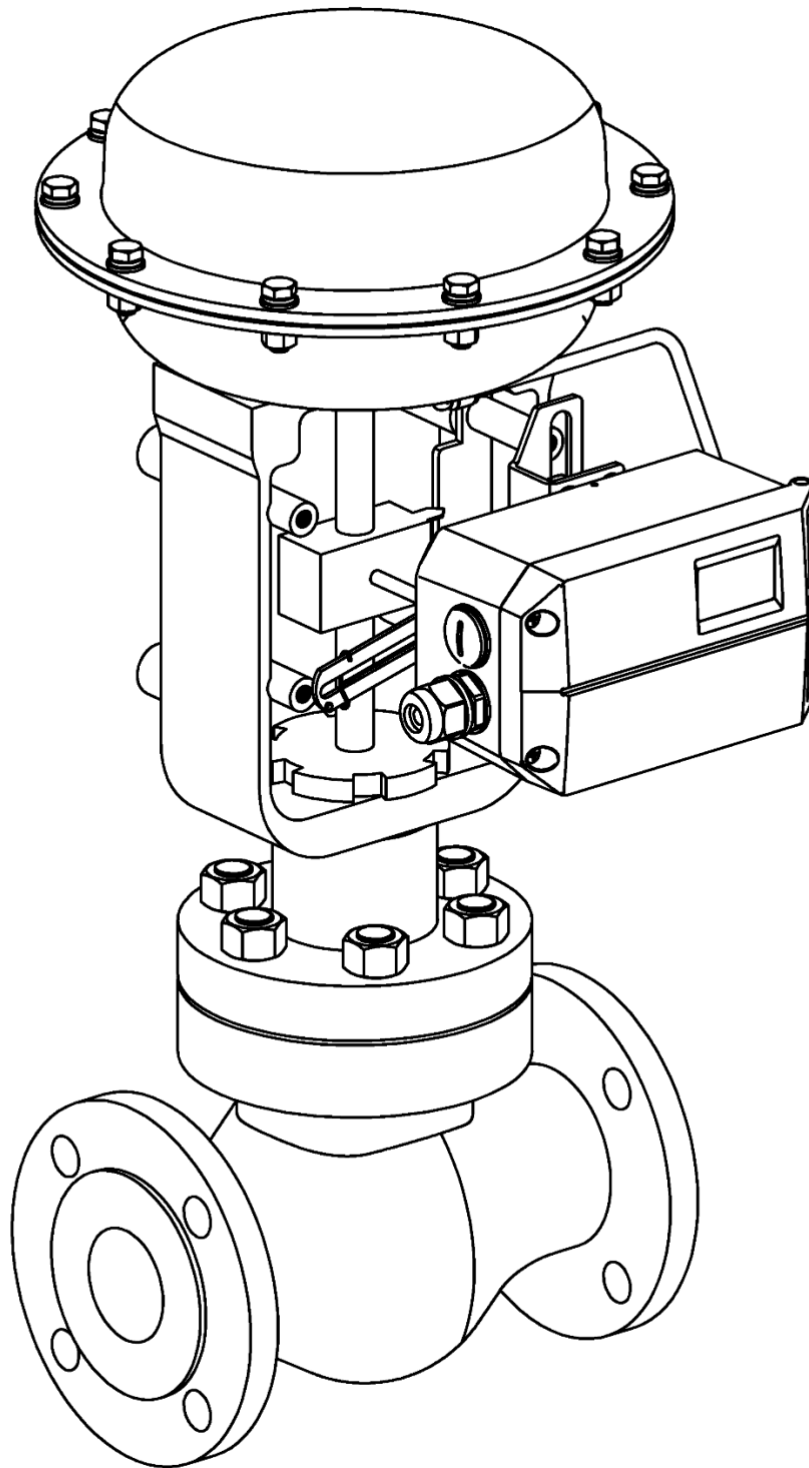


Figure 26. Linear stroke for normal type (Feedback lever B)

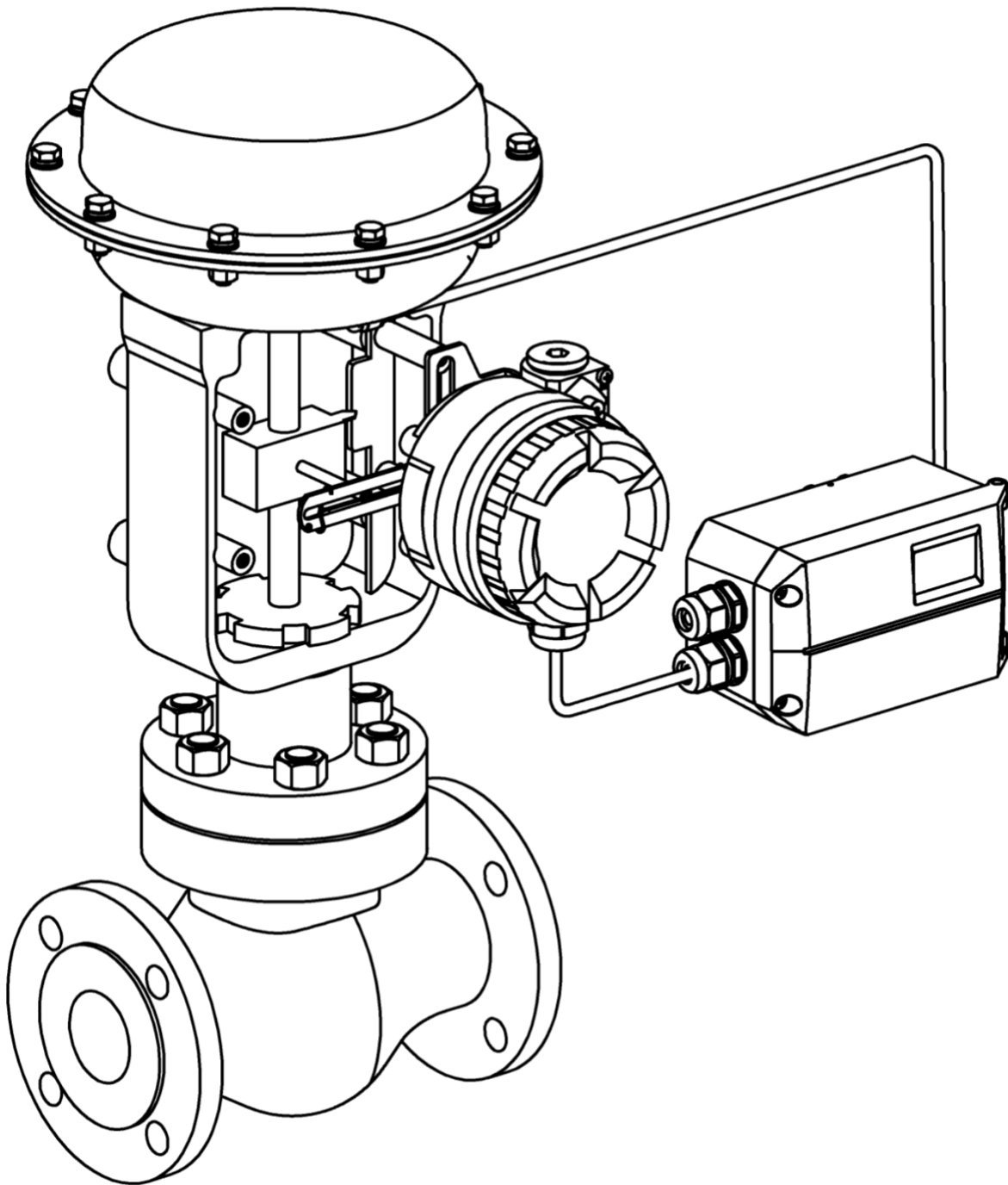


Figure 27. Linear stroke for remote type (Feedback lever B)

7.1.2. Installation of no piping connections

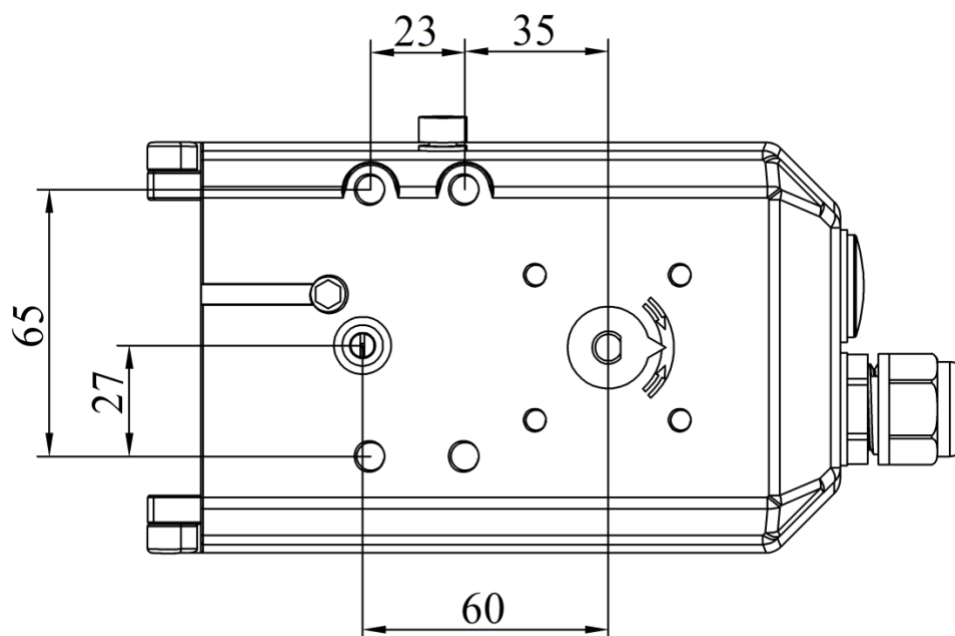


Figure 28. Relative position of no tubing connection holes and mounting holes

Refer to the installation of general piping connection, and pay attention to the following differences:

- Use a flathead screwdriver to remove the plug for no tubing connection on the back of the housing and block the air outlets OUT1 and OUT2 with a 1/4" plug. As shown in Figure 29.

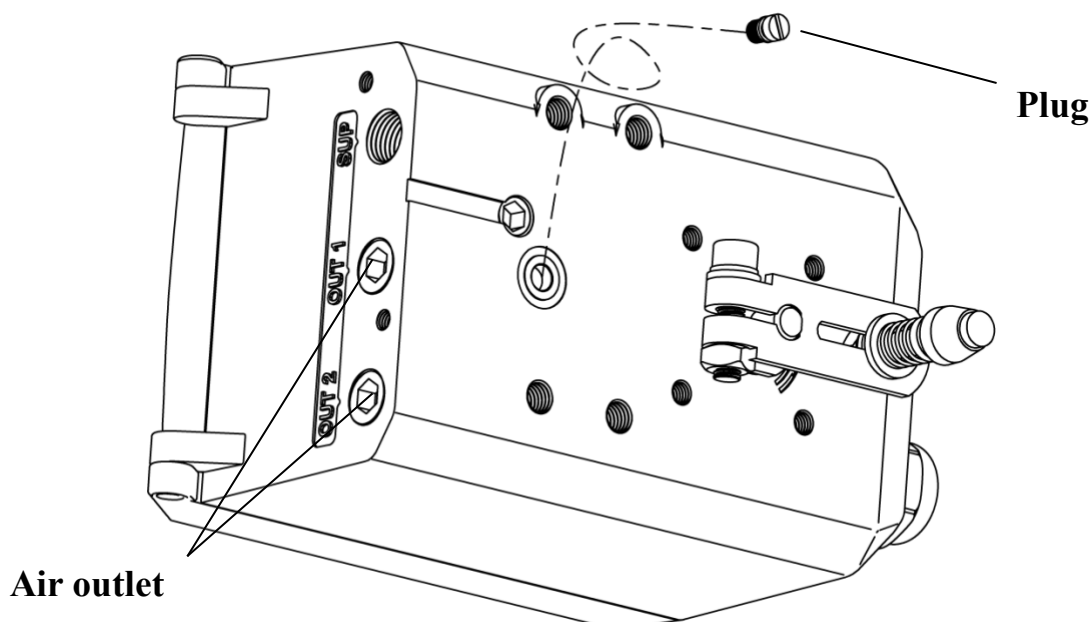


Figure 29. Schematic diagram of plug and air outlet

- No mounting bracket is required. Two M8 long screws are used to fix the positioner to the actuator without piping connections. Confirm that the sealing ring for no piping connection port is in good condition, and confirm that the feedback rod is correctly connected to the actuator

shaft.

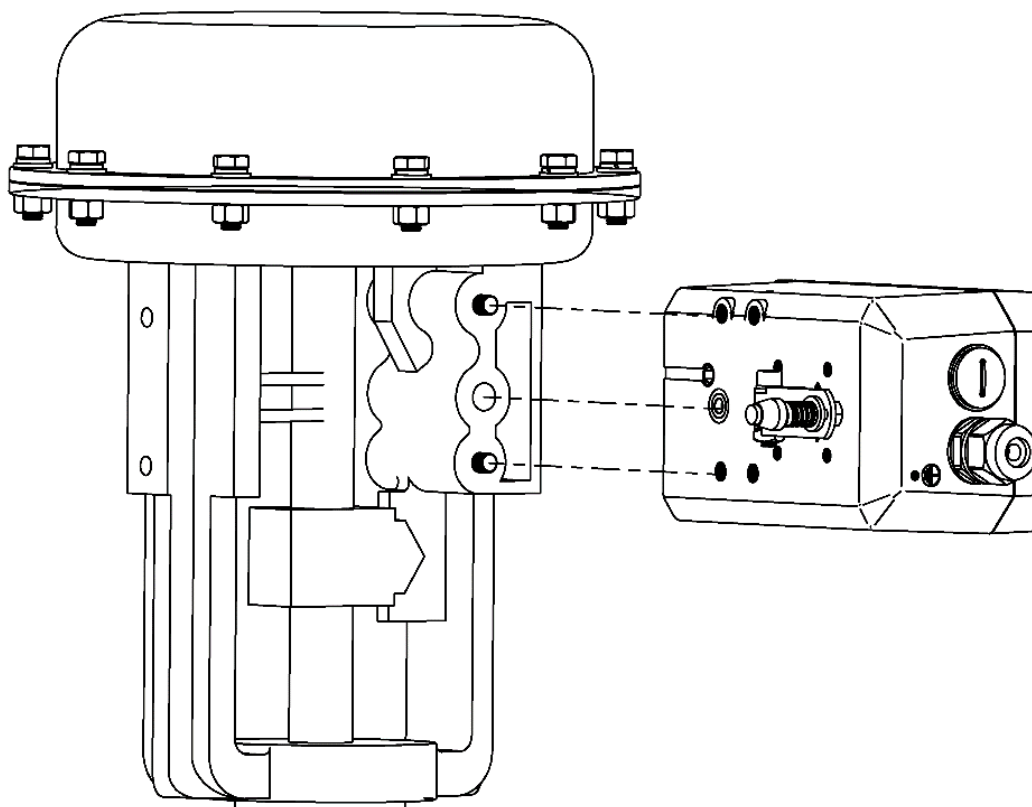


Figure 30. Mount to the actuator without piping connections

7.2. Rotary stroke (normal type or remote type)

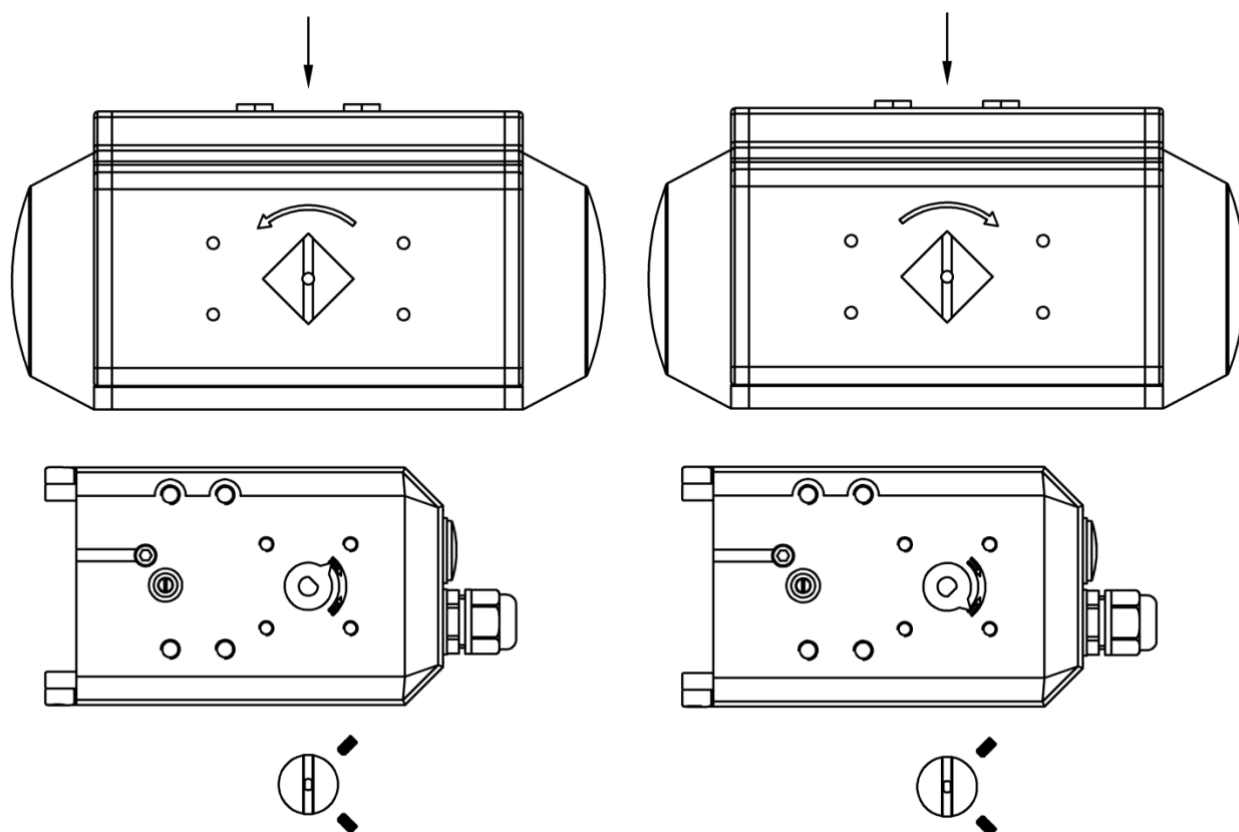
Rotary actuator mounting components			
No.	Name	Amount	Note
①	Adapter	1	Mounted on the positioner main stem.
②	Hexagon socket set screw	2	M4×8, fix adapter to the positioner main stem.
③	Rotary stroke mounting bracket	1	Compatible for actuators in different specifications.
④	M6 flat washer	4	Protect contact surface
⑤	M6 spring washer	4	Prevent screw loosening
⑥	M6 hexagon socket screw	4	M6×10
⑦	M5 hexagon socket screw	4	M5×8
⑧	M5 spring washer	4	Prevent screw loosening
⑨	M5 flat washer	4	Protect contact surface

Note before installation:

Please make the following preparations. In the installation steps, the first situation shown in Figure

31 is taken as an example. Figure 31 shows the slot direction and rotation direction of the actuator rotation axis at the initial position. ↓ indicates the position of the actuator pneumatic interface.

- Adjust the actuator rotation axis to the initial position. For single-acting actuators, exhaust the air from the actuator cylinder fully. For double-acting actuators, exhaust the air from one cylinder and fill the air into the other cylinder fully. Pay attention to the slot direction of the rotation axis at the initial position.
- Confirm the direction of rotation of the actuator axis. For single-acting actuators, fill air into the actuator cylinder at the initial position. For double-acting actuators, at the initial position, fill air into the cylinder which the air inside is fully exhausted, and exhaust air from the other cylinder which is filled with air. In this way, the direction of rotation of the rotating axis is judged.
- Rotate the pointer of the positioner feedback axis to the corresponding position shown in the following picture, and be sure to rotate the feedback axis within the range of the rotation mark.
- Place the adapter in the direction corresponding to the following picture.



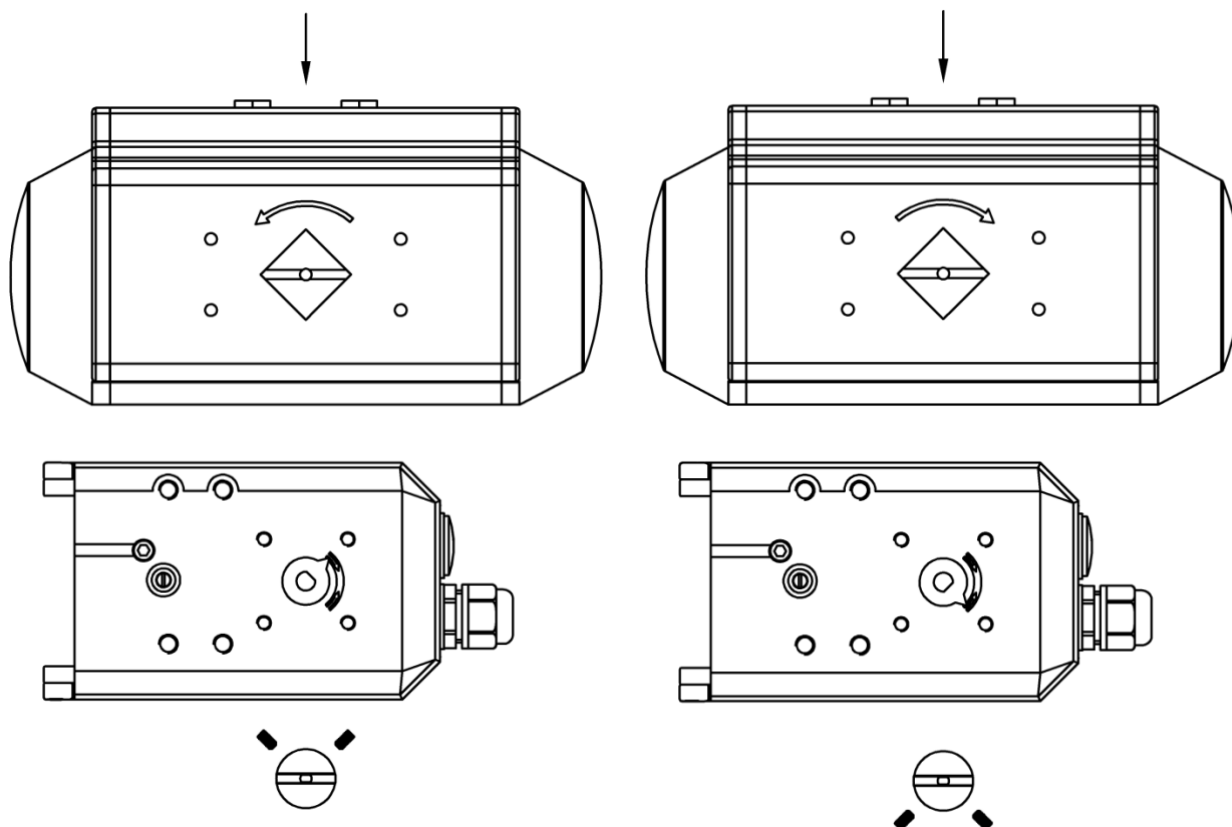


Figure 31. Four cases of installation matching

- Pay attention to the difference between the remote type and the normal type. For the installation of the remote type, please refer to the installation of the normal type.

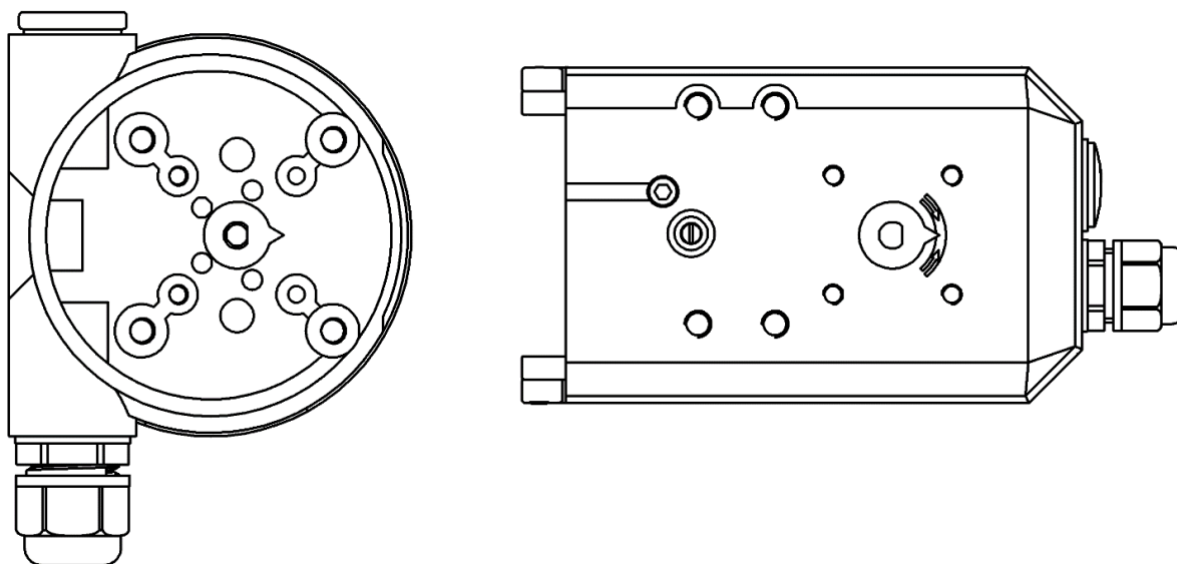


Figure 32. Comparison of the feedback axis pointers (remote type and normal type)

1. Confirm the initial position of the feedback axis of the positioner or the remote sensor (The operation is the same as the linear stroke installation in chapter 7.1).
2. Mount the adapter to the feedback axis of the positioner or the remote sensor.

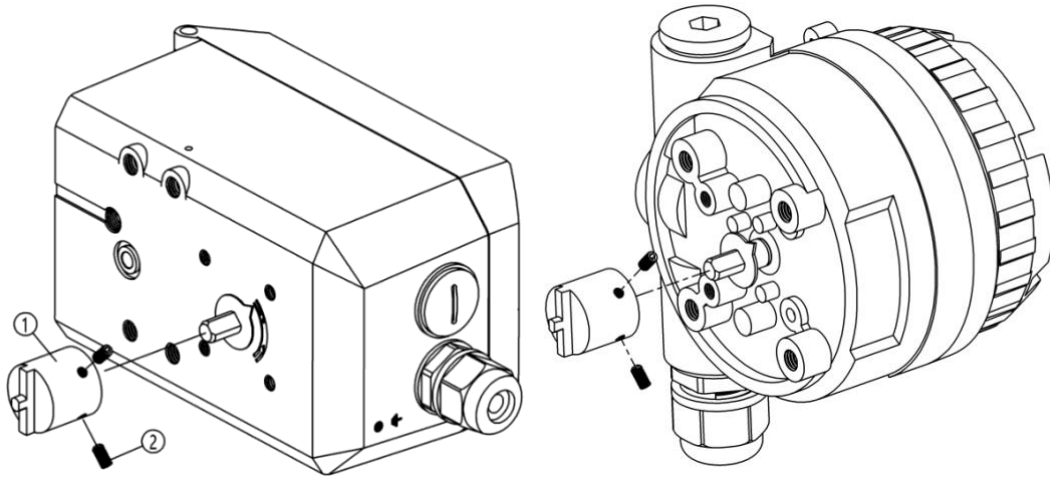


Figure 33. Adapter installation

Attach the adapter to the feedback axis in the direction in which it was prepared, and fix it with set screws②. Make sure one of the set screws is locked on the flat side of the feedback axis.

3. Mount rotary stroke mounting bracket to the bottom of the positioner.

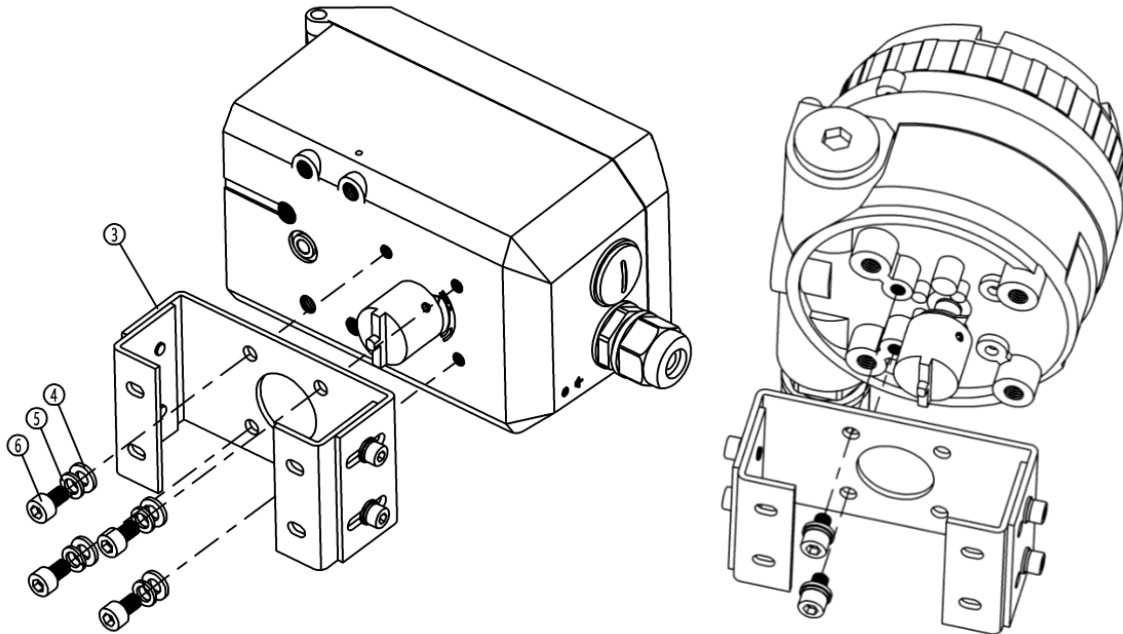


Figure 34. Rotary stroke mounting bracket installation

4. Mount the rotary stroke mounting bracket to the actuator.

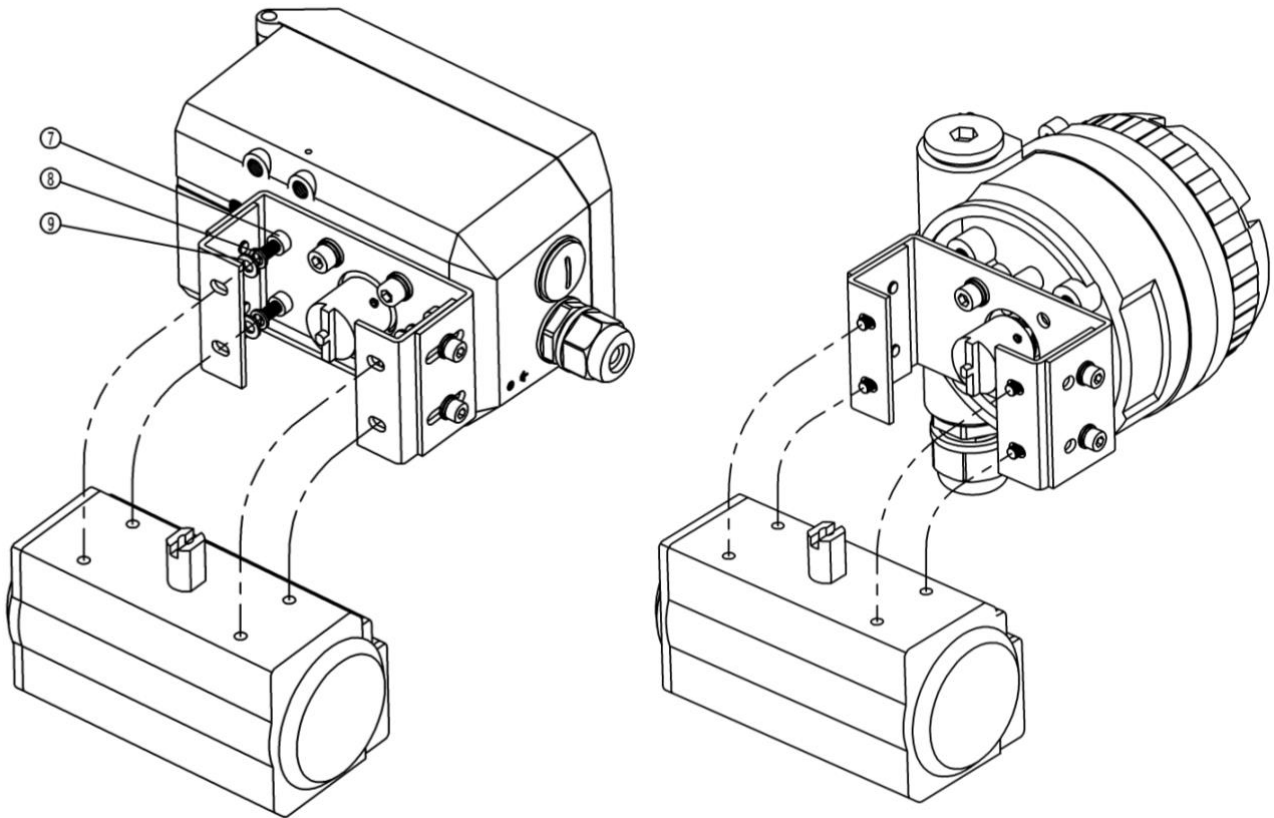


Figure 35. Installation with actuator

5. Overall schematic diagram.

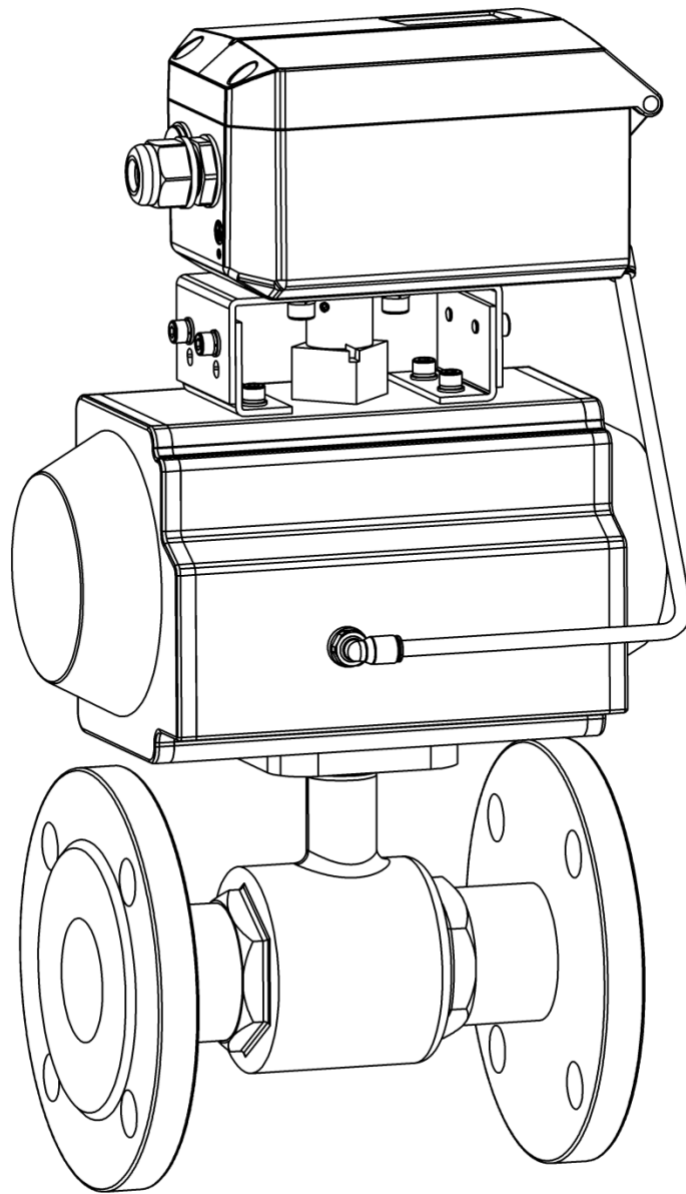


Figure 36. Rotary stroke for normal type

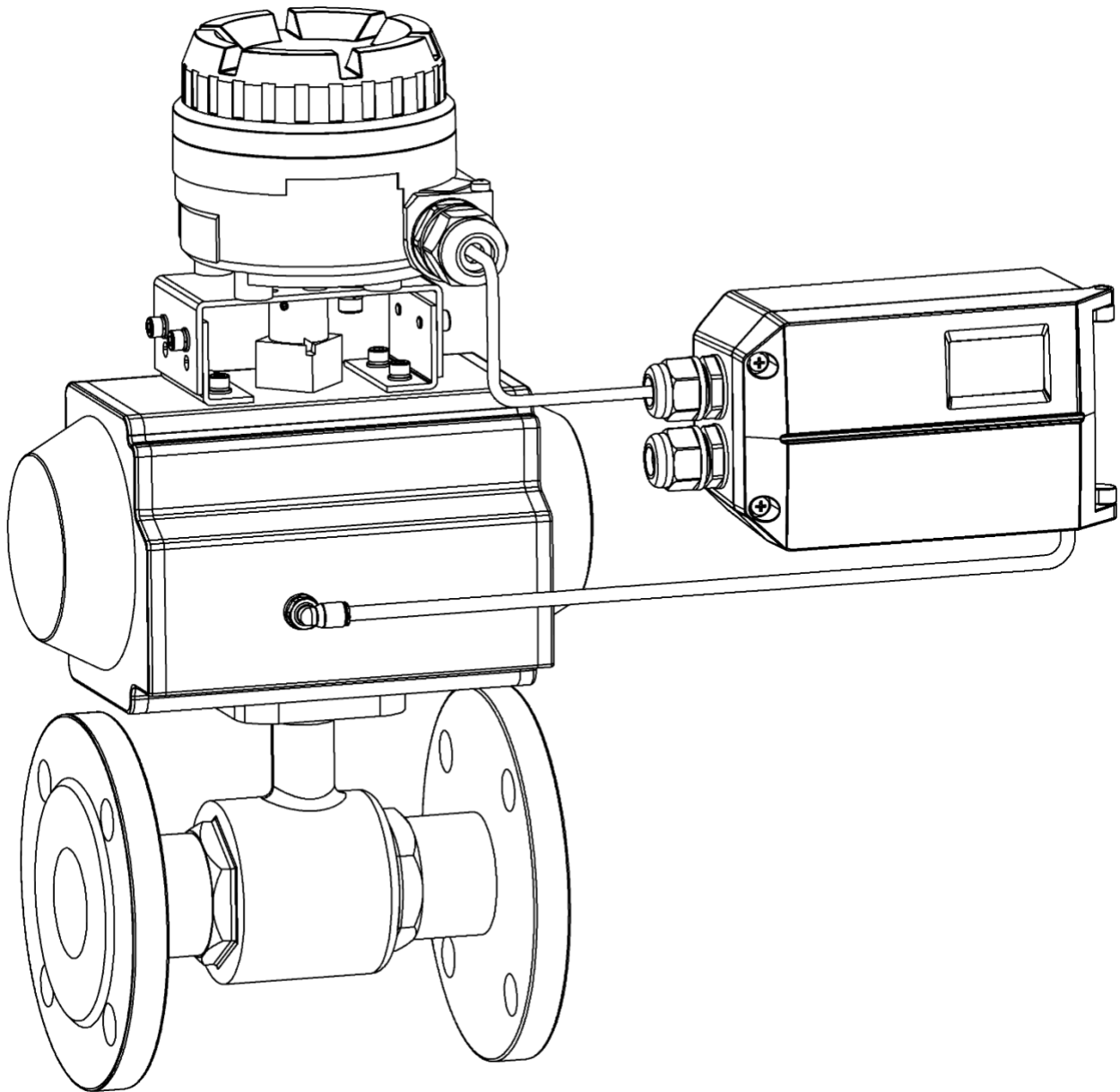


Figure 37. Rotary stroke for remote type

7.3. Separate type

Separate type mounting components			
No.	Name	Amount	Note
①	Sensor	1	Feedback the valve opening position
②	Mounting plate	1	Connect the positioner and the actuator
③	O-ring	2	$\Phi 20 \times 2$
④	Fastener	2	Fix the mounting plate, G1/4 Thread
⑤	M8 hexagon head bolts	4	M8×16
⑥	Sensor connector	1	Connect the sensor to the positioner

1. Assembly of the sensor and the actuator.

- Make sure that the stroke range and the screw thread size of the actuator which needs to combine meet the requirements.
- Separately measure the C1 value when the valve is fully closed and C2 value when the valve is fully open by **the depth ruler**. The values are the distance between the stem top and the datum clamp face of the actuator. As shown in Figure 38.

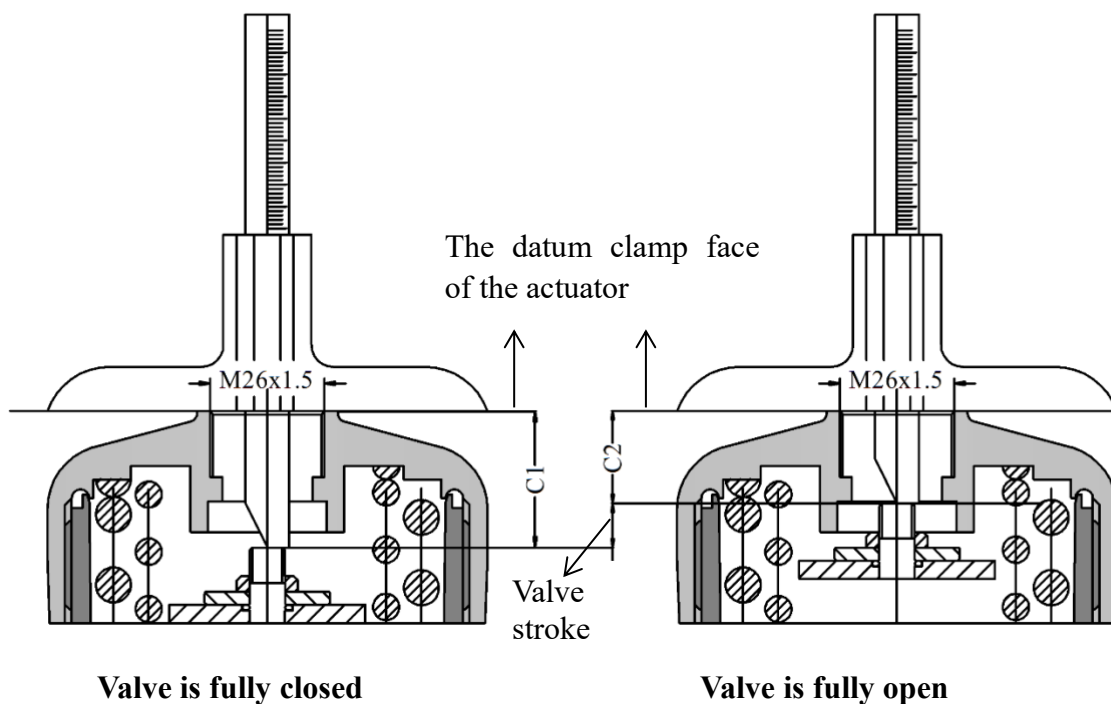


Figure 38. C1 value and C2 value measurement

- Adjust the adjusting nut of the displacement sensor. Then measure the D value (as shown in Figure 36) by **the depth ruler** in the state of the displacement sensor being completely loosened. Calculate the compression value $L1 = D - C1$, $L2 = D - C2$. It is recommended that the compression value L1 and L2 are both in the reference range which is showed in Table below. If L1 value or L2 value is unable to meet the reference range, adjust the D value according to the actual situation.

NOTE: The adjusted D value must ensure that $L1 > 0$, $L2 < \text{the maximum compression}$

value of the displacement sensor. Otherwise, the positioner cannot match the actuator.

Maximum valve stroke	D range	L1, L2 reference range
5~25 mm	45~51 mm	3~28 mm
25~50 mm	65~71 mm	3.5~53.5 mm

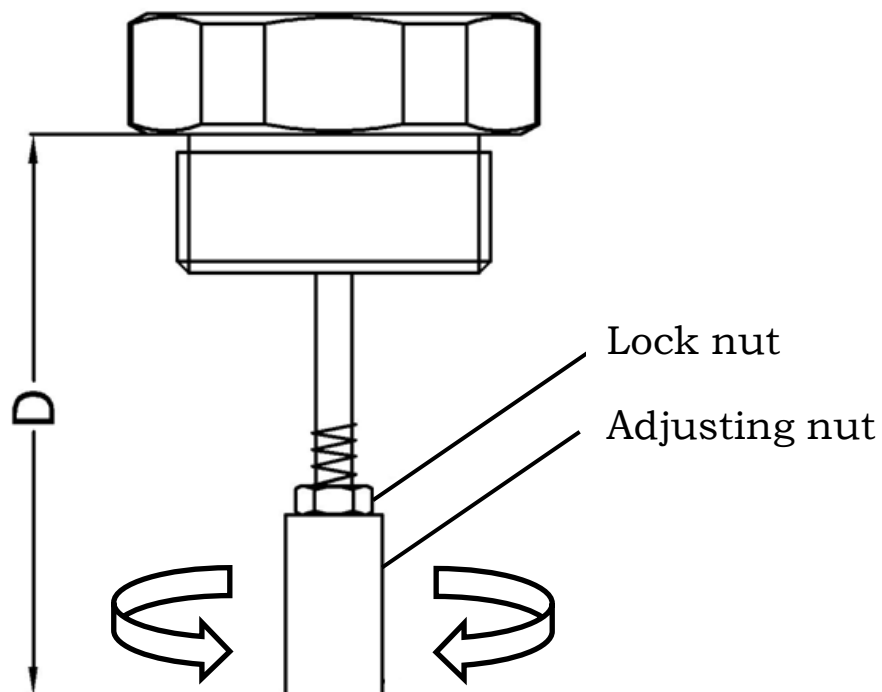


Figure 39. D value adjustment

- Raise the internal valve stem of the actuator to the highest position. Make the actuator connection of the sensor entering into the thread connection of the actuator by **NO.32 wrench**.

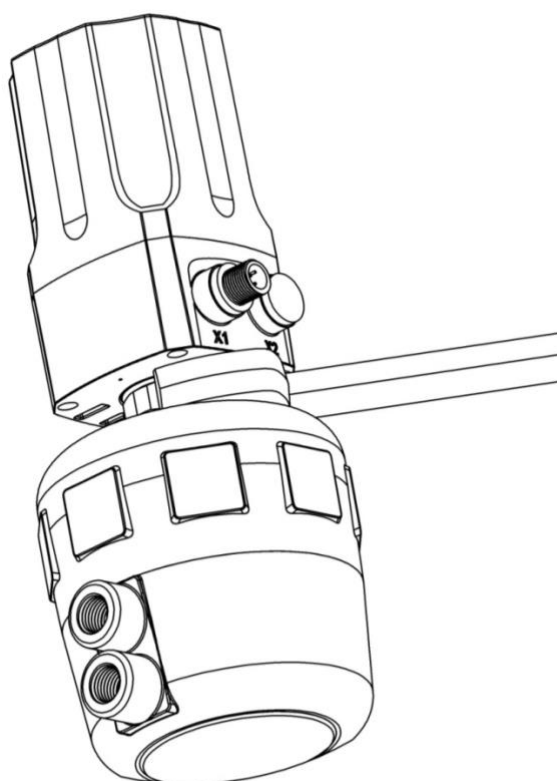
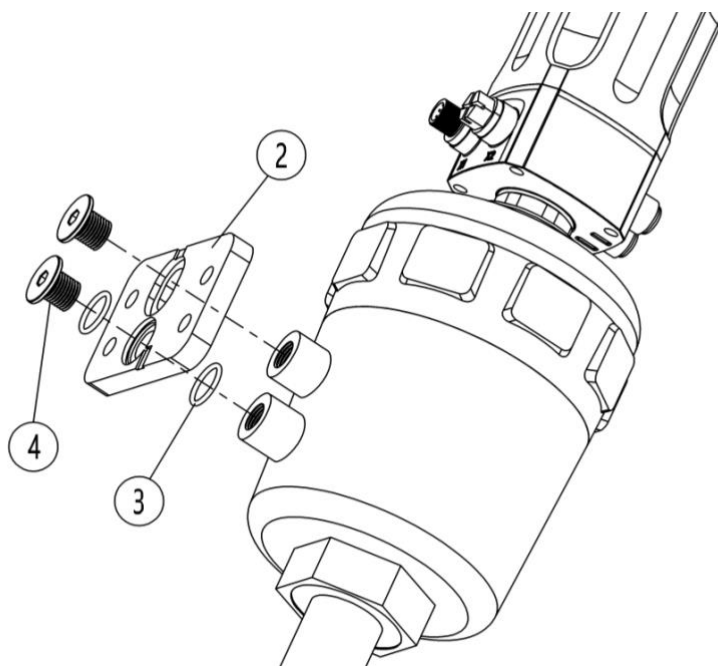


Figure 40. Sensor installation

2. Fix the mounting plate.

**Figure 41. Fix the mounting plate**

Put the O-ring③ into the corresponding sealing groove of the mounting plate②, fix the mounting plate② to the corresponding position of the actuator with the fastener④, and tighten it with an Allen wrench. (The contact surface between the O-ring and the actuator should be smooth and flat and it can completely cover the O-ring. The thread specification of the fastener ④ is G1/4, and the corresponding thread specification on the actuator is also G1/4 to install.)

3. Fix the positioner on the mounting plate.

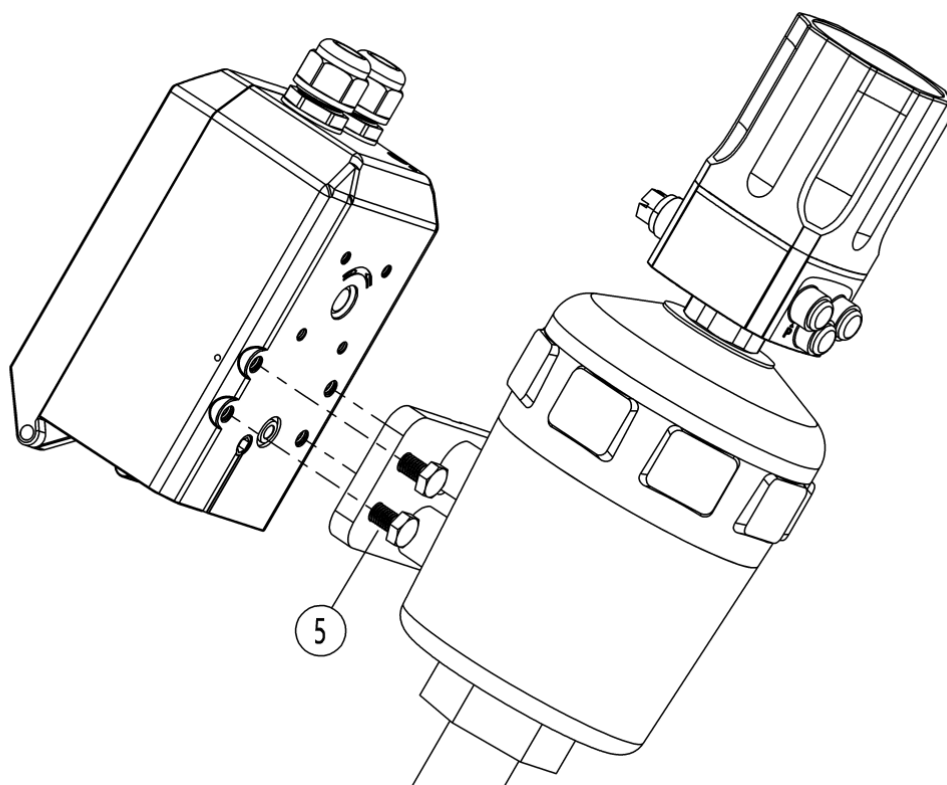


Figure 42. Fix the positioner

Fix the positioner on the mounting plate with hexagon head bolts⑤ and tighten with a wrench.

4. Connect the sensor.

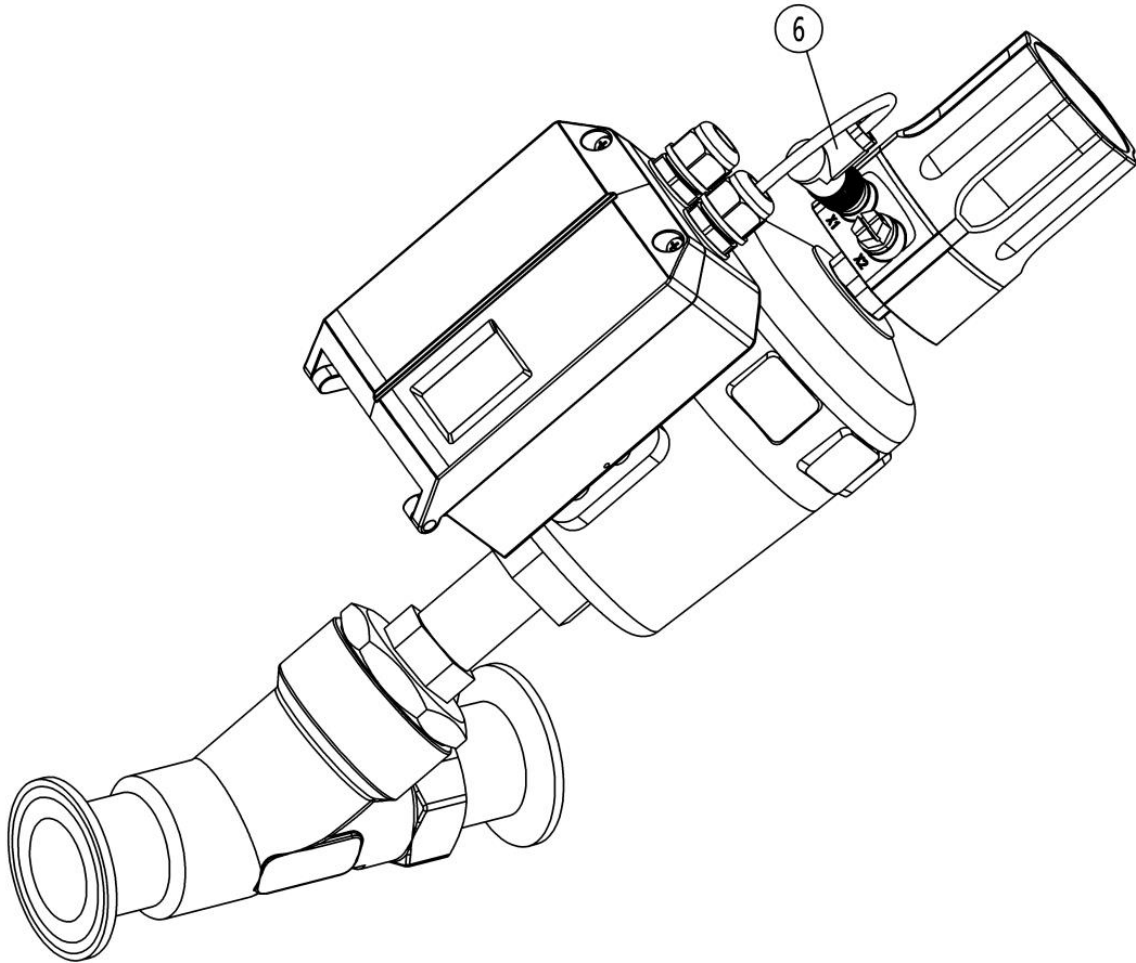


Figure 43. Connect the sensor

Insert the sensor connector⑥ into the corresponding position of the sensor and tighten. (Note: When installing, pay attention to insert the sensor connector into the corresponding limit position in the following figure and tighten it to prevent the sensor connector from being damaged)

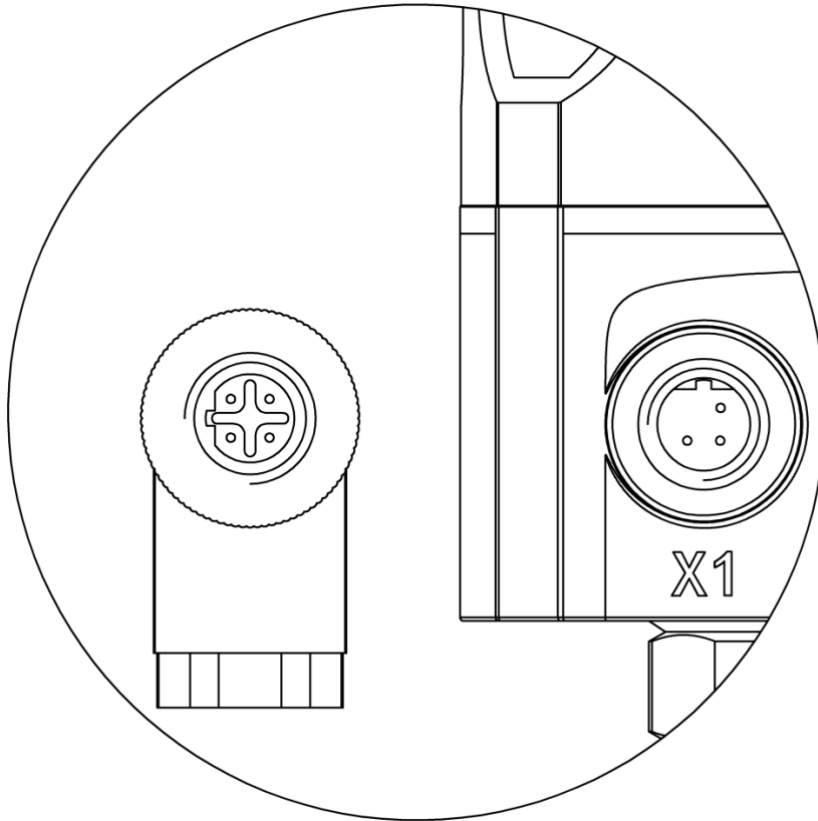


Figure 44. Sensor connector

7.4. Position feedback module

If it is required, feedback module is available when user selects. Feedback module is shown in Figure 45.

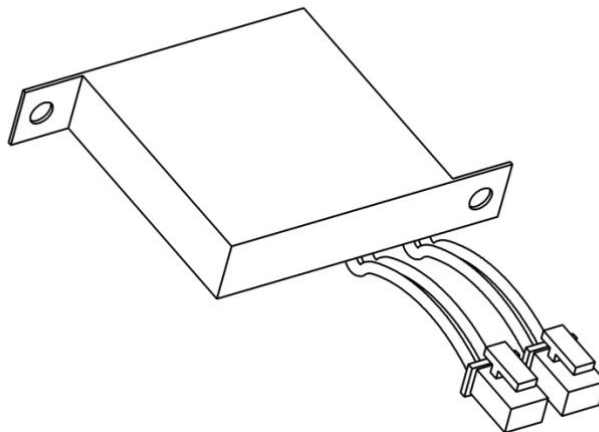


Figure 45. Feedback module

Installation of feedback module:

- Open the outer cover and take off the circuit board protective cover.

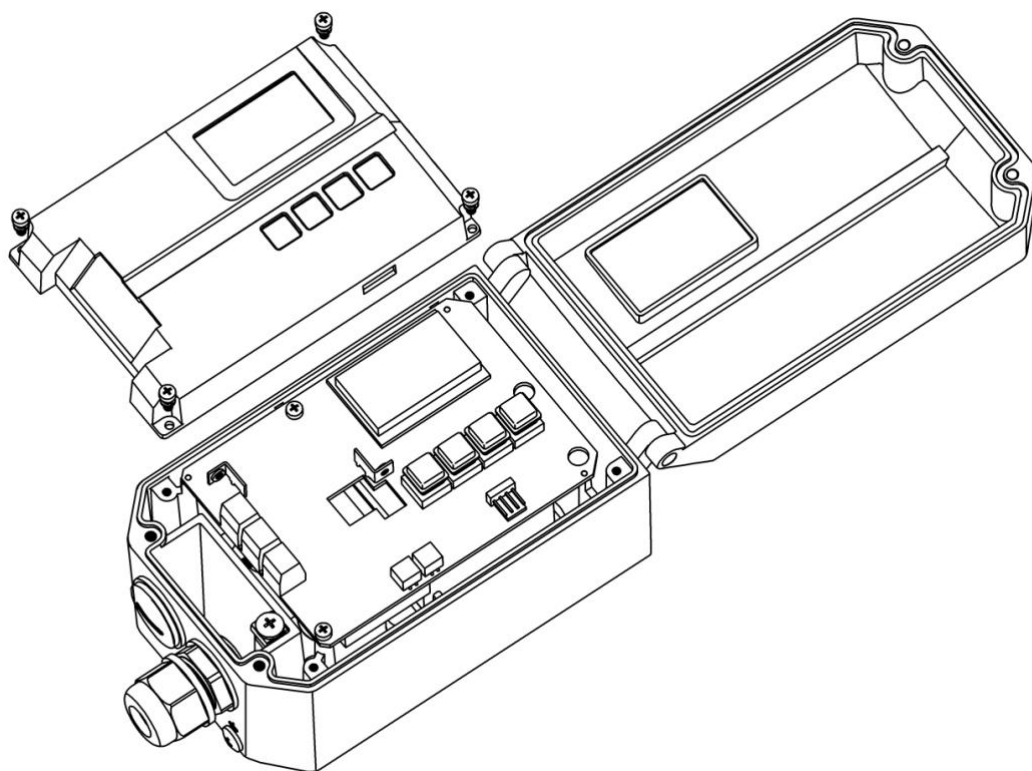


Figure 46. Remove the circuit board protective cover

- Install the feedback module according to the position as shown below, and connect electrical connectors of the module with the connectors on the circuit board according to the corresponding colors, fix the feedback module with M3 spring washer and M3 pan head screw, and finally install the circuit board protective cover.

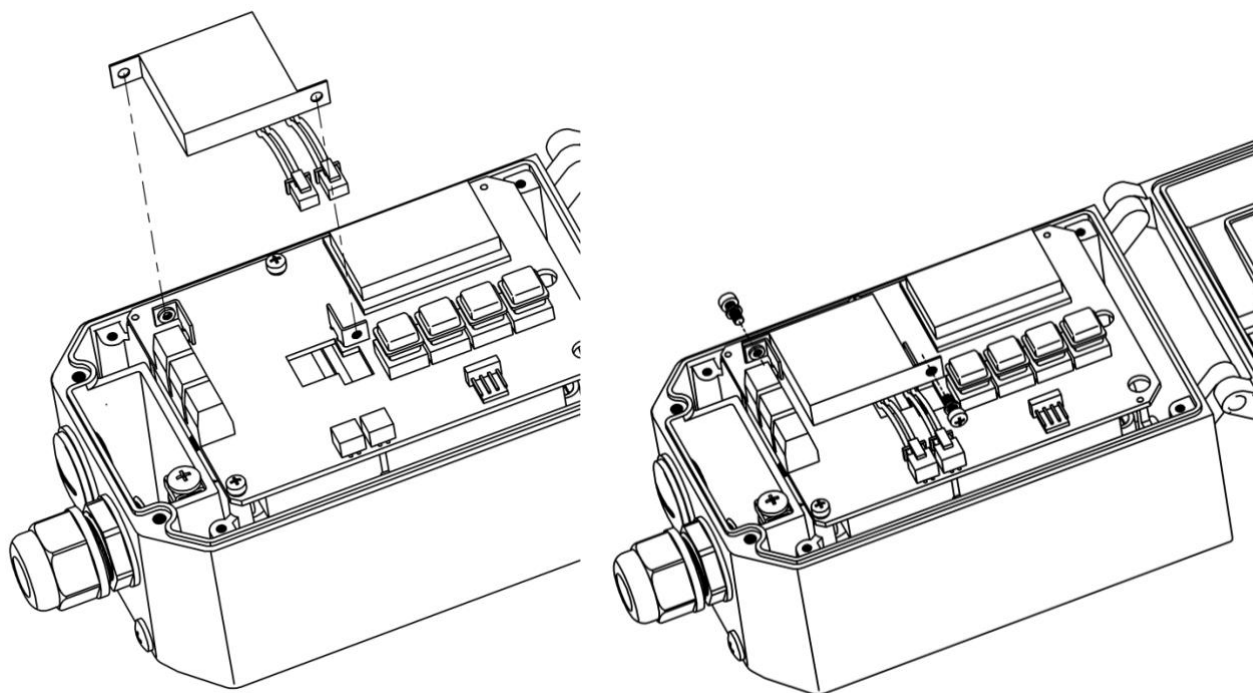


Figure 47. Feedback module installation

NOTE: Must install or remove the circuit board protective cover when the device is powered off.

8. Operation

8.1. Interface description

User's operating interface includes one LCD screen and 4 buttons.

LCD display description

Position	Description
Top line	● Display the percentage value of angle sensor in the initial interface (NOINI) or when running the initialization function. ● Display valve position percentage value in operating mode. ● Display parameter values in menu mode.
Bottom line	● Display indication signs in uninitialized state. ● Display automatic or manual mode in operating mode. ● Display setpoint percentage value in operating mode. ● Display function options in menu mode. ● Display initialization step and error sign in initialization process.

Button operation description

Button	Description
	● Enter the system menu. ● Switch automatic and manual mode in operating mode. ● Exit from the system menu to main interface ● Exit from submenu to previous menu.
	● Open or close valve in the initial interface (NOINI). ● Decrease the valve position value in manual mode. If press and hold this button first, then press and hold  button, the valve position value will be reduced quickly. ● Select function options or parameters down and decrease parameter values in menu mode.
	● Open or close valve in the initial interface (NOINI). ● Increase the valve position value in manual mode. If press and hold this button first, then press and hold  button, the valve position value will be increased quickly. ● Select function options or parameters up and increase parameter values in menu mode.
	● Enter submenu, enable or confirm parameter modification in menu mode. ● Run initialization or reset to factory settings. ● Run initialization in initial interface (NOINI) or in operating mode.

8.2. Display and operation of main interface

Positioner is in the uninitialized state before initialization. When LCD displays the sign **NOINI**, interface displays percentage value of sensor in the top line. As shown in Figure 48.



Figure 48. Uninitialized state interface

In this state, pressing   buttons can open and close valve. Open and close valve fully, and observe the percentage value of sensor displayed on the interface. For non-separate type, ensure that within the entire valve stroke range, the minimum sensor percentage value $\geq 2\%$, and the maximum sensor percentage value $\leq 98\%$. Otherwise, it is necessary to re-adjust the installation position to make the linear stroke feedback lever or the angle stroke adapter move within the effective range. For separate type, ensure that within the valve stroke range of 5-25mm, the minimum sensor percentage value $\geq 12\%$, and the maximum sensor percentage value $\leq 92\%$; within the valve stroke range of 25-50mm, the minimum sensor percentage value $\geq 2\%$, and the maximum sensor percentage value $\leq 97\%$. Otherwise, the D value of the sensor needs to be adjusted. In addition, the minimum and maximum percentage difference of the sensor is required to be greater than 16% (non-separate type) or 8% (separate type).

If you want to take a shortcut of running automatic initialization (INITA), press and hold  button for approx. 3s to run it in the initial interface (NOINI) or in the operating mode. In the initialization process, pressing  button will exit. After exiting, if the initialization is completed before, system enters manual mode interface. Otherwise, system enters initial interface (NOINI). After the initialization is completed, press  button to exit. After exiting, the system enters the manual mode interface.

Operating mode includes automatic mode and manual mode.

In automatic mode, system adjusts the valve position automatically by collecting the external 4-20mA input signal.

In manual mode, valve position can be adjusted by pressing   buttons manually.

In the main interface, the top line shows the valve position percentage value, and the bottom line shows the set-point percentage value. The last digit of the set-point percentage value is one decimal place. Sign **A** means automatic mode and sign **M** means manual mode. They can be switched by pressing  button. If the release time after pressing the  button is less than the operation time of entering the menu, operating mode can be switched. Otherwise, it will enter the menu. As shown in Figure 49.

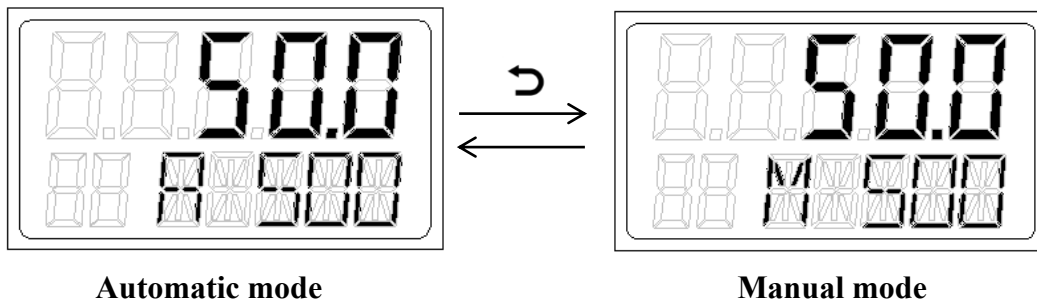


Figure 49. Operating mode interface

PST (partial stroke test) function can be executed in the automatic mode. Press and hold  button for approx. 3s to switch to the PST operation interface. Press  button to exit to the automatic mode interface. In the PST operation interface, if the PST function is not enabled, the first line of the interface will display **oFF**. If the PST function is enabled, when the absolute difference between the valve position and the starting position is within the tolerance range of the starting position and the PST parameter configuration is correct, Press and hold  button for approx. 3s to execute the PST function. The actuator moves from the starting position to the upper or lower limit of the target position according to the PST parameters. If the PST function is successfully executed, the interface will be display **SUCS**. If the PST function fails to execute, the interface will display **FAIL**. When executing PST function, the execution can be interrupted by pressing  button. If the PST function does not meet the execution conditions, the following error code will be displayed.

Error code	Description
Err 1	The absolute difference between the valve position and the starting position is not within the tolerance range of the starting position.
Err 2	PST parameter configuration error. The upper limit of the target position must be $\leq 99\%$, and the lower limit of the target position must be $\geq 1\%$.

8.3. Menu and functions

8.3.1. Display and operation of menu

Press and hold  button for approx. 3s to enter the menu. The menu interface will display as Figure 50. Press  button, it will exit from menu interface to manual mode interface. The positioner with HART function cannot modify parameters or perform initialization operation through HART communication in the menu interface.

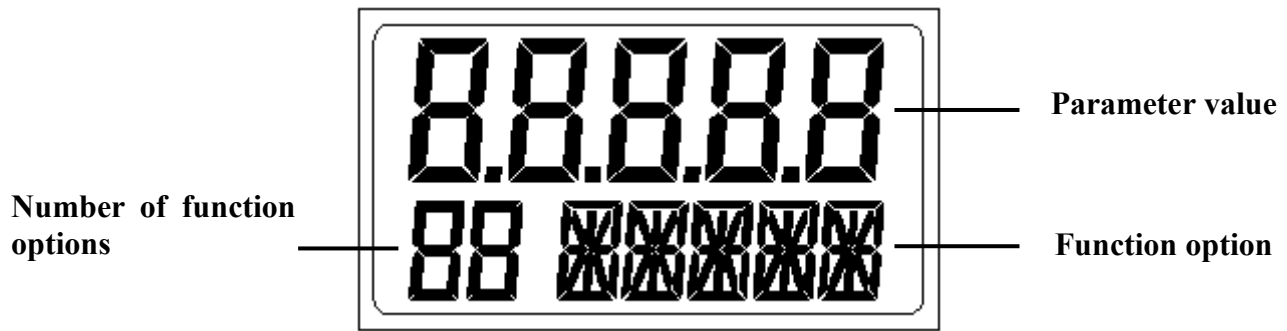


Figure 50. Menu interface

8.3.2. Functions description and operation

8.3.2.1. TYPE

TYPE is for setting the actuator type.

Options for setting parameter

Option	Description
Lin	Linear actuator with feedback lever A installed.
Turn	Rotary actuator.
FLin	Linear actuator with feedback lever B installed.
ELin1	Separate type actuator. Stroke range: 5-25mm.
ELin2	Separate type actuator. Stroke range: 25-50mm.

Select this function in the menu interface, press  button to start setting parameters, and the parameter will flash. Press   buttons to set parameter and press  button to confirm.

8.3.2.2. INITA

The function is auto initialization. It will automatically detect action direction, actual physical stroke of valve and control parameters.

Select this function in the menu interface, press and hold  button for approx. 3s to run, a scroll sign will appear in the lower left corner of LCD. Top line shows the percentage value of sensor and the step is showed in the bottom line. Sign **FINSH** will display on LCD after the auto initialization is completed.

For some reasons, the system will display an error message in the function option line during the auto initialization process and the auto initialization will be interrupted. Descriptions of error messages and solutions are showed in chapter 8.3.3.

8.3.2.3. INITM

The function is manual initialization. It is suitable for the user to confirm the valve stroke manually. The function requires the user to calibrate the valve stroke manually. Then it will automatically

detect action direction and control parameters. The operation flow is as follows:

- 1) Select this function in the menu interface, press and hold  button for approx. 3s to run, a scroll sign will appear in the lower left corner of LCD. Top line shows the percentage value of sensor and bottom line shows **END 1**.
- 2) When LCD displays **END 1**, press  buttons to let the valve position move to the endpoint 1 of the manual calibrating stroke, and press  button to confirm, then LCD will display **END 2**. Next, press  buttons again to let the valve position move to the endpoint 2 of the manual calibrating stroke, and press  button to confirm.
- 3) If there isn't error message after confirmation of **END 2**, the system will run the step 1 of initialization automatically and skip step 2 for stroke detection.

LCD will display **FINSH** when manual initialization is completed.

For some reasons, the system will display an error message in the function option line during the manual initialization process and the manual initialization will be interrupted. Descriptions of error messages and solutions are showed in chapter 8.3.3.

8.3.2.4. CAL

CAL is for calibrating 4-20mA input signal. When there is a big deviation between the set point value and the output value of the signal source, it can be calibrated by this function.

Sub-function options **4mA** and **20mA** are used for calibrating minimum and maximum value of 4-20mA input signal separately.

Select this function in the menu interface, press  button to enter sub-function selection operation, and press  buttons to select **4mA** or **20mA**, press  button to start parameter setting, AD value of actual input signal flashes on LCD (Quantify the set signal numerically, ranging from 0 to 4095). For option **4mA**, set the front-end input signal to 4mA signal; for option **20mA**, set the front-end input signal to 20mA signal. For example, when the front-end input signal is 4mA, value 650 will flash on LCD. After the AD value on LCD is stable, press  button to confirm it. The system will record current AD value (650) and it will be displayed on LCD. When the front-end input signal is 20mA, value 3270 will flash on LCD. After the AD value on LCD is stable, press  button to confirm it. The system will record current AD value (3270) and it will be displayed on LCD. The calibration of the 4-20mA input signal is completed after the operation of option **4 mA** and option **20 mA**.

For example, if 4-20mA signal is set as 50%(12mA) in the field, while the actual signal value collected by positioner is 52% (12.32mA), it indicates that there is a deviation between the input signal and the signal actually collected by positioner. In this case, calibrate the input signal collected by the positioner by operating as above guidance to make it correspond to 4-20mA signal of the front-end of the system.

8.3.2.5. SDIR

SDIR function sets the corresponding relationship between 4-20mA set-point signal and set-point value.

Select this function in the menu interface, press button to start setting, and the parameter will flash. Press buttons to set parameter and press button to confirm.

Options for setting parameter

Option	Description
riSE	4 mA → 0%, 20 mA → 100%.
FALL	4 mA → 100%, 20 mA → 0%.

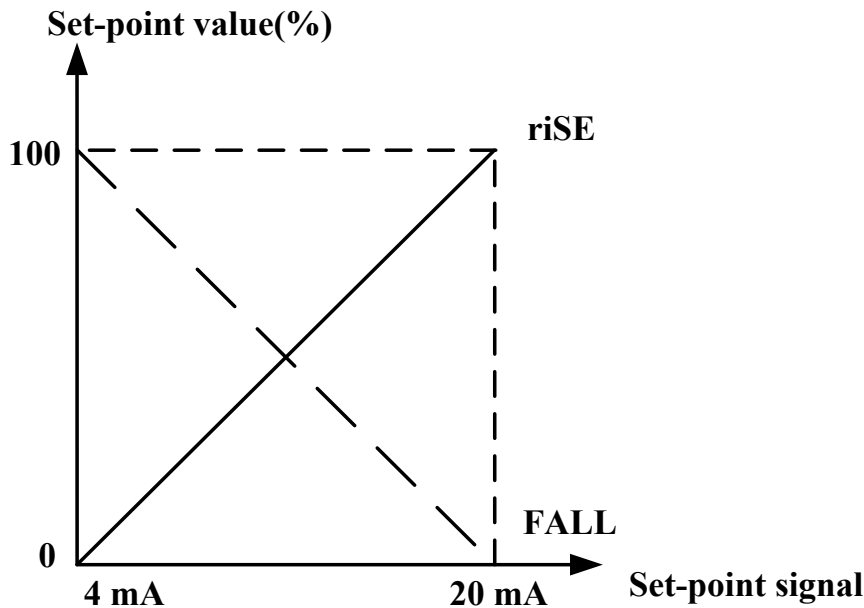


Figure 51. SDIR

8.3.2.6. CHAR

The characteristic curve is the relationship between set-point value and valve stroke.

In the actual control system, it is usually required to make the controlled variable have specific control characteristics (such as linearity). The user can choose and set the corresponding characteristic curve to achieve the control requirements.

The function is to determine the relationship between position set-point value and valve stroke.

Select this function in the menu interface, press button to start setting, and the parameter will flash. Press buttons to set parameter and press button to confirm.

Option for CHAR

Option	Description
Lin	1:1 linear transfer relationship between position set-point value and valve stroke.
1-25	1:25 equal percentage transfer relationship between position set-point value and valve stroke.
1-33	1:33 equal percentage transfer relationship between position set-point value and valve stroke.

1-50	1:50 equal percentage transfer relationship between position set-point value and valve stroke.
n1-25	1:25 inverse equal percentage transfer relationship between position set-point value and valve stroke.
n1-33	1:33 inverse equal percentage transfer relationship between position set-point value and valve stroke.
n1-50	1:50 inverse equal percentage transfer relationship between position set-point value and valve stroke.
FrEE	Freely programmable transfer relationship between position set-point value and valve stroke for user. The position set-point value scale ranging from 0-100% is divided uniformly into 21 nodes. A freely programmable valve stroke ranging from 0-100% is assigned to each node. User can set value by selecting option FR 0 , FR 5 , ..., FR 100 .

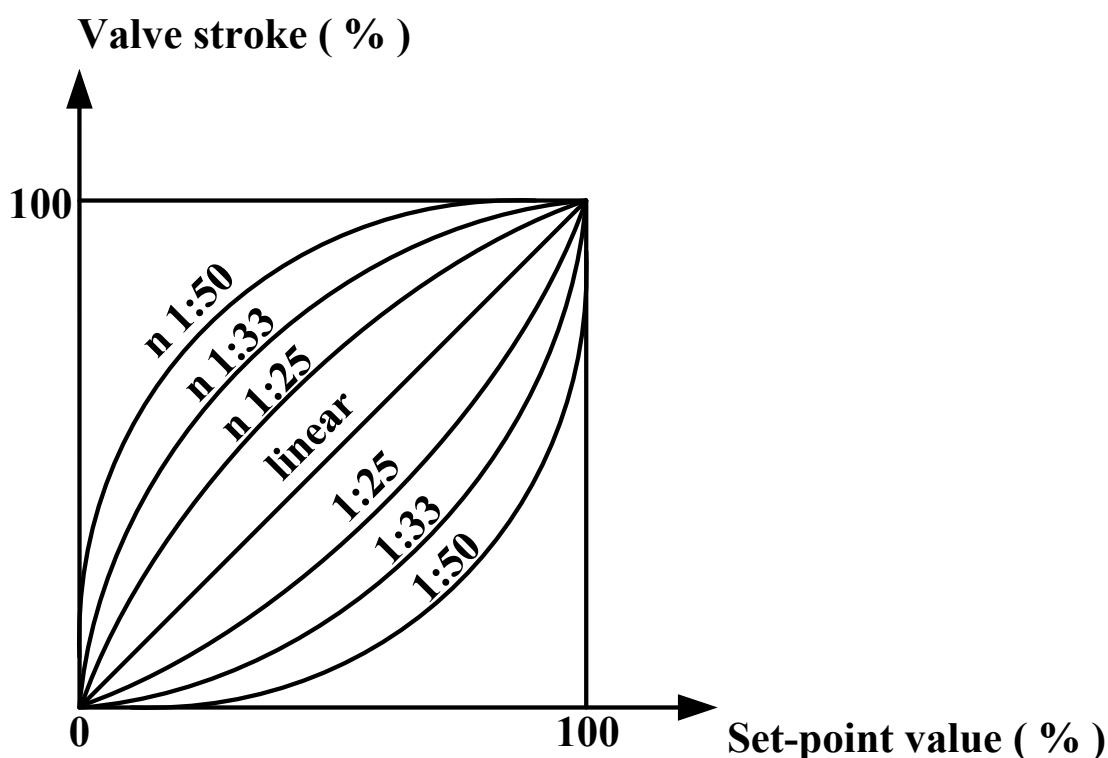


Figure 52. CHAR

8.3.2.7. FREE

Set value of **FrEE** characteristic curve in **CHAR** function option.

Sub-function options of **FREE** are **FR 0**, **FR 5**, ..., **FR 100**, 21 set points in total.

Select this function in the menu interface, press ☐ button to enter sub-function option, and select set point by pressing ☐ ☐ buttons, then press ☐ button to start setting parameter, and the

parameter will flash. Press $\blacktriangledown$ $\blacktriangle$ buttons to set parameter, it can be modified quickly by pressing $\blacktriangledown$ or $\blacktriangle$ button continuously, finally press $\bigcirc$ button to confirm.

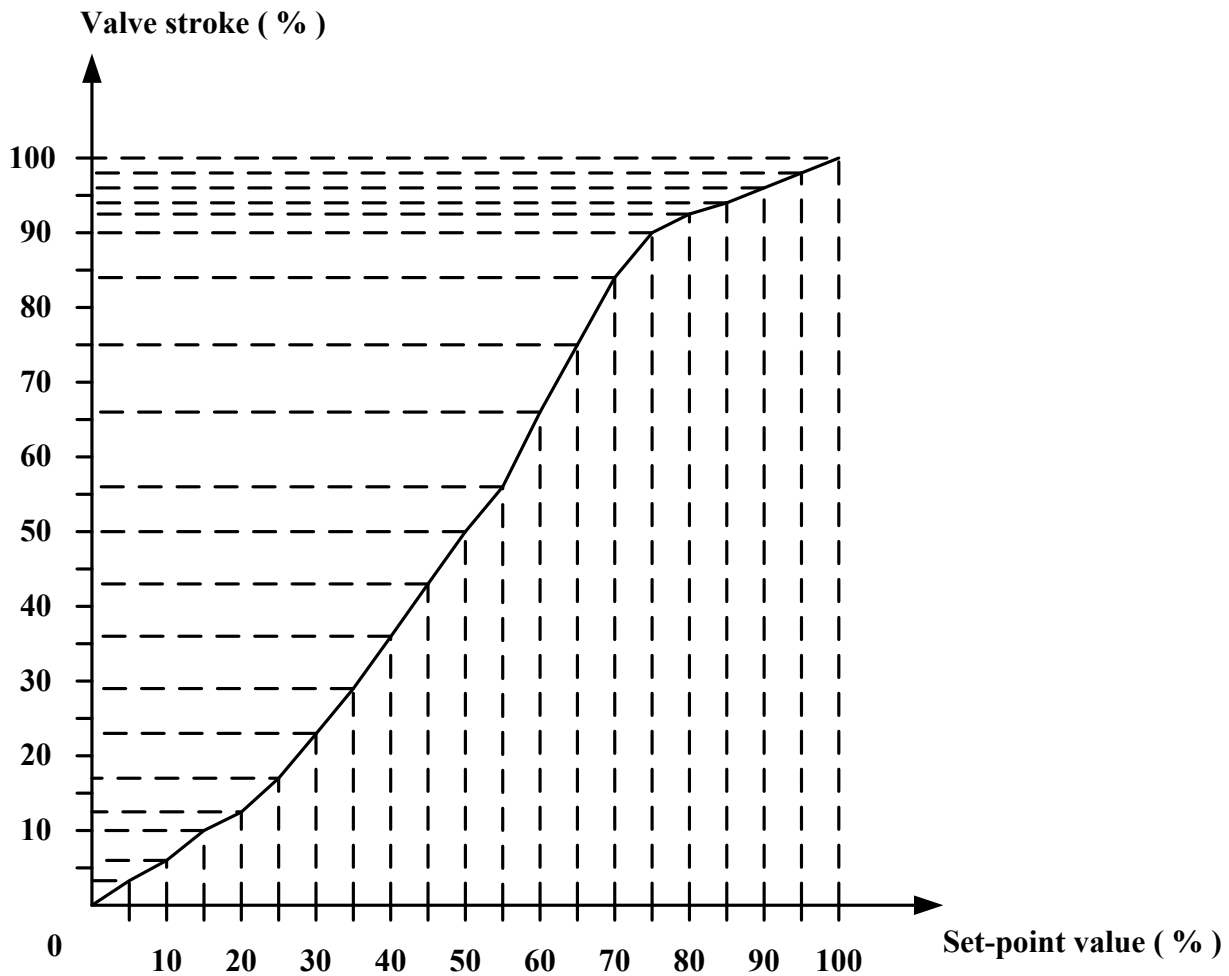


Figure 53. FREE

8.3.2.8. DB

Set Dead band zone of positioner.

The system does not adjust the valve stroke when the gap between the stroke value and the position set-point value is not bigger than the dead band value.

For example, positioner will not do adjustment if the actual valve position is not in the range of $50 \pm 1\%$ when the position set-point value is 50% and dead band value is 1%. If it's not in the range of $50 \pm 1\%$, the piezoelectric module will be driven to adjust valve position until it's in the range of $50 \pm 1\%$.

It's recommended to increase the dead band value if the valve position oscillates. The smaller the dead band sets, the higher control accuracy gets.

Select this function in the menu interface, press $\bigcirc$ button to start setting, and the parameter will flash. Press $\blacktriangledown$ $\blacktriangle$ buttons to set parameter, it can be modified quickly by pressing $\blacktriangledown$ or $\blacktriangle$ button continuously, finally press $\bigcirc$ button to confirm.

8.3.2.9. LIM

This function limits the automatic adjustment range in the whole valve physical stroke.

The **LIM** sub-function options **L MIN** and **L MAX** of set the minimum and maximum limits of the stroke respectively.

Select this function in the menu interface, press button to enter sub-function option, press buttons to select option **L MIN** or **L MAX**, press button to start setting, and the parameter will flash. Press buttons to set parameter, it can be modified quickly by pressing or button continuously, finally press button to confirm.

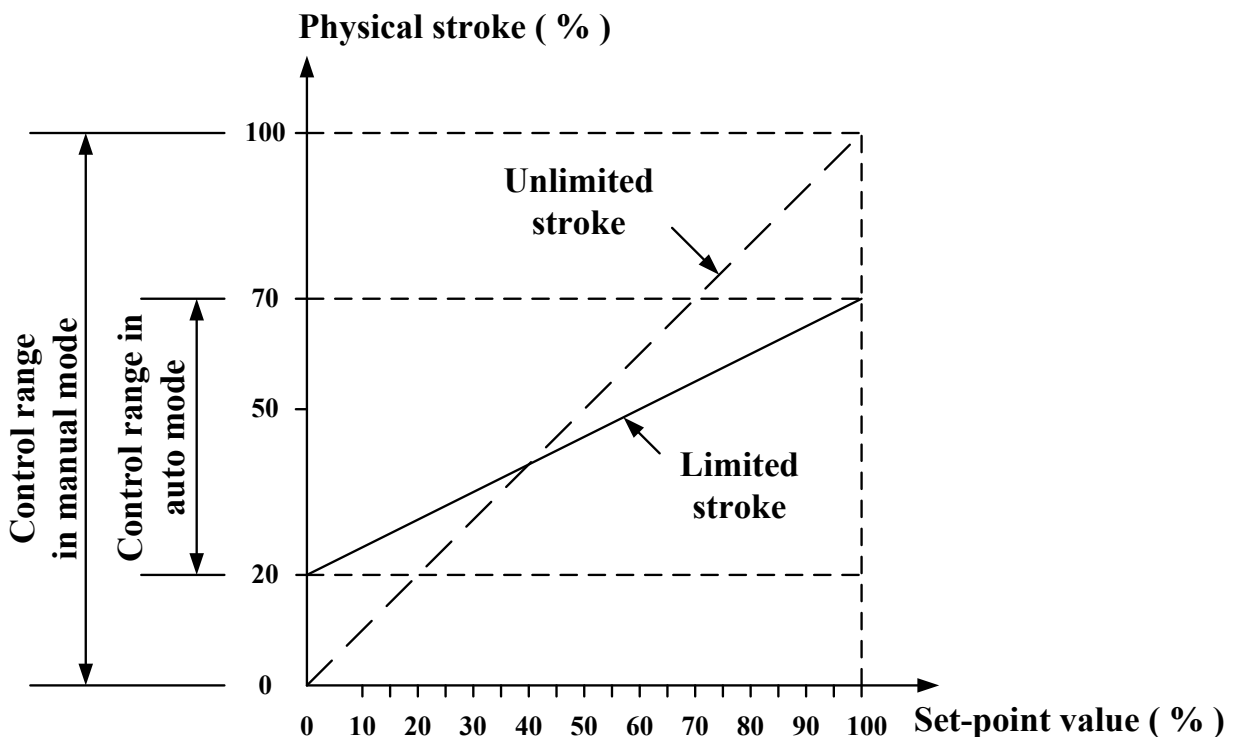


Figure 54. LIM

8.3.2.10.YDIR

This function is used to set the acting direction of the set-point value display, the position value display and position feedback signal output.

Select this function in the menu interface, press button to start setting, and the parameter will flash. Press buttons to set parameter and press button to confirm.

Options for setting parameter

Option	Description
riSE	The setpoint display, position value display, and position feedback signal output are upward trending.
FALL	The setpoint display, position value display, and position feedback signal output are downtrending.

8.3.2.11.CUT

This function is used for the positioner to fully close or open the valve in automatic mode. When the function is enabled, sign **CU** displays in the left bottom in main interface.

The **CUT** sub-function options **C MIN** and **C MAX** respectively set the minimum and maximum values.

Select this function in the menu interface, press $\odot$ button to enter sub-function option, press ∇ $\blacktriangle$ buttons to select option **C MIN** or **C MAX**, press $\odot$ button to start setting, and the parameter will flash. Press ∇ $\blacktriangle$ buttons to set parameter, it can be modified quickly by pressing ∇ or $\blacktriangle$ button continuously, finally press $\odot$ button to confirm.

When **C MIN** value is 0, full closing is disabled. When **C MAX** value is 100, full opening is disabled.

When valve is in the positioning state, if the set point value $\leq$ **C MIN**, the valve will be fully close; if set point value $\geq$ **C MAX**, it will be fully open.

When the set point value $>$ **C MIN** + 1%, valve will disengage from the full closing state.

When the set point value $<$ **C MAX** - 1%, valve will disengage from the full opening state.

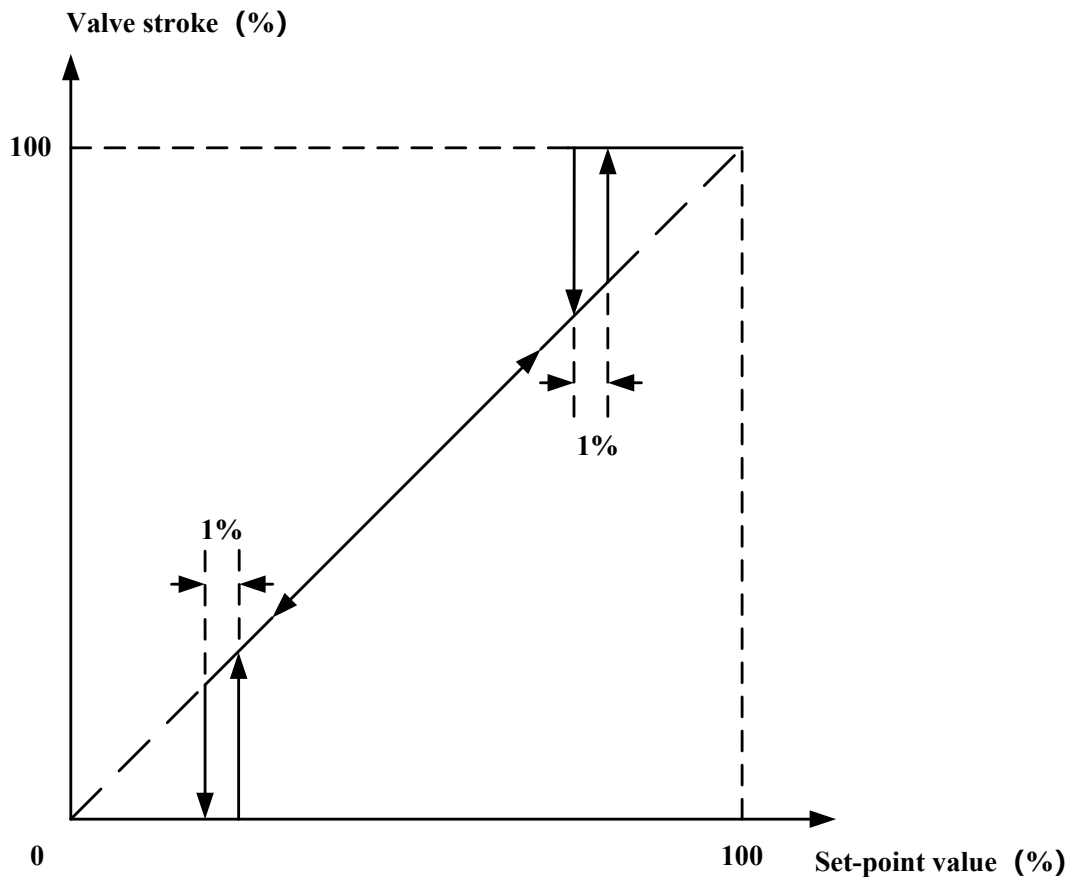


Figure 55. CUT

8.3.2.12.POS

This function is used to set the standard of position display and feedback signal output. Select this function in the menu interface, press  button to start setting, and the parameter will flash. Press   buttons to set parameter and press  button to confirm.

Options for setting parameter

Option	Description
FS	The position display and feedback signal output correspond to 0-100% of mechanical stroke. The set-point value is displayed as the actual valve position set value. Not affected by the L MIN and L MAX parameters.
LS	The position display and feedback signal output take the form of 0-100% to represent the range between the L MIN and L MAX parameters. The set-point value is displayed with this standard.

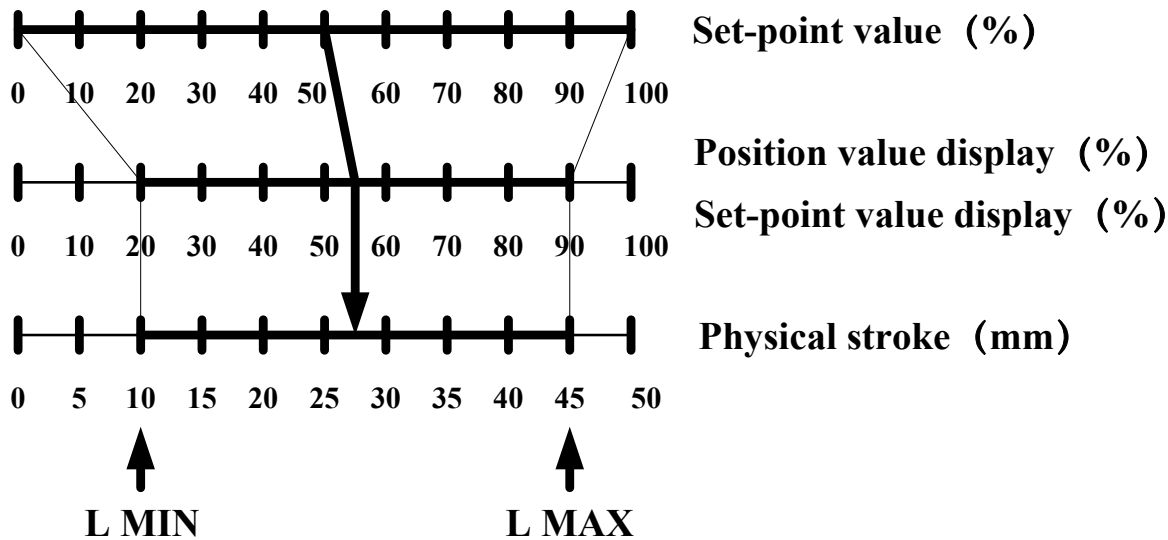


Figure 56. Example: POS = FS, L MIN = 20%, L MAX = 90%

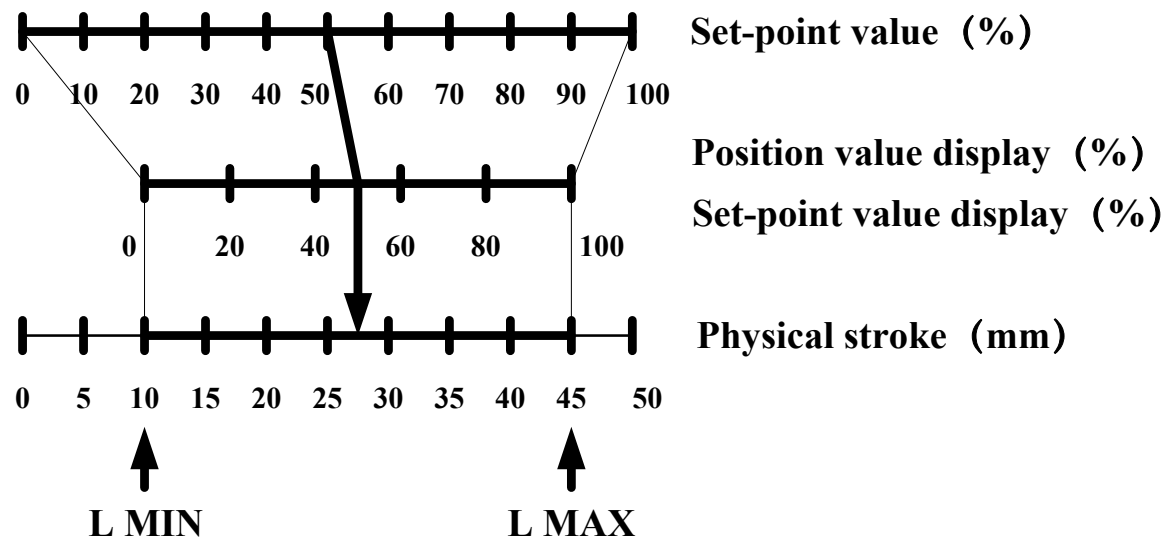


Figure 57. Example: POS = LS, L MIN = 20%, L MAX = 90%

8.3.2.13.FACT

Restore factory settings.

Select this function in the menu interface, press and hold  button for approx. 3s to reset to factory setting. Then the system is in an uninitialized state and the LCD displays **FINSH**.

8.3.2.14.WP

This function is a parameter write protection function. The parameter **oFF** is write protection disabled, and the parameter **on** is write protection enabled.

Select this function in the menu interface, press  button to start setting, and the parameter will flash. Press   buttons to set parameter and press  button to confirm.

When write protection is enabled, most menu option parameters cannot be modified, and initialization and factory reset functions cannot run.

8.3.2.15.ACT

This function is used to set acting mode. It is used for the manufacturer. It is not recommended for users to operate this option without special circumstances.

8.3.2.16.REF

Calibrate the reference point of the linear feedback lever. It is used for the manufacturer. It is not recommended for users to operate this option without special circumstances.

8.3.2.17.REC

Record the running data of the positioner. The parameters cannot be restored to factory values by running the **FACT** function.

Options for data recording

Option	Description
HOURS	Running hours count. Start recording after the positioner are powered on.
P CNT	Positive deviation count. In automatic mode, when the positioner is in position control, the position value corresponding to the initialized mechanical stroke is compared with the position set-point value. If the set-point value is greater than the position value, and the deviation between the two exceeds the dead zone value + 10% and lasts for more than 1 minute, the cumulative count is carried out once.
N CNT	Negative deviation count. In automatic mode, when the positioner is in position control, the position value corresponding to the initialized mechanical stroke is compared with the position set-point value. If the position value is greater than the set-point value, and the deviation between the two exceeds the dead zone value + 10% and lasts for more than 1 minute, the cumulative count is carried

	out once.
CLR	Clear the HOURS, P CNT, N CNT records. Select this option in the submenu of REC, press and hold  button for approx. 3s to run the function. Then the records are cleared and the LCD displays FINSH .
S/W	Enable or disable the data recording. The parameter oFF is disabled, and the parameter on is enabled.

8.3.2.18.LCD

This function is used to set the LCD display direction. The parameter **uP** is positive direction, and the parameter **do** is reverse direction. The parameter cannot be restored to factory value by running the **FACT** function.

For individual linear valves, if the device needs to be mounted in reverse direction to the valve, this parameter can be set so that the LCD is displayed in a positive direction.

Select this function in the menu interface, press  button to start setting, and the parameter will flash. Press   buttons to set parameter and press  button to confirm.

8.3.2.19.DIAG

Diagnostic parameters. Select this option in the menu interface, press  button to enter.

8.3.2.19.1. PST

Partial stroke test parameters. The parameters **STPOS**, **RANGE**, **STEP**, and **DIR** are associated with the stroke of the initialization.

Select the parameter option in the menu interface, press  button to start setting, and the parameter will flash. Press   buttons to set parameter and press  button to confirm.

To perform PST function (partial stroke test), please refer to section 8.2 for details.

Option	Description
S/W	Enable or disable partial stroke test. The parameter oFF is disabled, and the parameter on is enabled.
STPOS	Starting position for partial stroke test.
RANGE	The tolerance range for the starting position. For example, the starting position is 50% with a tolerance range of 2%. Only perform partial stroke test when the valve position is within the range of 48% to 52%.
STEP	Step stroke.
DIR	Stroke direction for partial stroke test. uP : The actuator moves upwards, from the starting position to the upper limit of the target position. do : The actuator moves downwards, from the starting position to the lower limit of the target position. uP do : The actuator moves up and down, first moving from the starting position

	to the upper limit of the target position. Then move from the upper limit of the target position to the lower limit of the target position. Upper limit of the target position = STPOS + RANGE + STEP. Lower limit of the target position = STPOS - RANGE - STEP.
TIME	Limit time for partial stroke test. Unit: seconds. After starting the partial stroke test, if the limit time is reached and the actuator has not yet moved to the upper or lower limit of the target position, the test is considered to have failed. Please set this value reasonably based on the actual operating condition of the valve.

8.3.2.20.SPLIT

This function is used for split range control.

The **SPLIT** sub-function options **S MIN** and **S MAX** respectively set the minimum and maximum values. It is recommended that the difference between **S MAX** and **S MIN** should not be less than 30.

Select this function in the menu interface, press ☐ button to enter sub-function option, press ☐ ☐ buttons to select option **S MIN** or **S MAX**, press ☐ button to start setting, and the parameter will flash. Press ☐ ☐ buttons to set parameter, it can be modified quickly by pressing ☐ or ☐ button continuously, finally press ☐ button to confirm.

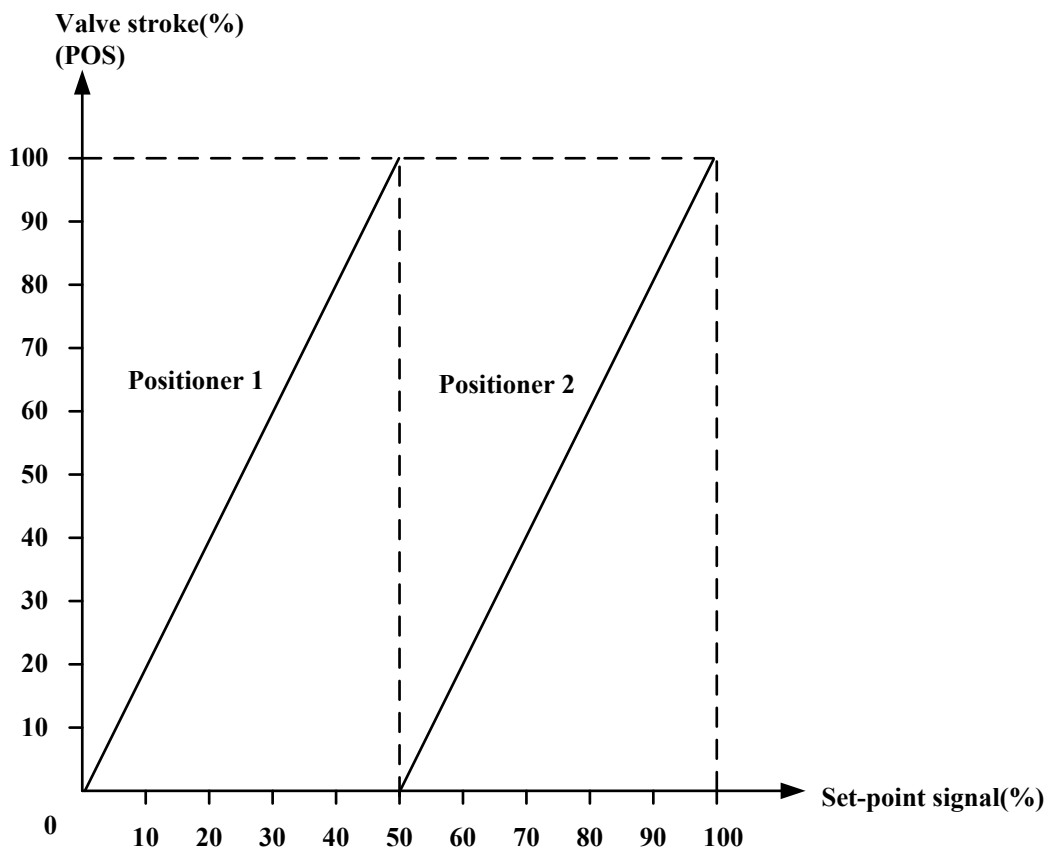


Figure 58. SPLIT

8.3.2.21.EXT

This function is used to optimize the display of position values at 0% and 100% of the stroke endpoint.

When the valve position is at 0% or 100% of the stroke endpoint, the position value displayed on the LCD may not be 0% or 100%. For example, displaying 0.2% at 0% of the stroke endpoint. If the user wants the position value to be displayed as 0%, set this function parameter. When the absolute value of the difference between the position value and 0% or 100% is less than or equal to the parameter value, the LCD displays 0% or 100%.

Select this function in the menu interface, press  button to start setting, and the parameter will flash. Press   buttons to set parameter, it can be modified quickly by pressing  or  button continuously, finally press  button to confirm.

8.3.3. Error message during initialization

Sign	Meaning	Possible reasons	Solutions
ERR 1	Actuator action error	● No air pressure or insufficient air pressure ● There is a leakage from actuator or positioner.	● Check air source and it's pressure to make sure that it meets the requirement ● Eliminate air leakage
ERR 2	For non-separate type positioner, rotation angle of actuator feedback lever or rotating shaft is error. For separate type positioner, valve stroke does not meet requirements.	● The non-separate type positioner is not installed correctly. As a result, the rotation angle of actuator feedback lever or rotating shaft doesn't meet the installation requirements. ● When running the manual initialization, the difference from END 1 to END 2 doesn't meet the installation requirements.	● For the non-separate type positioner, in the initial interface (NOINI), adjust the installation position by the angle sensor percentage value displayed on LCD, make sure the minimum and maximum percentage difference of the angle sensor rotation is greater than 16%. ● If it's in the manual initialization operation process, press   buttons to re-calibrate END 1 and END 2, make sure that difference percentage value between two endpoints of sensor is bigger than 16% (non-separate type) or 8% (separate type).
ERR 3	error minimum	The positioner is not	For the non-separate type positioner,

	stroke value of sensor	installed correctly.	in the initial interface (NOINI), adjust the installation position by the sensor percentage value displayed on LCD. Make sure that minimum percentage value of sensor $\geq 2\%$. For the separate type positioner, readjust the D value. Make sure that minimum percentage value of sensor $\geq 12\%$ (ELin1) or 2% (ELin2).
ERR 4	Error maximum stroke value of sensor	The positioner is not installed correctly.	For the non-separate type positioner, In the initial interface (NOINI), adjust the installation position by the sensor percentage value displayed on LCD. Make sure that maximum percentage value of sensor $\leq 98\%$. For the separate type positioner, readjust the D value. Make sure that maximum percentage value of sensor $\leq 92\%$ (ELin1) or 97% (ELin2).

8.3.4. Tips of menu option or function cannot access

When setting menu option parameters or running initialization, the following signs may appear to indicate that they cannot be accessed. See the table below for specific instructions.

Sign	Meaning
P1	Write protection is enabled.
P2	The reference point of the linear feedback lever is not calibrated, and the initialization operation of the linear actuator cannot be performed.

8.3.5. Menu function options summary description

Options	Functions	Parameter value	Factory settings
1 TYPE	Actuator type setting	Lin Turn FLin ELin1 ELin2	Lin
2 INITA	Auto initialization		
3 INITM	Manual initialization		
4 CAL→4 mA	Calibrate 4mA set point signal	Current signal AD value	655

4 CAL→20 mA	Calibrate 20mA set point signal	Current signal AD value	3277
5 SDIR	Set the direction of set point signal	riSE FALL	riSE
6 CHAR	Select characteristic curve	Lin 1:25 1:33 1:50 n1:25 n1:33 n1:50 FrEE	Lin
7 FREE→FR 0, FR 5...FR 100	Custom parameters settings	0.0% – 100.0%	0.0% 5.0% etc. to 100.0%
8 DB	Set dead band	0.2 – 10.0%	1.0%
9 LIM→L MIN	Set minimum value for stroke range limit function	0.0% – 100.0%	0.0%
9 LIM→L MAX	Set maximum value for stroke range limit function	0.0% – 100.0%	100.0%
10 YDIR	Set the acting direction of position display, set-point display and position feedback signal output	riSE FALL	riSE
11 CUT→C MIN	Set minimum value for tight cut function	0.0% – 100.0%	1.0%
11 CUT→C MAX	Set maximum value for tight cut function	0.0% – 100.0%	100.0%
12 POS	Set Position display and feedback signal output standard	FS LS	FS
13 FACT	Reset to factory setting		
14 WP	Write protection	oFF on	oFF
15 ACT	Acting mode selection		
16 REF	Calibrate the reference point of the linear feedback lever		
17 REC→HOURS	Running hours count	0-876000	0
17 REC→P CNT	Positive deviation count	0-99999	0
17 REC→N CNT	Negative deviation	0-99999	0

	count		
17 REC→CLR	Clear data recording		
17 REC→S/W	Enable or disable the data recording	oFF on	on
18 LCD	LCD display direction	uP do	uP
A PST→S/W	Enable or disable PST	oFF on	oFF
A PST→STPOS	PST starting position setting	0.0% – 100.0%	100.0%
A PST→RANGE	PST starting position tolerance range setting	0.2% – 10.0%	2.0%
A PST→STEP	PST step stroke Setting	1.0% – 98.8%	10.0%
A PST→DIR	PST stroke direction setting	uP do uPdo	do
A PST→TIME	PST limit time setting	1s – 100s	50s
20 SPLIT→S MIN	Set minimum value for split range control function	0.0% – 70.0%	0.0%
20 SPLIT→S MAX	Set maximum value for split range control function	30.0% – 100.0%	100.0%
21 EXT	Optimization display of stroke endpoint position value	0.0% – 10.0%	0.0%

8.4. HART DD file and DTM file description

8.4.1. Device dynamic variable description

Dynamic variable	Description
PV	Position setpoint percentage value
SV	Position percentage value

8.4.2. Device custom function description

The device custom function is in the **Detailed setup** directory of the DD file and DTM file. The function options and descriptions are shown in the following table:

Options	Description
TYPE	See chapter 8.3.2.1 for details.

INIT	Automatic initialization start or stop, initialization status indication. For the initialization function, please refer to Chapter 8.3.2.2 and Chapter 8.3.2.3.
SDIR	See chapter 8.3.2.5 for details.
CHAR	See chapter 8.3.2.6 for details.
FREE	See chapter 8.3.2.7 for details.
DB	See chapter 8.3.2.8 for details.
LIM	See chapter 8.3.2.9 for details.
YDIR	See chapter 8.3.2.10 for details.
CUT	See chapter 8.3.2.11 for details.
POS	See chapter 8.3.2.12 for details.
FACT	See chapter 8.3.2.13 for details.
REC	See chapter 8.3.2.17 for details.
Setpoint	Setpoint value setting.
Status	System status indication.
DIAG→PST	See chapter 8.3.2.19.1 for details.

The options and descriptions in the **INIT** directory are shown in the following table:

Options	Description
INIT status	Initialization status indication.
INIT start	Automatic initialization starts.
INIT stop	Automatic initialization stops.

INIT status signs and descriptions are shown in the following table:

Signs	Description
NOINI	Uninitialized.
FINSH	Initialization finish.
STEP1, STEP2, STEP3	Initialization steps.
ERR 1, ERR 2, ERR 3, ERR 4	Initialization error message.

The options and descriptions in the **Setpoint** directory are shown in the following table:

Options	Description
PV	Device dynamic variable.
SV	Device dynamic variable.
Setpoint source	Set the setpoint source. Can be set to 4-20mA or HART , the default is

	4-20mA. When set to 4-20mA , the setpoint value is determined by the external 4-20mA signal. When set to HART , the setpoint value is determined by the input value from HART communication. The HART Setpoint input option is jumped out from the directory. It is used to enter the setpoint value.
HART Setpoint input	Enter the setpoint value if Setpoint source is set to HART .

The options and descriptions in the **Status** directory are shown in the following table:

Options	Description
Working status	System working status.
Cutoff status	Cutoff status in automatic mode.

Working status signs and descriptions are shown in the following table:

Signs	Description
NOINI	The system is not initialized.
Config mode	The system is in menu configuration mode or performing initialization.
Auto mode	The system is in automatic mode.
Manu mode	The system is in manual mode.

Cutoff status signs and descriptions are shown in the following table:

Signs	Description
No	The system is not in cutoff status.
Cutoff down	Cutoff status corresponds to C MIN .
Cutoff up	Cutoff status corresponds to C MAX .

The options and descriptions in the **DIAG→PST** directory are shown in the following table:

Options	Description
Parameters	PST parameters.
Test	Operate PST.

The options and descriptions in the **PST→Test** directory are shown in the following table:

Options	Description
PST start	Start PST.
PST stop	Stop PST.
PST status	PST status indication.

PST status signs and descriptions are shown in the following table:

Signs	Description
Not running	PST is not running.
Running	PST is running.
SUCS	PST is successful.
FAIL	PST is failed.

8.5. Feedback signal

The positioner can be optionally equipped with a 4-20 mA feedback signal. It indicates the percentage value of the valve position.

The feedback signal module is based on a two-wire system, it needs 24V DC power supply. The feedback signal will stop updating after entering the menu.

8.6. Adjust air flow

1. Remove the circuit board protective cover.

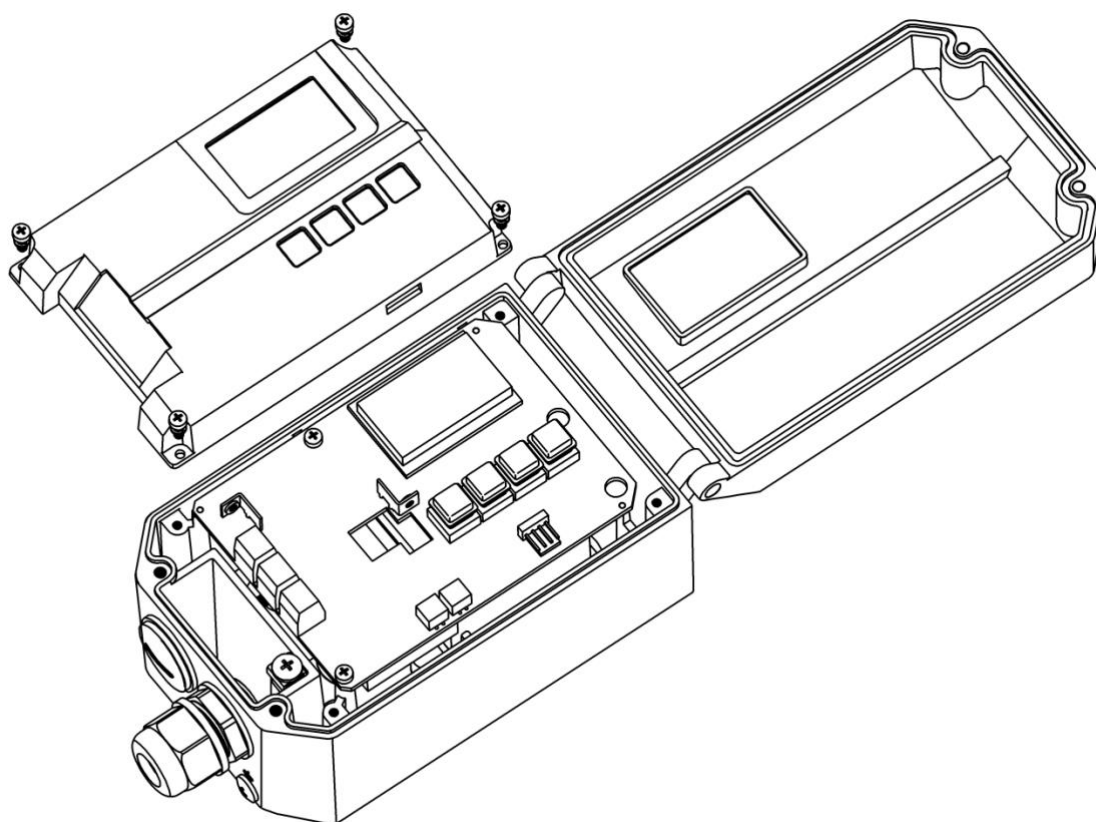


Figure 59. Remove the circuit board protective cover

NOTE: Must install or remove the circuit board protective cover when the device is powered off.

2. Adjust restrictors

- Restrictors Y1① and Y2② can reduce air output to increase the stability of positioning for small volume actuators.
- Turning the Restrictors in clockwise direction with a flat blade screwdriver can reduce the air flow until it is cut off.
- When adjusting restrictors, it is recommended to close them first and then open them again slowly.
- Make sure two restrictors are turned to the similar position for the double-acting actuator.

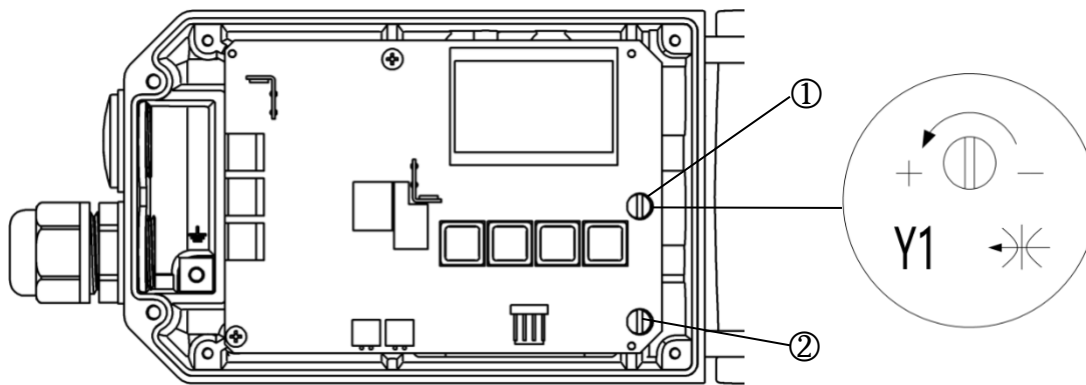


Figure 60. Air flow adjustment

- ① Restrictors Y1
- ② Restrictors Y2, only for double-acting actuator.

9. Limit switch adjustment and wiring

9.1. Mechanical limit switch

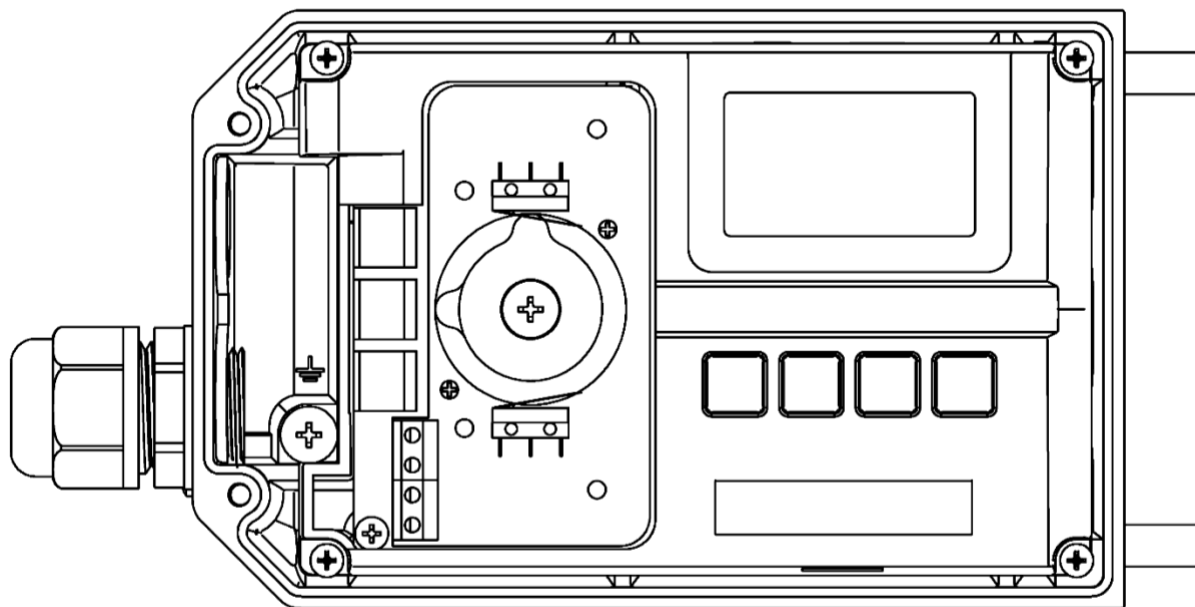
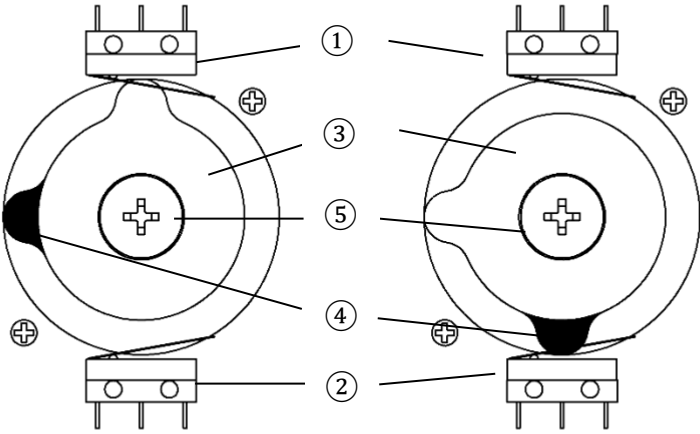


Figure 61. Mechanical limit switch option

9.1.1. Mechanical limit switch cam adjustment

The cam positions are preset at the factory according to the product model. To adjust the cam angle for switching signal points, follow the steps below:

1. Remove the upper cover. Use a Phillips screwdriver to loosen the fixing screws 2 turns counterclockwise, but do not remove the screws completely, so that the two cams can rotate relative to each other.
2. Adjust the positioner to bring the valve to the closed position. Use a screwdriver to adjust the No. 4 cam until contact switch 2 is activated.
3. Adjust the positioner to bring the valve to the fully open position. Use a screwdriver to adjust and adjust the No. 3 cam until contact switch 1 is activated. During this process, ensure that the No. 4 cam does not rotate relative to the main shaft.
4. After adjustment is complete, tighten the fixing screws.

Mechanical limit switch	Part Name
	① Contact Switch 1
	② Contact Switch 2
	③ Inductive Cam for Contact Switch 1
	④ Inductive Cam for Contact Switch 2
	⑤ Fixing screw

9.1.2. Wiring for mechanical limit switch

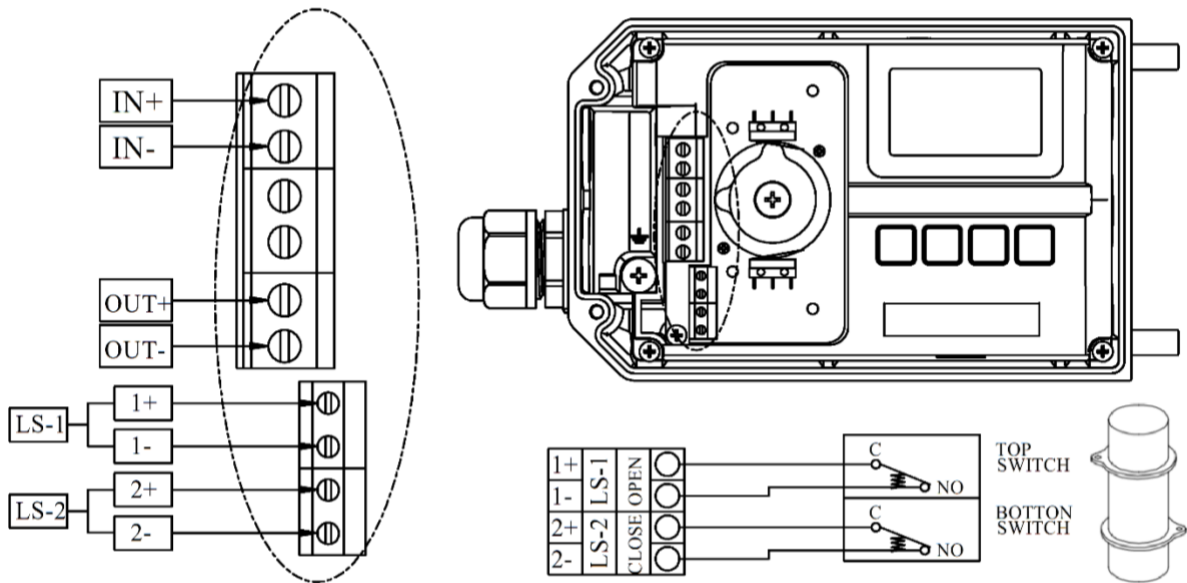


Figure 62. Wiring diagram

9.2. Intrinsic safety limit switch

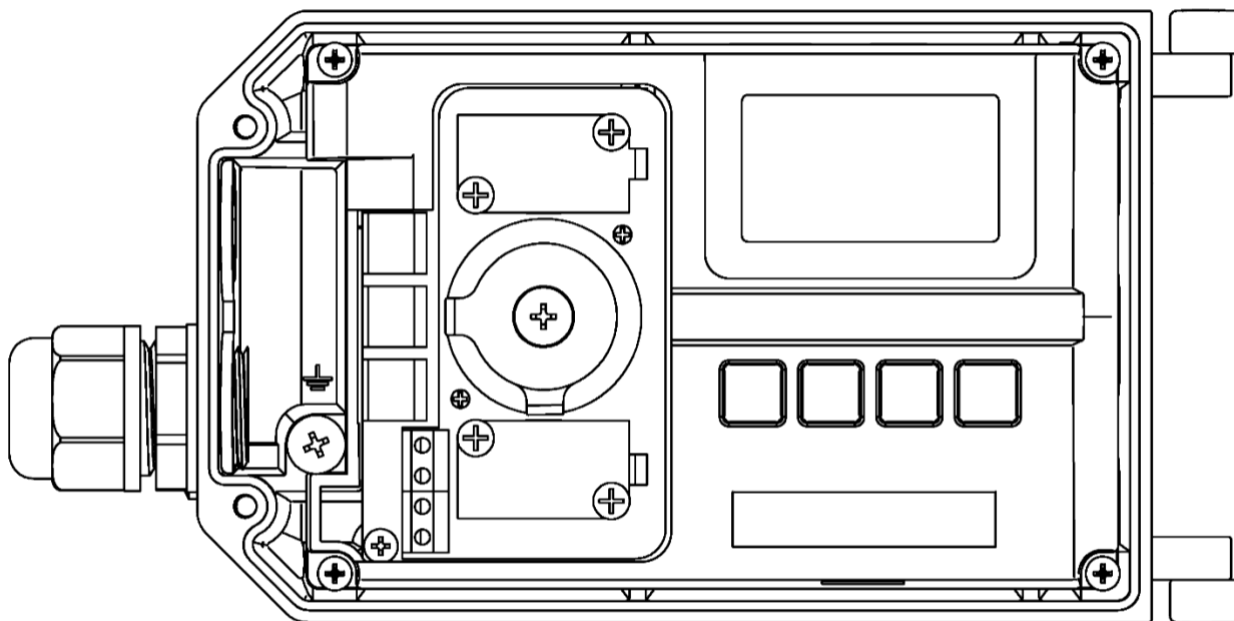
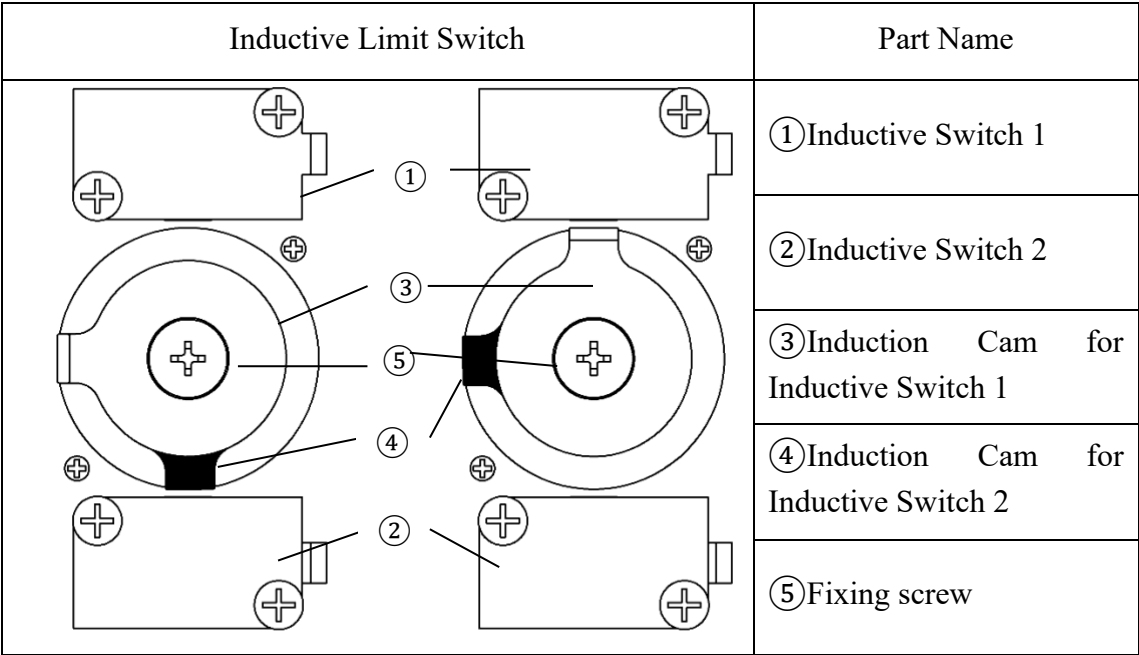


Figure 63. Intrinsic limit switch option

9.2.1. Intrinsic safety limit switch cam adjustment

The cam positions are preset at the factory according to the product model. To adjust the cam angle for switching signal points, follow the steps below:

1. Remove the upper cover. Use a Phillips screwdriver to loosen the fixing screws by turning them counterclockwise for 2 full turns, but do not unscrew them completely, so that the two cams can rotate relative to each other.
2. Adjust the positioner to bring the valve to the closed position. Use a screwdriver to turn and adjust Cam No. 4 to the triggered state (the side indicator light of inductive Switch 2 goes off).
3. Adjust the positioner to set the valve to the fully open position. Use a screwdriver to turn and adjust Cam No. 3 to the triggered state (the side indicator light of Inductive Switch 1 goes off). During this process, ensure that Cam No. 4 does not rotate relative to the main shaft.
4. After adjustment is complete, tighten the fixing screws.



9.2.2. Wiring for intrinsic safety limit switch

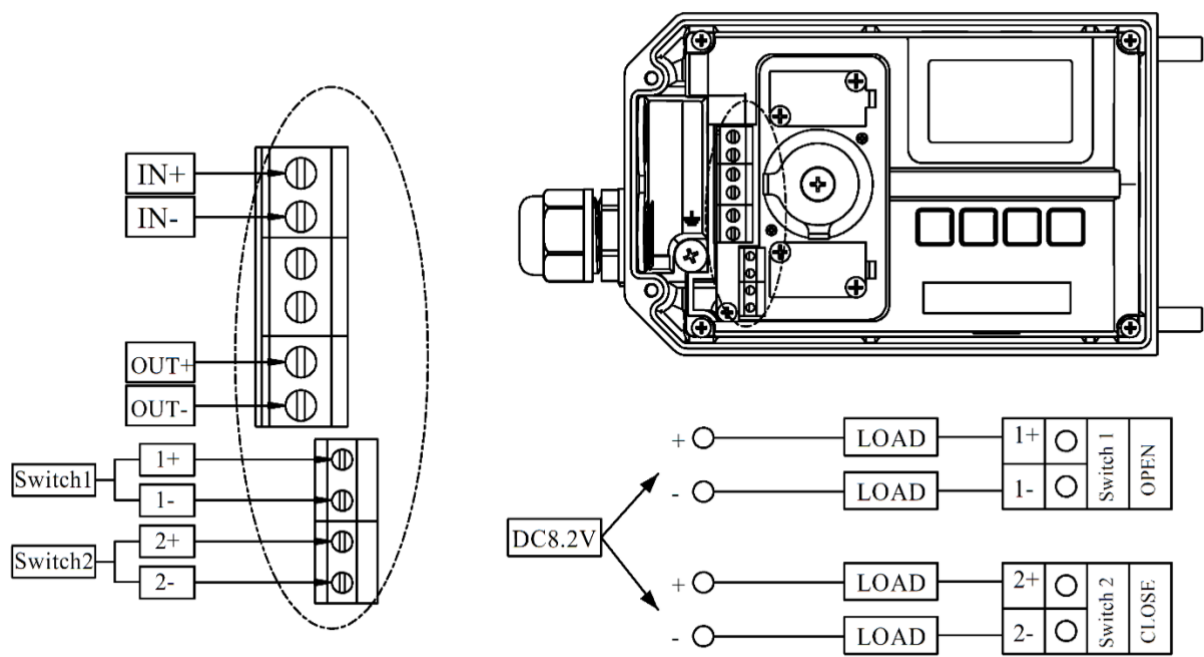


Figure 64. Wiring diagram

Note: For intrinsic safety explosion-proof requirements, a matched discrete input isolated safety barrier must be used.

10. Trouble shooting

Contents	Possible reasons	Solutions
LCD has no display	Error electrical connections.	Check the electrical connections
	No current output from current source	Make sure that there is current output from the current source.
	The current source is out of specified range	Use the proper current source.
	Others	Consult with manufacturer.
There is no air output in OUT1 or OUT2 (Without any action)	The air supply pressure is abnormal	Check the setting of the air pressure reducing valve.
	No input current	Make sure the input current is proper. (4-20mA DC)
	Accessory pipe leakage	Check the pipe and connection to make sure that there isn't any leakage.
	Others	Consult with manufacturer.
Bad accuracy (Linear and hysteresis phenomena)	The air supply pressure changes	Check whether there is any abnormality of the air supply pressure reducing valve
	The mounting bolts loose	Make sure the mounting bolts are tightened.
	The connection place between the positioner and the actuator has gap	Check the connection.
	Set-point value deviation	Adjust the current output signal.
		Calibrate the set-point signal.
	Others	Consult with manufacturer.

11. Warranty terms

1. If the product is found to have quality problems which are confirmed by our company staff, customers have after-sale services for product maintenance or free replacement in the warranty period. Service response time is 24 hours (excluding non-working days).
2. The warranty period of the product is based on the company's latest warranty policy, which is no less than 12 months after the sale.
3. The following situations for repaired product do not belong to the warranty range:
 - (1) The date is not in the warranty period.
 - (2) The product is disassembled without authorization and permit by the product company.
 - (3) The damage causes from the operation which is not according to the product instruction manual or other human factors. Including but not limited to:
 - 1> The product surface has collision scars.
 - 2> Error wiring or error power supply makes the product damaged.
 - 3> Parts and accessories are lost.
 - 4> The product is damaged due to the oil entering the product without oil separator or filter pressure reducer being installed.
 - 5> Error using the waterproof electrical connectors makes the product damaged.
 - 6> Plugging or removing the vent plug without permission.
 - (4) Force majeure (natural disasters) causes product failure or damage.
4. According to the actual situation, the product company offers the free or fee-based maintenance services outside the warranty range.
5. The terms become effective since the two sides signed a supply contract.

V260427

The changed contents of this manual are not noticed.

The Company reserves the final interpretation for related technical updating

Attachment

Air Supply Requirements for Intelligent Valve Positioner

All Series Products

In accordance with technical specifications, all series of intelligent valve positioners require Class 3 quality compressed air supply. Supplying compressed air that meets the air source standards ensures stable normal operation of the positioners.

Class 3 Dew Point: Dew point shall be -20°C . (If the actual operating ambient temperature of the positioner is lower than -20°C , the dew point of the supplied compressed air shall be 10°C lower than the actual operating ambient temperature of the positioner accordingly.)

Class 3 Solid Particle Size & concentration: 5.0 mg/m^3 (corresponding particle size: $5.0\text{ }\mu\text{m}$). Particles larger than $5.0\text{ }\mu\text{m}$ are prohibited from entering the equipment.

Class 3 Oil Content: 1.0 mg/m^3 , the cumulative oil content per cubic meter of air shall not exceed 1.0 mg .

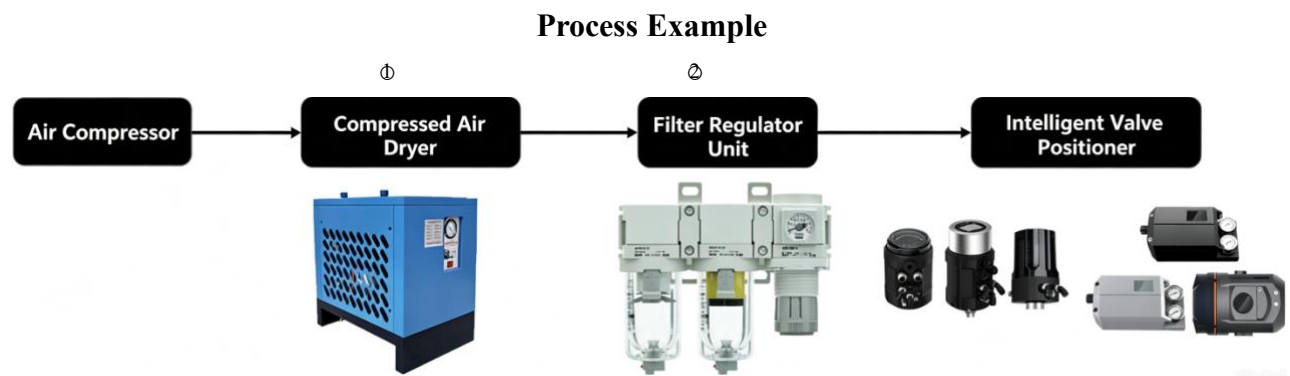


Figure 1. Process Flow Diagram

- ① Install a compressed air dryer on the main pipeline to remove most moisture contained in compressed air; the pressure dew point after filtration can reach -20°C .
- ② Select one of the air preparation assemblies shown in Figure 2 and install it upstream of the positioner. Depending on the selected configuration, install the filter regulator or air filter upstream, followed by the mist separator downstream. The filtration system shall remove particles larger than $5.0\text{ }\mu\text{m}$ and reduce the residual oil concentration to no more than 1.0 mg/m^3 .

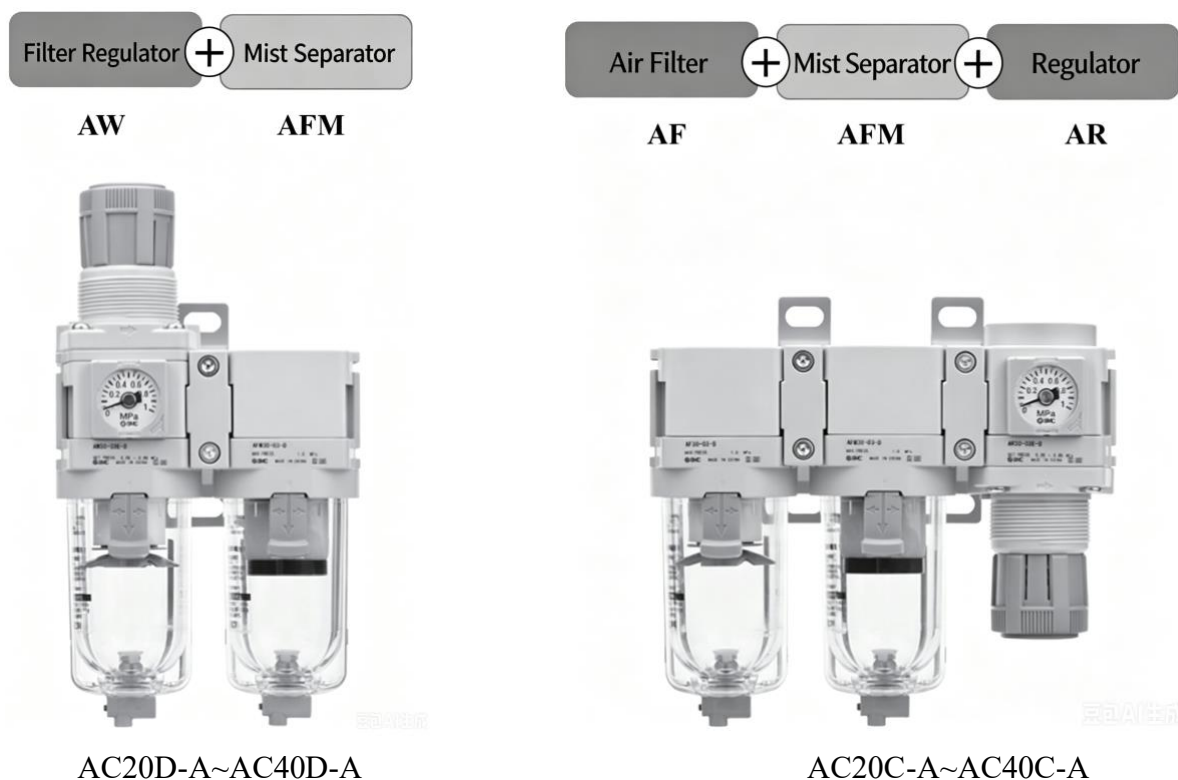


Figure 2. Filter Regulator Assembly

Filter Regulator Selection Recommendations

Selection Combination	Air Filter + Mist Separator + Regulator AF AFM AR 		Filter Regulator + Mist Separator AW AFM 
	AC 30 C — [] 03 DG — [] — [] — A 1 2 3 4 5 6		AC 30 D — [] 03 DG — [] — [] — A 1 2 3 4 5 6
Selection Model No.	SMC AC20C-02G-A		SMC AC20D-02G-A SMC AC30D-02G-A
	When the quality of compressed air at the inlet side is slightly lower than the operating requirements of the positioner		When the compressed air quality at the inlet meets the operating requirements of the positioner

Basic Parameters	Fluid: Air Ambient & Operating Temperature: -5~60°C (no freezing) Proof Pressure: 1.5 MPa Operating Pressure Range: 0.05~1.0 MPa Adjustable Pressure Range: 0.05~0.7 MPa Filtration Rating: AW: 5 µm, AFM: 0.3 µm (99.9% collection efficiency) Bowl Material: Polycarbonate Structure: Relieving type		
Selection Parameters	① Main Body Size: 20 Rated Flow Rate: 200 L/min Bowl Guard: Standard (Steel Band) Weight: 0.39 kg ② Thread Type (No Mark): Rc ③ Port Size Code 02: 1/4 ④ No Mark: Manual Drain Pressure Gauge G: Round Pressure Gauge with Limit Indicator ⑤ No Mark: No Accessories ⑥ No Mark: No Special Options	① Main Body Size: 20 Rated Flow Rate: 150 L/min Bowl Guard: Standard (Steel Band) Weight: 0.33 kg ③ Thread Type (No Mark): Rc ④ Port Size Code 02: 1/4 ⑤ No Mark: Manual Drain Pressure Gauge G: Round pressure gauge with limit indicator ⑥ No Mark: No accessories ⑥ No Mark: No special options	① Main Body Size: 30 Rated Flow Rate: 330 L/min Bowl Guard: Standard Equipment (Polycarbonate) Weight: 0.66 kg
1Series Positioner*	●	●	/
IP Series Positioner*	●	/	●

*●Recommended selection

Note: The rated air handling flow rate of the filter shall be higher than the maximum operating flow rate of the positioner. If multiple positioners are installed on the same air supply line, the total maximum operating flow rate shall be the sum of each unit. (1 Series Max Flow: 1500 / 1600: Q1-17 L/min, Q2-95 L/min 1880S: 17 L/min IP Series Max Flow: IP5500: 155 L/min IP6000 / IP6500: 187 L/min IP6000d: 150 L/min All above data are measured under 0.6 MPa supply pressure.)

Important Notes

1. Select filter regulators with suitable performance based on site working conditions to avoid equipment failure caused by high temperature, low temperature, high pressure, corrosive atmosphere and other harsh environments. Refer to the selection table at the end of this appendix.
2. Regularly inspect the condition and performance of the filter. Increase inspection frequency under high-frequency operating conditions to prevent malfunctions caused by clogged filter elements. (Typical failures include: ① Loss of filtration performance, allowing foreign matter to enter and damage the positioner; ② Clogging of the filter elements, resulting in an abnormal air supply and preventing the positioner from operating normally.)
3. For filter regulators with an auto-drain function, blockage of drain holes shall be prevented. Regular inspections can avert excessive water accumulation in the filter bowl caused by filter malfunctions. Manually drained filter regulators shall be drained manually on a regular schedule according to the water accumulation rate under actual working conditions.
4. Carry out regular maintenance or replace any nonconforming filter/regulator units in accordance with the operating instructions of the filter regulator to avoid unnecessary failures.