

MODEL CT-1

CONTROL VALVE

PRODUCT MANUAL

Thank you very much for choosing the Yoshitake's product. To ensure the correct and safe use of the product, please read this manual before use. This manual shall be kept with care for future references. The symbols used in this manual have the following meanings.

	Warning	This symbol indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
	Caution	This symbol indicates a hazardous situation that, if not avoided, may result in minor or moderate injury or may result in only property damage.

Table of Contents

1. Specifications.....	1
2. Nominal size selection	2
3. Appearance and dimensions	3-4
4. Structure.....	5
5. Operation.....	5
6. Operating example.....	6-7
7. Storage	8
8. Installation	
8.1 Installation for body part	8-9
8.2 Wiring and piping.....	10-12
8.3 Test run.....	13
8.4 Positioner readjustment	13-16
9. Warning and caution for use	16
10. Maintenance and inspection	
10.1 Troubleshooting	17
10.2 Warning and caution for maintenance.....	18
10.3 Dairy inspection.....	18
10.4 Regular inspection	18
10.5 Replacing gaskets, packings and positioners.....	18
Warranty Information	

YOSHITAKE

■EPDT-318a■

⚠ Caution

- (1) Please confirm that the indications on the product correspond with the specifications of the ordered product model before use.
* If they are different, do not use the product and contact us.
- (2) This product might be discontinued or improved without prior notice.
- (3) In order to ensure successful and safe operation of our valves the entire operation manual must have been read thoroughly and understood prior to installation and commissioning, maintenance, otherwise, serious injury or equipment malfunction could happen and control valve may be damaged. It is out of the guarantee repair or replacement are not uncompensated by us.

This is the diaphragm type control valve that controls the pressure, flow rate, liquid surface and temperature by using electrical/pneumatic positioner.

1. Specifications

Model		CT-1	
Size		15~100A	
Application	Control	Steam, Air, Cold and hot water, Oil, Non-dangerous fluid	
	Driving force	Compressed air	
Connection		JIS 10KRF	
Temperature		-5~210°C (Freeze is not available)	
Valve(Flow) characteristic		Equal percent	
Range ability		30:1	
Valve & valve seat		Metal seal type	
Leakage rate		Cv×less than or 0.01%(ANSI Class IV)*1	
Driving type		Pneumatic single acting diaphragm drive	
Actuator action		Normal closed *2	
Operation air pressure		0.1~0.3MPa	
Ambient temperature		-20~70°C	
Material	Body	SCPH2 (A216 WCB)	
	Valve	Stainless steel	
	Valve seat	Stainless steel	
	Gasket	Stainless steel + Graphite coating	
	Grand packing	PTFE	
	Diaphragm	EPDM	
Accessory		EP-1type DC4 ~ 20mA electrical/pneumatic positioner (2wires)	
		EP-1Stype DC4~20mA smart positioner (2wires)	
		Air regulator (Pressure regulator)	

*1: As for the Cv value, please see "2. Nominal size selection" shows rated Cv value.

*2: In case of no inlet signal, valve is closed because of spring load, and inlet signal is increased, valve will be opened.

*3: Please apply air pressure between 0.4-1.0 MPa for air regulator.

2. Nominal size selection

The appropriate nominal size can be calculated by obtaining the Cv value for the operating conditions in question, as shown below.

【In case of steam application】

$$P_2 > \frac{P_1}{2} \quad C_v = \frac{Wk}{138 \sqrt{\Delta P (P_1 + P_2)}}$$

$$P_2 \leq \frac{P_1}{2} \quad C_v = \frac{Wk}{120P_1}$$

P_1 : Inlet press.(MPa·A) W : Max. steam flow rate(kg/h)
 P_2 : Reduced press.(MPa·A) ΔP : $P_1 - P_2$ (MPa)
 k : $1 + 0.0013 \times \{\text{Super-heated temp. (}^\circ\text{C)} - \text{Saturated heat temp. (}^\circ\text{C)}\}$
 C_v : C_v value depend on each size

【In case of air application】

$$P_2 > \frac{P_1}{2} \quad C_v = \frac{Q}{2940} \sqrt{\frac{(273+t)G}{\Delta P (P_1 + P_2)}}$$

$$P_2 \leq \frac{P_1}{2} \quad C_v = \frac{Q \sqrt{(273+t)G}}{2550P_1}$$

P_1 : Inlet press.(MPa·A) Q : Max gas flow rate (m³/h nominal condition)
 P_2 : Reduced press.(MPa·A) t : Gas temperature(°C)
 ΔP : $P_1 - P_2$ (MPa) G : Specific gravity (it is against air)
 C_v : C_v value depend on each size

【In case of liquid】

$$C_v = \frac{0.365V\sqrt{G}}{\sqrt{\Delta P}}$$

V : Max. liquid flow rate (m³/h) G : Specific gravity (It is against water)
 ΔP : $P_1 - P_2$ (MPa)
 C_v : C_v value depend on each size

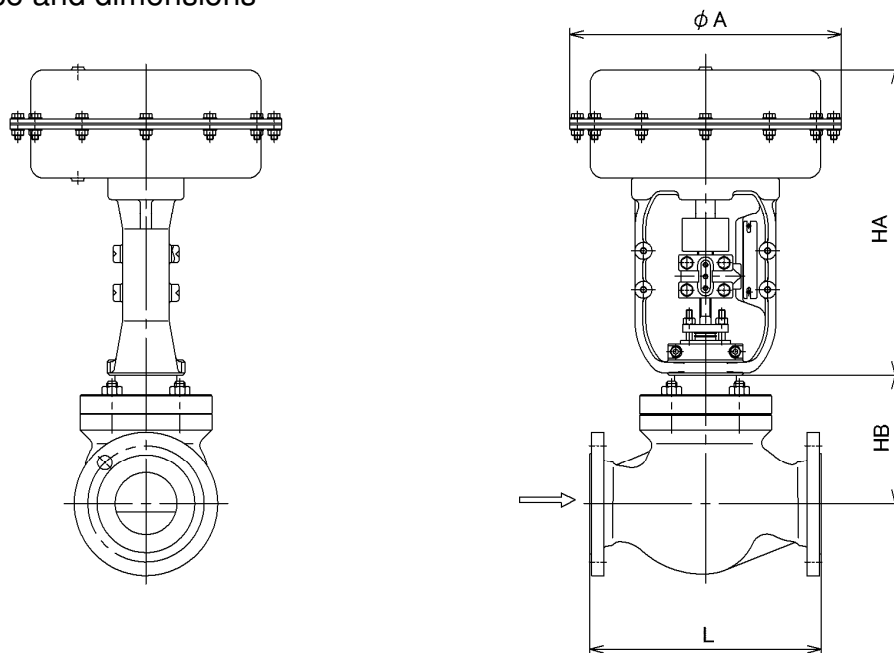
● Rated Cv value

Size	15A	20A	25A	32A	40A	50A	65A	80A	100A
Rated Cv value	6	9	14	25	33	50	85	106	175

Caution

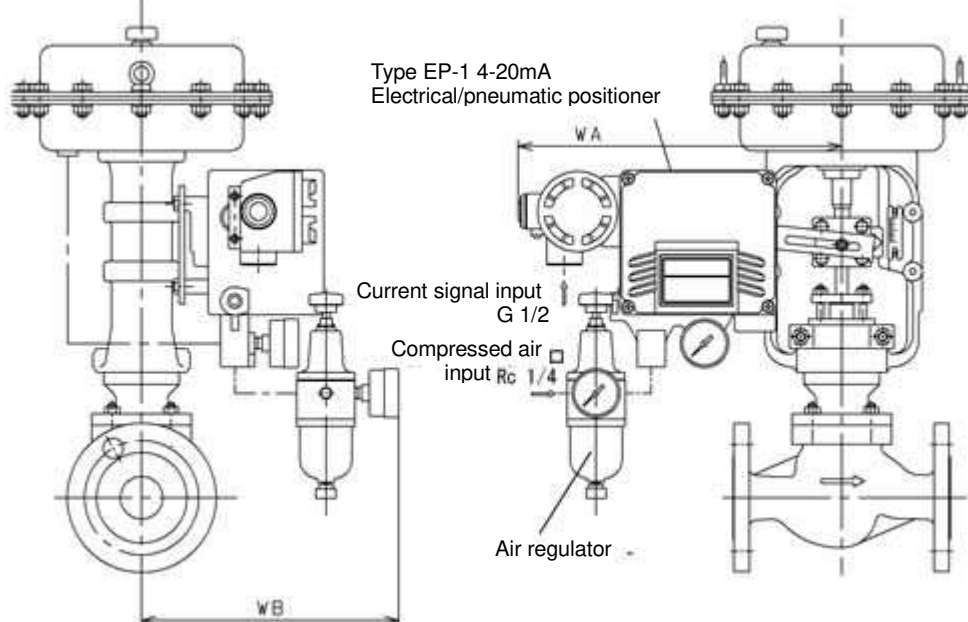
When selecting pipe size, please take piping condition and application into consideration and secure a safety rate of 80 %

3. Appearance and dimensions



Size	L	HA	HB	A	Stroke	Weight(kg)
15A	184	276	100	220	20	13
20A	184	276	100	220	20	13
25A	184	276	106	220	20	16
32A	222	320	111	270	25	22
40A	222	320	111	270	25	22
50A	254	320	124	270	25	28
65A	276	394	135	350	30	48
80A	298	394	167	350	40	61
100A	352	394	187	350	40	75

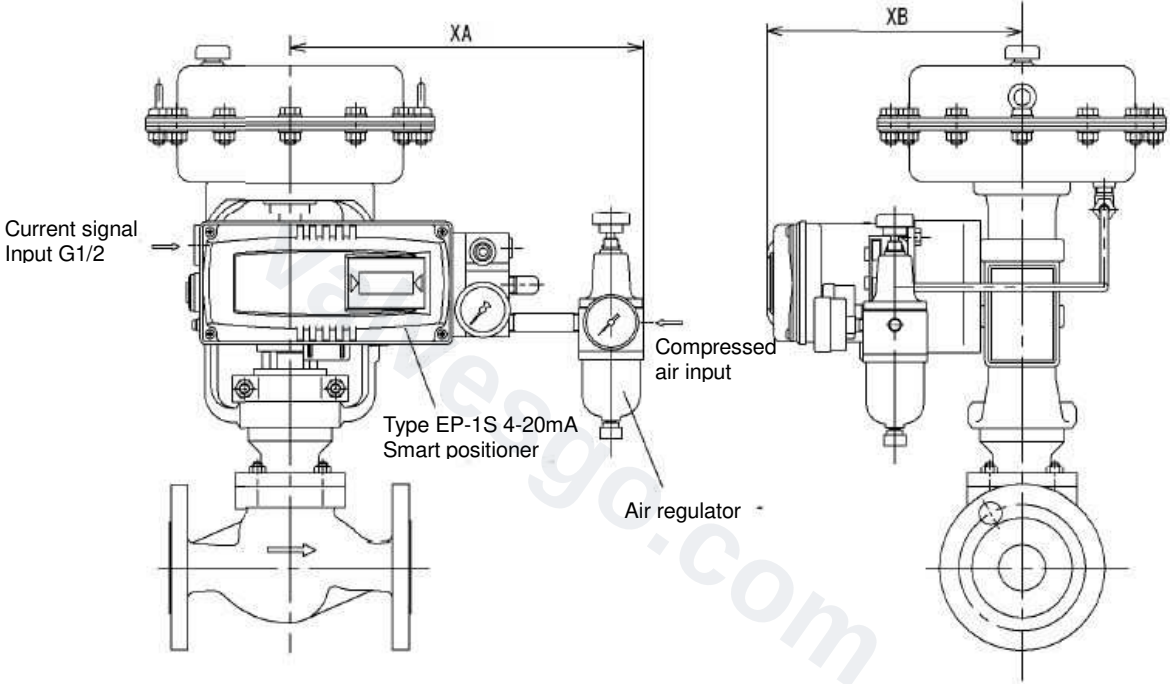
*In case of including accessories, it is provided as following condition.
[EP-1 type electrical/pneumatic positioner]



(mm)

Size	WA	WB
15A	295	230
20A		
25A		
32A	305	235
40A		
50A		
65A	320	240
80A		
100A		

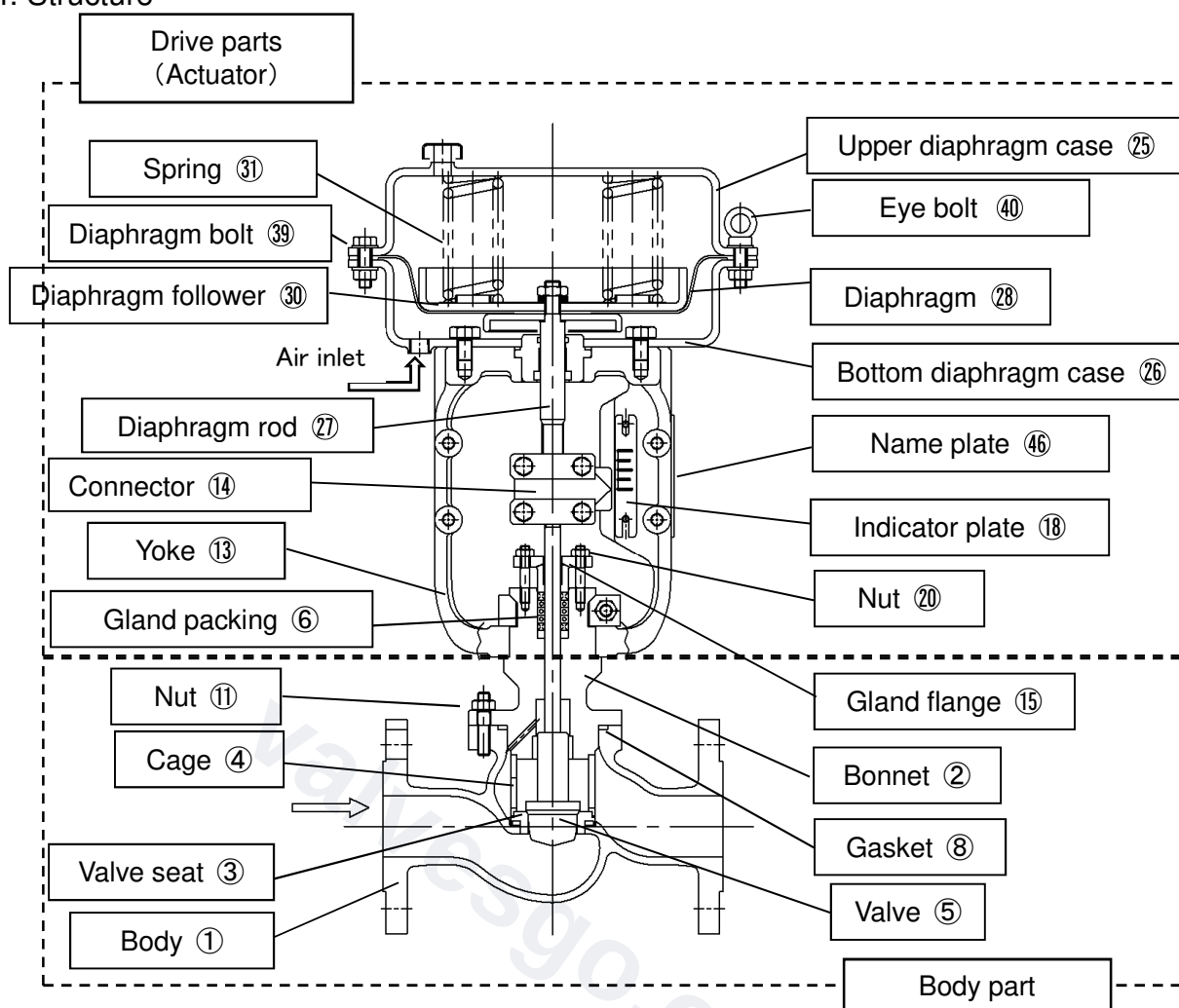
[EP-1S type smart positioner]



(mm)

Size	XA	XB
15A	290	210
20A		
25A		
32A	300	
40A		
50A		
65A	310	
80A		
100A		

4. Structure



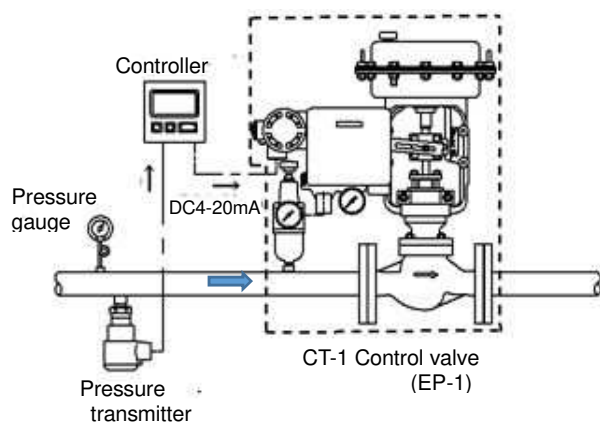
5. Operation

This product is a reverse-operated, and valve opens by the air pressure increased in the diaphragm case. Operated air pressure passes through the air connection port of the bottom diaphragm case "26", and by increasing air pressure on the diaphragm and the diaphragm follower "30", the spring "31" is compressed by the direction of spring is compressed. And the valve "5" is opened by displacing upward of the diaphragm rod "27" and connector "14" which is assembled with the diaphragm follower "30", and the fluid flows. In addition, the valve is displaced to the closing direction when the air pressure is decreased.

6. Operating example

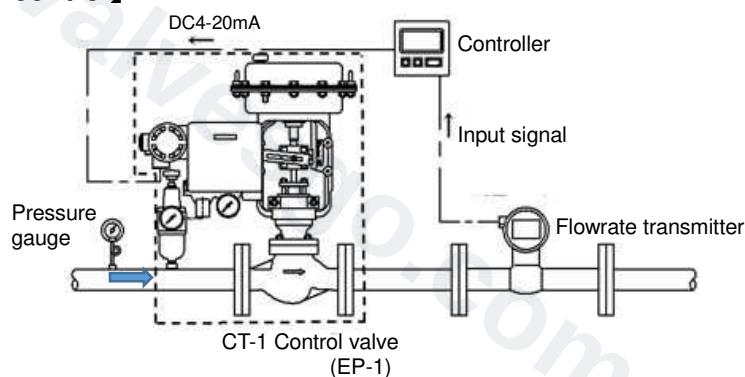
*Please prepare the sensor or measuring instrument by user themselves.

【Example of pressure control】



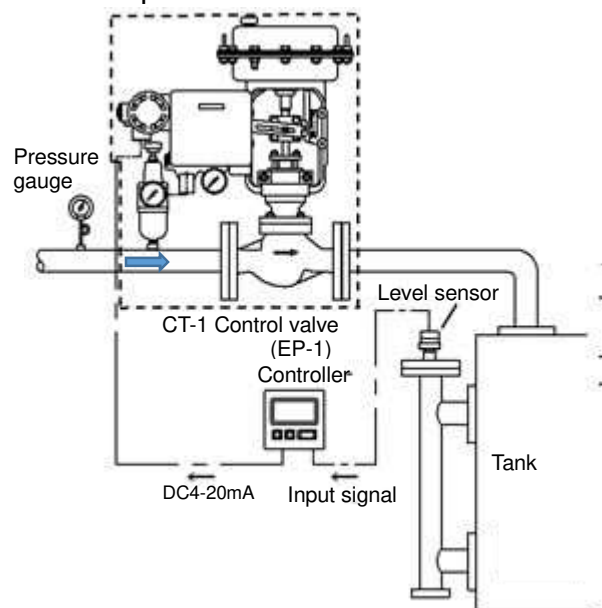
Signal	Valve action (Open degree of valve)	Fluid
20mA	Full opened (100%)	Press.: Min.
↑	↑	↑
Signal increase	Open	Press.: Decrease
↑	↑	↑
4mA	Full closed (0%)	Press.: Max.

【Example of flow control】



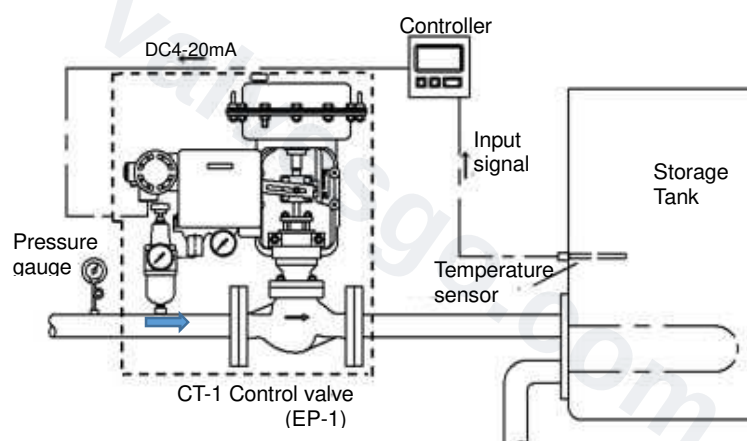
Signal	Valve action (Open degree of valve)	Flow rate
20mA	Full opened (100%)	Flow rate: Max.
↑	↑	↑
Signal increase	Open	Flow rate: Increase
↑	↑	↑
4mA	Full closed (0%)	Flow rate: Min.

【Example of water level control】



Signal	Valve action (Open degree of valve)	Tank
20mA	Full opened (100%)	Water level: Surge
↑	↑	↑
Signal increase	Open	Water level: Increase
↑	↑	↑
4mA	Full closed (0%)	Water level: No change

【Example of temperature control】



Signal	Valve action (Open degree of valve)	Fluid	Fluid in the tank
20mA	Full opened (100%)	Steam flow rate: Max.	Temperature: Max.
↑	↑	↑	↑
Signal increase	Open	Steam flow rate: Increase	Temperature: Increase
↑	↑	↑	↑
4mA	Full closed (0%)	Steam flow rate: Flow rate 0	Temperature: No change

7. Storage

Please storage the product in the package by installation. During storage, please follow these points.

- * After open the package for checking product, please storage into original package again.

- * Do not storage the product where rain falls, temperature is above 60°C, and dust or mist make damage for the product.

- * Before installation, do not remove seal and plastic cap which is used for pneumatic and electrical connection.

8. Installation

8.1 Installation for body part

Warning

(1) Due to heavy product, make sure to use hanging machine to hold the product. When hang this product up from package, use adequate hanging belt.

Eye bolt is installed at actuator in aim of hanging. When using eye bolt, use both eyebolt and make hanging belt same load at both side. (See Fig.4)

Besides, do not hold positioner when installation.

*Otherwise product may fall and cause injury.

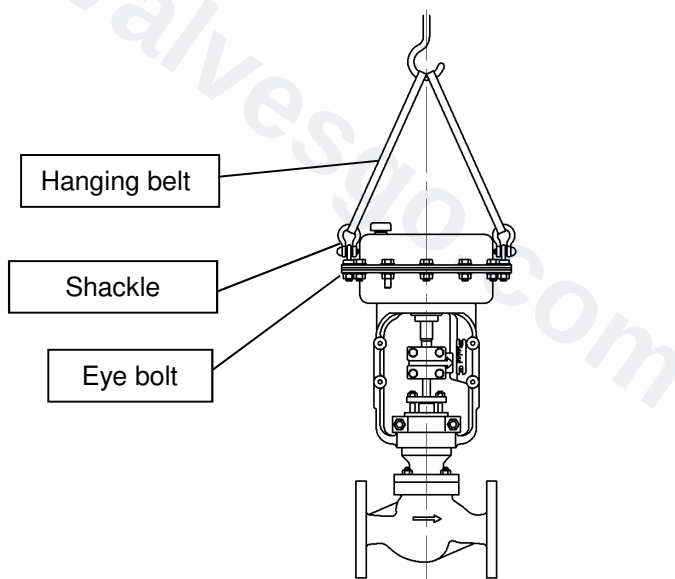


Fig.4

⚠ Caution

- (1) Do not disassemble the valve unreasonably
*Disassembling the valve at your discretion may affect the original performance
- (2) Remove foreign matter and scales from the lines before connecting the valve.
- (3) Install the stop valve before and after the control valve
- (4) To ensure the connect properly without any leakage.
*If the connecting way is improper, leakage may be happened by vibration. And in case of high temperature, it may result in personal injury.
*When using the seal tape for piping, be aware not to enter it inside valve. In case of the seal tape for piping enter the valve, it may result in malfunction or device damage.
- (5) To install the product, check the direction of the product so that the fluid flowing and the arrow marked on the product are in the same direction.
(Install the valve perpendicularly to horizontal lines).
Please see the fig 5.
*Improper installation causes the malfunction.
- (6) Do not apply excessive load, torque or vibration to the valve
- (7) Do not get out the seal or polyethylene cover from the positioner or regulator until the pneumatic piping or construction of the electrical signal wiring is started.
- (8) The area to be frozen, please have the step to prevent from freezing.
*If the fluid is frozen, it may result in malfunction.

*In order to have easy maintenance, be sure to have enough space for inspection.
Please see the fig.5.

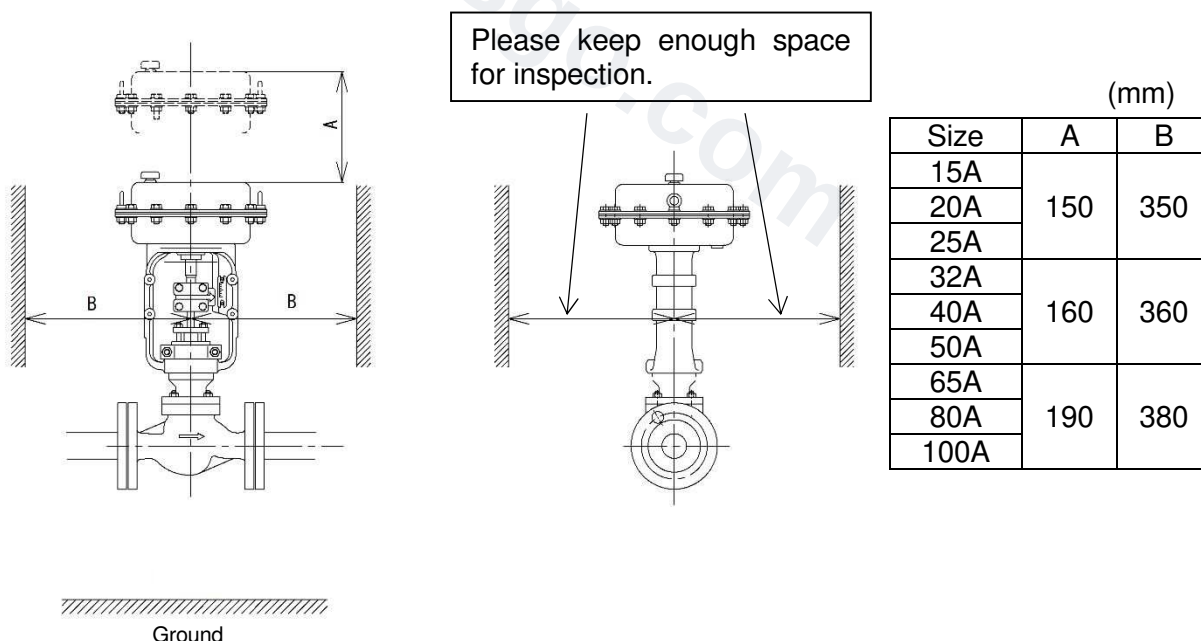


Fig.5

*Ambient temperature of the location where installing the valve should be between -20~70°C. In addition, please use the shielding plate or insulation in case the valve is affected by direct sunlight or radiant heat.

8.2 Wiring and piping

Warning

- (1) Electrical wiring must be done by expert or professional person.
- (2) This product is not available for the place (Atmosphere) where have the retention of explosive gas.
*Since it is not in the explosion-proof structure, there is a danger of fire.
- (3) When having the wiring work, please do the work in an environment where does not enter the rainwater or surrounding water. Also please make sure the rainwater or surrounding water so not enter the wiring port.
*In case of water enters there, there is the risk of electric shock
- (4) When wiring, please make sure the power supply is not provided.

Caution

- (1) Please have the proper piping diameter so as not to have pressure drop when piping to the positioner.
*The valve may not work properly.
- (2) When using the seal tape for piping, be aware not to enter it inside valve. If the seal tape for piping enter the valve, it may result in malfunction or device damage.
- (3) The compressed air the supply to the actuator, positioner and air regulator must the clean dry air which is not include the moisture, oil, and foreign matter.
*The valve may not work properly if the foreign matter comes in.
- (4) When purchasing the accessories, the air regulator and positioner are connected to the actuator when supplying, so please do not give the damage to the piping of air regulator and wiring for positioner.

【Method of connecting the air piping to the air regulator】

·When purchasing the goods with accessories, it is delivered by the structure with shown in Fig. 6-7. Please connect the air piping to the operating air connection port in Fig.6-7.

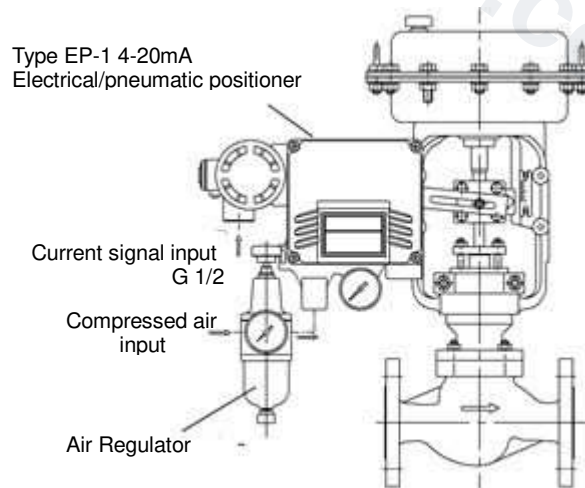


Fig.6

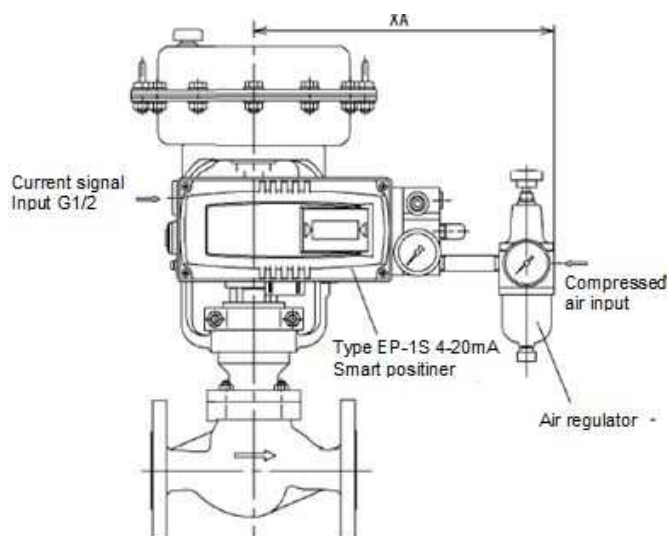


Fig. 7

【How to connect the signal cable to the pneumatic positioner】(In case of EP-1 type)

•When purchasing the goods with accessories, it is delivered by the structure with shown in Fig. 6. Please draw the signal cable from the external DC signal connection port shown in Fig.6. Connection way is 2 wire type. Please confirm and do wire the DC 4-20mA with the external signal line.

*Terminal wiring method (See Fig.8)

- ① Remove the set screw of the terminal box (Use the hex wrench) and remove the terminal box cover.
- ② Please connect the positive terminal of the terminal block located in the terminal box to the positive line of external input line. (In case of negative terminal, please connect the negative terminal of the terminal block located in the terminal box to the negative line of external input line). To protect the positioner, earth the gland earth terminal. When connecting, please tighten the terminal fastening firmly so that there is no connection failure.
- ③ After connecting the external line, tighten and fix the set screw after closing the terminal box cover. (Tightening torque: 0.25N · m)

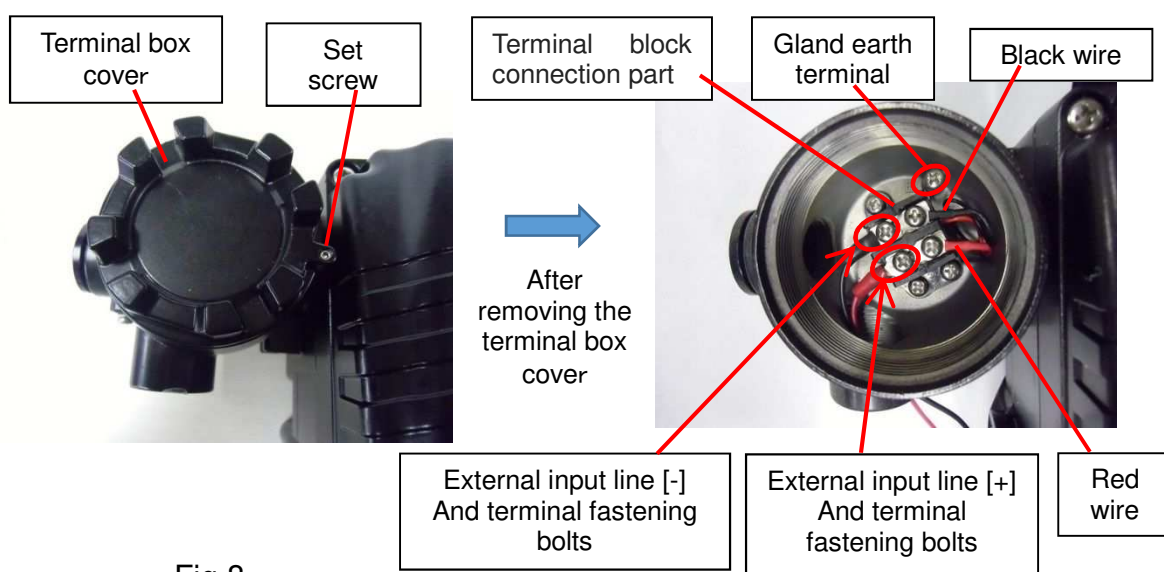


Fig.8

【How to connect the signal cable to smart positioner】(In case of EP-1S type)

•When purchasing the goods with accessories, it is delivered by the structure with shown in Fig. 7. Please draw the signal cable from the external DC signal connection port shown in Fig.7. Connection way is 2 wire type. Please confirm and do wire the DC 4-20mA with the external signal line. The positioner operates at 3.2 mA DC of minimum supply current. Do not supply more than 24 mA DC.

*Terminal wiring method (See Fig.9)

- ①Remove the cover on the positioner by loosen 4 screws.
- ②Connect external input line[+] to [IN+] terminal box and external input line[-] to [IN-] terminal box at left side of positioner. To avoid defective of cable, fix the cable by terminal fastening bolt (M3 screw).
- ③To protect the positioner, earth the inside or outside gland earth terminal.
- ④After connect external cables, tighten the screw and fix the cover. Please put cover as display can be shown.

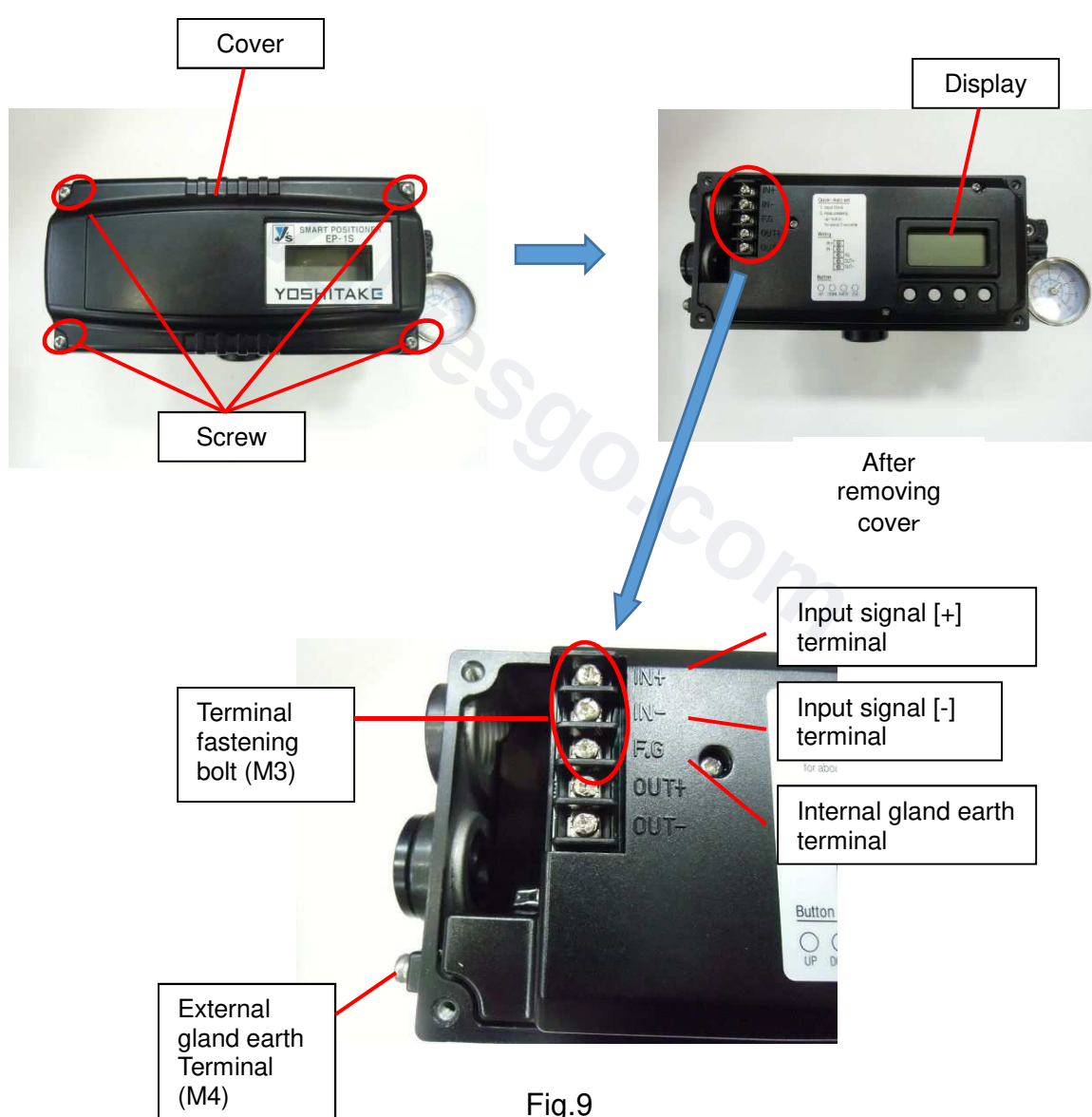


Fig.9

8.3 Test run

If the product comes with accessories, it is shipped with positioner set to zero point and the span adjusted, but it may be dropped or received impact during transportation or installation, so before operation, be sure to have a test run.

Caution

The product operates while a test run. Be sure to conduct a test run before operation. And, please have a test run in a pressure-free state with no fluid inside.

[Test run procedure]

- (1) Connect a regulator or current generator so that the positioner receives a 4-20mA DC pseudo input signal.
- (2) With the air pressure applied to the air regulator, confirm the product operates with its opening from 0 to 100% when the pseudo input signal of 4 to 20mA DC (0 to 100%) is given to the positioner and changed between 0-100%. If the opening is incorrect, readjust the positioner according to "8.4 Positioner readjustment".

8.4 Positioner readjustment

Caution

The product operates during the positioner adjustment, so make sure that there is no fluid inside the product, and readjust the positioner under no pressure.

【For EP-1 electropneumatic positioner】

- (1) Loosen 4 screws on the cover with a cross-head screwdriver and remove the cover. Then, readjust the zero-adjustment part and the span adjustment part. (Fig. 10)

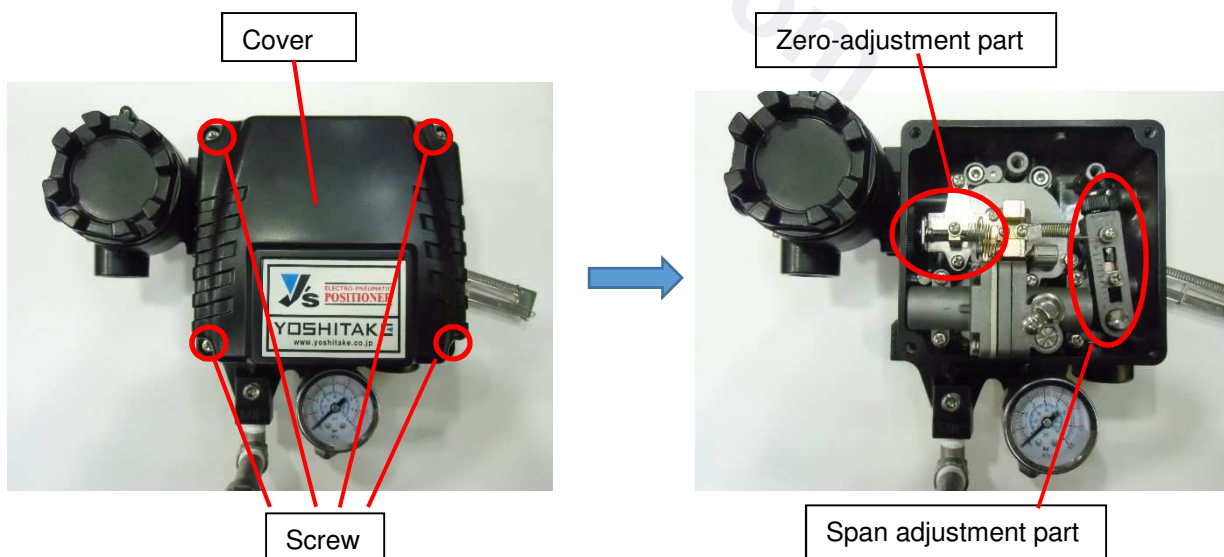
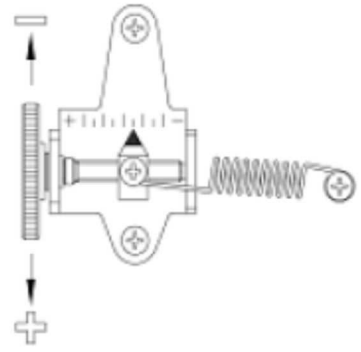


Fig.10

- (2) Supply air pressure by the air regulator, and input the signal (4mA DC) of zero opening into the positioner. Then turn the knob of the zero-adjustment part clockwise or counterclockwise to align the initial point (zero point) of the actuator. In the right figure, the "+" is the direction in which the zero point becomes higher, and the "-" is the direction in which the zero point becomes lower.

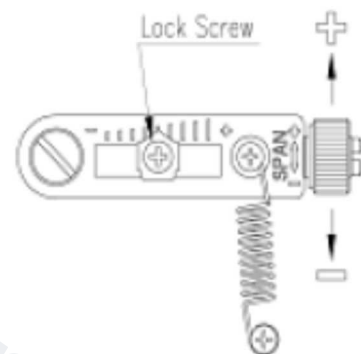
After that, check that the pointer of the pressure gauge attached to the positioner starts to move when the input signal is 4.8 to 4.9 mA DC. If it does not move, adjust it to the position where the pointer of the pressure gauge starts to move with the zero adjuster.



- (3) Loosen the lock screw of the span adjustment part. After finishing the zero-point adjustment, apply the input signal (12mA DC) of 50% opening into the positioner. In this state, adjust the scale position of the stroke indicator plate attached to the actuator to half of the position of the full stroke. If the position is low, turn the span in the "+" direction to increase the span, and if the position is high, turn the span in the "-" direction to decrease the span.

Next, apply the input signal (20mA DC) of 100% opening into the positioner. In this state, adjust the scale position of the stroke indicator plate attached to the actuator to the full stroke position.

If the above span adjustment is performed, the zero-point changes. So, after adjusting the span, check the zero point again with the input signal (4mA DC) of zero opening and readjust. Repeat steps (2) and (3) until the stroke position stabilizes in this process.



- (4) When the adjustment is completed, tighten the lock screw of the span adjustment part. And install the cover in the reverse order (1)

【For EP-1S smart positioner】

EP-1S type has auto-calibration function, so auto-calibration can be done the positioner readjustment.

* Method of auto-calibration (See Fig.11-13)

- ① Confirm display works (power is supplied) and air is supplied to positioner.
- ② Loosen screw on the cover of positioner (4point) and remove the cover.

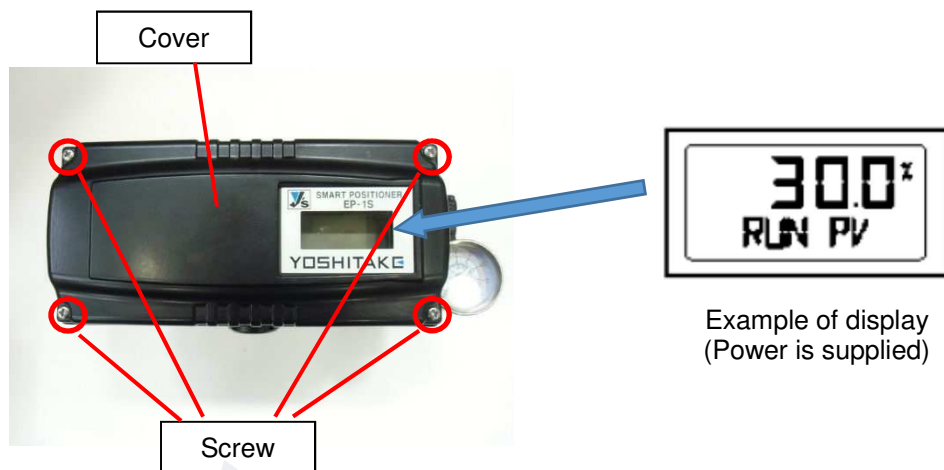


Fig. 11

③ Input 12mA DC to positioner. Auto calibration cannot be conducted with any other input signal. Press and hold [] (hereafter ENTER key) for approx. 3 seconds. [AUTO CAL] is shown on the display. Press ENTER key once, and [AUTO1] appears. Press ENTER key and auto-calibration starts. (Fig.12) Auto-calibration requires around 2-3 minutes depending on the size. [Complete] is shown when finished. Press ENTER key, and then positioner is put into usual operation mode.

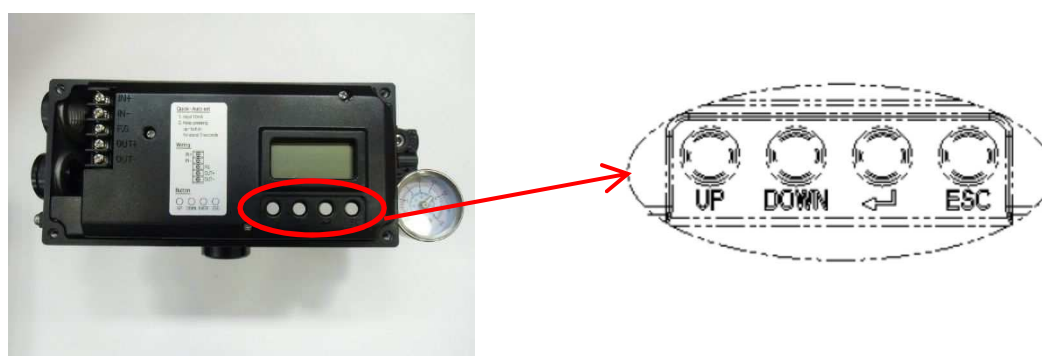


Fig. 12

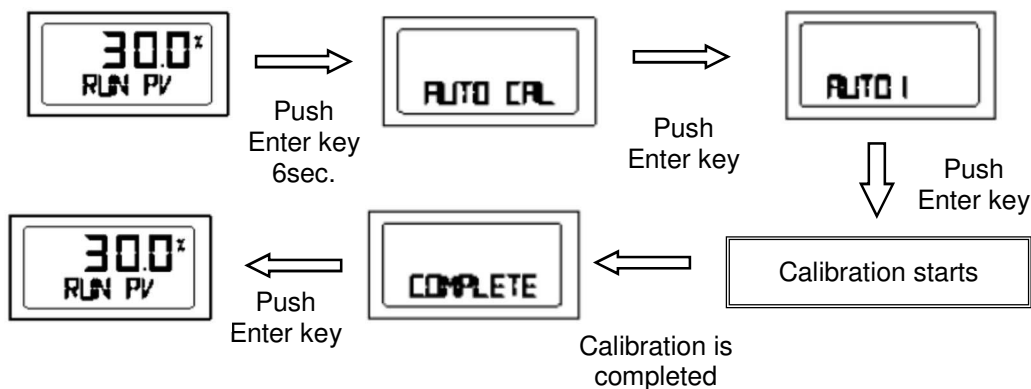


Fig. 13

④Auto-calibration is completed when display shows standard indication as Fig.13. Mount cover on the positioner and fix by tightening screw. Please put cover as display can be shown.

*During calibration, if 「CHK AIR」 is shown, air is not supplied to positioner. In this case, please check air connection.

9. Warning and caution for use

⚠ Warning

- (1) Before flow the steam in pipe line, make sure steam can flow without any dangerous at the end of pipe line and pipe line is connected tightly.
*Failure to follow this notice may result in burns and property damage.
- (2) Do not touch the valve directly with bare hands.
*Failure to follow this notice may result in burns.

⚠ Caution

- (1) Be sure to close the terminal box cover
*In case of remaining the cover opened, rainwater or surrounding water enter inside and it cause the leakage and malfunction

10. Maintenance and inspection

10.1 Troubleshooting (Please see the structure described 4)

Problem	Cause	Solution
Not working	1. Operating pneumatic pressure or external signal are not supplied.	1. Please confirm the presence or absence of the operating air (more than 0.35MPa) by the pressure gauge, etc. And confirm the external signal tester by using tester.
	2. Air piping is clogged or leaked.	2. In case of clogged, please clean it. When leaking, please replace the piping.
	3. Diaphragm bolt is loosen.	3. Retighten it.
	4. Leakage is happened between bottom diaphragm case and diaphragm rod.	4. Replace the product.
	5. Failure is occurred on accessories of positioner or regulator.	5. Inspect or replace the positioner or regulator.
	6. Failure is occurred on body part or actuator	6. Inspect or replace the product.
	7. Sensitivity of the positioner is inadequate.	7. Replace the positioner.
Working is unstable	1. Abnormal signal from the controller	1. Adjust controller again and confirm the signal system.
	2. Operating pneumatic pressure is not constant.	2. Check the air piping and exchange it to the bigger piping diameter.
Leakage from valve⑤	1. The valve does not move to the full closed position (Not moving downward)	1. Adjust the zero point again by using the controller.
	2. There are any scratches on the valve seat③1 or valve⑤	2. Replace the product.
Leakage from grand packing⑥ or gasket part⑧	1. The nut on grand part⑩ or body part⑪ is loosen.	1. Retighten the nut. After retightening, there is still leak, exchange the packing.
	2. The harden pf the grand packing⑥ or gasket⑧	2. Replace them.

10.2 Warning and caution for maintenance

Warning

- (1) Do not touch the valve or piping directly with bare hands
*Failure to follow this notice may result in burns
- (2) Do not disassemble the valve unreasonably
*Disassembling the valve at your discretion may affect the original performance
*In case of disassembling, please be sure to ask our staff

Caution

- (1) In case of no operation for a long period of time or regular inspection, discharge internal pressure from the valves, lines, and equipment completely.
* The scale or foreign matter inside of the pipe may cause malfunction.
- (2) After having the long term suspension, please do the inspection before re-operation.

10.3 Daily inspection

Please check the leakage from the pipe and the body portion (leak sound, etc.) following items during operation of facilities.

10.4 Regular inspection (1 time/Month)

- (1) Please make sure that there is no looseness on the installed piping of inlet and outlet side of the product.
- (2) Giving a false signal of 4-20mA DC to positioner, when it is changed by the opening signal from 0 to 100%, please make sure that the product is operated by the opening degree of 0 to 100%
*If the abnormality is found, please contact us.

10.5 Replacing gaskets, packings and positioners

For disassembling the product by replacing the gasket, packing, or positioner, please refer to SM-741 "CT-1 Disassembly and Assembly Procedure".

Although it varies greatly depending on the use conditions, the recommended period for replacing gaskets and packings is about two years.

Warranty Information

1. Limited warranty

This product has been manufactured using highly-advanced techniques and subjected to strict quality control. Please be sure to use the product in accordance with instructions on the manual and the label attached to it.

Yoshitake warrants the product to be free from any defects in material and workmanship under normal usage for a period of one year from the date of receipt by the original user, but no longer than 24 months from the date of shipment from Yoshitake's factory.

2. Parts supply after product discontinuation

This product may be subject to discontinuation or change for improvement without any prior notice. After the discontinuation of the product, Yoshitake supplies the repair parts for 5 years otherwise individually agreed.

3. This warranty does not cover the damage due to any of below:

- (1) Valve seat leakage or malfunction caused by foreign substances inside piping.
- (2) Improper handling or misuse.
- (3) Improper supply conditions such as abnormal water pressure/quality.
- (4) Water scale or freezing.
- (5) Trouble with power/air supply.
- (6) Any alteration made by other than Yoshitake.
- (7) Use under severe conditions deviating from the design specifications (e.g. in case of corrosion due to outdoor use).
- (8) Fire, flood, earthquake, thunder and other natural disasters.
- (9) Consumable parts such as O-ring, gasket, diaphragm and etc.

Yoshitake is not liable for any damage or loss caused by malfunction or defect of the product.

YOSHITAKE

INTERNATIONAL DEPT.

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