KGP5000 series

Smart valve positioner

Model KGP5000 / 5003

Instruction Manual

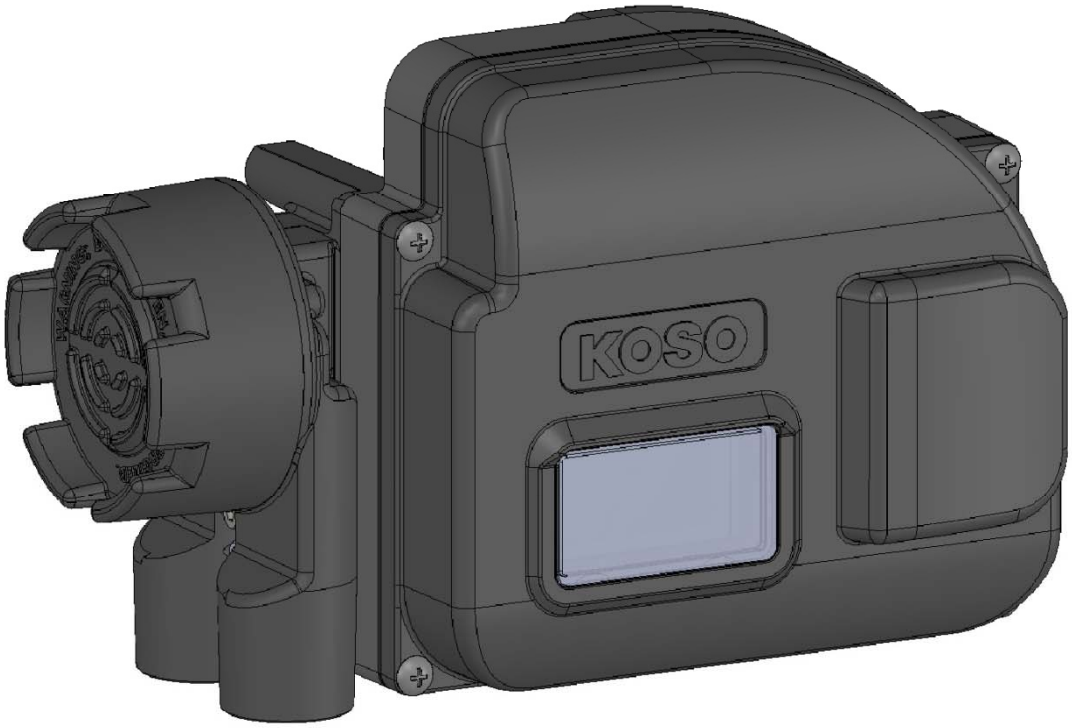


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1. INTRODUCTION

Please read carefully at first!
This instruction manual includes specifications, installation & calibration, maintenance procedures, guide to the diagnosis and treatment of failure, troubleshooting, replacement of parts, and so on for the KGP5000 series smart valve positioner. Read carefully before installing and using the positioner.

In order to get the support you need, contact your KOSO sales office. Please refer to this instruction manual on the reverse side for contact information.

Please keep this instruction manual for future reference!

Notes regarding this instruction manual;

- The user should read and understand this publication.
- The contents of this publication are subject to change without notice to improve specifications.
- The contents of this publication may not be reproduced or duplicated in whole or in part, without prior consent.
- This publication may not be revised so long as changes in structure and specifications have no effect on the operation of the positioner.
- The contents of this publication are described as correct as possible but if anything is unclear or you have any questions, please contact KOSO sales office.

1.1. Scope of this instruction manual

This document is compatible with the following versions as below.

Electronics Version	:	1.0.0 and more
Software Version	:	1.0.2 and more
Model		
KGP5000	:	Without HART communication, without position transmitter
KGP5003	:	With HART communication, with position transmitter
HART EDD/FDI		
EDD Version	:	3 and more
FDI Version	:	03.00.00 and more

1.2. Safety notices

This document describes safety notices by using warnings and cautions as below. The user should thoroughly review safety notices described in this instruction manual prior to installation, operation, maintenance for the positioner.

Warning

Death or severe personal injury can occur if the user fails to keep safety precautions.

Caution

Minor personal injury or property damage, damages or breakdown of the positioner and the system equipped with the positioner can occur if the user fails to keep safety precautions.

It should be noted that this instruction manual includes information for only this smart valve positioner. Therefore, it is the responsibility of the user to take into account safety considerations relate to any other installation methods or operation methods except the method provided herein.

1.3. Product summary

KGP5000 series smart valve positioner is a control device mounted on the pneumatic actuator for control valve, which positions a control valve according to a 4 to 20mA signal from a higher-level control system or a control device. Position feedback control system which receives feedback signal mapped to the desired valve travel and compares both input signal and feedback signal enables accurate positioning of a control valve.

In addition, it is possible to use this positioner in order to operate various types of pneumatic actuator such as linear or rotary motion actuators both of single and double acting.

Furthermore, the positioner utilizing digital techniques performs the functions of advanced PID controller, local user interface (LUI) using LCD, diagnostics utilizing sensing techniques with potentiometers and internal pressure sensors. Such features enable an easy installation and calibration, an effective monitoring and an efficient process management relevant to operations and maintenance.

1.3.1. Parts description

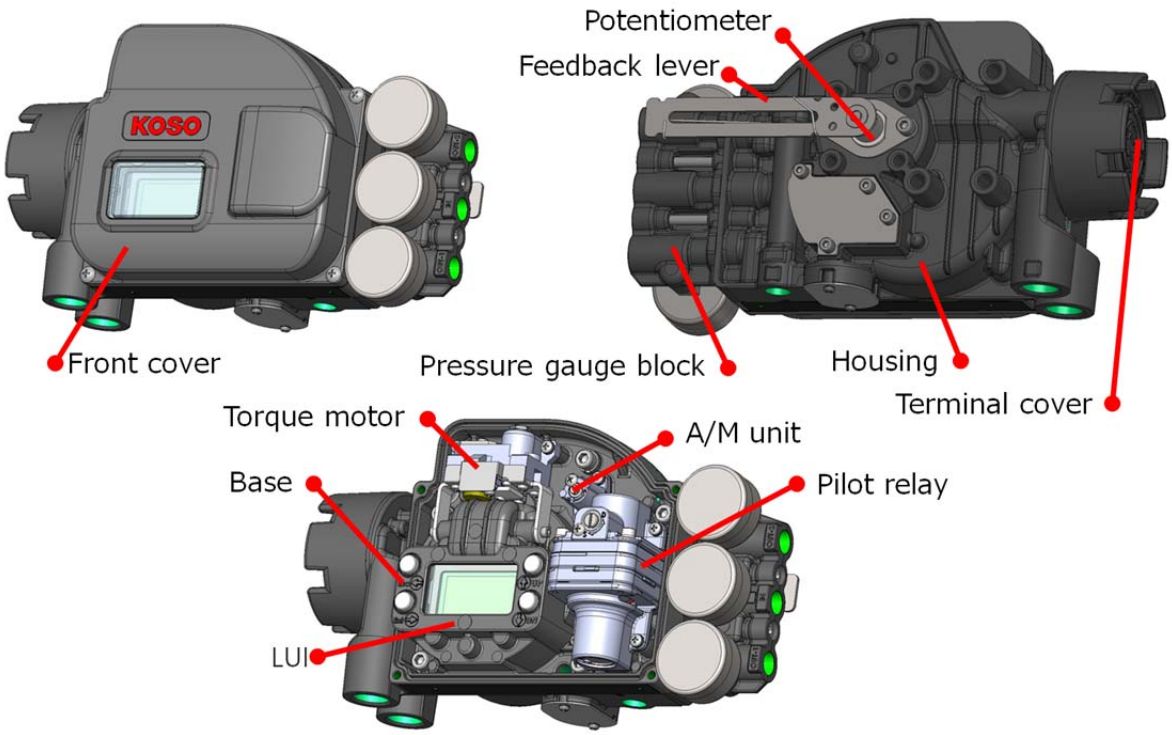


Figure 1.3.1 Product parts

1.3.2. Principle of operation

The principle of operation and the process flow diagram are shown in figure 1.3.2a and 1.3.2b.

The CPU(central process unit) receives a 4 to 20mA signal, an actual valve position feedback signal as control valve travel from a potentiometer attached to the feedback lever and pressure signal into which ADC(A/D converter) converts signal from pressure sensors (supply pressure Ps, output pressure Pout1 & Pout2).
The deviation generated by the control algorithm is the difference between an input signal and a valve position feedback signal.

In order to reduce the deviation, the control algorithm generates the error signal mapped to the deviation and converts the error signal into the IP signal current, which flows into the torque motor.
The converted IP signal generates the nozzle backpressure which is connected to the pilot relay and causes a change in the output pressure, the actuator is moved in a manner to reduce the control deviation.

By repeating this process, the positioner achieves the valve control that the control valve travel goes to the travel mapped to the input signal.

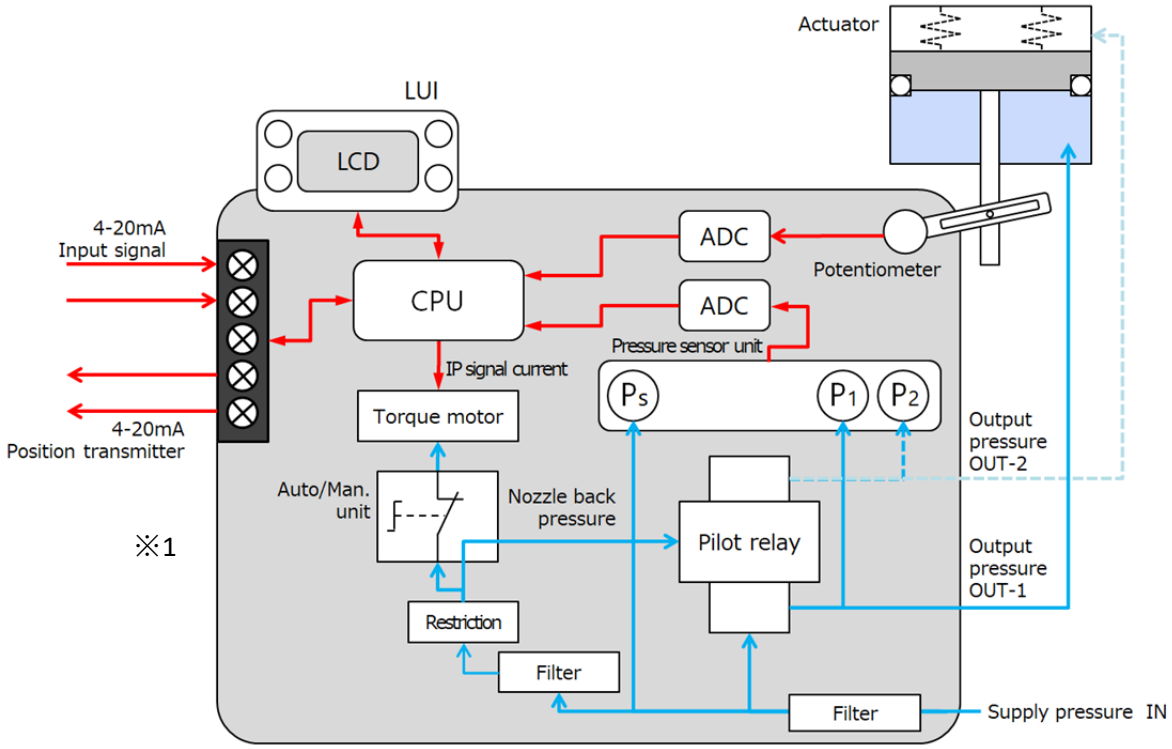


Figure 1.3.2a Principle of operation

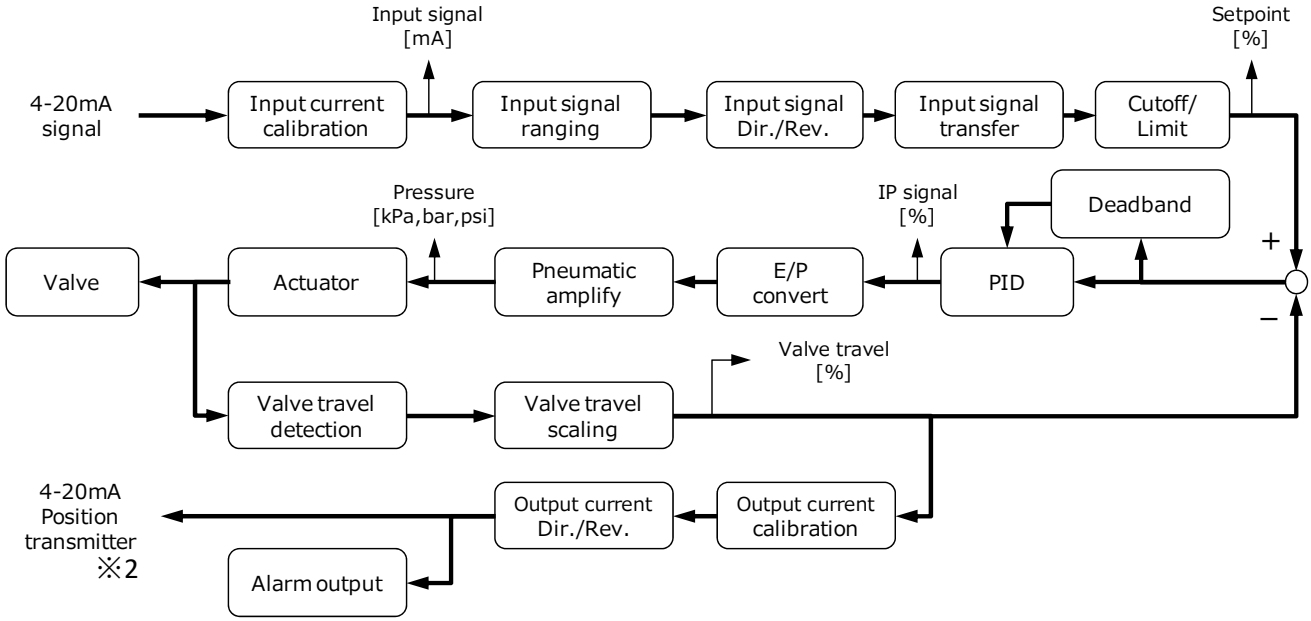


Figure 1.3.2b Process flow diagram

※1,※2 Model KGP5003 only

1.4. Specifications

General specifications ;

Available types of actuators for mounting;

KOSO diaphragm type : 5200LA
KOSO cylinder type : 6300LA
KOSO high power type : 5300LA
KOSO rotary type : 63D0RC(6300RA)
Actuators manufactured in accordance with the standards IEC60534-6, VDI/VDE3845

Travel range;

Stroke : 12 ~ 250mm

※ Strokes above 250mm are available with special kits.

Angle : 40 ~ 100˚

Action ; Single acting/ Double acting

Environmental conditions ;

Operating temperature range;

Dust water proof (Non-explosion protection) type : -40 ~ 80˚C
Explosion proof type : Refer to section 3.
LCD : -20 ~ 70˚C

Operating humidity range;

5 ~ 95%RH (non-condensed)

Electrical specifications ;

Input signal ;

Positioner control

Service current range :
4-20mADC
Split range available

CPU startup / HART communication current
Minimum operating current : 3.8mA
Maximum permissible current: 24mADC
Compliance voltage@20mA
Model KGP5000：8.6VDC
(Input impedance 430Ω)
Model KGP5003：9.6VDC
(Input impedance 480Ω)
Polarity protection ; -40VDC

Position transmitter output ;

※Model KGP5003 only

Power supply range : 17~31VDC
Current signal range : 4~20mADC
Position signal : 3.8mA ＜ ‥ ＜20.5mA
Alarm signal : ≦3.6mA or ≧21mA
according to *NAMUR NE43
Burn-out direction
LO or HI depending on setting
LO only under input signal failure
Maximum voltage : 40VDC
Polarity protection ; -40VDC

Pneumatic data ;

Supply pressure ;

Minimum : 140kPa, Maximum : 800kPa
Supply medium : Air, Nitrogen
Air quality :
JIS B 8392(2012) / ISO8573-1(2010),
Particle size : class 5
(2~5μ filter is recommended)
Oil content : class 3 (1ppm or less)
Humidity : pressure dew point must be at least 10˚C lower than the housing temperature of the positioner.

Output pressure ;

Action : Double / Single direct

Air consumption ;

Single acting type : 6NL/min or less at 140kPa
: 9NL/min or less at 300kPa
※at 50% position of full travel
Double acting type
: 16NL/min or less at 400kPa
: 20NL/min or less at 550kPa
※ at balance pressure
(70% of supply pressure)

Maximum output capacity ;

165NL/min or more at 140kPa
290NL/min or more at 300kPa
370NL/min or more at 400kPa
500NL/min or more at 550kPa

Enclosure;

Housing material ; Aluminum die-casting alloy
Standard coating material ; Acrylic resin paint
Heavy duty coating material (option);
Polyurethane resin paint
Elastomer materials ; Silicone for air passage

NBR for others

Protection code ; IP66

TIIS, CCC(NEPSI), KOSHA：

TÜV Rheinland Certificate No. AK 50363732 0001

IECEx, ATEX, EAC, CNS：

TÜV Rheinland Certificate No. AK 50448750 0001

Pneumatic connections ; Rc1/4 or 1/4NPT

Electric connections ;

according to the specifications as below

G1/2, 1/2NPT, M20x1.5

Mounting threads ; 4xM8，Φ50-4xM6

Weight ; 3.0kg (not include pressure gauge)

Dimensions; W218 x H149 x D133

Performance ;

Position control

Linearity ; ±1.0%

Hysteresis ; 0.7%

Position transmitter output

※Model KGP5003 only

Linearity ; ±0.5%

Hysteresis ; 0.3%

1.5. Marking label

A specification plate (Nameplate) is attached with the positioner as below shown. For Ex-proof type, refer to section 3.

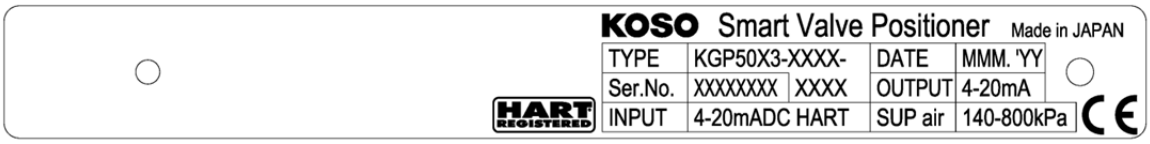


Figure. 1.5.1 Specification plate (Standard type)

The specification plate includes the contents as below

- TYPE : Code number
- Ser. No. : Serial number
- INPUT : Input signal
- DATE : Manufactured date
- OUTPUT : Output signal
- SUP air : Supply pressure range
- Country of origin
- Warning relevant to explosions

1.6. Certificates and approvals

Explosion protection：

TIIS(JIS) ：Ex d IIC T6 Gb

KOSHA ：Ex d IIC T6

IECEx, CCC(NEPSI), TS(CNS), ECAS ：Ex db IIC T6 Gb

ATEX ：II 2 G Ex db IIC T6 Gb

EAC ：1Ex db IIC T6 Gb

CE marking

ATEX directive(2014/34/EU) ：EN60079-0-1

EMC directive(2014/30/EU) ：EN61000-4-2,-3,-4,-5,-6,-8

：EN61000-6-4

RoHS directive(2011/65/EU) +(EU)2015/863：EN IEC63000:2018

HART communication approval： HART7 ※Model KGP5003 only

1.7. Tools

Warning

- **Keep away from a magnet material or a magnetic-tripped screwdriver. It unexpectedly moves the control valve so that it may cause the death or serious damage.**

To install and operate the positioner, the following tools are required.

① Phillips screwdriver： No.2
Front cover, torque motor, pilot relay, A/M unit

② Flat screwdriver： 6×100mm
Switching the screw of the A/M unit, switching the screw of the pilot relay

③ Hex key
3mm： lock screw of the terminal cover
4mm： pressure gauge block

④ Spanner：10mm
Adjusting the gap between nozzle and nozzle pad of the torque motor

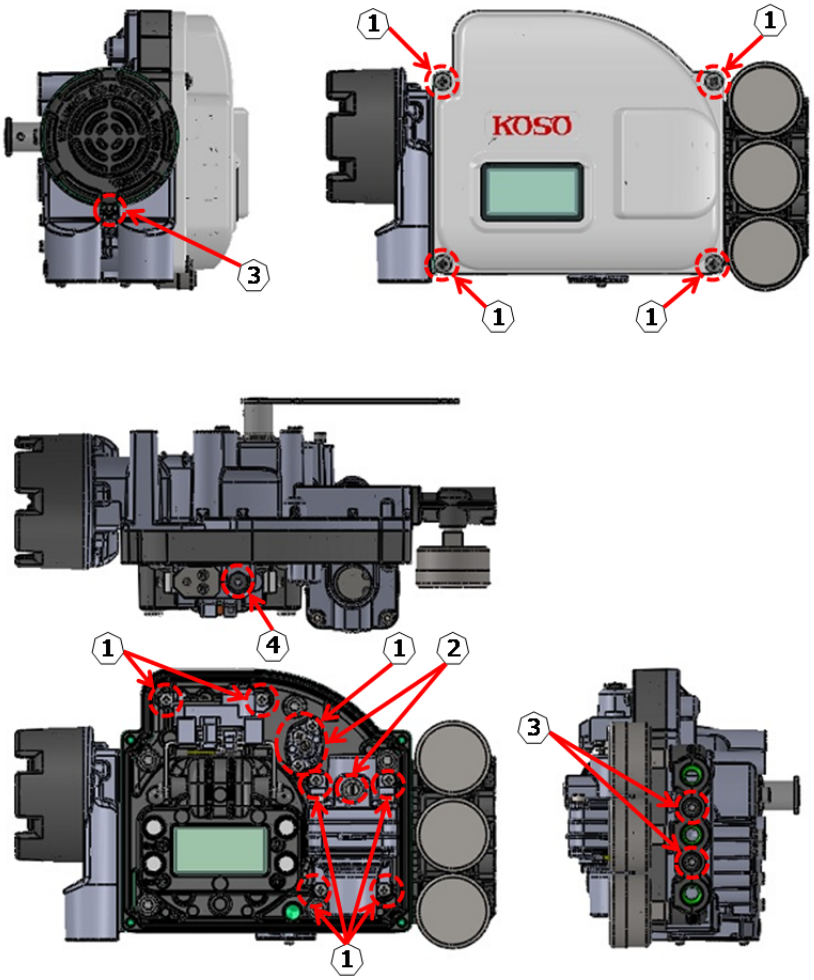


Figure 1.7 Parts to use tools

1.8. Storage

The following instructions must be observed in order to store the positioner.

If the device is to be stored in unused state；

1. Store it in the packed state of product shipment.
2. Keep away from the environment in where vibration and impact, noise, etc. may be caused and store it in an indoor environment free of flooding.

If the used device is to be stored；

1. Fasten tightly the terminal cover. In addition, block the electric conduit ports to prevent the intrusion of humidity, dust.
2. Block the pneumatic connection ports and the exhaust port with tape to prevent the intrusion of humidity, dust.
3. Keep away from the environment in where vibration and impact, noise, etc. may be caused and store it in an indoor environment free of flooding.

1.9. Warranty certificate

We'll set a guarantee period without charge of our product to 1 year after payment at your designation place. When a defect of a product and a breakdown have formed by improper use method and use environment by all except for the condition indicated on this instruction manuals and catalog specifications, etc., this no charge guarantee period isn't applied, so please accept it beforehand. Further, when there is warranty rule by a contract different from the above, we assume that its condition is given priority to.

2. MOUNTING

Warning

- Prior to mounting the positioner on the actuator, be certain the air supply is locked out. The feedback lever movement during air supply may cause death or severe damage.
- Perform the mounting after confirming that flammable, explosive gases are not present and the environment is not saturated with water or steam.

Caution

- When mounting the positioner, take care not to give a mechanical or physical shock caused by impact, drop etc. The shock may produce damage or readjustment.
- Secure enough space for mounting.
- Perform the mounting at the place to meet the environmental specification limits of the positioner.
- IECEx and ATEX explosion proof type have a hexagon socket set screw in the bottom right of the four M8 screw holes on the backside to mount the positioner itself. Do not remove the screw to keep the waterproof and dustproof performance unless the screw hole is applied for mounting the positioner.

2.1. Mounting posture and position

The positioner has an exhaust port as shown below. Avoid installation by posture by which the exhaust port will be the upper side.

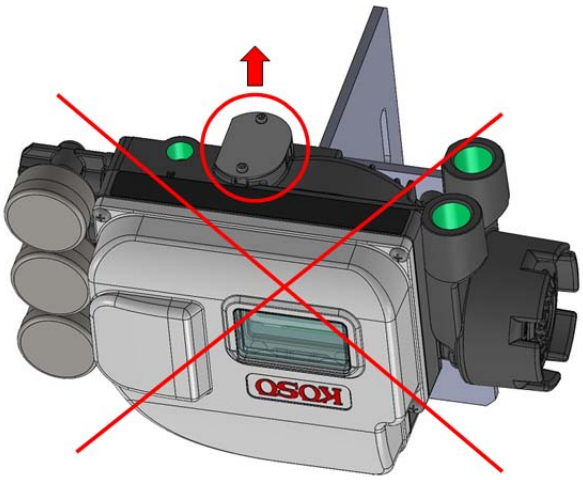


Figure 2.1a Example of upside-down mounting（Incorrect example）

Mount the positioner to a linear actuator in a position that the feedback lever is in the horizontal position at 50% of full travel.

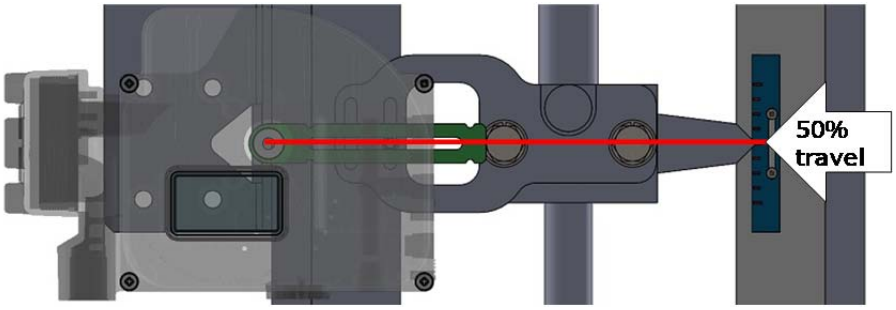


Figure 2.1b Mounting position（example of linear type）

2.2. Mounting to linear motion actuator (5200LA, 6300LA, 5300LA)

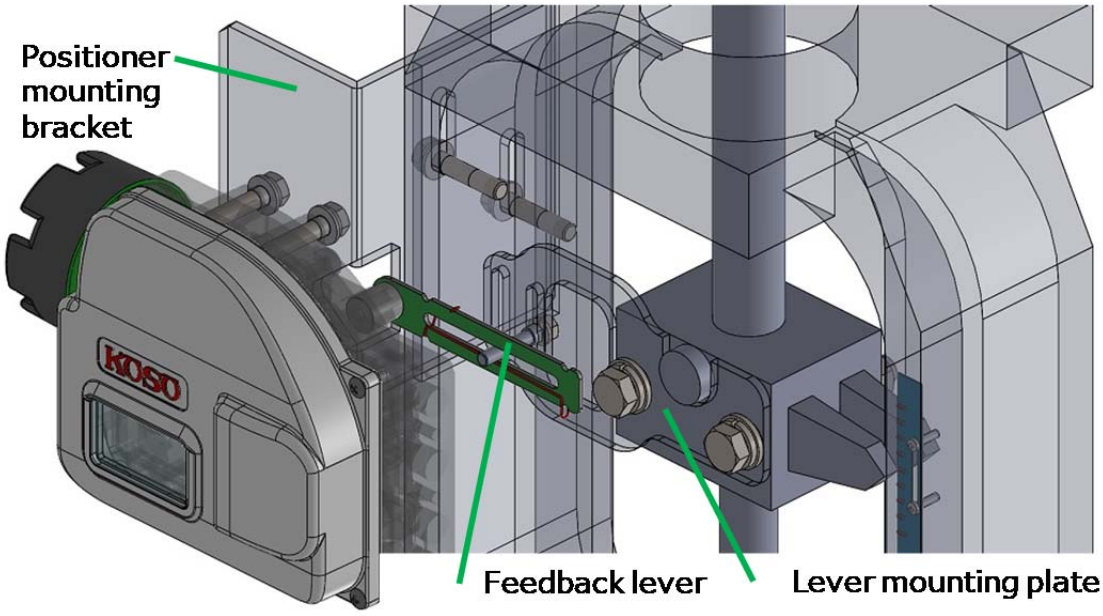


Figure 2.2a Example of mounting to linear motion actuator

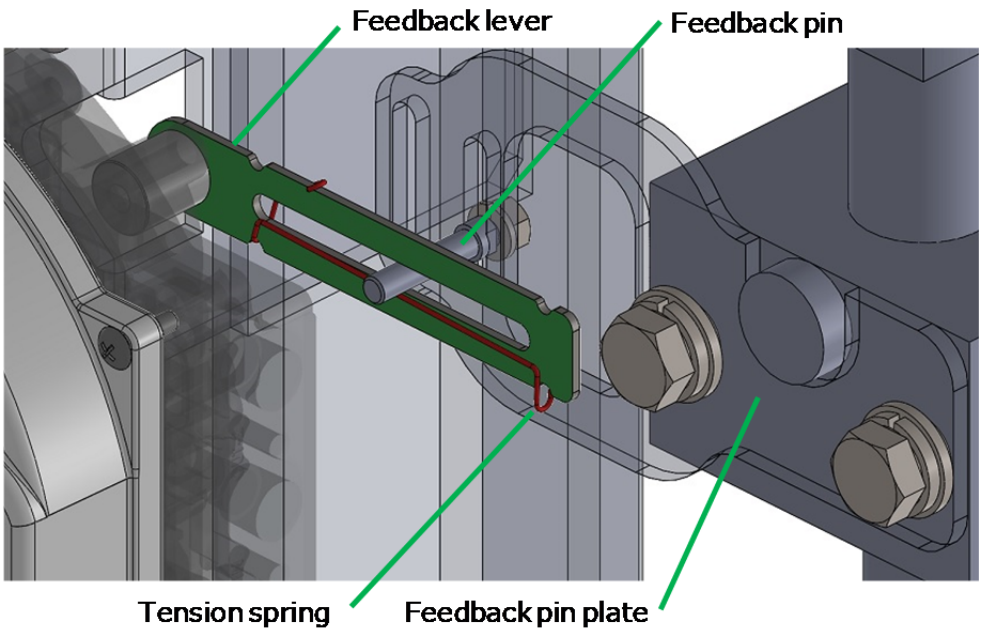


Figure 2.2b Mounting position of tension spring

Be sure the upper side of a tension spring hits a feedback pin.

2.3. Mounting to rotary motion actuator (6300RC)

Mount the positioner to a rotary motion actuator in a position that the feedback lever is in the horizontal position at 50% of full travel.

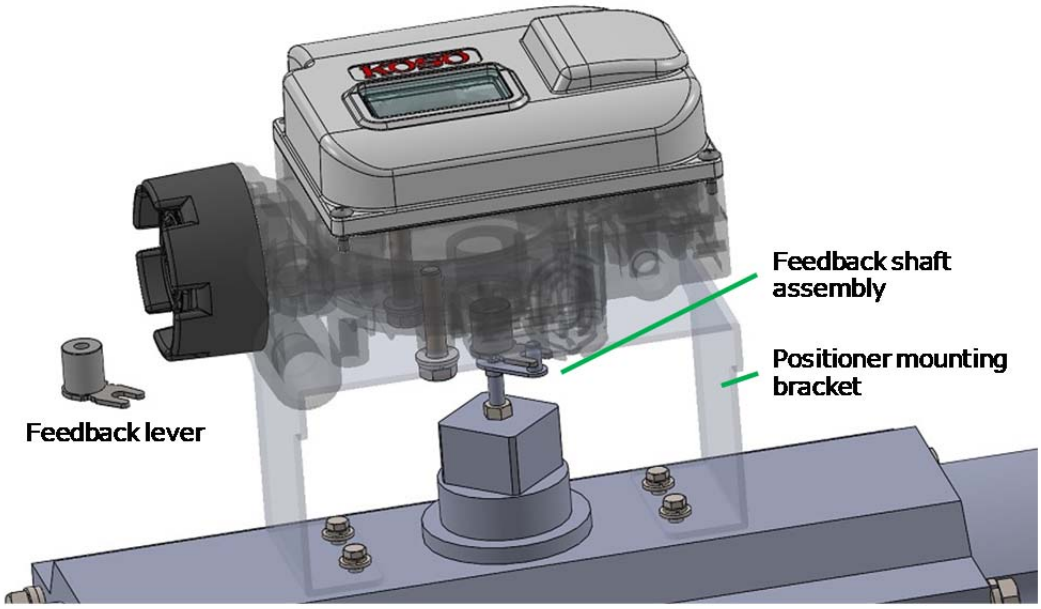


Figure 2.3 Example of mounting to rotary motion actuator

2.4. NAMUR mounting to rotary motion actuator (VDI/VDE3845)

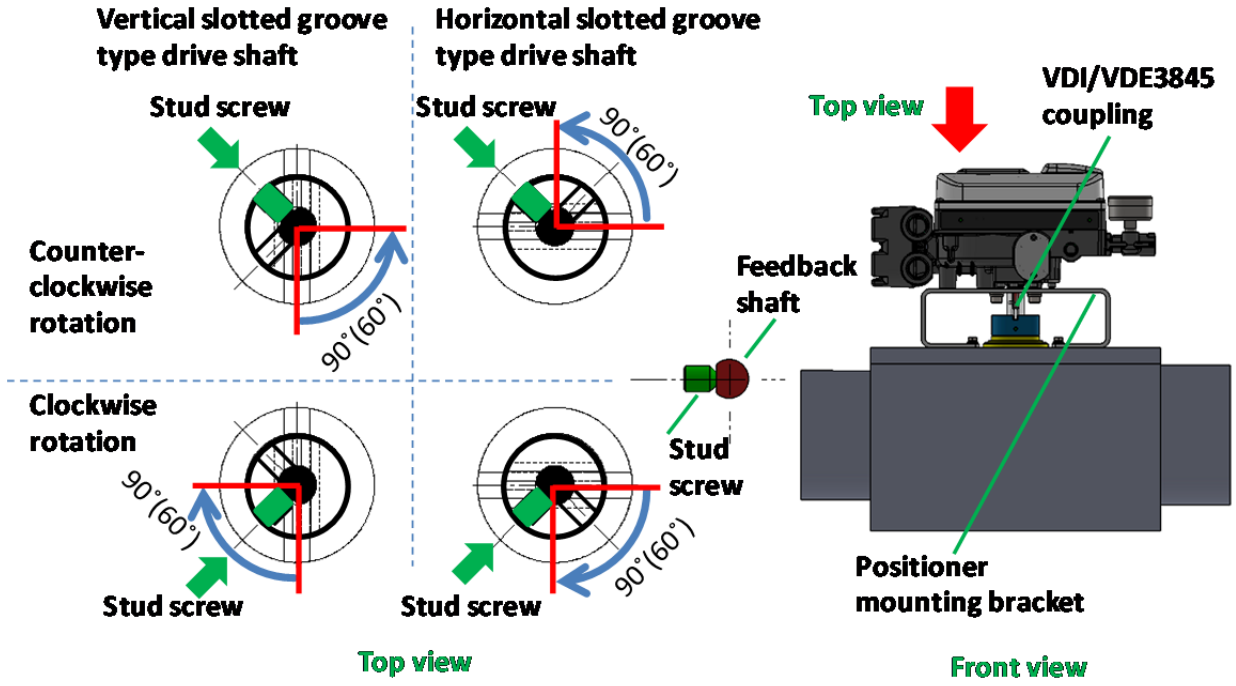


Figure 2.4 Example of NAMUR mounting to rotary motion actuator

2.5. Pressure connections

Caution

- Be certain the supply pressure does not exceed the maximum allowable pressure of the positioner and the actuator to apply.
- Use a clean, dry, oil-free instrument air. Refer to section 1.4 regarding air quality standards.
- Excessive use of sealant on the thread connections can cause a failure of the positioner. Make sure the sealant is not mixed with the air.
- Don't use tape type sealant on the thread connections. Residues of the sealant may block the air flow inside the positioner and can cause malfunction of the positioner and accessories.

Figure 2.5 shows pneumatic connections.
Since screw thread types may vary with specifications, make pneumatic connections after confirming specifications.

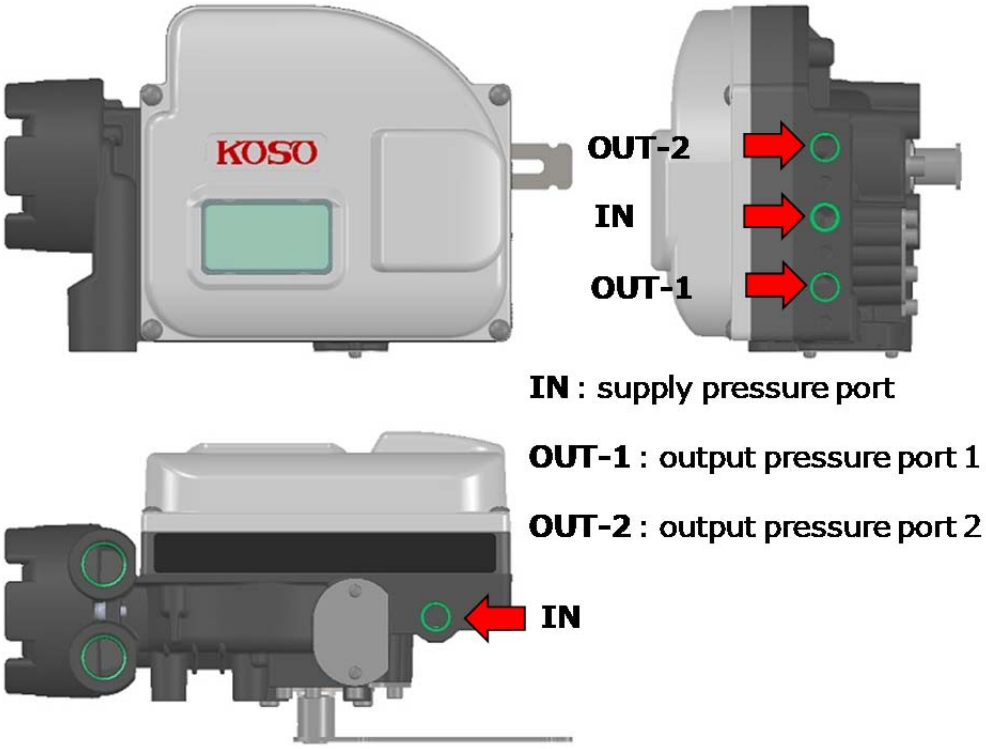


Figure2.5 Pneumatic connections

2.5.1. Supply pressure connection

Connect either one【IN】input of two input ports of the positioner on the air supply.
In addition, block the unused input port with screw plug.

2.5.2. Output pressure connections

In case of factory shipment of the positioner mounted on an actuator, pneumatic installation of output connections is carried out together with the mounting. But in case of mounting at the customer's facilities, connect pressure outputs of the positioner on an actuator inputs as followings.

For single acting actuator ;

Connect the【OUT-1】output of the positioner on the input of a single acting actuator.
In addition, block the unused inlet port with screw plug.

For double acting actuator ;

A double acting actuator has the logic that when input signal goes to zero, the【OUT-1】output goes to zero pressure and the【OUT-2】output goes to supply pressure.

Connect the【OUT-1】and【OUT-2】outputs of the positioner, respectively, on the actuator inputs according to the direction of motion of the actuator.

2.6. Electrical connections

Warning

- Disconnect the power supply before wiring connections.
- Wiring connections must be done in accordance with national electrical code requirements.
- Avoid wiring connection on wet weather days or in environments are saturated with water. They are liable to electric leakage or damage to the positioner.

Caution

- Close the unused entries for flameproof enclosures with blanking elements to avoid the intrusion of humidity, dust, etc.
- The entries shall be sealed with sealants to avoid the intrusion of water or rain
- Earthing and bonding conductor shall be connected by terminal lugs (Tinning copper).
- Earthing or bonding conductor shall be firmly connected by using screws with captive spring lock washer(M4) provided on the positioner in such a way to prevent loosening and twisting.
- When using the flame proof type, a conductor with a cross-sectional area of at least 1mm^2 shall be used for internal earthing.
- When using the flame proof type, a conductor with a cross-sectional area of at least 4mm^2 shall be used for external bonding.
- Check the specifications of cable glands and blanking elements to make sure to use only suitable Ex certificated cable glands and blanking elements. See Table 2.6a shows the suitable Ex certificated cable glands and blanking elements for each proof type.

The figure2.6a below shows the layout of the entries for electrical connections and terminals.
There are a few different types of thread for entries.
You can identify the type of the thread by the engraved letter on the outside of entries. The letter“M” means M20X1.5, the letter”N” means 1/2NPT and the letter“_” means G1/2.

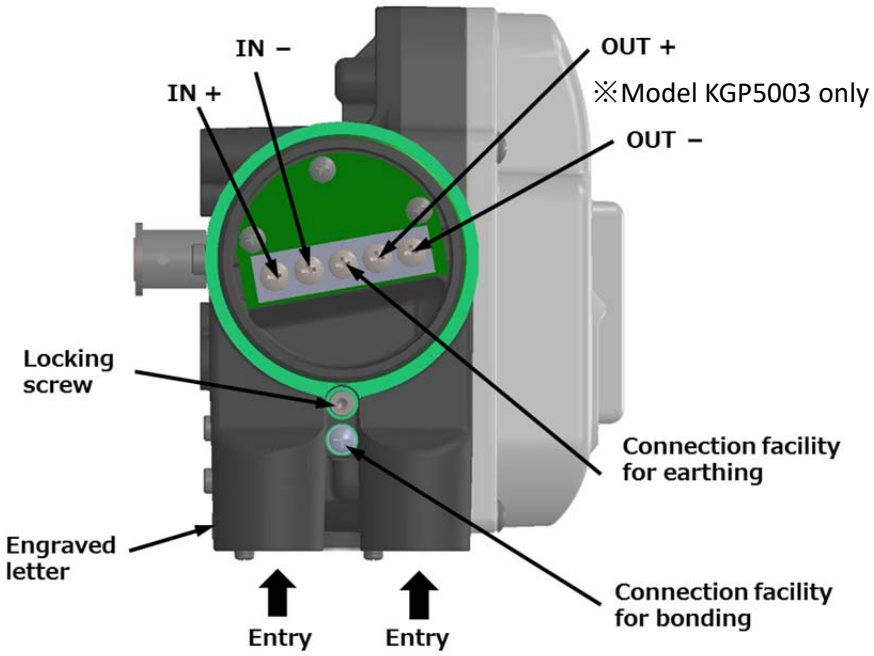


Figure 2.6a Entries and Connection facilities

The positioner uses a 4-20mA loop current and the HART communication is carried out through the digital signal which is superposed on this loop current.
Notes of the assembly of connection facilities are as follows.

1. Select correct wires.
   - The cross-sectional area of the wire conductor for IN± and OUT± shall be less than or equal to that of the internal earthing conductor.
2. Select correct terminal lugs for the size of the wire you are using.
   - A terminal lug has an acceptable wire size range. Using too large terminal lug may cause the wire to slip out.
   - The width of the connection facilities for a terminal lug is 8.1mm and the fastener for a terminal lug is M4 screw, therefore the dimensions should be B ＜8.1mm and d2＞ 4mm in case of ring terminal as Figure2.6b
3. Strip the insulation from insulated wire.
   - Stripping length depends on the terminal lug type and shape. Please follow the instructions for each terminal lug. Figure2.6b shows an example in case of non-insulated ring terminal (JIS C 2805)

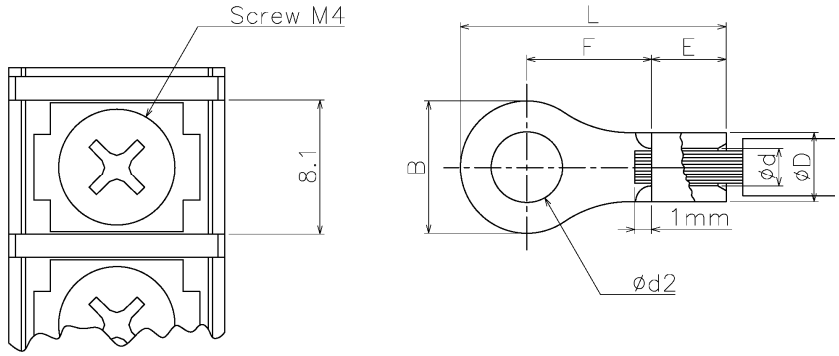


Figure 2.6b Terminal lug example (non-insulated ring terminal : JIS C 2805)

4. Crimp with the crimping tool
   - Select the correct crimping tool based on the size and type of the terminal lug. Please follow the instructions for each crimping tool.
5. Assemble the parts of connection facilities as shown in Figure2.6c.

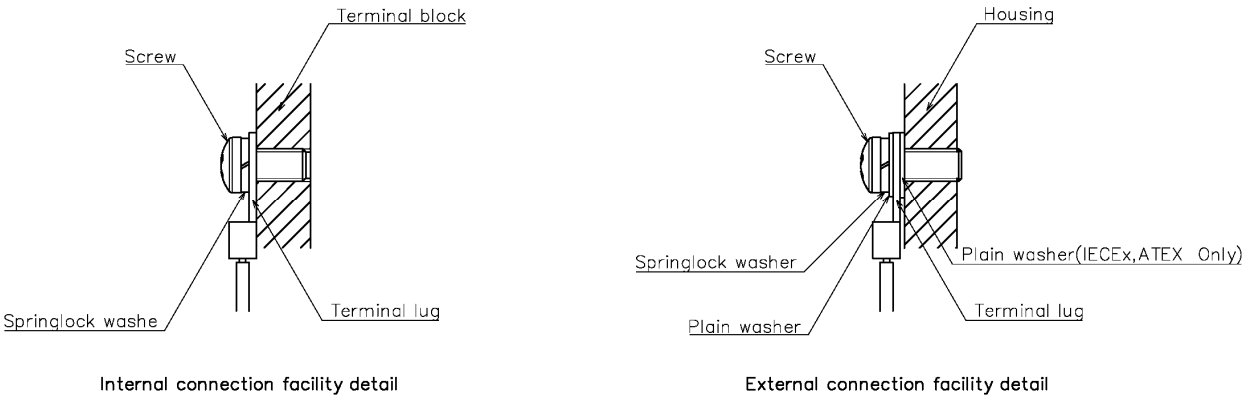


Figure 2.6c Connection facilities detail

Make wiring connections according to the following procedure. Refer to the above instruction on procedure 3 to 5.

1. Remove the terminal cover.
2. Lead a cable into the terminal box from the outside through the entries and the cable gland.
3. Connect wires of loop current, respectively, to IN+ and IN- of the positioner.
4. Connect wires of position transmitter, respectively, to OUT+ and OUT- of the positioner.※ Model KGP5003 only
5. As illustrated in figure 2.6a, two connection facilities for earthing and bonding conductors are available. The two connection facilities are equipotential. Make wiring connections according to local electrical codes which apply to the application.
6. Fix a cable with the cable gland following the instruction manual of the cable gland manufacturer.
7. Replace the terminal cover.
8. Turn the cover locking screw counterclockwise to fix the terminal cover.

Field wiring diagram is shown in figure 2.6d and 2.6e.

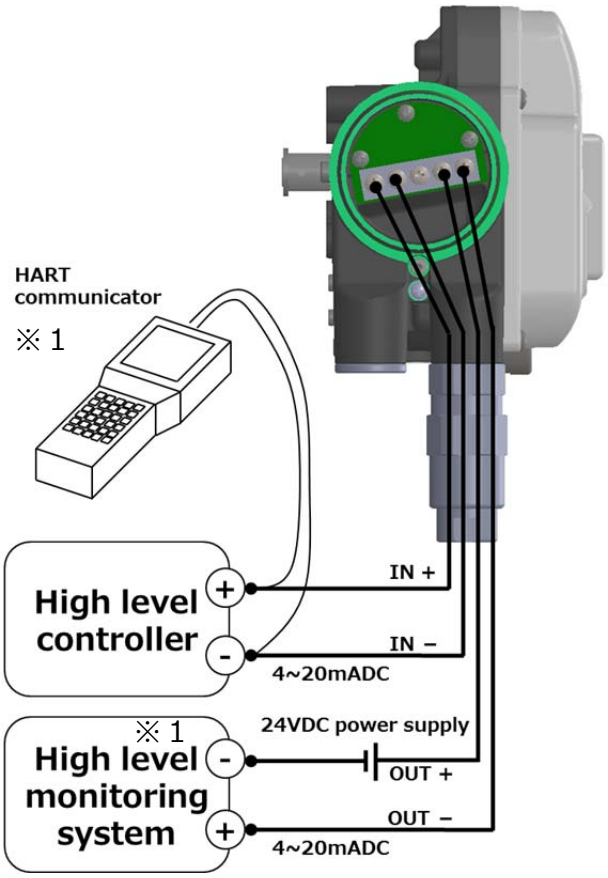


Figure 2.6d Field wiring diagram for 1 cable(4-core)

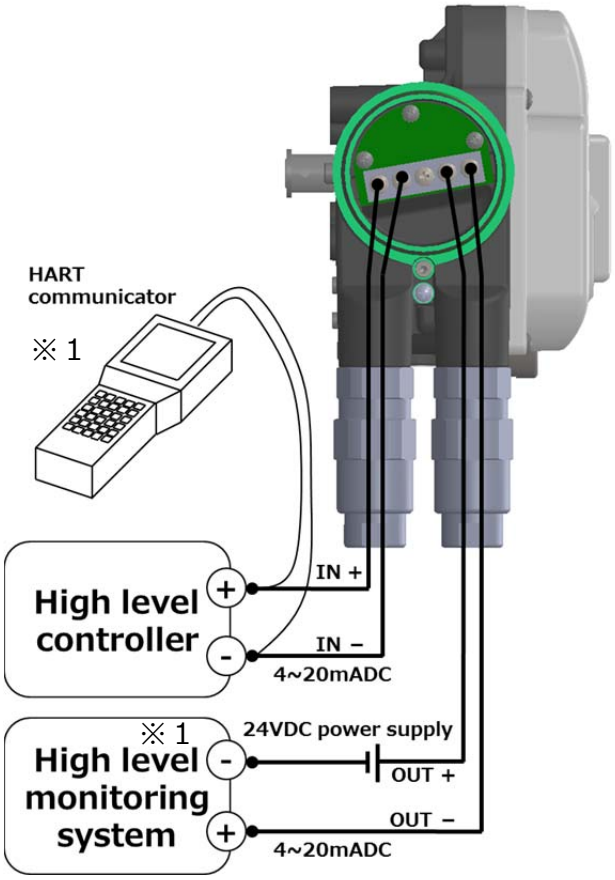


Figure 2.6e Field wiring diagram for 2 cable(2-core)

※1 Model KGP5003 only

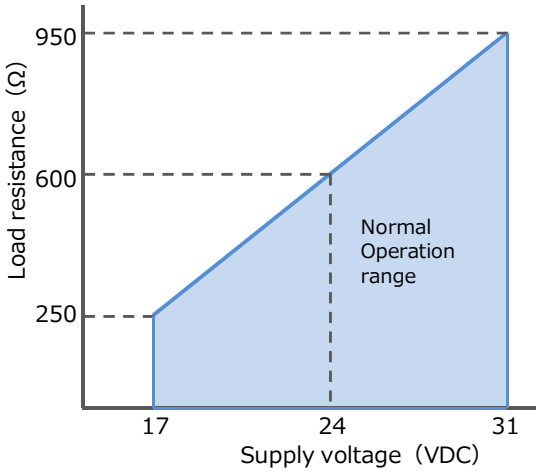


Figure 2.6f Load resistance to supply voltage relationship via the connection of position transmitter

Supply power to the positioner according to the load resistance. It should be noted that the supply power must not be exceed 40VDC.

Table 2.6a The suitable Ex certificated cable glands and blanking elements for each proof type

Proof type	Thread form of entries	Certification	Rated ambient temperature range	Service temperature range
TIIS	G1/2	Ex d IIC Gb	-20℃～+60℃	-20℃～+63℃
CCC(NEPSI)	1/2NPT	Ex db IIC Gb	-40℃～+70℃	-40℃～+73℃
KOSHA	1/2NPT	Ex d IIC	-20℃～+60℃	-20℃～+63℃
IECEx TS(CNS) ECAS	1/2NPT or M20X1.5	Ex db IIC Gb	-40℃～+70℃	-40℃～+72℃
ATEX	1/2NPT or M20X1.5	II 2 G Ex db IIC Gb	-40℃～+70℃	-40℃～+72℃
EAC	1/2NPT or M20X1.5	1Ex db IIC Gb	-40℃～+70℃	-40℃～+72℃

2.7. Restriction plate (optional): Hunting suppression parts in small actuator

If the actuator is small and the hysteresis due to packing friction is heavy, the control performance may be degraded, such as hunting, because the PID parameters preset in this positioner will not perform the expected control.
In order to improve such a phenomenon, it is effective to use a restriction plate.

2.7.1. Guideline for applying restriction plate

It is recommended to use a restriction plate when the hysteresis is more than the value (%) in the actuator size described below.

Actuator size：5221LA, 6315LA, AT201, AT251, AT301, AT351
Hysteresis

For Single-acting actuator：Output pressure difference to spring range is 30% or more

e.g.) Differential pressure more than 36kPa in the spring range of 120kPa (80-200kPa)

For Double-acting actuator：The ratio of output pressure difference and supply air pressure is 15% or more

e.g.) Differential pressure of 60kPa or more at the supply pressure of 400kPa

2.7.2. Installation of restriction plate

By installing a restriction plate, the flow rate of supply air to the actuator is reduced, and hunting will be suppressed.

Installation procedure)

1. Remove the two M5 screws securing the pressure gauge block.
2. Remove the O-ring with care for scratches.
3. First insert the restriction plate into the output air pressure port (see Figure 2.7.2), then set the O-ring.
   - For single-acting actuator, attach to output pressure port 1 [OUT-1].
   - For double-acting actuator, attach to each of output pressure port 1 [OUT-1] and output pressure port 2 [OUT-2].
4. Tighten the pressure gauge block with M5 screws. Recommended tightening torque: 300 to 350 N・cm

※ After installing the restriction plate, set up this positioner referring to the instruction manual <4.4.4 Setting procedure when installing restriction >.

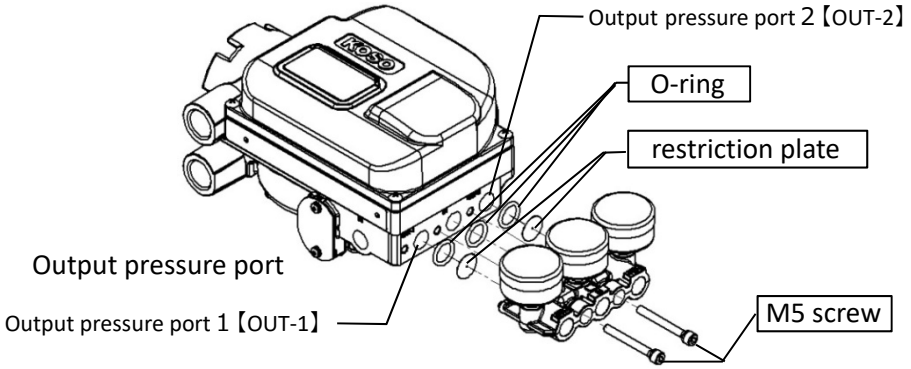


Figure 2.7.2 Output pressure port

3. EXPLOSION PROOF TYPE

Warning

- Please do a wiring work in the explosion protection area according to a prescribed guideline by an explosion protection guideline.
- When doing a wiring work and an adjustment work, please work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- The following special conditions of the flameproof joints are necessary for safety using. Please contact us for more details.
  They are not intended to be repaired by user. Inspection and repair require some specialized knowledge. To ensure safe operation, please consult with a sales representative.
  - The Terminal cover has at least 9 engaged threads.
  - The gap between the Push-button and the Base has 0.1mm max.
  - The gap between the Magnetic shaft and the Base has 0.1mm max.
  - The gap between the Shaft and the Bearing has 0.065mm max.
  - The gap between the Fire prevention pin and the Housing has 0.1mm max.
  - The gap between the Base and the Housing has 0.1mm max.
  - The gap between the Potentiometer housing and the Housing has 0.1mm max.
  - The screws of steel grade A2-50 shall be used to assemble the Windowpane fixing plate on the Base.
  - The screws of steel grade A2-70 shall be used to assemble the flameproof enclosure excluding above.
  - The screw of steel grade A2-50 have a tensile strength of 500MPa
  - The screw of steel grade A2-70 have a tensile strength of 700MPa

Caution

Note

It is possible to open the front cover during an operation.

3.1. TIIS flameproof type

A) Model No. : KGP51XX (Electrical entries: G1/2)

B) Marking : Ex d IIC T6 Gb (Certificate No. : TC22443X)

IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.

T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +60°C.

Gb : The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

C) Input current : 4 to 20mA(Service input range)

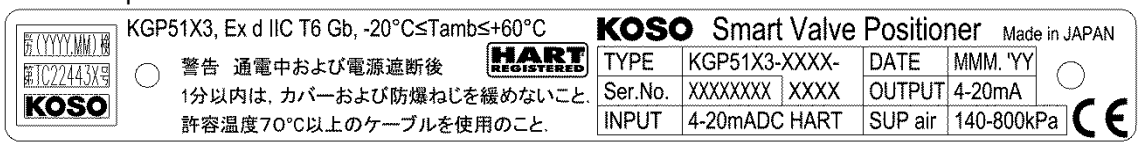
: 3.8 to 24mA(Maximum permissible input range ※1)

D) Ambient temperature range : -20℃ ≤ Tamb ≤ +60℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : JNIOSH-TR-46:2015

G) Specification plate



H) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- Use the cable gland provided by us. Use of another cable gland is not allowed and may be unable to maintain the explosion proof characteristics.
- Appropriate sealing ring (packing) for installation is depends on your cable diameter. Select correct sealing ring.
- When an entry is not used, it shall be closed by the blanking element provided by us.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly. ※2
- If damage or crack is found on Housing, Base, Terminal cover or Windowpane, Stop use of the product immediately and consult with our sales representative.

※1 Current range which cannot cause permanently damage, but we cannot ensure all functions will operate correctly.

※2 IP66 has certified by TÜV Rheinland.

3.2. CCC(NEPSI) flameproof type

A) Model No. : KGP52XX (Electrical entries: 1/2NPT)

B) Marking : Ex db IIC T6 Gb (CCC Certificate No. : 2020322307000438
NEPSI Certificate No. : GYJ23.1345X)
IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.
T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +70°C.
Gb : The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

C) Input current : 4 to 20mA

D) Ambient temperature range : -40℃ ≤ Tamb ≤ +70℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : GB/T 3836.1-2021, GB/T 3836.2-2021

G) Specification plate



H) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- The cable entries shall be provided with suitable above B) certified cable glands, when an entry is not used it shall be closed by a suitable above B) certified blanking element.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly.

3.3. KOSHA flameproof type

A) Model No. : KGP53XX (Electrical entries: 1/2NPT)

B) Marking : Ex d IIC T6 (Certificate No. : 17-AV4BO-0350X)

IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.

T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +60°C.

The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

C) Input current : 4 to 20mA

D) Ambient temperature range : -20℃ ≤ Tamb ≤ +60℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : 2020-33

G) Specification plate



H) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- The cable entries shall be provided with suitable above B) certified cable glands, when an entry is not used it shall be closed by a suitable above B) certified blanking element.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly.

3.4. IECEx flameproof type

A) Model No. : KGP54XX (Electrical entries: 1/2NPT, M20)

B) Marking : Ex db IIC T6 Gb (Certificate No. : IECEx DEK 17.0037X)
IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.
T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +70°C.
Gb : The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

C) Input current : 4 to 20mA

D) Ambient temperature range : -40℃ ≤ Tamb ≤ +70℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : IEC 60079-0 : 2011, IEC 60079-1 : 2014-06

G) Specification plate



H) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- The cable entries shall be provided with suitable above B) certified cable glands, when an entry is not used it shall be closed by a suitable above B) certified blanking element.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly.
- IECEx explosion proof type has a hexagon socket set screw in the bottom right of the four M8 screw holes on the backside to mount the positioner itself. Do not remove the screw to keep the waterproof and dustproof performance unless the screw hole is applied for mounting the positioner.

3.5. ATEX flameproof type

A) Model No. : KGP55XX (Electrical entries: 1/2NPT, M20)

B) Marking : II 2 G Ex db IIC T6 Gb (Certificate No. : DEKRA 17ATEX0076 X)
IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.
T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +70°C.
Gb : The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

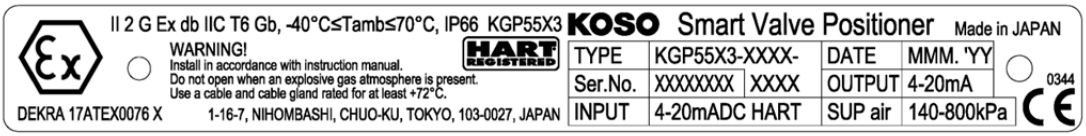
C) Input current : 4 to 20mA

D) Ambient temperature range : -40℃ ≤ Tamb ≤ +70℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : EN 60079-0 : 2012 +A11, EN 60079-1 : 2014

G) Specification plate



H) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- The cable entries shall be provided with suitable above B) certified cable glands, when an entry is not used it shall be closed by a suitable above B) certified blanking element.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly.
- ATEX explosion proof type has a hexagon socket set screw in the bottom right of the four M8 screw holes on the backside to mount the positioner itself. Do not remove the screw to keep the waterproof and dustproof performance unless the screw hole is applied for mounting the positioner.

3.6. EAC flameproof type

A) Model No. : KGP56XX (Electrical entries: 1/2NPT, M20)

B) Marking : 1Ex db IIC T6 Gb (Certificate No. : ЕАЭС RU C-JP.АД07.В.04614/22)
IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.
T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +70°C.
Gb : The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

C) Input current : 4 to 20mA

D) Ambient temperature range : -40℃ ≤ Tamb ≤ +70℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : ГОСТ 31610.0-2014 (IEC 60079-0: 2011)
ГОСТ IEC 60079-1-2013

G) Specification plate



H) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- The cable entries shall be provided with suitable above B) certified cable glands, when an entry is not used it shall be closed by a suitable above B) certified blanking element.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly.
- EAC explosion proof type has a hexagon socket set screw in the bottom right of the four M8 screw holes on the backside to mount the positioner itself. Do not remove the screw to keep the waterproof and dustproof performance unless the screw hole is applied for mounting the positioner.

3.7. TS(CNS) flameproof type

A) Model No. : KGP54XX (Electrical entries: 1/2NPT, M20)

B) Marking : Ex db IIC T6 Gb (Certificate No. : TD04010D)

IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.

T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +70°C.

Gb : The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

C) Input current : 4 to 20mA

D) Ambient temperature range : -40℃ ≤ Tamb ≤ +70℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : CNS 3376-0/C 1038-0 (IEC 60079-0 : 2011),
CNS 3376-1/C 1038-1 (IEC 60079-1 : 2014-06)

G) Specification plate



H) TS Label



I) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- The cable entries shall be provided with suitable above B) certified cable glands, when an entry is not used it shall be closed by a suitable above B) certified blanking element.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly.
- CNS explosion proof type has a hexagon socket set screw in the bottom right of the four M8 screw holes on the backside to mount the positioner itself. Do not remove the screw to keep the waterproof and dustproof performance unless the screw hole is applied for mounting the positioner.

3.8. ECAS flameproof type

A) Model No. : KGP54XX (Electrical entries: 1/2NPT, M20)

B) Marking : Ex db IIC T6 Gb (Certificate No. : 26-06-196318/E26-06-205419/NB0002)
IIC : This equipment is intended for use in above-ground industries with flammable gases, vapors, or mists. It has a flameproof enclosure classified as IIC suitable for use in explosive atmospheres such as hydrogen and acetylene.
T6 : The maximum surface temperature of this equipment can rise to +85°C when the ambient temperature is +70°C.
Gb : The practicable location of this device is hazardous areas of Zone1(First-class dangerous place)and Zone2(Second-class dangerous place). It can't be used in hazardous area of Zone0.

C) Input current : 4 to 20mA

D) Ambient temperature range : -40℃ ≤ Tamb ≤ +70℃

E) Ambient atmospheric pressure : 80kPaA to 110kPaA (absolute)

F) Applicable standard : UAE.S IEC 60079-0, UAE.S IEC 60079-1

G) Specification plate



H) Instruction for safe use:

- When doing a wiring work and an adjustment work, must work after it's confirmed that explosive gas doesn't exist in the environment.
- In case of using explosion proof type, do not open the terminal cover when an explosive atmosphere is present.
- During operation, terminal cover must be closed tighten and be locked certainly by a lock screw.
- Do not loosen fastening screws of parts no. 12,19,24,25 indicated in chapter 10, and do not disassemble the positioner and potentiometer.
  There is a possibility that the explosion protection performance can't be maintained any more.
- The cable entries shall be provided with suitable above B) certified cable glands, when an entry is not used it shall be closed by a suitable above B) certified blanking element.
- To meet the protection code of IP66, the cable ground suitable for use must be selected and installed correctly.
- IECEx explosion proof type has a hexagon socket set screw in the bottom right of the four M8 screw holes on the backside to mount the positioner itself. Do not remove the screw to keep the waterproof and dustproof performance unless the screw hole is applied for mounting the positioner.

4. SETUP AND INFORMATION

Warning

- Changes in parameters and so on owing to setup procedure may cause unexpected movements of the valve. Perform the setup in the conditions such as offline state which does not directly affect the process.
- Don't remove the terminal cover of the positioner during or after the passage of electric current. In case the terminal cover must be opened reluctantly, perform that after confirming that flammable, explosive gases are not present and the environment is not saturated with water or steam.
- Don't touch the moving parts during the setup procedure. It causes personal injury.
- **Keep away from a magnet material or a magnetic-tripped screwdriver.** It unexpectedly moves the control valve so that it may cause a serious damage.
- Don't use a wireless transceiver near the positioner.

4.1. Local user interface (LUI)

4.1.1. Removing and replacing front cover

Warning

- Removing the front cover makes an exhaust sound louder. If necessary, perform that after wearing hearing protectors such as ear plugs and so on.

Caution

Touching the moving part of a torque motor causes a change in output pressure from the positioner, and which leads to an accident. Take care not to touch it with hands or the front cover.

It is necessary to remove the front cover in order to perform settings through the local user interface, adjustments and settings of the units such as pilot relay, torque motor, A/M.
Remove and replace the front cover by loosening and fastening screws as shown in figure 4.1.1. While replacing the front cover, take care not to apply too much torque force to it.
Recommended fastening torque : 150N･cm



Figure 4.1.1 Front cover with screws attached

4.1.2. Operating push buttons

The local user interface (hereinafter, referred to as LUI) may be operated to perform setting of the positioner, monitoring of operational status, maintenance, etc. LUI consists of an eight-line liquid crystal display (hereinafter, referred to as LCD), four push buttons.

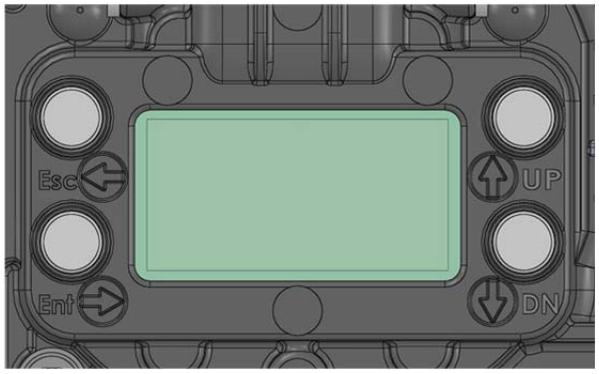


Figure 4.1.2 Local user interface (LUI)

Symbol		Name	Description
Esc		Escape button	Return to the previous menu level Exit the current menu
Ent		Enter button	Execute the selection of a menu
UP		Up button	Track menu while moving the cursor Increase or decrease a menu value
DN		Down button	

4.1.3. Screen and features on the LCD

The examples of operating push buttons and the displayed screen on the LCD and operating push buttons are shown as below.

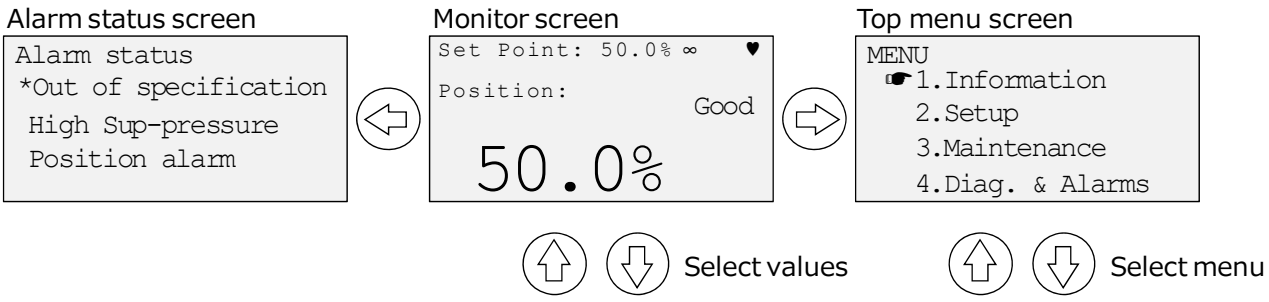


Figure 4.1.3a Example of operating push buttons and the displayed screen on the LCD

The measured values are displayed as below by pressing the down arrow key.

Position ⇒ Input signal(%) ⇒ Input signal(mA) ⇒ Pressure-Sup ⇒ Pressure-Out1 ⇒ Pressure-Out2

The possible configuration indications are shown as in figure 4.1.3b.

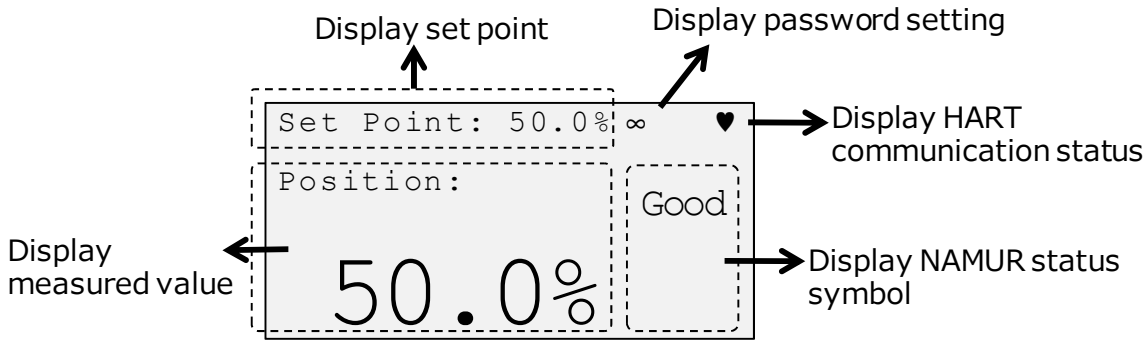


Figure 4.1.3b Possible configuration indications

Display of password setting;

The password is set：symbol ∞

Password setting is disabled：symbol ↄ

4.1.4. Menu tree on the LCD

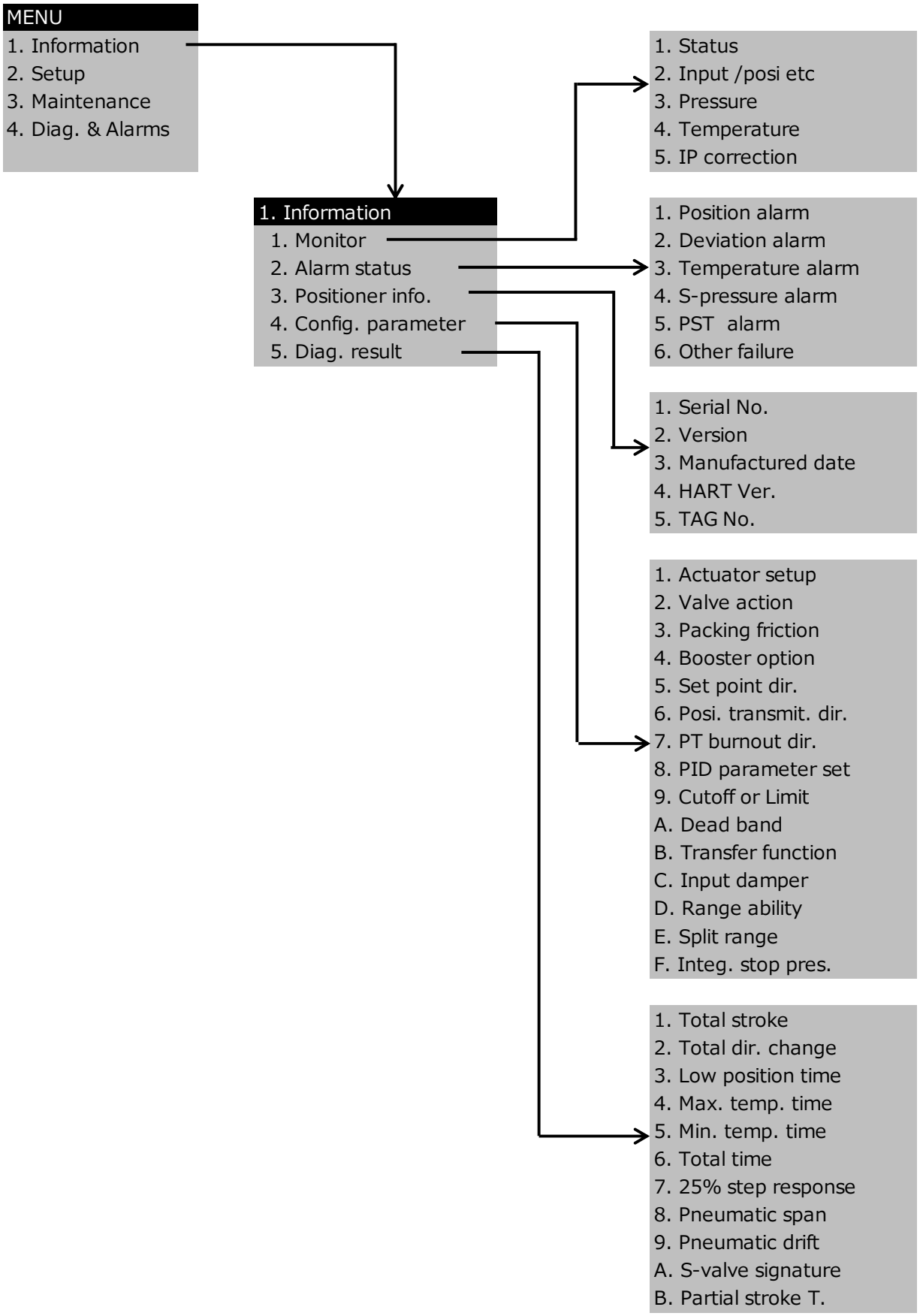


Figure 4.1.4a Information menu

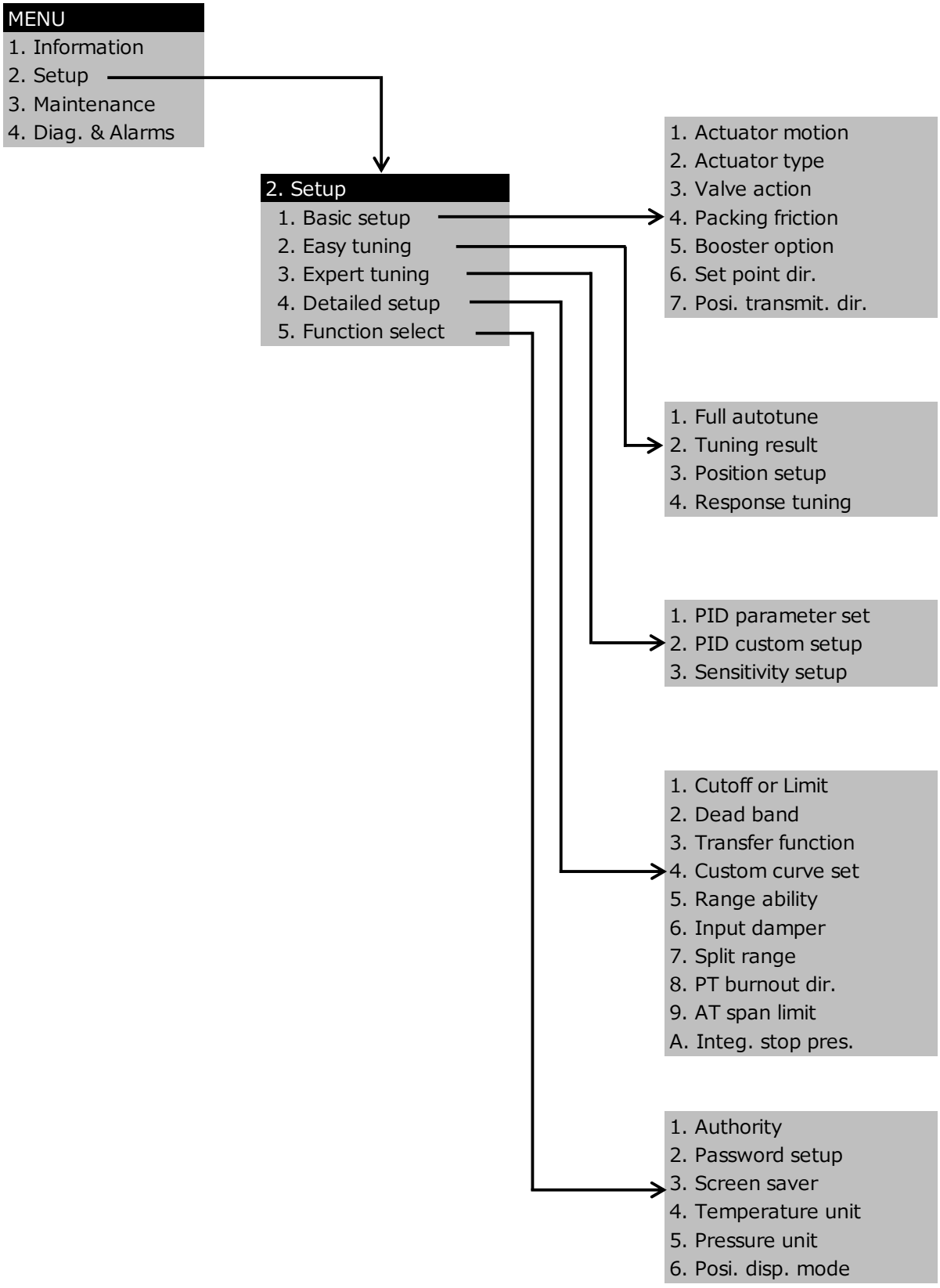


Figure 4.1.4b Setup menu

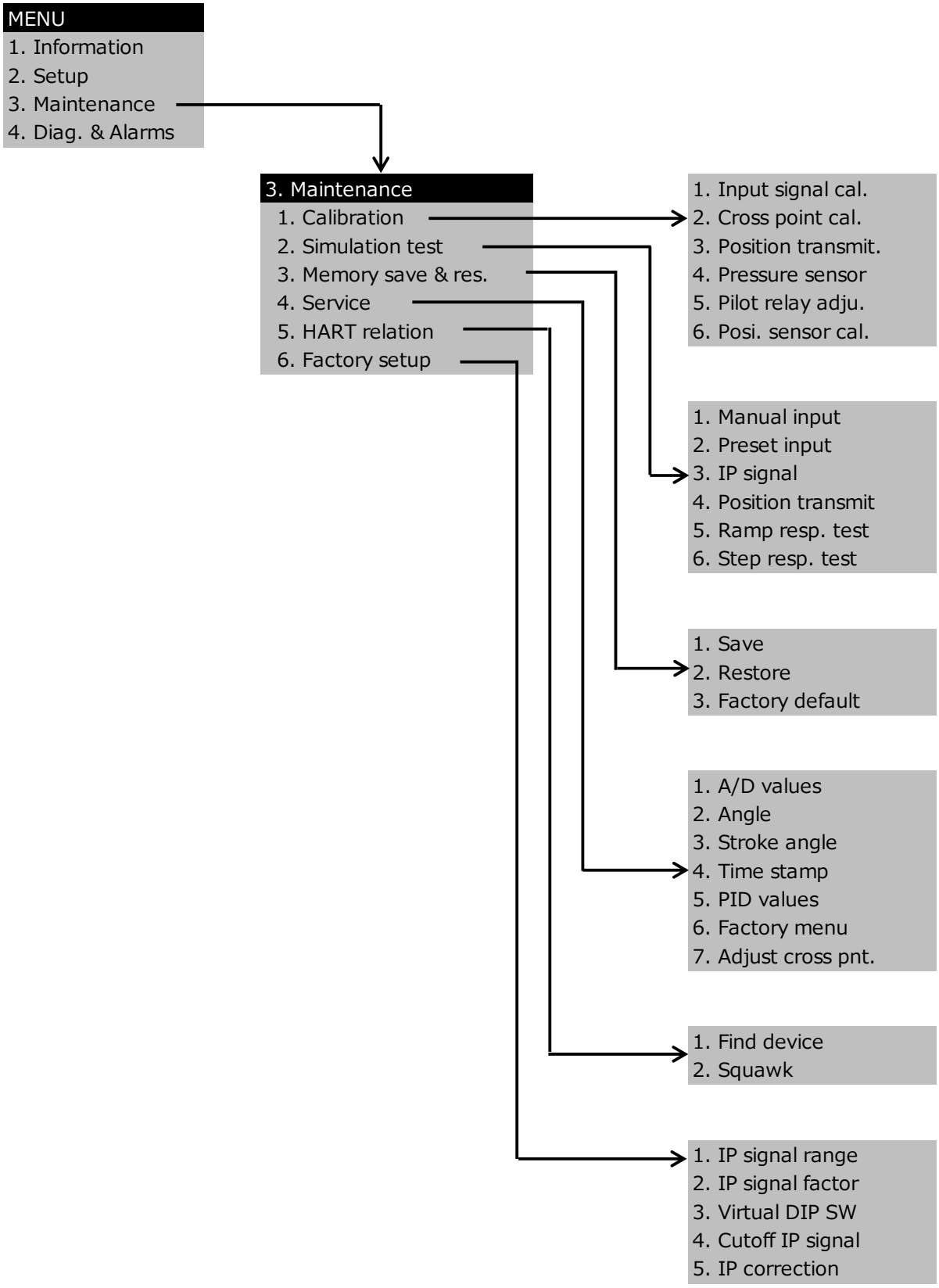


Figure 4.1.4c Maintenance menu

※"Factory setup" menu items may differ from the descriptions on this page for the actual product.

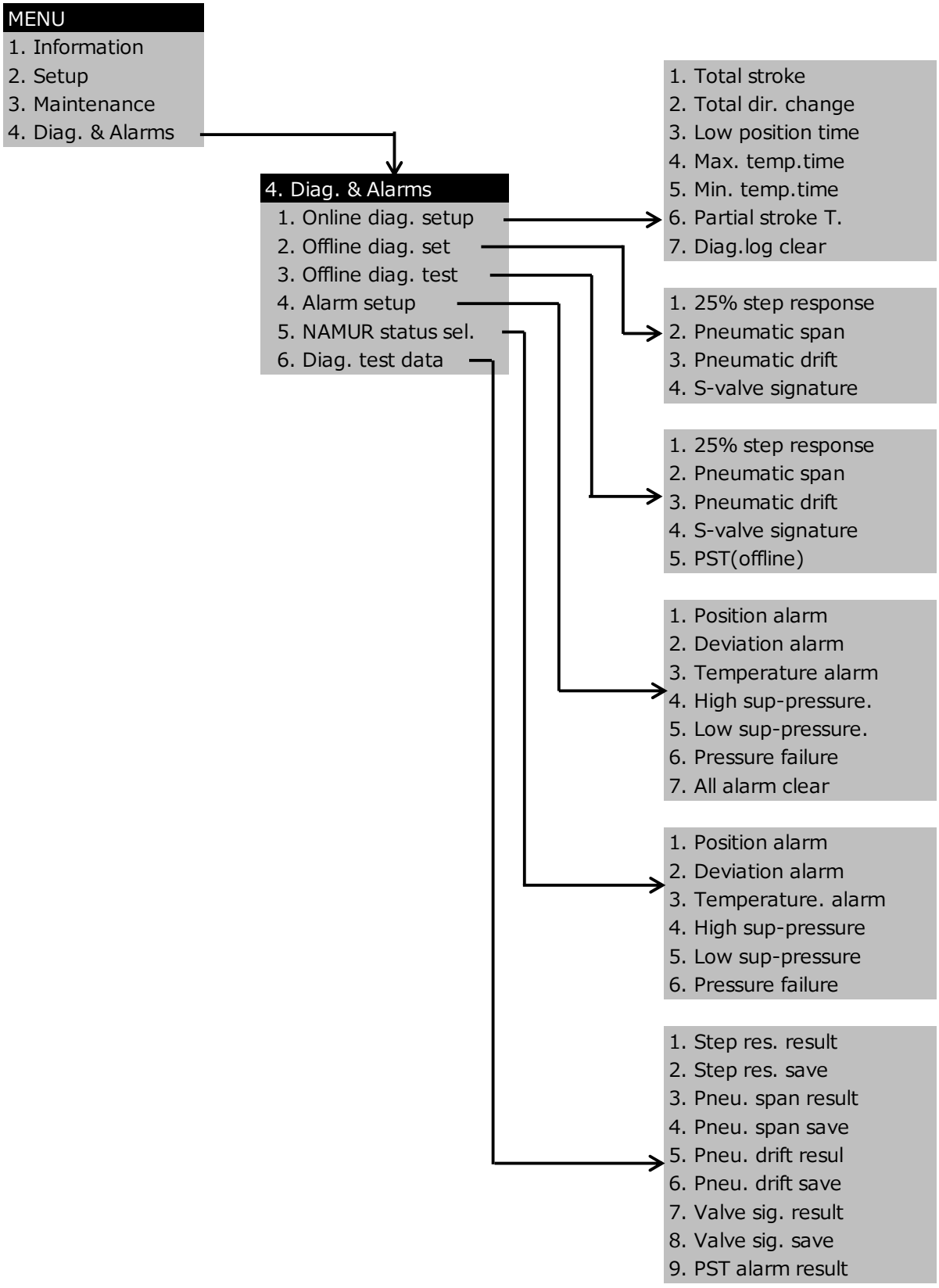
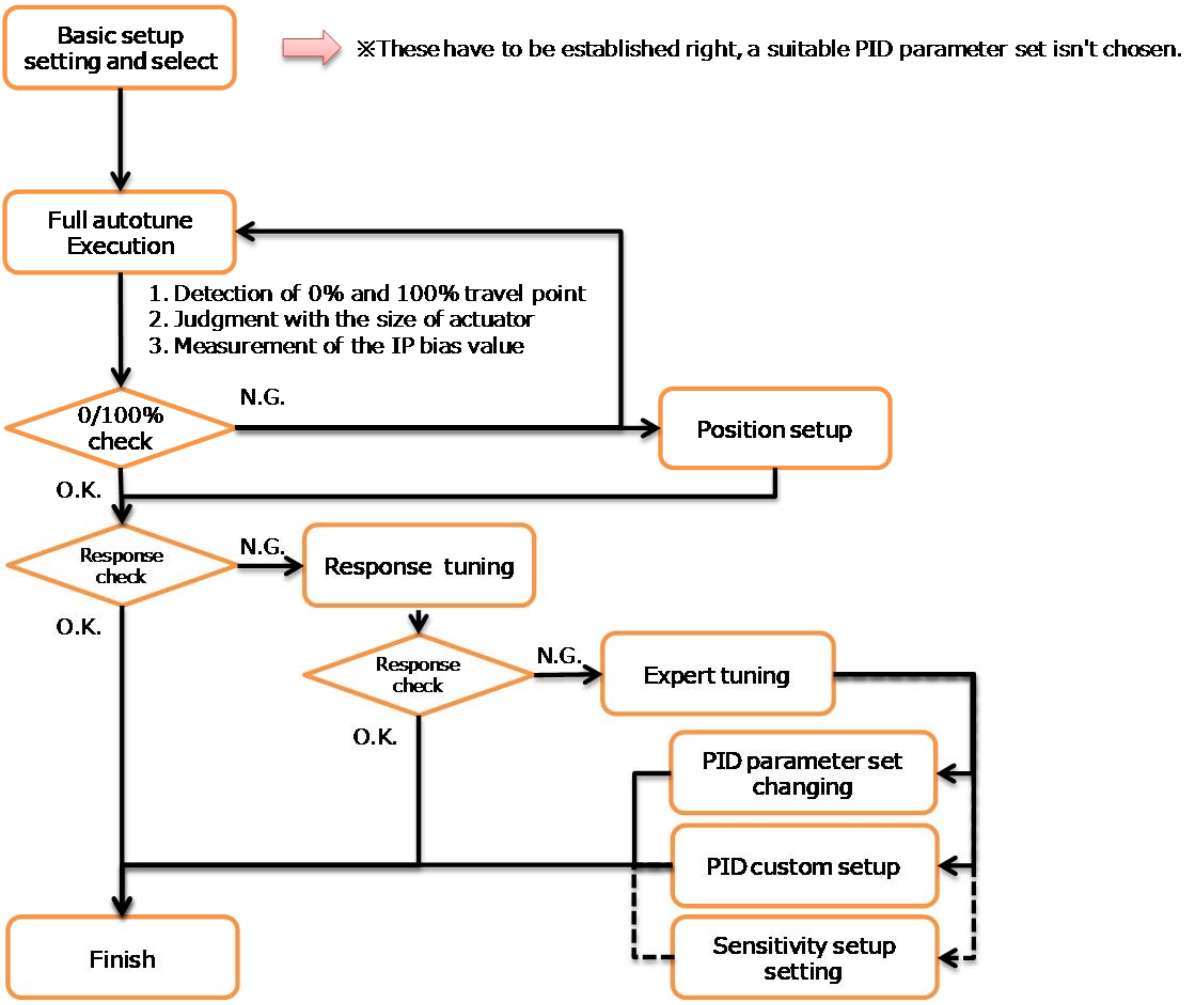


Figure 4.1.4d Diag. & Alarms menu

4.2. Flow chart of settings procedure

In case of the purchase of a control valve with the positioner, settings described in the sections 4.3 to 4.10 are completed at the factory. Accordingly, it is not necessary to repeat the settings. Please perform only section 4.11.

However, if the positioner is specified on the order or it is separated from the control valve for maintenance, if necessary, perform the setting according to the following procedure.



4.3. Basic setup

4.3.1. Basic settings required for control by the positioner

Select essential parameters necessary for the control of the positioner. Perform basic setup surely before performing the following setup (easy tuning) in next section.

MENU > Setup >Basic setup (2-1-)

Table 4.3 Basic setup parameters

Key menu	Description	Parameters	Default
Actuator motion	Set stem motion type of a actuator	Linear / Rotary	※1
Actuator type	Set acting type of a actuator Single acting actuator : Single Double acting actuator : Double KOSO high power actuator : 5300	Single / Double / 5300	※1
Valve action	Set direction of a valve when Pout1 is output Air to Open : ATO Air to Close : ATC	ATO / ATC	ATO
Packing friction	Set packing material used for valve body Low friction material such as PTFE, etc. : Low High friction material such as GRAFOIL, etc. : High	Low / High	Low ※2
Booster option	Set the presence of booster Absence of booster : Disable Presence of booster : Enable In case Enable is selected, set the booster size according to the flow coefficient The Cv value is over 1.5 : Large The Cv value is within 1.5 : Small	Disable / Enable (After selecting Enable Large/Small Selection)	Disable ※2
Set point dir.	Set the direction to convert 4-20mA input signals to the percentage Normal : 4mA=0%, 20mA=100% Reverse : 4mA=100%, 20mA=0%	Normal / Reverse	Normal
Posi. Transmit.dir. **※3**	Set the direction to convert input signal to the percentage of the transmitter output signal Normal : 0%=4mA, 100%=20mA Reverse : 0%=20mA, 100%=4mA	Normal / Reverse	Normal

※1・・・The parameters setup is carried out according to the specified model code at the factory.

※2・・・When the factory mounts the positioner on the actuator, the parameters setup is carried out.

※3・・・Model KGP5003 only

4.3.2. List of operation setting patterns for actuator

Table 4.3.2a Linear motion single acting type actuator・Operation list 【Push-down close】

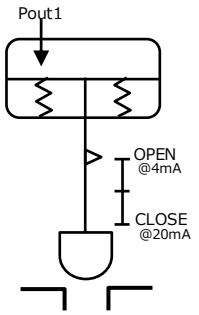
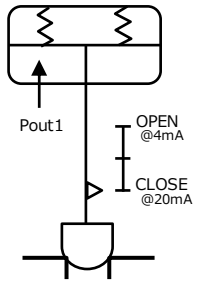
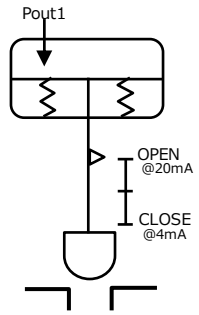
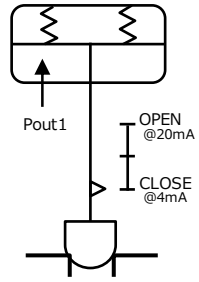
Control valve operation			4→20mA Valve close (Signal to Close)		4→20mA Valve open (Signal to Open)	
Valve body operation			Push-down close			
Actuator motion direction			Direct acting (DA)	Reverse acting (RA)	Direct acting (DA)	Reverse acting (RA)
	Piping connection		Pout1			
Positioner settings	Valve action		ATC	ATO	ATC	ATO
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input	Open		Close	
		LCD display	100%		0%	
		20mA input	Close		Open	
		LCD display	0%		100%	
	Air supply fail		Open	Close	Open	Close
	De-energized		Open	Close	Open	Close
						

Table 4.3.2b(Reference table) Linear motion single acting type actuator・Operation list 【Push-down open】

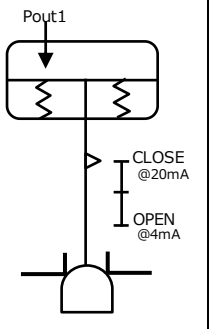
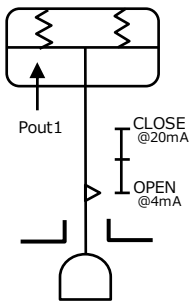
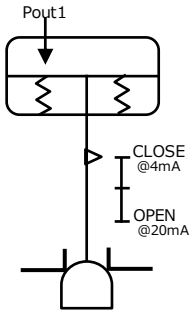
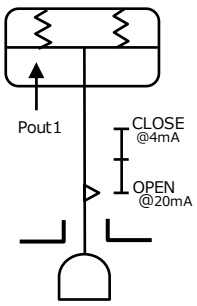
Control valve operation			4→20mA Valve close (Signal to Close)		4→20mA Valve open (Signal to Open)	
Valve body operation			Push-down open			
Actuator motion direction			Direct acting (DA)	Reverse acting (RA)	Direct acting (DA)	Reverse acting (RA)
	Piping connection		Pout1			
Positioner settings	Valve action		ATO	ATC	ATO	ATC
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input LCD display	Open		Close	
			100%		0%	
		20mA input LCD display	Close		Open	
			0%		100%	
	Air supply fail		Close	Open	Close	Open
	De-energized		Close	Open	Close	Open
						

Table 4.3.2c Linear motion double acting type actuator・Operation list 【Push-down close】

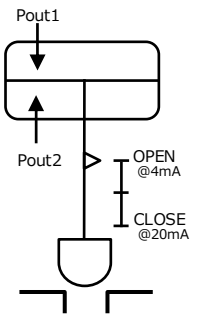
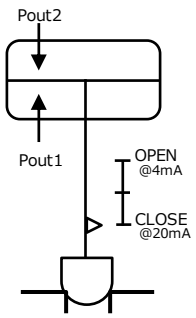
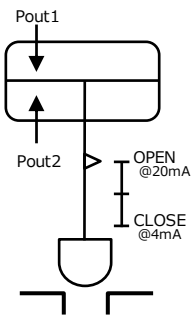
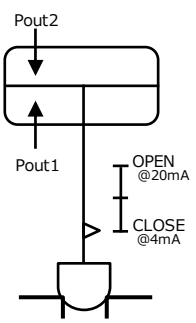
Control valve operation			4→20mA Valve close (Signal to Close)		4→20mA Valve open (Signal to Open)	
Valve body operation			Push-down close			
Piping connection	Stem rising side		Pout2	Pout1	Pout2	Pout1
	Stem down side		Pout1	Pout2	Pout1	Pout2
Positioner settings	Valve action		ATC	ATO	ATC	ATO
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input	Open		Close	
		LCD display	100%		0%	
		20mA input	Close		Open	
		LCD display	0%		100%	
	Air supply fail		Indefinite			
	De-energized		Open	Close	Open	Close
						

Table 4.3.2d(Reference table)　Linear motion double acting type actuator・Operation list 【Push-down open】

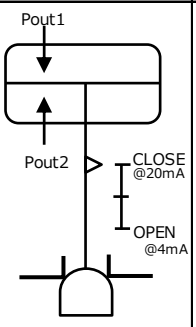
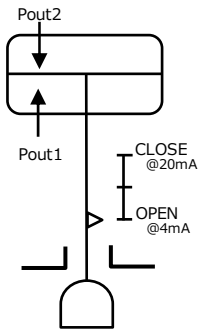
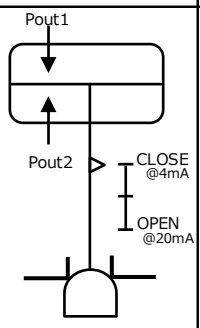
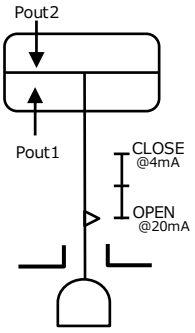
調節弁動作			4→20mA弁閉 (Signal to Close)		4→20mA弁開 (Signal to Open)	
Valve body operation			Push-down open			
Piping connection	Stem rising side		Pout2	Pout1	Pout2	Pout1
	Stem down side		Pout1	Pout2	Pout1	Pout2
Positioner settings	Valve action		ATO	ATC	ATO	ATC
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input	Open		Close	
		LCD display	100%		0%	
		20mA input	Close		Open	
		LCD display	0%		100%	
	Air supply fail		Indefinite			
	De-energized		Close	Open	Close	Open
						

Table 4.3.2e Rotary motion single acting type actuator・Operation list 【Counterclockwise open】

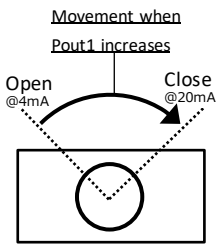
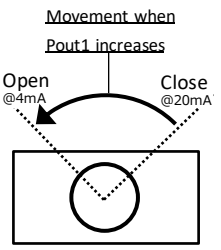
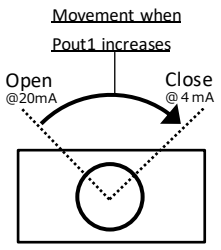
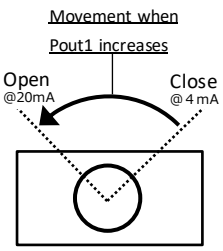
Control valve operation			4→20mA Valve close (Signal to Close)		4→20mA Valve open (Signal to Open)	
Valve body operation			Counterclockwise open			
Actuator motion direction			Clockwise with Pout1 increase	Counterclockwise with Pout1 increase	Clockwise with Pout1 increase	Counterclockwise with Pout1 increase
	Piping connection		Pout1			
Positioner settings	Valve action		ATC	ATO	ATC	ATO
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input LCD display	Open		Close	
			100%		0%	
		20mA input LCD display	Close		Open	
			0%		100%	
	Air supply fail		Open	Close	Open	Close
	De-energized		Open	Close	Open	Close
						

Table 4.3.2f(Reference table) Rotary motion single acting type actuator・Operation list

【Counterclockwise close】

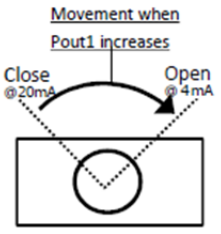
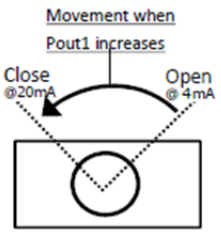
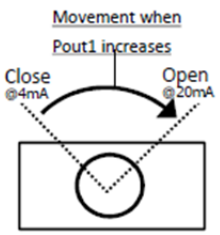
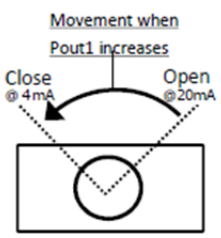
Control valve operation			4→20mA Valve close (Signal to Close)		4→20mA Valve open (Signal to Open)	
Valve body operation			Counterclockwise close			
Actuator motion direction			Clockwise with Pout1 increase	Counterclockwise with Pout1 increase	Clockwise with Pout1 increase	Counterclockwise with Pout1 increase
	Piping connection		Pout1			
Positioner settings	Valve action		ATO	ATC	ATO	ATC
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input LCD display	Open		Close	
			100%		0%	
		20mA input LCD display	Close		Open	
			0%		100%	
	Air supply fail		Close	Open	Close	Open
	De-energized		Close	Open	Close	Open
						

Table 4.3.2g Rotary motion double acting type actuator・Operation list 【Counterclockwise open】

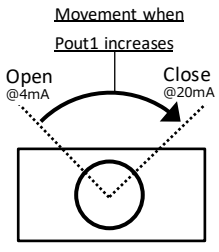
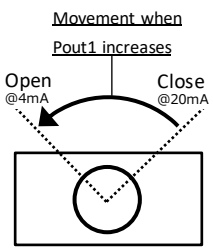
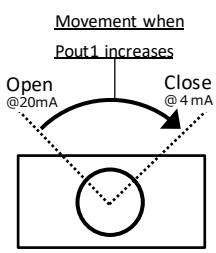
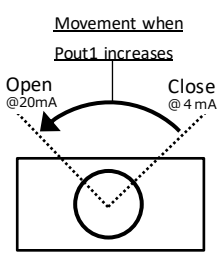
Control valve operation			4→20mA Valve close (Signal to Close)		4→20mA Valve open (Signal to Open)	
Valve body operation			Counterclockwise open			
Actuator motion direction			Clockwise with Pout1 increase	Counterclockwise with Pout1 increase	Clockwise with Pout1 increase	Counterclockwise with Pout1 increase
Piping connection	Increased air pressure Counterclockwise side		Pout2	Pout1	Pout2	Pout1
	Increased air pressure clockwise side		Pout1	Pout2	Pout1	Pout2
Positioner settings	Valve action		ATC	ATO	ATC	ATO
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input	Open		Close	
		LCD display	100%		0%	
		20mA input	Close		Open	
		LCD display	0%		100%	
	Air supply fail		Indefinite			
	De-energized		Open	Close	Open	Close
						

Table 4.3.2h Rotary motion double acting type actuator・Operation list 【Close counterclockwise】

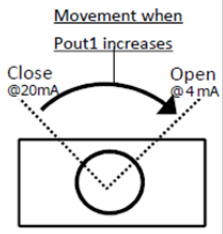
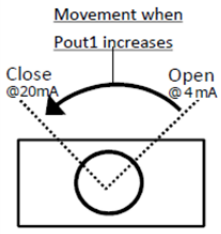
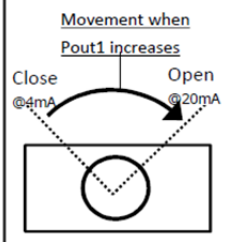
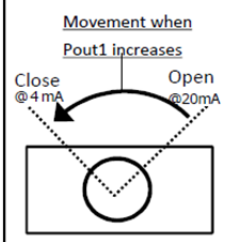
Control valve operation			4→20mA Valve close (Signal to Close)		4→20mA Valve open (Signal to Open)	
Valve body operation			Counterclockwise close			
Actuator motion direction			Clockwise with Pout1 increase	Counterclockwise with Pout1 increase	Clockwise with Pout1 increase	Counterclockwise with Pout1 increase
Piping connection	Increased air pressure Counterclockwise side		Pout2	Pout1	Pout2	Pout1
	Increased air pressure clockwise side		Pout1	Pout2	Pout1	Pout2
Positioner settings	Valve action		ATO	ATC	ATO	ATC
	Set point dir.		Reverse		Normal	
Comprehensive operation	Open or Close of valve	4mA input LCD display	Open		Close	
			100%		0%	
		20mA input LCD display	Close		Open	
			0%		100%	
	Air supply fail		Indefinite			
	De-energized		Close	Open	Close	Open
						

Table 4.3.2i Power off state

	Relay type	De-energized
	Single acting normal operation	OUT-1 output air pressure 0
	Double acting	OUT-1 output air pressure 0 OUT-2 output air pressure Supply air pressure

4.4. Easy tuning

Easy tuning is the setup to ensure that the positioner is operated smoothly relative to the actuator on which the positioner is mounted. It is possible to perform easily zero/span adjustments of a control valve, selection of suitable PID parameters, setting of other parameters necessary to control.

Note

Before performing this operation (easy tuning), all parameters of basic setup described in section4.3 must be configured. If wrong parameters were configured, it is possible to choose unsuitable PID parameters.

4.4.1. Full autotune

While performing a sequence of operations, it configures automatically settings such as detection and calibration of zero･span, selection of suitable PID parameters to apply the control, detection and calibration of IP signal current bias.

Note

The configuration time varies with actuator size.

Execute full autotune ;

MENU > Setup >Easy tuning > Full autotune (2-2-1)

Confirm the result of the execution(full autotune) ;

MENU > Setup >Easy tuning > Tuning result (2-2-2)

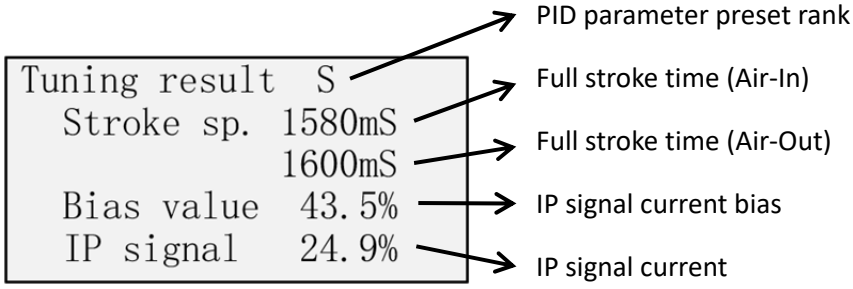


Figure 4.4.1 Example of tuning result

4.4.2. Position setup

It is possible to perform Zero/span settings only independently, otherwise full autotune. There are two different ways of Zero/span settings whether to specify Zero/span manually or to determine these automatically.

Manual calibration ;

MENU > Setup >Easy tuning > Position setup > 0%, 100% (2-2-3)

While pressing the up ⇧ or ⇩ arrow key, adjust individually the value of each position in 0% and 100% of the valve travel.

Auto calibration ;

MENU > Setup >Easy tuning > Position setup > Auto span (2-2-3)

4.4.3. Response tuning

This operation is used to perform an additional fine adjustment relevant to the control response after performing PID tuning.

MENU > Setup >Easy tuning > Response tuning (2-2-4)

A. In case the higher response sensitivity is desired,
i.e., you wish to reduce response time by making the response quicker,
Select 'Aggressive' from 'Response tuning' menu and the most suitable stage among nine stages (+1～+9). The response sensitivity increases in proportion to number of the stage.

B. In case the lower motion sensitivity is desired,
i.e., you wish to decrease the overshoot by making the response slower,
Select 'Stable' from 'Response tuning' menu and the most suitable stage among five stages (-1 ～-9). The response sensitivity decreases in proportion to number of the stage.

C. In case of restoring the response to original settings
Select 'Normal' from 'Response tuning' menu.

4.4.4. Setting up procedure with restriction plate

The following is the setting when applying the restriction plate described in【2.7. Fixed aperture plate (optional)】of the instruction manual.

1. Set the dead band to 0.5% ※Optional
MENU > Setup >Detailed setup > Dead band (2-4-2)
Please refer to 【4.7.Detailed setup】in the instruction manual.

2. Execute the full autotune
MENU > Setup >Easy tuning > Full autotune (2-2-1)
Please refer to【4.4.1.Full autotune】in instruction manual

If the full autotune does not finish because of hunting.

A. Please change the response tuning from 0 to -5, and execute full autotoune again.
MENU > Setup >Easy tuning > Response tuning (2-2-4)
Please refer to【4.4.3 response tuning】in the instruction manual

B. Please lower the selected rank and execute again as Custom
MENU > Setup >Expert tuning > PID parameter set (2-3-1)
Please refer to【4.5.1.Preset setting for PID parameter】in the instruction manual

※Zero span adjustment is completed even if full autotune does not finish due to hunting

3. Check the step response ※Not always necessary
MENU > Diag & Alarms > Offline diag. set. > 25% step response (4-2-1)
Please refer to【7.2.1.Summary of offline diagnostics】in the instruction manual

4. Additional adjustment

If overshoot appears, make the following adjustments.

A. Overshoot slowly (when pressure change is relatively slow)

It is considered that this occurrs because the proportional gain is too small. Raise the rank or set the Response tuning in the positive direction.

B. Overshoot immediately (when pressure change is fast)

It is considered that this occurrs because the proportional gain is too big. Lower the rank or set the Response tuning in the negative direction.

If you perform the full autotune again after changing the rank, the parameters of the originally inappropriate rank will be selected. To avoid this, select Custom after changing the rank. With this operation, the PID parameter will be set to the value of the selected rank.

Change of rank by applying restriction plate

The use of restriction plate reduces the supply and exhaust speed of the positioner. Therefore, by measuring the time during full autotune, the positioner will recognize that it is controlling a large actuator. By this reason, a PID parameter with a higher rank than the normally selected parameter is selected. The following table shows the ranks that are selected when applying restriction plate.

Type	Actuator	Rank selected	
		With restriction plate	Without
Single /rotary	AT201	M or L	XS
	AT251	M or L	SS
	AT301	L	SS
	AT351	LL	S
Double /rotary	AT201	M or L	XS
	AT251	L	SS
	AT301	L	SS
	AT351	LL	S
Single /linear	5221LA	L or LL	SS
Double /linear	6315LA	M	XS

4.5. Expert tuning

Use this setting in case in which the desired response has not been achieved through easy tuning. More suitable control parameters are configured according to each actuator by tuning individually parameters necessary to control the response.

4.5.1. Preset setting for PID parameter

Caution

- If you change the rank by two or more, unexpected behavior (too slow response, too fast response) may occur, so perform a thorough test operation in advance and confirm that there are no problems.
- In general, lowering the proportional gain takes longer to start moving and delays reaching the target opening. On the other hand, increasing the proportional gain causes instability and hunting.

It is possible to select preset values prepared previously as PID parameter sets inside the device.

MENU > Setup >Expert tuning > PID parameter set (2-3-1)

Parameter sets corresponding to maximum seven ranks defined as XS, SS, S, M, L, LL, XL are prepared previously in an ascending order of the proportional gain. Select the parameter set as necessary. If parameters are need to be specified individually through custom setting, select 'custom' menu.

To increase response sensitivity：select PID parameter set with higher proportional gain

To decrease response sensitivity：select PID parameter set with lower proportional gain

Table 4.5.1a. Correspondence table between rank and each actuator size（※）

Rank	5200LA	6300LA	6300RC	5300LA
XS	Φ218	Φ150	AT201U	-
SS	Φ270	Φ150	AT251U,AT301U	Φ270S
S	Φ270,Φ350	Φ200	AT351U,AT401U	Φ270S,Φ270L,Φ350S
M	Φ350,Φ450S	Φ300	AT451U,AT501U	Φ350S,Φ350L,Φ450S
L	Φ450S	Φ450	AT551U,AT601U	Φ450S,Φ450M,Φ450L
LL	Φ450L	Φ450,Φ600S	AT651U,AT701U	Φ450M,Φ450L
XL	Φ650	Φ450L,Φ600		-

※・・・The factors such as travel stroke, supply pressure, etc. affect the selection of the set relative to the actuator to apply. You may have to change the set to get the desired response according to the difference in the factors even if the setup is performed within the same actuator.

Table4.5.1b. Correspondence table between rank and each actuator size in the booster settings (※)

Rank	5200LA	6300LA	6300RC	5300LA
XS	–	Φ200	–	-
SS	Φ350	Φ300	AT401U,AT501U	Φ270L,Φ350S
S	Φ450S	Φ450	AT501U,AT551U	Φ350L,Φ450S
M	Φ450S,Φ450L	Φ450,Φ600S	AT601U,AT651U	Φ450M
L	Φ450L	Φ450L,Φ600	7328RB,AT701U	Φ450L
LL	Φ650S	Φ600	7337RB	-
XL	Φ650L	–	-	-

※・・・The factors such as travel stroke, supply pressure, etc. affect the selection of the set relative to the actuator to apply. You may have to change the set to get the desired response according to the difference in the factors even if the setup is performed within the same actuator.

4.5.2. Custom setting for PID parameter

Caution

- If you change the value of each parameter significantly, unexpected behavior (response is too slow, response is too fast) may occur, so please perform thorough testing in advance to confirm that there are no problems.
- In general, lowering the proportional gain takes longer to start moving and delays reaching the target opening. On the other hand, increasing the proportional gain causes instability and hunting.

It is possible to tune individually PID parameters shown as below.

MENU > Setup >Expert tuning > PID custom setup (2-3-2)

Table 4.5.2. Customizable PID parameters

	Category	Type of pressure action	Description and applicable conditions	Value range
P **D** **I**	Outside parameter	Air-IN (Increase in output pressure)	When deviation is |e|≥b and Po1 output pressure increases, these parameters will be applied. P: Proportional gain, D: Derivative gain, I: Integral gain	0.1～99.9
rP **rD** **rI**		Air-OUT (Decrease in output pressure)	When deviation is |e|≥b and Po1 output pressure decreases, these parameters will be applied. rP: Proportional gain, rD: Derivative gain, rI: Integral gain	
Inside P **Inside D** **Inside I**	Inside parameter	Air-IN (Increase in output pressure)	When deviation is |e|≤b and Po1 output pressure increases, these parameters will be applied. Inside P: Maximum proportional gain, then, P(e)=Inside P+(P-Inside P)*e/b Inside D: Maximum derivative gain, then, D(e)=Inside D+(D-Inside D)*e/b Inside I: Integral gain	0.1～99.9
Inside rP **Inside rD** **Inside rI**		Air-OUT (Decrease in output pressure)	When deviation is |e|≤b and Po1 output pressure decreases, these parameters will be applied. Inside rP: Maximum proportional gain, then, rP(e)=Inside rP+(rP-Inside rP)*e/b Inside rD: Maximum derivative gain, then, rD(e)=Inside rD+(rD-Inside rD)*e/b Inside rI: Integral gain	
b			Set the deviation to switch between outside parameters and inside parameters, and which will be used to optimize the response. IF b is set to zero (0), the outside parameters are valid only.	0～10%

※Outside parameter means the parameters which are used when deviation is |e|≥b.

※Inside parameter means the parameters which are used when deviation is |e|≤b.

If 'b' parameter is set, Gain P(e) is switched as shown below.

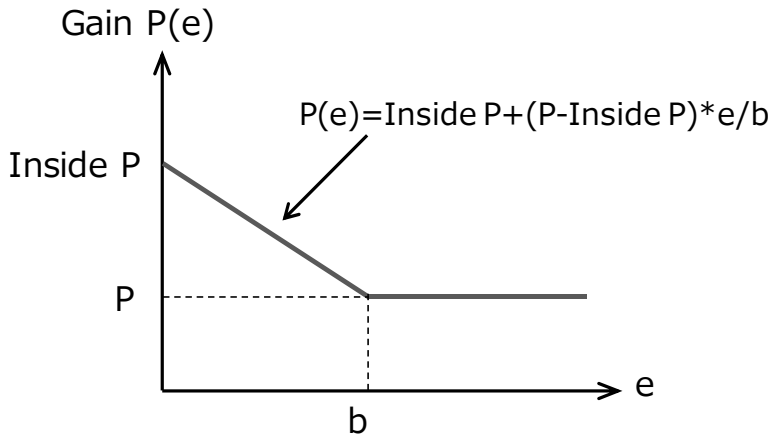
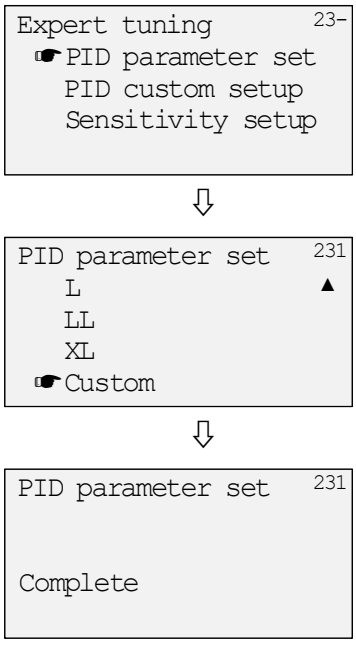


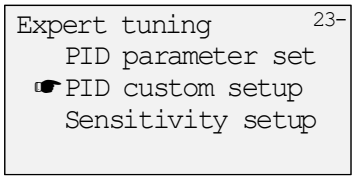
Figure 4.5.2. Gain switching (Example of proportional gain)

The procedure is shown as followings.

① Select 'Custom' from 'PID parameter set' menu.



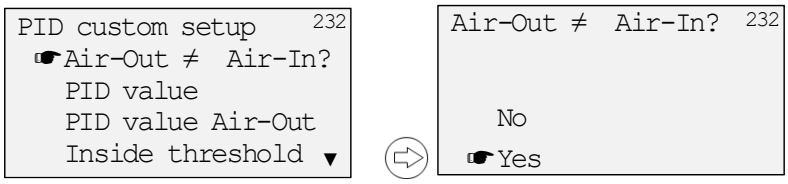
② Select 'PID custom setup'



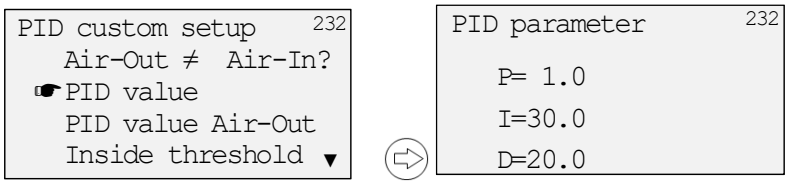
Select whether or not Air-Out (decrease in output pressure) is same with Air-In (increase in output pressure).

※If any other submenu except 'Custom' was selected from PID parameter menu, the value of

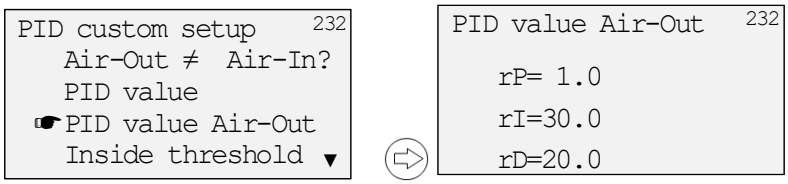
parameters will not be able to be changed through the following procedure ③.



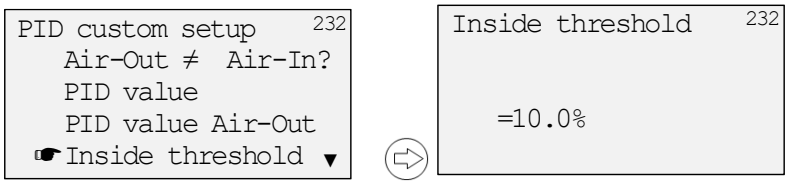
③ Set PID parameters of Air-In



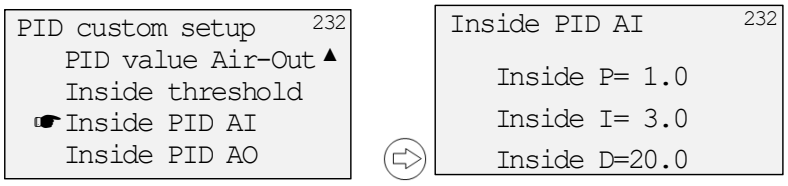
④ Set PID parameters of Air-Out



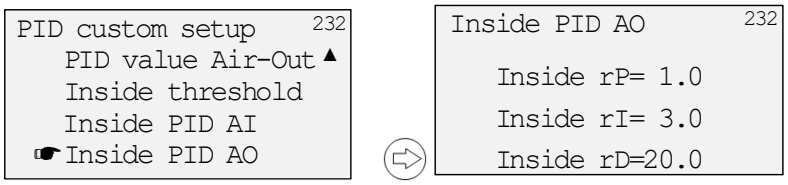
⑤ Set a value of Inside threshold （b）



⑥ Set parameters of Inside Air-In



⑦ Set parameters of Inside Air-Out



⑧ Store the set values if necessary.

4.5.3. Setup for IP signal current bias

IP signal current bias is the parameter necessary to determine the control output signal (IP signal) corresponding to an input signal inside the device.
There are two different ways whether to determine IP signal current bias automatically or to specify it manually.

Auto setup；
MENU > Setup > Expert tuning > Sensitivity setup (2-3-3)

A. Set IP signal current bias and PID parameters together.
Sensitivity setup > Auto bias & size select (2-3-3-)

B. Set IP signal current bias only.
Sensitivity setup > Auto bias (2-3-3-)

Manual setup；
MENU > Setup > Expert tuning > Sensitivity setup > Manual Bias (2-3-3-)
Specify individually IP signal current bias of each position in 25% and 75% of the valve travel.

4.6. Error messages

If the problems cause during the operations such as full auto tune in section 4.4.1, auto setup of position setup in section 4.4.2, auto setup of IP signal bias, the following error messages will be displayed and the performance will be stopped.

Table 4.6 List of error messages

Code	Error description and solution	
Error1	Phenomenon	**It does not reach the 0% travel position or steady state.**
	Possible causes	Lack in off-balanced pressure
	Solution	Confirm off-balanced pressure
Error2	Phenomenon	**It does not reach 100% travel position or the steady state.**
	Possible causes	Decrease or pulsation in supply pressure
	Solution	Confirm the supply pressure
Error3	Phenomenon	**It does not reach or set 25%，75% travel position.**
	Possible causes	・Valve friction is large and a limit cycle is occurring. ・A limit cycle has occurred due to mechanical backlash such as the tension spring falling off or the screw loosening. ・The appropriate PID parameters are not set.
	Solution	➢ Set dead band ➢ Remove mechanical backlash ➢ After changing the suitable PID parameters, perform the setup of position setup and IP signal bias.
Error5	Phenomenon	**It does not get correct span. Span is too narrow.**
	Possible causes	Decrease or pulsation in supply pressure
	Solution	Confirm the supply pressure

※In addition to the possible causes of each error code, if five minutes is passed while performing the specified operation, the error codes will be displayed.

4.7. Detailed setup

Set values which need to be changed to achieve the desired response.

MENU > Setup > Detailed setup (2-4-)

Table 4.7. Item list of the detailed setup

Key menu	Description	Parameters	Default
Cutoff	Set the control range which tracks the input signal 0% : If the input signal is lower than this value, IP signal will be cutoff to the low side. The range of values available is 0.1~50.0%. 100% : If the input signal is higher than this value, IP signal will be cutoff to the high side. The range of values available is 50.0~99.9%. ※ 1 The parameters setup is carried out according to the specified model code at the factory. Linear actuator : 0.5% at the 0% side Disable at the 100% side Rotary actuator : 0.5% at the 0% side 99.5% at the 100% side ※Choose either one Cutoff or Limit as shown below	Value/Disable	※1
	⚠ **Handling precautions** Be sure to use the cutoff setting if you want to control the mechanical hit position as 0% or 100%. When using a stopper, optimal rise and fall operations can be achieved by setting the mechanical hit position to about 0.5% plus on the 0% side and about 0.5% minus on the 100% side. Example: If the stopper position is 30%, set to 30.5%.		
Limit	Set high and low limit percentage of input signal which the positioner may recognize 0% : This value is a low limit above which the input signal is in effect. The range of values available is 0.1~50.0%. 100% : This value is a high limit below which the input signal is in effect. The range of values available is 50.0~99.9%. ※Choose either one Cutoff as shown above or Limit	Value/Disable	Disable
Dead band	Set the deviation value below which the integral action is disabled.	Value/Disable (0.1~10.0%)	Disable
Transfer function	Set the type of the flow characteristic curve Linear：Linear characteristics Equal percent Low :	As shown on the left	Linear

Key menu	Description	Parameters	Default
	Low equal percentage characteristics (Rangeability 30:1) Equal percent Mid : Middle equal percentage characteristics (Rangeability 50:1) Equal percent Hig : High equal percentage characteristics (Rangeability 100:1) Quick opening : Quick opening characteristics (Rangeability 30:1) Custom curve: Customized characteristics ※In case of using equal percent characteristic besides the rangeability mentioned above, input the value directly to “Range ability”.		
Custom curve set	Set the flow characteristic curve by specifying arbitrary 20 points. ※Since the 0% valve travel corresponds to the 0% input and the 100% valve travel corresponds to the 100% input, set points of the intervals between them. ※ Define the relationship in such a way that the valve travel monotonically increases as the input increases.	Value/Unused	Unused
Range ability	Specify a rangeability in relevant to the equal percentage characteristic curve. ※This setup is available on condition that the equal percentage characteristics from’ flow characteristic curve’ menu was selected previously. ※If the rangeability is set to 1, it becomes the value of each equal percent characteristics.	Value	1
Input damper	Set the damping coefficient to the input signal. As the value becomes lager, the response becomes slower because the primary delay time constant becomes larger.	Value/Unused (0.1~99.9%)	Unused
Split range	To set the split range, enter input signal values between 4 and 20 mA corresponding to the valve openings (%). Example 1) Where it is desired to set 4 mA to 0% and 12 mA to 100% Set 0%=4mA Set 100%=12mA and Set Point to Normal Example 2) Where it is desired to set 4mA to	0%/100%	0%=4mA 100%=20mA

Key menu	Description	Parameters	Default
	100% and 12mA to 0% Set 0%=4mA Set 100%=12mA and set point to Reverse		
PT burnout dir.	Set the burnout direction of position transmitter, when a failure occurs. Low setting： When the current is lower than 3.6mA, the lower current (burnout signal) will flow High setting： When the current bigger than 21mA, the bigger current (burnout signal) will flow ※ If the input signal is zero, the current of Low setting will flow regardless of above setting.	Low/High	Low
AT span limit	Set the full mechanical limit of valve travel over the 100% travel position, when the positioner detects the 100% travel position. ※This value is valid only in condition when 'Linear' from 'actuator motion' menu is selected on the basic setup.	Value (100~150%)	105%
	⚠ **Handling precautions** When setting the overstroke value to 100%, be sure to enable the setting on the Cutoff 100% side. By setting the value according to the actuator, you can save the time of adjusting the span from the next time onward.		
Integ.stop press	When the supply air pressure falls below the set threshold value, the correction operation by integration is stopped.	Value/Unused (0~999kPa)	50kPa

4.8. Function select

You can configure individually the following functions.

MENU > Setup > Function select (2-5-)

Table 4.8. List of selectable functions

Key menu	Description	Parameters	Default
Authority ※ **Model KGP5003 only**	Set access permission to HART communication. Select HART in case in which settings should be configured via not LUI but HART communication only. Once HART is selected, only 'Information' from 'TOP' menu will be able to be accessed through LUI. ※To reset from HART to LCD(LUI), the following special operation must be conducted. When a screen is displayed as shown below, *MENU > Information > Monitor > Status* 1. Press the up and left arrow keys simultaneously for four (4) seconds. 2. When a 'Yes/No' confirmation is displayed, select 'Yes'. 3. The switching from HART to LCD(LUI) of access authority will be completed.	LCD / HART	LCD
Password setup	Set password. Once the password is set, only 'Information' from 'TOP' menu will be able to be accessed unless you type the password. If forgetting the password, please inquire to the business office of this manual end.	Three-digit integer	Unused
Screen saver	Set the time for screen saver during which the LCD screen display will be turned off. It is possible to extend the life span of the LCD with a limited life by using screen saver.	Value/ Unused	Unused
Temperature unit	Set temperature unit displayed on the LCD.	℃ / °F	℃
Pressure unit	Set pressure unit displayed on the LCD.	kPa/bar/psi	※
Posi. disp. mode	Change the display method of valve travel displayed on of the LCD home screen Normal: Indicate travel position with a decimal point Simple: Indicate travel position as an integer	Normal / Simple	Normal

※・・・The parameters setup is carried out according to the specified model code at the factory.

4.9. Memory management

4.9.1. Memory save

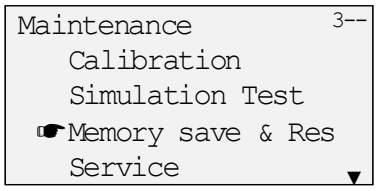
Since calibration and configuration data is not saved automatically, store the data in either of the following ways.

A. Data storage by using 'Memory save & res.' menu on the LCD

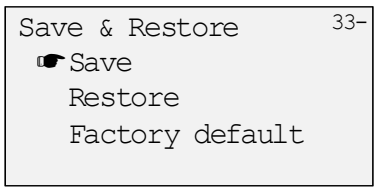
MENU > Maintenance > Memory save & res. (3-3-)

The procedure is shown as followings.

① Select 'Memory save & Res' menu and press the right ⇨ arrow key.



② Select 'Save' menu and press the right ⇨ arrow key.



③ Select 'Yes' confirmation and press the right ⇨ arrow key.



④ If the screen is displayed as shown below and is returned to the ② screen, the data storage will be complete.



B. Data storage immediately after performing each operation

After performing each operation, press the left ⇦ arrow key once and then a screen will be displayed as shown below before returning to 'TOP' menu screen. You can store the data by confirming 'Yes'.



4.9.2. Restore set value

Select 'Restore' menu in the same way shown as section 4.9.1.
It restores current set-values with the saved data.

※You'll lose the contents of the temporary change before saving.

4.9.3. Restore factory default

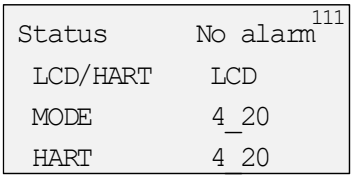
Select 'Factory default' menu in the same way shown as section 4.9.1.
It resets to the factory settings.

4.10. Information

4.10.1. Display of status

The operator can confirm the current status of the positioner.

MENU > Information > Monitor >Status (1-1-1)

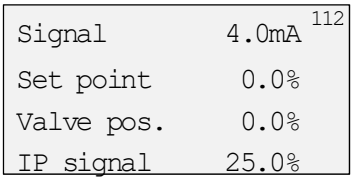


Status : Existence of alarm
LCD/HART : Access authority
MODE : Mode on LUI(LCD) access
HART : Mode on HART access

4.10.2. Display of operating status

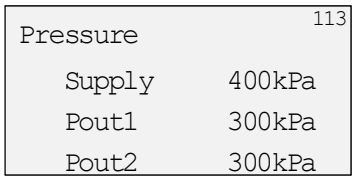
The operator can confirm operating status of the positioner such as input signal, set point, valve position, IP signal.

MENU > Information > Monitor > Input / posi etc (1-1-2)



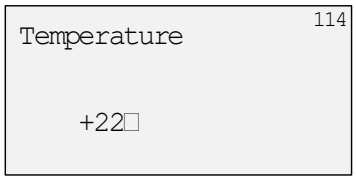
Signal : Input signal
Set point : Set point
Valve pos. : Valve position
IP signal : IP signal current

The operator can confirm the values of the current pressure.
MENU > Information > Monitor > Pressure (1-1-3)



Supply : Supply pressure
Pout1 : Output pressure 1
Pout2 : Output pressure 2

The operator can confirm the value of the current temperature inside the positioner.
MENU > Information > Monitor > Temperature (1-1-4)



4.10.3. Display of inner information

The operator can confirm the information as below.

- Serial number ※
- Each version (Positioner, electric board, software)
- HART version ※
- TAG number ※

※ Model KGP5003 only

MENU > Information > Positioner info. (1-3-)

4.10.4. Display of configuration information

It is possible to confirm the information as below.

- Stem motion type and acting type of the actuator
- Valve action
- Packing type
- Booster relay option
- Set point direction
- Position transmitter direction
- Burnout direction of transmitter output
- PID parameter set
- Set value of cutoff/limit
- Dead band
- Change of output characteristics
- Inputted damper
- Range ability
- Split range
- Integral stop pressure

MENU > Information > Config. parameter (1-4-)

4.11. Confirmation before operation

Caution

- For normal operation, apply 3.8mA DC or higher. Also, do not apply more than 24mA DC.
- Immediately after turning on the power, the response may slow down, so apply 3.8mA DC or more after turning on the power.

Note

During operation, if the input signal falls below 3.6 mA DC or exceeds 21.0 mA DC, the unit will enter a cutoff.
In this condition, the LCD will display “Under” for both the Set Point and Input Signal (%) when the input signal is below 3.6 mA DC, and “Over” when the input signal exceeds 21.0 mA DC.

4.11.1 Verification procedure

Before operating, checking the specification on clause 1.4 on this documents and performing the following operation check.

1. Make sure that the feedback lever and pin are not damaged or broken.
2. Make sure that the air piping is supplied with the proper supply air pressure and that there are no air leaks.
3. Make sure a 4-20mA DC is applied to the input signal.
4. Refer to section 5.1.2 and verify that the IP signal is within 40%～60%. If the IP signal is outside the range, perform the adjustment.
5. Check the operation with the input signal that meets your needs in advance.

5. MAINTENANCE

Warning

- If the exhaust port becomes clogged with contaminants, high pressure will be applied to the front cover. It could blow off the cover when trying to remove it, and cause hazards. Before removing it, confirm that the exhaust port of the housing is surely opened.
- Always wear protective suit, gloves, and eyeglasses before performing any maintenance operation.

Caution

- Don't remove the fall prevention screws from pilot relay, A/M unit.

5.1. Adjustment · switching

5.1.1. Auto·Manual mode switching

Caution

- Remove electrical power or provide the input signal which makes the function of the cutoff to be valid before performing Auto/ manual switching.
  As this operation is performed while an input signal is being received, the positioner will increase the integral gain in order to reduce the deviation between the input signal and travel signal of the valve. Consequently, when the operator will switch the positioner to the auto mode, it will take long time to move the valve to the desired position because of the stored integral gain.

There are two control modes in the positioner; in auto mode or in manual mode. Auto mode is the normal mode in which the output pressure is adjusted automatically in order to position the valve travel corresponding to an input signal. In manual mode, the output pressure is adjusted manually through external devices such as a regulator and so on.

The operator can switch the positioner to the manual mode through mechanical operation such as turning the screw clockwise attached to the A/M (Auto/Manual) unit.

In auto mode ; the output pressure corresponding to the nozzle backpressure which is generated in the torque motor is outputted.

In manual mode ; the output pressure which reaches to the supplied pressure by bypassing the nozzle backpressure is outputted.



Figure 5.1.1. A/M unit

This manual control enables the actuator equipped with the positioner to be positioned to the travel corresponding to the output pressure. But a double acting actuator moves the valve to a fully-open or fully-closed position differently from a single acting actuator.

5.1.2. Torque motor adjustment

Adjust the gap of nozzle flapper parts, namely, nozzle and nozzle pad.
The procedure is shown as below.

① Set 'Input/posi etc' from 'Monitor' menu, then, the following screen will be shown.
MENU >Information >Monitor >Input/posi etc (1-1-2)

Signal	8.0mA	112
Set point	25.0%	
Valve pos.	25.0%	
IP signal	43.0%	

② Input the signal corresponding to the 50% travel position.

Signal	12.0mA	112
Set point	50.0%	
Valve pos.	50.0%	
IP signal	45.0%	

③ While turning the nozzle of the torque motor clockwise or counterclockwise, adjust the value of 'IP signal' to 50±2%. Then, the procedure is now complete.

Signal	12.0mA	112
Set point	50.0%	
Valve pos.	50.0%	
IP signal	50.0%	

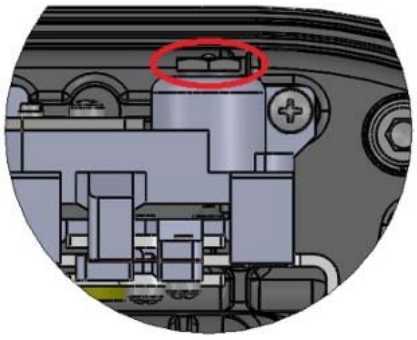


Figure 5.1.2a Nozzle adjustment of torque motor

5.1.3. Action switching of pilot relay

The operator can switch the pilot relay between single action mode and double action mode by turning the screw attached to the pilot relay.

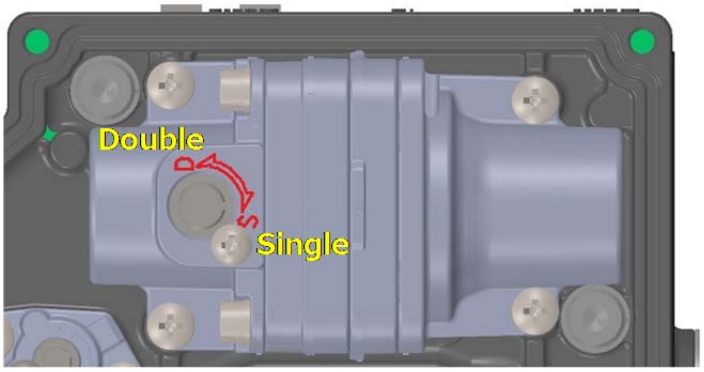


Figure 5.1.3. Action switching of pilot relay

Switching to single action mode;

Turn the switch screw clockwise until it reaches its end position.

Switching to double action mode;

Turn the switch screw counterclockwise until it hits the fall prevention screw.
Since a balance pressure becomes supply pressure at this time, subsequently, the operate need s to perform 「Adjustment of balance pressure」 operation described in next section.

5.1.4. Balanced pressure adjustment of pilot relay

When the pilot relay is used in double action mode, the operator needs to adjust the balanced pressure of the output pressure 1 and 2 by rotating switch screw. When turning the switch screw counterclockwise, the balanced pressure increases. But when turning the switch screw clockwise, the balanced pressure decreases. Adjust the balanced pressure to 70-80% of the supply pressure.

Once set the following menu shown below, then, you can adjust it while confirming the values of the output pressure 1 and 2.
It should be noted that the larger the actuator, the more it takes time to adjust the pressure.

MENU > Maintenance > Calibration > Pilot relay adju. (3-1-5)

Below figure shows the screen under 'Pilot relay adju.' menu. The explanation for the meaning of each value is shown as below.

```
Pilot relay adju.          315
balance air AAAA-BBBB
   Pout1:   CCCCkPa
   Pout2:   DDDDkPa
```

AAAA：Low limit of the balanced pressure (70% of the supply pressure)
BBBB：High limit of the balanced pressure (80% of the supply pressure)
CCCC：the current value of Pout1
DDDD：the current value of Pout2

5.2. Calibration

Since the operation described in this section is preset from the factory, generally, it is not necessary to repeat this. However, since there is a case in which a deviation is produced from long-term operation and so on, if necessary, perform this operation.

5.2.1. Storage of calibration data

Caution

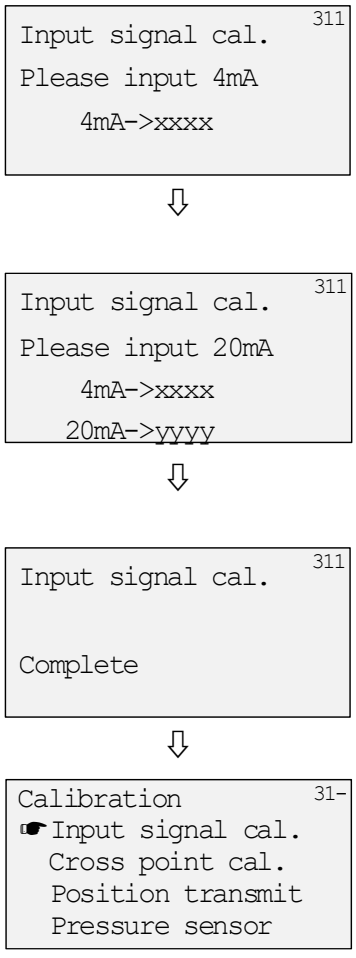
Since calibration data is not stored automatically, perform 'memory save' operation as following the procedure described in section 4.9.

5.2.2. Input signal calibration

Calibrate the value of input signal which the positioner can receive.

MENU > Maintenance > Calibration >Input signal cal. (3-1-1)

The procedure to calibration each value of 4mA and20mA is shown as below.



4mA calibration;

① Flow 4mA to the positioner on the screen shown left.
※'xxxx' represents an A/D (converted digital) value which the positioner may detect.

② Press the right ⇨ arrow key.

20mA calibration;

③ Flow 20mA to the positioner on the screen shown left.
※'yyyy' represents an A/D (converted digital) value which the positioner may detect.

④ Press the right ⇨ arrow key.

⑤ Left screen will be displayed.

⑥ If the screen will be displayed as shown left, the calibration will be completed.

5.2.3. Cross point calibration

Note

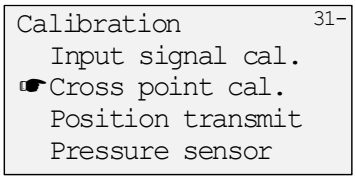
It is possible for the precision not to be get enough even if the cross point calibration was performed because the degree of the precision varies with the potentiometer attached to the positioner. In that case, perform the cross point adjustment described in section 5.5.3.

Calibrate the position which of the feedback lever becomes in the horizontal position. It is necessary to perform it in order to precisely control the travel position. When a feedback lever isn't installed horizontally in the 50% position, this calibration will be required.

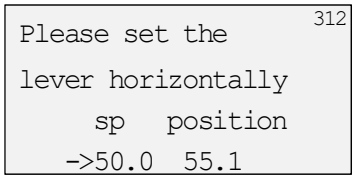
MENU > Maintenance > Calibration >Cross point cal. (3-1-2)

The procedure is shown below.

① Select 'Cross point cal.' from 'Calibration' menu.



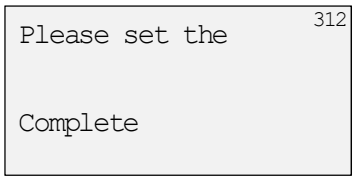
② If the below screen is displayed, make the feedback lever to be in the horizontal position while pressing the up or down arrow key.



sp：This shows the desired position value of the valve travel. Change the value while pressing the up or down arrow key.

position：This shows the current position value of the valve travel.

③ Once the position is in the horizontal position, then, press the left arrow key. If the screen will be displayed as shown below and returned to the screen ①, the calibration will be completed.

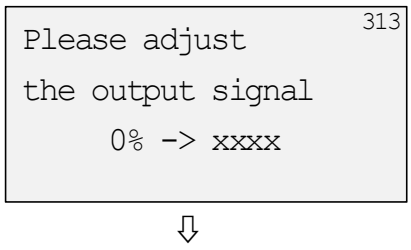


5.2.4. Position transmitter calibration

Calibrate the position transmitter signal which the positioner may send. ※Model KGP5003 only

MENU > Maintenance > Calibration > Position transmit cal. (3-1-3)

The procedure to calibrate individually the position transmitter signal of each position in 0% and 100% is shown below.



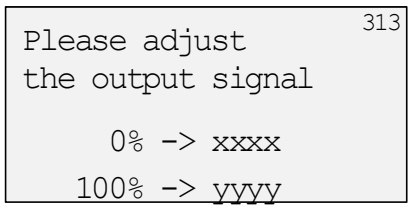
⇩

0% output calibration;

① If the screen is displayed as shown left, adjust the shown value until the output signal becomes the value correspondent to 0% while pressing the up or down arrow key.

※'xxxx' represents an A/D (converted digital) value which the positioner may detect.

② Press the right arrow key.



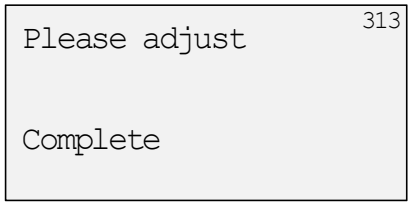
⇩

100% output calibration;

③ If the screen is displayed as shown left, adjust the shown value until the output signal becomes the value correspondent to 100% while pressing the up or down arrow key. .

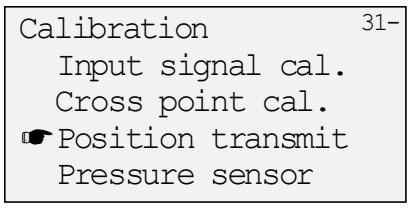
※'yyyy' represents an A/D (converted digital) value which the positioner may detect.

④ Press the right arrow key.



⇩

⑤ Left screen will be displayed.



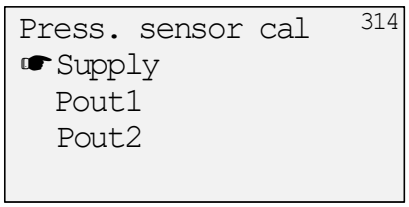
⑥ If the screen will be displayed as shown left, the calibration will be completed.

5.2.5. Pressure sensor calibration

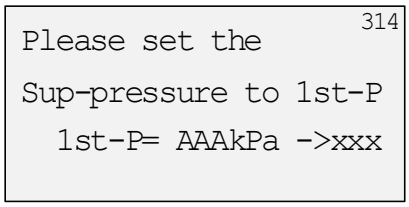
Calibrate three pressure sensors attached in the positioner. It is necessary to connect the positioner to a pressure measuring device of gauge pressure type which is used for pressure reference. It is required to calibrate both of the first order pressure (1st-P) and the second order pressure (2nd-P) for each sensors.

MENU > Maintenance > Calibration > Pressure sensor (3-1-4)

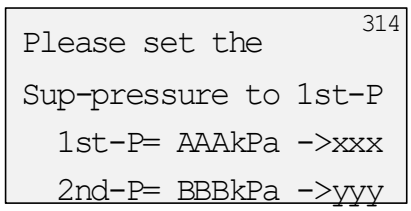
The procedure to calibrate the supply pressure sensor is showed as below.



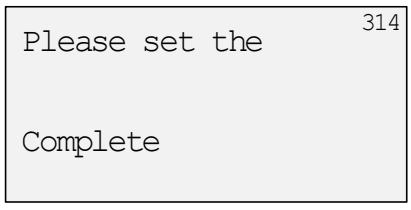
⇩



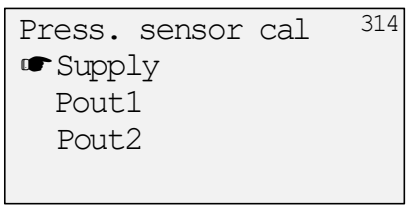
⇩



⇩



⇩



① If the screen is displayed as shown left, select 'Supply' from 'Press. sensor cal' menu.

The first pressure calibration;

② If the screen is displayed as shown left, adjust the value until AAA goes to the supplied pressure while pressing the up ⇧ or down ⇩ arrow key. Generally, AAA is the atmosphere pressure.
※'xxxx' represents an AD (converted digital) value which the positioner may detect.

③ Press the right ⇨ arrow key.

The second pressure calibration;

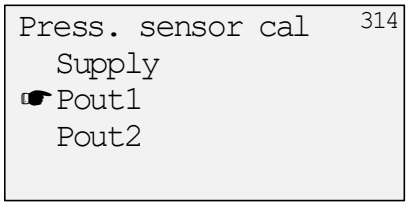
④ If the screen is displayed as shown left, adjust the Value until BBB goes to the supplied pressure while pressing the up ⇧ or down ⇩ arrow key. Generally, BBB is the supply pressure.
※'yyy' represents an AD(converted digital) value which the positioner may detect.

⑤ Press the right ⇨ arrow key.

⑥ Left screen will be displayed.

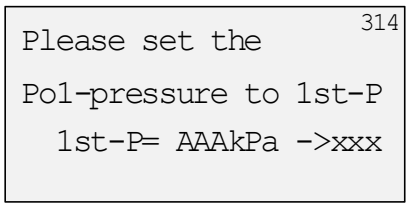
⑦ If the screen will be displayed as shown left, the calibration will be completed.

The procedure to calibrate the sensor for output pressure 1 is showed as below.



① If the screen is displayed as shown left, select 'Pout 1' from 'Press. sensor cal' menu.

⇩



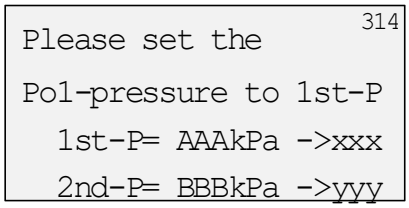
⇩

The first pressure calibration;

② If the screen is displayed as shown left, adjust the value until AAA goes to the supplied pressure while pressing the up ⇧ or down ⇧ arrow key. Generally, AAA is the atmosphere pressure.

※'xxxx' represents an AD (converted digital) value which the positioner may detect.

③ Press the right ⇨ arrow key.



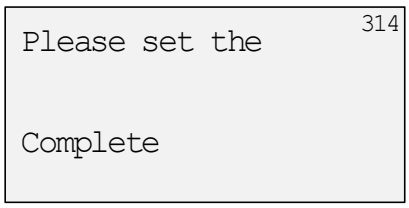
⇩

The second pressure calibration;

④ If the screen is displayed as shown left, adjust the Value until BBB goes to the supplied pressure while pressing the up ⇧ or down ⇧ arrow key. Generally, BBB is the supply pressure.

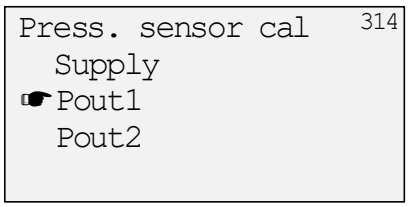
※'yyy' represents an AD(converted digital) value which the positioner may detect.

⑤ Press the right ⇨ arrow key.



⑥ Left screen will be displayed.

⇩



⑦ If the screen will be displayed as shown left, the calibration will be completed.

Please also calibrate by these procedure about Pout2.

【Supplementary explanation on the pressure sensor calibration】
It is necessary to set individually the first pressure and second pressure while calibrating the pressure sensor. When knowing the correct value of supply pressure, the operator can perform the operation by following the procedure as below which is the relatively simple process without pressure measuring device.

Calibration of the supply pressure sensor;
1. Set the first pressure to zero after blocking the supply pressure to the positioner.
2. When setting the second pressure to the supply pressure, provide the supply pressure to the positioner.

Calibration of the output pressure 1;
1. Set the first pressure to zero after blocking the supply pressure to the positioner.
2. When setting the second pressure to the supply pressure, provide the supply pressure to the positioner by switching A/M unit to the manual mode.

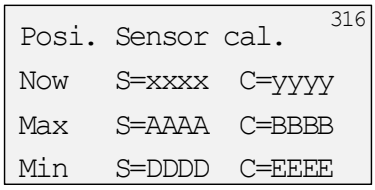
Calibration of the output pressure 2;
1. Set the first pressure to zero after blocking the supply pressure to the positioner.
2. When setting the second pressure to the supply pressure, provide the supply pressure to the positioner by supplying the input signal which sets the IP signal current to zero.
※Pilot relay adjustment needs to be double acting when using this method.

5.2.6. Potentiometer calibration

The operator may perform the calibration of potentiometer attached the positioner. Since the calibration is performing at the factory, in general, it is not necessary to do it again.

But when the positioner is removed from the actuator, rotate the feedback lever 360 degrees clockwise or counterclockwise according to the following procedure before the calibration.

MENU > Maintenance > Calibration > Posi. sensor cal. (3-1-6)



Now: Current value of sensor output
Max: Maximum value of sensor output
Min : Minimum value of sensor output
S :Sine wave value C : Cosine wave value

① When the above screen is displayed, rotate slowly the axis of the potentiometer two times.
② Once press the right ⇨ arrow key, then the set of values will be saved and the calibration will be completed.

5.3. Simulation test

Caution

Simulation test is the function which enables the positioner to be operated regardless of the signal from a higher-level control system connected with the positioner. Prior to operating this function, make sure that the simulation will not affect the process.

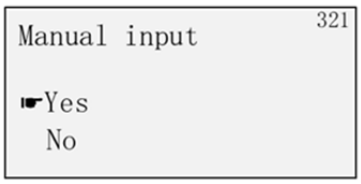
It is possible to generate input signal, IP signal current and position transmitter output in similar manner with the desired control. And it is also possible to check simply the response by generating ramp and step input in a similar way.

5.3.1. Input signal simulation

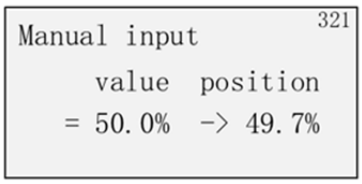
It is possible to move the control valve by providing the input signal which is similar to the desired signal.

There are two modes in the simulation; manual mode or preset mode. The manual mode makes the positioner to detect continuously all the values among the process that the current value goes to the displayed (input) value. But the preset mode makes the positioner to detect only the displayed (input) value. The simulation of the ramp response and so on is suitable to use the manual mode and the simulation of the step response and so on is suitable to use the preset mode.

Manual mode;
MENU > Maintenance > Simulation test > Manual input (3-2-1)

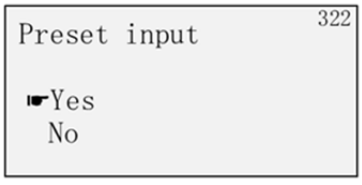


① Select 'Yes' confirmation and press the right arrow key.

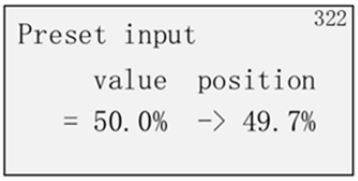


② If the screen is displayed as shown left, adjust the value until it becomes desired value by pressing the up or down arrow key to move a control valve.

Preset mode;
MENU > Maintenance > Simulation test > Preset input (3-2-2)



① Select 'Yes' confirmation and press the right arrow key.



② If the screen is displayed as shown left, adjust the value until it becomes desired value by pressing the up or down arrow key. .

③ Press the right arrow key to move a control valve.

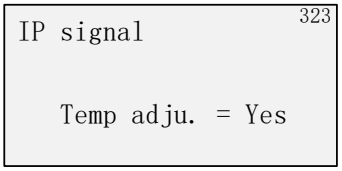
5.3.2. IP signal simulation

It is possible to move the control valve by providing the IP signal directly to the torque motor unit.

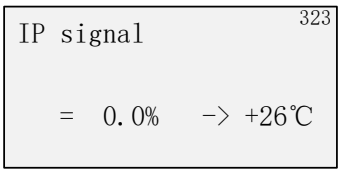
MENU > Maintenance > Simulation test > IP signal (3-2-3)

The procedure is shown as below.

① Select whether or not to adjust temperature. In general, confirm the displayed indication as it is.

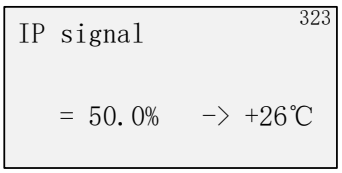


② Input an arbitrary IP signal.
The present temperature value used for temperature correction is indicated at the same time.

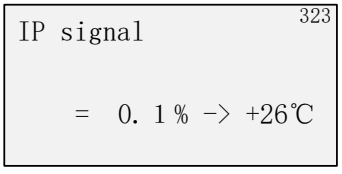


Supplementary explanation)

※The operator can change the value in 50% interval while pressing the right arrow key.



※The operator can change the value in 0.1% interval while pressing the left or right arrow key.



5.3.3. Simulation of position transmitter signal

It is possible to generate position transmitter signal which is similar to the desired signal.

※Model KGP5003 only

MENU > Maintenance > Simulation test > Position transmit (3-2-4)



※The operator can change the value in 0.1% interval while pressing the left ⇧ or right ⇩ arrow key.

※The value will be changed as below.

0%→ set value → 100% → burn out Hi → burn out Lo → 0%

5.3.4. Ramp response simulation

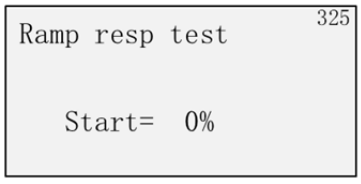
It is possible to move the control valve by providing the ramp signal which is similar to the desired signal.

MENU > Maintenance > Simulation test > Ramp response test (3-2-5)

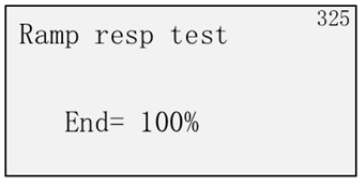
Parameter	Description	Unit
Start	Set the start position of the valve travel	*[%]*
End	Set the end position of the valve travel	*[%]*
Ramp time	Set the one-way travel time of the ramp response	*[s]*
Wait time	Set the delay time required for the start of the ramp response	*[s]*
Repeat	Set the motion type whether or not to repeat the ramp response	*Once/Repeat*

The procedure is shown as below.

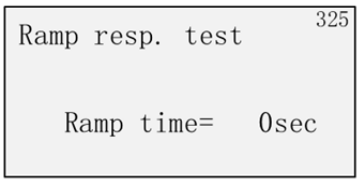
① Set the Step.



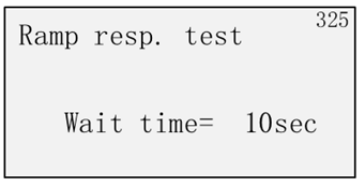
② Set the end position of the valve travel.



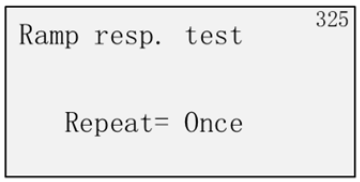
③ Set the ramp time .



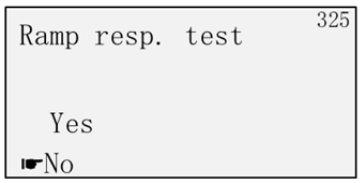
④ Set the wait time.



⑤ Select the motion type (number of repetitions).



⑥ Confirm the execution.



⑦ If you confirm 'Yes', the test will start. If pressing the left arrow key, the test will be forcibly terminated.

5.3.5. Step response simulation

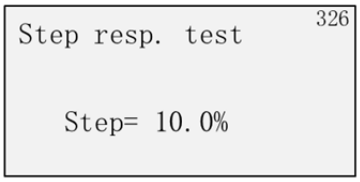
It is possible to move the control valve by providing the step signal which is similar to the desired signal.

MENU > Maintenance > Simulation test > Step response test (3-2-6)

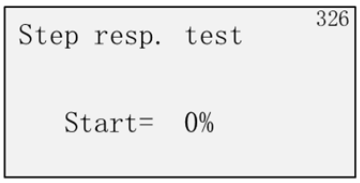
Parameter	Description	Unit
Step	Set the interval of the step response	*[%]*
Start	Set the start position of the valve travel	*[%]*
End	Set the end position of the valve travel	*[%]*
Step time	Set the delay time required for the start of the step response	*[s]*
Repeat	Set the motion type whether or not to repeat the step response	*Once/Repeat*

The procedure is shown as below.

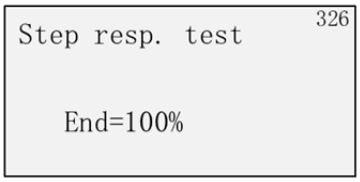
① Set ‘Step’ (the interval).



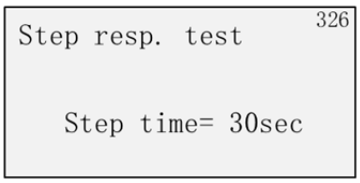
② Set ‘Start’ (position).



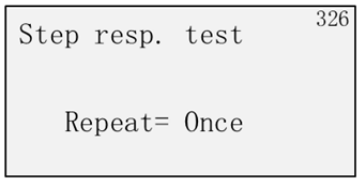
③ Set ‘End’ (position).



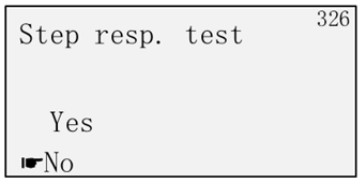
④ Set ‘Step time’ (delay time)



⑤ Set ‘Repeat’ (number of repetitions)



⑥ Confirm the execution.



5.4. Assembly(unit) cleaning ・ replacement

Caution

To use the positioner for a long time, it is necessary to clean or replace the assembly (unit) with scheduled maintenance.

5.4.1. Restriction cleaning

Remove accumulated dust and so on around the restriction.

If the restriction becomes clogged with dust, the flow of the back pressure which is generated in the torque motor becomes decrease so that this may result in a response delay of the pilot relay or the actuator.

Cleaning procedure)

1. Disconnect the device supply pressure.
2. Remove the front cover and A/M unit.
3. Insert the cleaning needle or wire(Diameter: Φ0.28 or less) to remove accumulated dust.
4. Carry out the process 2 in the reverse. Then, cleaning will be completed.

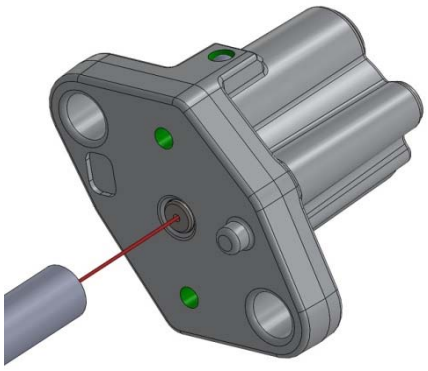


Figure 5.4.1 Restriction part

5.4.2. Wire mesh filter cleaning

Remove accumulated dust and so on around the wire mesh filter attached the button of A/M unit.

Note

Since the wire mesh filter is fragile and deformable, please handle with care. In addition, in order to place it to the desired position, remove the positioner from the actuator and perform the cleaning in a position that the front side of the positioner is toward the top.

Cleaning procedure)

1. Disconnect the device supply pressure.
2. Remove the front cover and A/M unit.
3. Remove O ring and the filter.
4. Remove an accumulated dust, etc. attached to the filter.
5. While taking care of the position of O ring and the filter, replace these (Refer to figure 5.4.2).
6. Carry out the process 2 in the reverse. Then, cleaning will be completed.

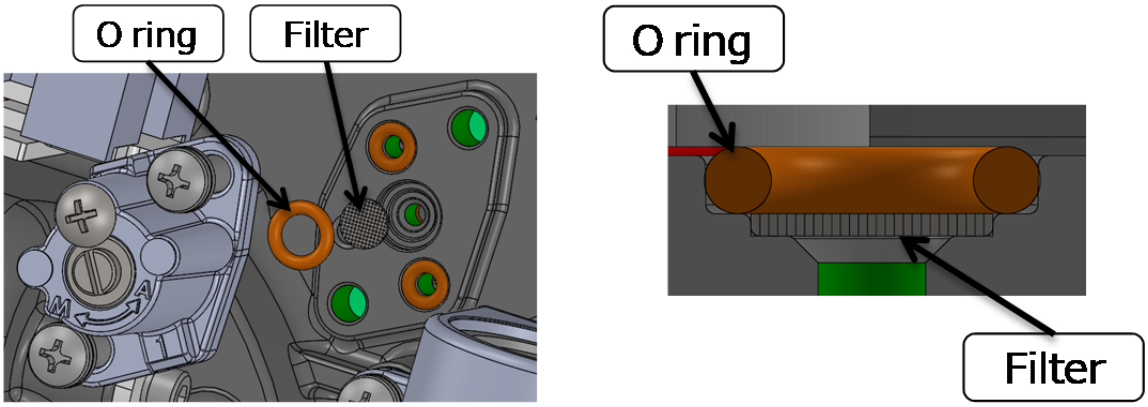


Figure 5.4.2 Wire mesh filter part

5.4.3. Nozzle flapper cleaning

Remove accumulated dust and so on around the nozzle flapper.

If the contaminant such as dust, etc. is accumulated around the nozzle flapper, the change in the back pressure which is generated in the torque motor becomes decrease so that this may cause an adverse effect on the operation of the positioner such as the pressure reduction of the output pressure from the pilot relay and so on.

Cleaning procedure)

1. Disconnect the device supply pressure.
2. Remove the front cover.
3. Insert a paper (thickness of business card) the gap between the nozzle and the flapper. Put it in and out with several repetitions.
4. After cleaning, confirm IP signal as following the procedure of section 5.1.2. If necessary, adjust the torque motor and set the IP signal current bias.
5. Replace the front cover. Then, cleaning will be completed.

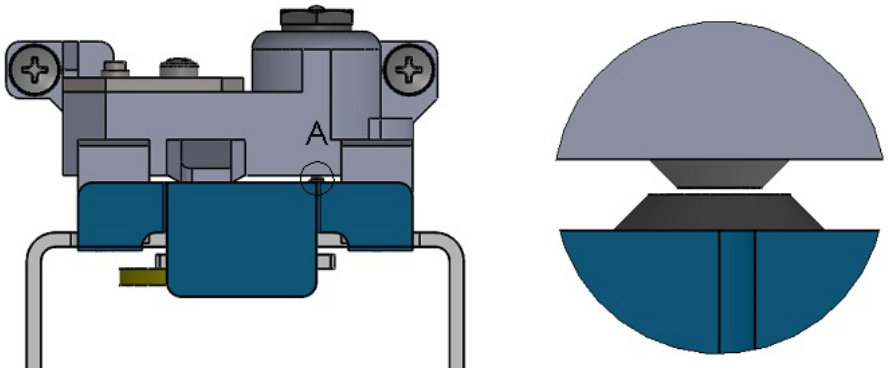


Figure 5.4.3 Cleaning site of nozzle flapper

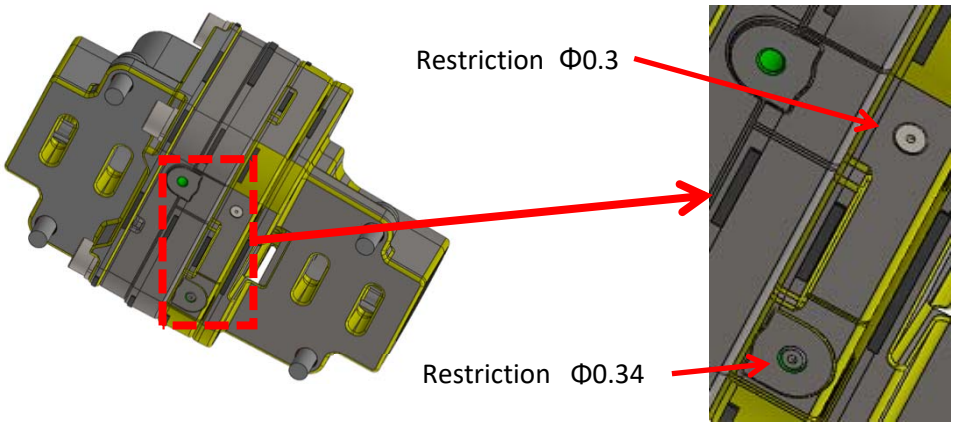
5.4.4. Pilot relay restriction cleaning

Remove accumulated dust and so on around the restrictions.

The pilot relay has two different restrictions.
If, after torque motor adjustment has been done, the IP signal current bias setup is still not effective, then it is recommended to clean the restrictions.
The diameter of the restrictions is 0.3mm or 0.34mm, so a piano wire smaller than that is suitable.

Cleaning procedure)

1. Disconnect the device supply pressure.
2. Remove the front cover and the pilot relay.
3. Insert the wire into the restrictions and remove accumulated dust and so on.
4. Restore the pilot relay and the front cover. Then, cleaning will be completed.



5.5. Service menu

5.5.1. Identification of inner parameters

While entering the following menu as below, the operator can identify A/D converted values, value of potentiometer angle, set value of cross point, time stamp of software, current values of PID parameters.

MENU > Maintenance > Service (3-4-)

5.5.2. Switching of factory setup

Caution

Since the suitable parameters are configured at the factory, in general, do not perform switching of factory setup and the reconfiguration on its menu. The reconfiguration of the values causes the case that the desired response may not be achieved.

MENU > Maintenance > Service > Factory menu (3-4-6)

5.5.3. Cross point adjustment

Note

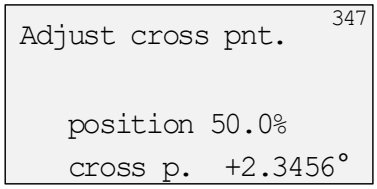
If the desired precision may not be achieved even if the calibration of cross point described in section 5.2.3 was performed, perform the adjustment of this section.

MENU > Maintenance > Service > Adjust cross pnt. (3-4-7)

The procedure is shown as below.

① Provide the input signal (generally, 12mA) correspondent to the 50% position of the valve travel to the positioner.

② Adjust cross p.(cross point) so that the actual position becomes 50% while pressing the up or down arrow key.



③ Once press the right key, then, the set value will be stored and the calibration will be completed.

5.5.4. Factory Setup

Caution

This setup is a menu for adjustments and settings made by the manufacturer.

※Normally, do not change the settings.

5.5.4.1. Summary of Factory Setup

Summary of Factory Setup is indicated in Table 5.5.4.1

Table 5.5.4.1 Factory Setup ※

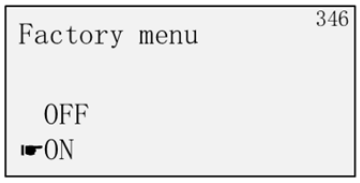
Items	Summary of Factory Setup
IP signal range	This setting limits the output range of the IP signal. (※Normally, do not change the settings.)
	Set value; Air-In [%]：Set the output range of the IP signal when the output pressure is increased. Air-Out [%]：Set the output range of the IP signal when the output pressure is decreased.
IP signal factor	This is the setting of the output coefficient of the IP signal. (※Normally, do not change the settings.)
	Set value; IP signal factor [-]：Set the output coefficient (magnification) of the IP signal.
Virtual DIP SW	It is a manufacturer-set switch in the positioner. (※Normally, do not change the settings.)
	Set value; SW1：Setting1~8 SW2：Setting9~16
Cutoff IP signal	This is the setting of the IP signal to be output at the time of cutoff. (※Normally, do not change the settings.)
	Set value; 0% side [%]：Set the IP signal with 0% side cutoff. 100% side [%]：Set the IP signal with 100% side cutoff.
IP correction	This is the setting of the reference value to detect and fix its displacement of the IP signal. (※Normally, do not change the settings.)
	Set value; Disable/ Enable: Set the IP correction function. In case Enable is selected IP deviation: Set a threshold of the IP deviation as the determination condition. Time: Set a continuous detection time over a threshold of the IP deviation as the determination condition.

※"Factory setup" menu items may differ from the descriptions on this page for the actual product.

5.5.4.2. Display of Factory Setup

To display the Factory Setup menu, make the following settings.

Factory Menu；
MENU > Maintenance > Service > Factory Menu > (3-4-6)



①Select ON and press the button.

②The Factory Setup menu appears in MENU> Maintenance.

6. ALARMS

This device has a self-diagnosis function that generates an alarm.
Alarm conditions related to valve opening, deviation, temperature, and pressure can be set arbitrarily. Additionally, a status classification defined by NAMUR107 can be assigned to each alarm, and a symbol mark can be displayed on the LCD.
In addition, when a severe failure of memory or sensors is detected, the IP signal is forcibly cut off and the system operates in a fail-safe manner. Additionally, the position transmitter outputs a burnout signal.

Note
The cause of alarm is taken as well as an alarm has to be released to return when an IP signal current signal blocked off compulsorily by failure.

Status symbols defined in NAMUR107 are shown in Table6.

Table 6. NAMUR status

Symbol mark	Category	Description / Action to take	Action by software
	Maintenance required	The problem caused by degradation and wear-out of the device out has occurred. Action) Adjust device or replace parts	Alarm only
	Check function	The problem caused by setting and adjustment of the device out has occurred. Action) Check setting and adjust device	Alarm only
	Out of specification	The problem caused by environment in which the device is used has occurred. Action) Remove environmental condition	Alarm only
	Failure	The problem caused by internal defects of the device has occurred. Action) Replacement of device or parts	IP signal is forcibly interrupted (to the fail-safe direction), and Position transmitter outputs burn-out.

6.1. Summary of alarms

Alarms unable to change setting;
Alarms caused by a breakdown inside the positioner are shown in Table 6.1a.

Table 6.1a. Alarms caused by a breakdown (unable to change setting)

Contents	Cause	Action to take
Memory failure	Failure of EEPROM	Replace the device or inquire to our office
Potentiometer failure	Failure of angle sensor	

After detecting these failures, the symbol marks of failure based on NAMUR107 are indicated on LCD. (Refer to right symbol mark)



Alarm of input signal level is shown in Table 6.1b.

Table 6.1b. Alarms caused by a breakdown (unable to change setting)

Contents	Description	Purpose to use
Input signal alarm "4-20 signal"	When the input signal of 4-20mA drops below 3.6mA, an alarm is occurred.	To detect a drop of the input signal level.
	Set-value; None (※Unable to change threshold) Status category; Out of specification (※Unable to change) 	

Alarms able to change setting (User selectable);
The description, the purpose to use, the setting about user selectable alarms are shown in Table.6.1c.
It's possible to set a threshold of alarm according to the user's conditions for use, and also to assign a symbol mark based on NAMUR107 and to indicate on LCD.

Table 6.1c. Alarms (able to change setting)

Contents	Description	Purpose to use
Position alarm	When the valve position exceeded an upper and lower threshold, an alarm is occurred.	To detect drifts of zero and span caused by wear-out and defect of control valves
	Set-value; 0% side threshold[%], 100% side threshold [%] Status category; Check function(default) 	
Deviation alarm	When the deviation of input signal and valve position exceeded a threshold, an alarm is occurred.	To detect sticking of control valve or actuator and air leakage of piping
	Set-value; Deviation threshold[%]※, Judgment time of deviation occur[s] Status category; Check function(default) ※Set a deviation threshold over the cutoff value. 	

Contents	Description	Purpose to use
Temperature alarm	When the temperature exceeded an upper and lower threshold, an alarm is occurred.	To detect use by the temperature outside the specification which leads to early degradation of parts
	Set-value; Low temp. threshold[°C,°F], High temp. threshold[°C,°F] Status category; Out of specification(default) 	
High sup-pressure	When the supply pressure exceeded an upper threshold, an alarm is occurred.	To detect use by high supply pressure which leads to break of actuator diaphragm
	Set-value; High pressure threshold[kPa,bar,psi] Status category; Out of specification(default) 	
Low sup-pressure	When the supply pressure exceeded a lower threshold, an alarm is occurred.	To detect use by low supply pressure that leads to lack of actuator output.
	Set-value; Low pressure threshold[kPa,bar,psi] Default status category; Out of specification. 	
Pressure failure	When the A/D value of pressure sensors exceeded a threshold, an alarm is occurred.	To detect abnormality of pressure sensors.
	Set-value; Disable / Enable (※Unable to change threshold) Status category; Failure ※To disable under failure condition, once, remove the input signal. (Cycle the power.) 	

Table6.1d. Items of alarm setting

Contents	Description	Parameter	Default
Position alarm	Set the upper and lower thresholds to give a position alarm. 0%：As the travel position falls below a lower threshold, an alarm is occurred. Able to change the setting in the range of -25 to 50% 100%：As the travel position exceeds an upper threshold, an alarm is occurred. Able to change the setting in the range of 50 to 125%	Value/Unused	0% side Unused, 100% side Unused
Deviation alarm	Set the threshold and the determination time to give a deviation alarm. Deviation：Deviation threshold（※）	Value/Unused (1~100%)	Unused

	Able to change the setting in the range of 1 to 100% Time: Determination time of the deviation occurrence Able to change the setting in the range of 1 to 999 sec ※ Set a deviation threshold over the cutoff value.		
Temperature alarm	Set the upper and lower threshold to give a temperature alarm. Low: As the temperature falls below a lower setting value, an alarm is occurred. Able to change the setting in the range of -45 to 25℃ High: When the temperature exceeds an upper set-value, an alarm is occurred. Able to change the setting in the range of +25 to +85℃	Value/ Unused	Low side Unused, High side Unused
High sup-pressure	Set the threshold to give a high supply pressure alarm. As the supply pressure exceeds an upper threshold, an alarm is occurred.	Unused/Value (0~999kPa)	Unused
Low sup-pressure	Set the threshold to give a low supply pressure alarm. As the supply pressure falls below a lower threshold, an alarm is occurred.	Unused/Value (0~999kPa)	Unused
Pressure failure	Set the pressure failure alarm. ※Unable to change the threshold	Disable/Enable	Disable

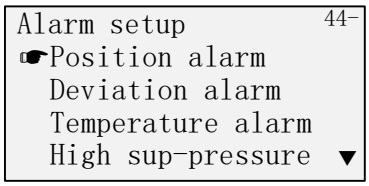
6.2. Alarm setting / Check and Clear of result

It's possible to operate setting, check of a result and clear of result of each alarm from following menu.

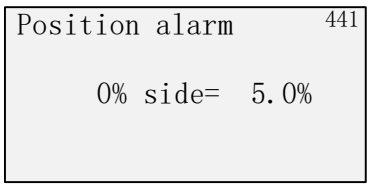
6.2.1. Position alarm

Setting;
MENU > Diag. & Alarms > Alarm setup (4-4-)

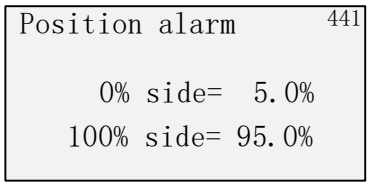
① Move by pressing ⇧ ⇩ button, and select Position alarm by ⇨ button.



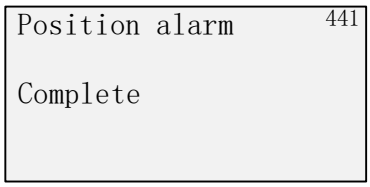
② Change the 0 % side threshold value by pressing ⇩ ⇧ button.



③ Change the 100% side threshold value by pressing ⇩ ⇧ button.

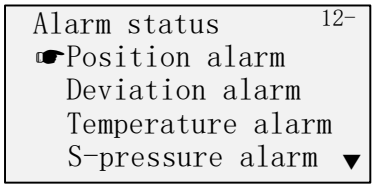


④ After pressing Ent ⇨ button, “Complete” is displayed.

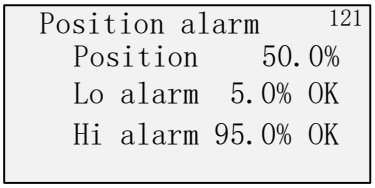


Check of result;
MENU > Information > Alarm status (1-2-)

① Move by pressing ⇧ ⇩ button, and select Position alarm by ⇨ button.



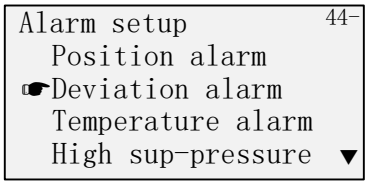
② Checking status of Lo alarm and Hi alarm on the screen.



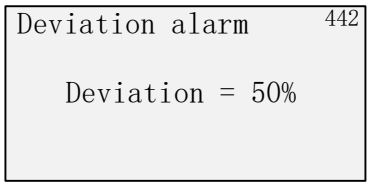
6.2.2. Deviation alarm

Setting;
MENU > Diag. & Alarms > Alarm setup (4-4-)

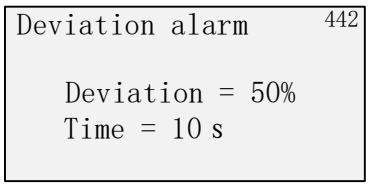
① Move by pressing ⇧ ⇩ button, and select Deviation alarm by ⇨ button.



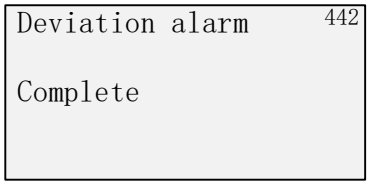
② Change the Deviation threshold value by pressing ⇩ ⇧ button.



③ Change the Time threshold value by pressing ⇩ ⇧ button.

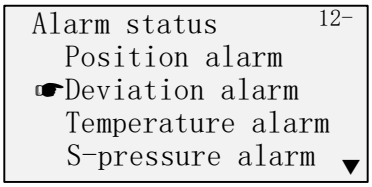


④ After pressing Ent ⇨ button, “Complete” is displayed.

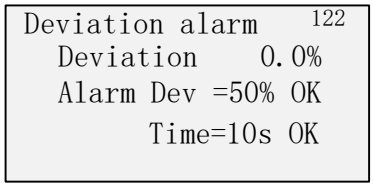


Check of result;
MENU > Information > Alarm status (1-2-)

① Move by pressing ⇧ ⇩ button, and select “Deviation alarm” by ⇨ button.



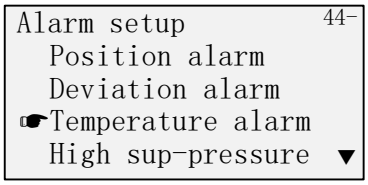
② Checking status of Alarm Dev and Time on the screen.



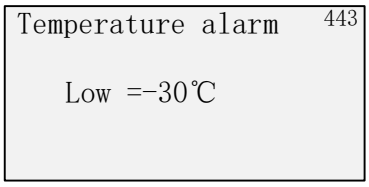
6.2.3. Temperature alarm

Setting;
MENU > Diag. & Alarms > Alarm setup (4-4-)

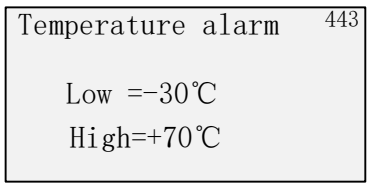
① Move by pressing ⇧ ⇩ button, and select Temperature alarm by ⇨ button.



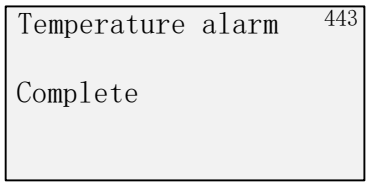
② Change the Low threshold value by pressing ⇩ ⇧ button.



③ Change the High threshold value by pressing ⇩ ⇧ button.

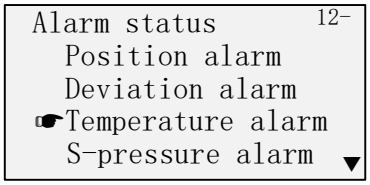


④ After pressing Ent ⇨ button, “Complete” is displayed.

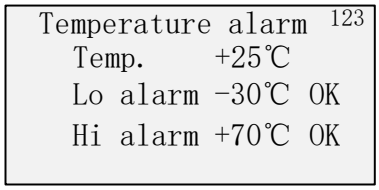


Check of results;
MENU > Information > Alarm status (1-2-)

① Move by pressing ⇧ ⇩ button, and select “Temperature alarm” by ⇨ button.



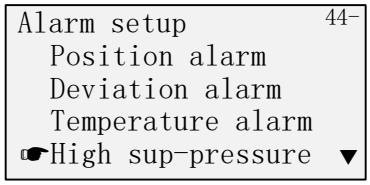
② Checking status of Alarm Lo and Hi on the screen.



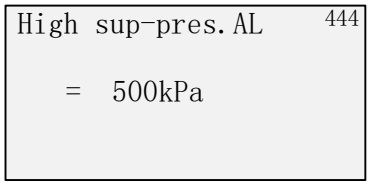
6.2.4. High Sup-pressure alarm

Setting;
MENU > Diag. & Alarms > Alarm setup (4-4-)

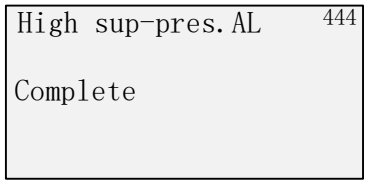
① Move by pressing ⇧ ⇩ button, and select High Sup-pressure alarm by ⇨ button.



② Change the High Sup-pressure threshold value by pressing ⇩ ⇧ button.

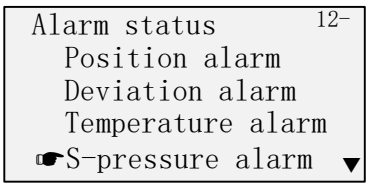


③ After pressing Ent ⇨ button, “Complete” is displayed.

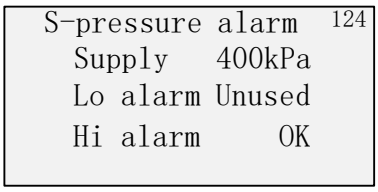


Check of result;
MENU > Information > Alarm status (1-2-)

① Move by pressing ⇧ ⇩ button, and select “S-pressure alarm” by ⇨ button.



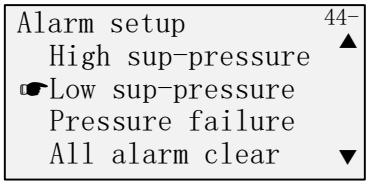
② Checking status of Alarm Lo and Hi on the screen.



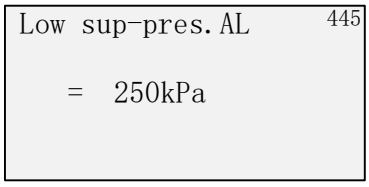
6.2.5. Low Sup-pressure alarm

Setting;
MENU > Diag. & Alarms > Alarm setup (4-4-)

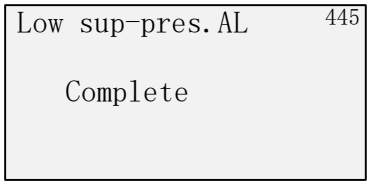
① Move by pressing ⇧ ⇩ button, and select Low Sup-pressure alarm by ⇨ button.



② Change the Low Sup-pressure threshold value by pressing ⇩ ⇧ button

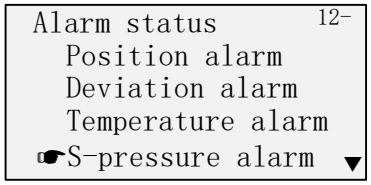


③ After pressing Ent ⇨ button, “Complete” is displayed.

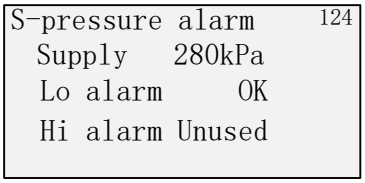


Check of result;
MENU > Information > Alarm status (1-2-)

① Move by pressing ⇧ ⇩ button, and select “S-pressure alarm” by ⇨ button.



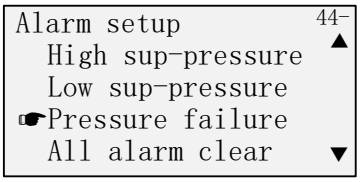
② Checking status of Alarm Lo and Hi on the screen.



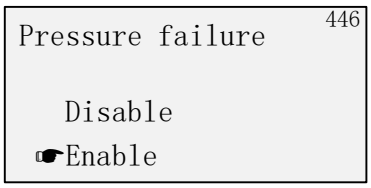
6.2.6. Pressure failure alarm

Setting;
MENU > Diag. & Alarms > Alarm setup (4-4-)

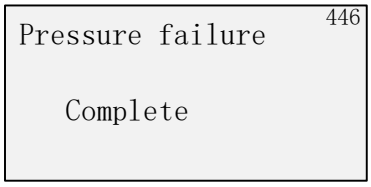
① Move by pressing ⇧ ⇩ button, and select Pressure failure by ⇨ button.



② Move by pressing ⇧ ⇩ button, and select Enable by ⇨ button.

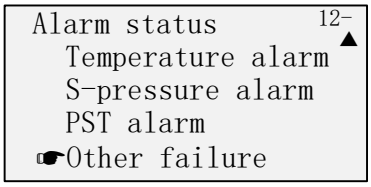


③ After pressing Ent ⇨ button, "Complete" is displayed

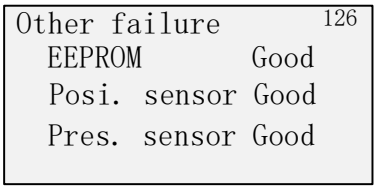


Check of results;
MENU > Information > Alarm status (1-2-)

① Move by pressing ⇧ ⇩ button, and select "Other failure" by ⇨ button.



② Checking status of Alarm Pres. sensor in the screen.

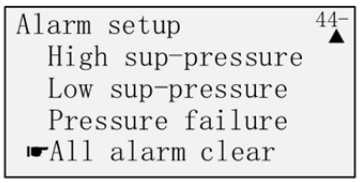


6.2.7. Alarm clear

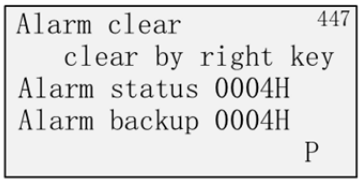
Setting ;

MENU > Diag. & Alarms > Alarm setup (4-4-)

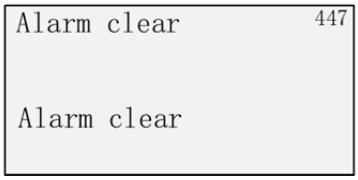
① Move by pressing ⇧ ⇩ button, and select “All alarm clear” by ⇨ button.



② Checking status of Alarm status and backup on the screen.



③ After pressing Ent ⇨ button, “Alarm clear” is displayed.



6.3. Allocation of NAMUR indication

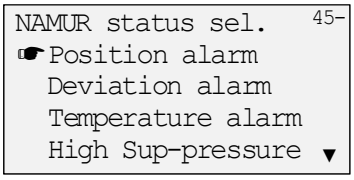
The status category related to each alarm can be selected voluntarily.

Setting;

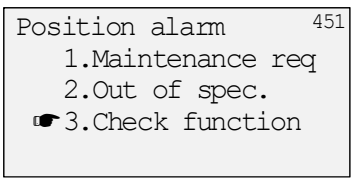
MENU > Diag. & Alarms > NAMUR status sel. (4-5-)

Example of position alarm)

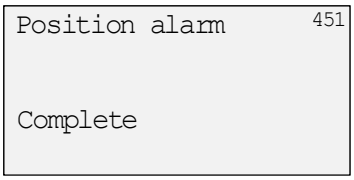
① Select the “Position alarm” and push ⇨ button



② The following screen is indicated, so choose the status assigned by ⇧ ⇩ button and push ⇨ button.



③ If the following is indicated, it's finished.



7. DIAGNOSTICS

This positioner is equipped with the on-line diagnostics which acquires and estimates data during plant operation and the offline diagnostics performed in maintenance. Through appropriate diagnostic settings based on an operating condition of the installation environment and a process, it's possible to do efficient prevention and forecast preservation.

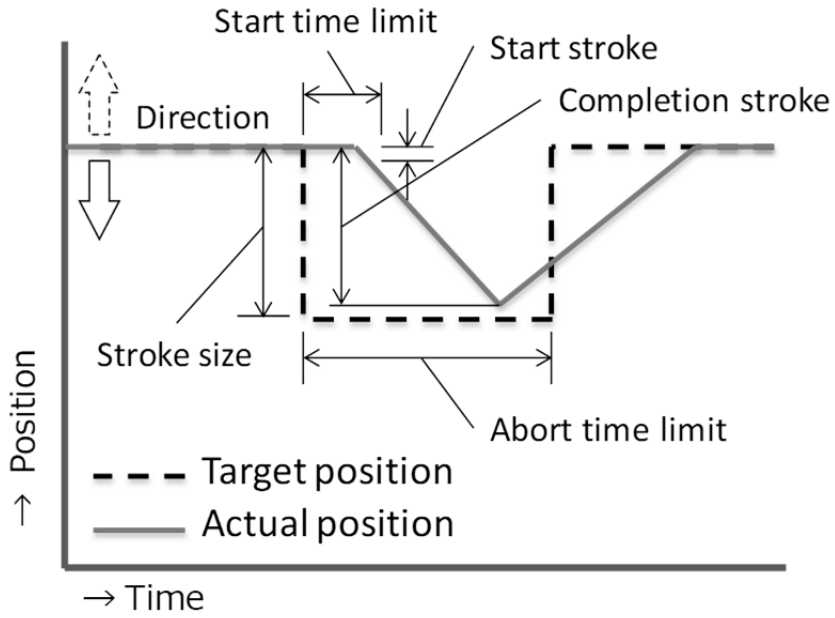
7.1. Online diagnostics

7.1.1. Summary of online diagnostics

Summary and set value of online diagnostics is indicated in Table 7.1.

Table 7.1 Online diagnostics

Items	Summary of online diagnostics
Total stroke	When a valve travel change beyond a threshold has happened, its displacement is accumulated, and it's indicated. It's possible to use it for a prediction of long-term deterioration such as wear of packing and damage of spring.
	Indicated value; The 200% valve position change is counted as 1. Ex) The five times full stroke of 100% equals to the 5 counts. It's indicated until at most about 4,200,000,000 counts (For example, if one round trip is made every 10 seconds, you can count equivalent to 2600 years), and when this is exceeded, it's reset by a zero. Set value; Criteria [%]: A threshold of the position change to accumulate is set.
Total direction change	When a valve travel direction change beyond a threshold has happened, its number of times is accumulated, and it's indicated. It's possible to use it for a prediction of long-term deterioration such as wear of packing and damage of spring.
	Set value; Criteria [%]: A change width to judge direction change is set.
Low position time	Time when the valve travel was in the range of threshold is accumulated, and it's indicated. It's possible to use it for a prediction of damage of the valve body caused by control by the low position.
	Set value; Criteria [%]: A position to judge low position is set.
Maximum temperature time	Time when the temperature was over threshold is accumulated, and it's indicated. It's possible to use it for a prediction of degradation and damage of a part caused by high temperature environment.
	Set value; Criteria [℃/°F]: A temperature to judge high temperature is set.
Minimum temperature time	Time when the temperature was under threshold is accumulated, and it's indicated. It's possible to use it for a prediction of degradation and damage of a part caused by low temperature environment.
	Set value; Criteria [℃/°F] : A temperature to judge low temperature is set.
Partial stroke test	Test to move such emergency shutdown valves partially and periodically, and to confirm its safety functions. It's possible to give a partial valve travel change and to check the defective performance of sticking of a valve periodically.
	Set value; Disable / Enable : Select a periodical execution or not Stroke size [%] : Set a position width to move Completion stroke [%] : Set a stroke to judge movement completion Start stroke [%] : Set a stroke to judge movement start

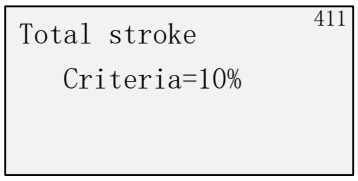
Items	Summary of online diagnostics
	Abort time limit [s] : Set a time to judge movement cancellation before movement completion Start time limit [s] : Set a time to judge movement cancellation before movement start Abort pressure [kPa,bar,psi] : Set a output pressure 1(Pout1) change to judge movement cancellation Interval day [day] : Set an interval of periodical execution Direction : Set a direction to move  Fig. 7.1.1. Conceptual diagram of each parameters

7.1.2. Online diagnostics setting / Confirmation and Clear of results

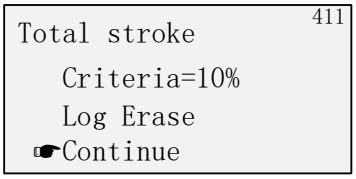
7.1.2.1. Total stroke

Setting;
MENU > Diag & Alarms > Online diag. setup (4-1-)

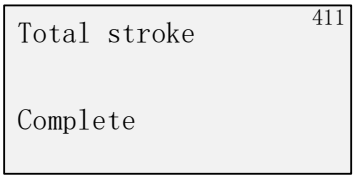
① Input the set value. Set value can be changed using ⇧⇩ buttons.



② Select the “Continue”, and push ⇨ button

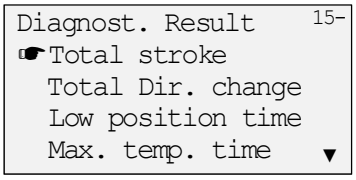


③ If the following is indicated, it’s finished.

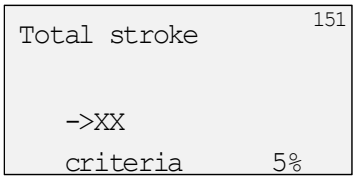


Check of result;
MENU > Information > Diag. result (1-5-)

① Select the “Total stroke”, and push ⇨ button



② The following screen is indicated, and present value (XX) and threshold value are also indicated.

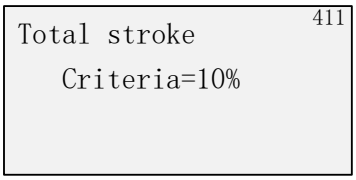


③ Push ⇦ button, then go back to screen shown in ①.

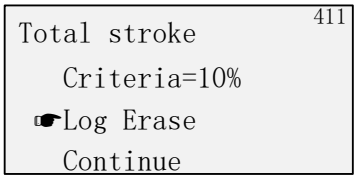
Clear of result;
MENU > Diag & Alarms > Online diag. setup > Total stroke (4-1-1)

Example of total stroke)

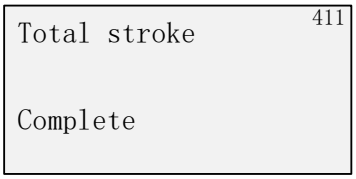
① Push ⇨ button and go to ②.



② Select the “Log Erase”, and push ⇨ button.



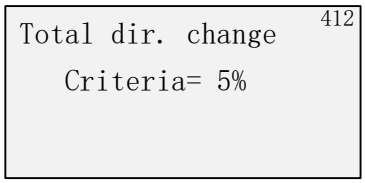
③ If the following is indicated, it’s finished.



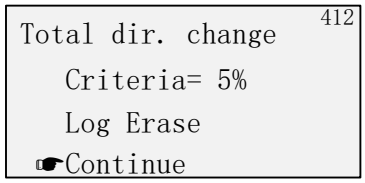
7.1.2.2. Total direction change

Setting;
MENU > Diag & Alarms > Online diag. setup (4-1-)

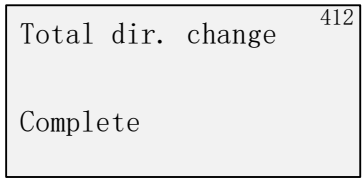
① Input the set value. Set value can be changed using ⇧⇩ buttons.



② Select the "Continue", and push ⇨ button

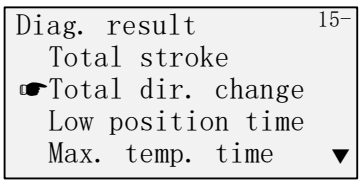


③ If the following is indicated, it's finished.

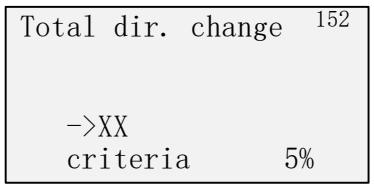


Check of result;
MENU > Information > Diag. result (1-5-)

① Select the "Total dir. change", and push ⇨ button



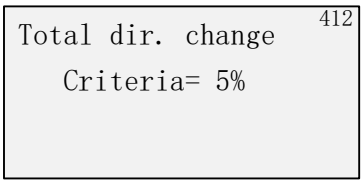
② The following screen is indicated, and present value (XX) and threshold value are also indicated.



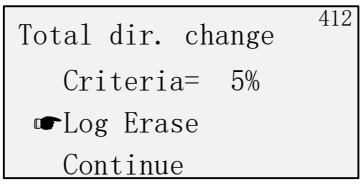
③ Push ⇦ button, then go back to screen shown in ①.

Clear of result;
MENU > Diag & Alarms > Online diag. setup > Total dir. change (4-1-2)

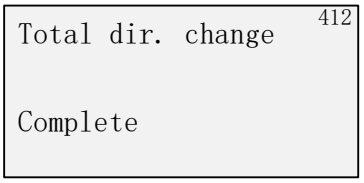
① Push ⇨ button and go to ②.



② Select the “Log Erase”, and push ⇨ button.



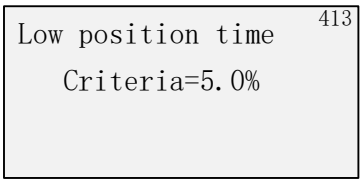
③ If the following is indicated, it’s finished.



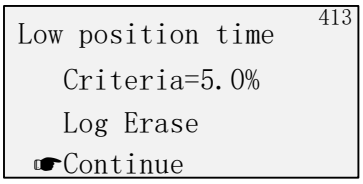
7.1.2.3. Low position time

Setting;
MENU > Diag & Alarms > Online diag. setup (4-1-)

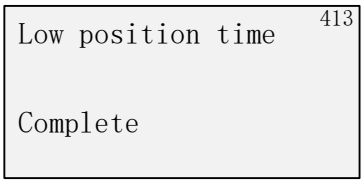
① Input the set value. Set value can be changed using ⇧⇩ buttons.



② Select the “Continue”, and push ⇨ button

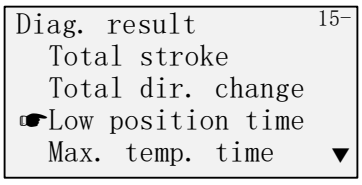


③ If the following is indicated, it’s finished.

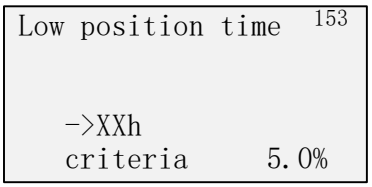


Check of result;
MENU > Information > Diag. result (1-5-)

① Select the “Low position time”, and push ⇨ button



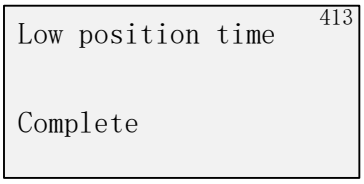
② The following screen is indicated, and present value (XX) and threshold value are also indicated.



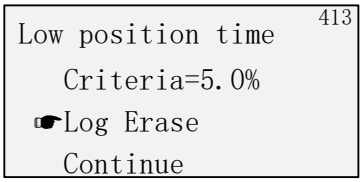
③ Push ⇦ button, then go back to screen shown in ①.

Clear of result;
MENU > Diag & Alarms > Online diag. setup > Low position time (4-1-3)

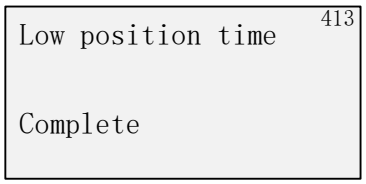
① Push ⇨ button and go to ②.



② Select the “Log Erase”, and push ⇨ button.



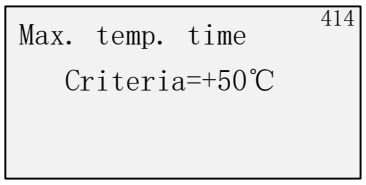
③ If the following is indicated, it’s finished.



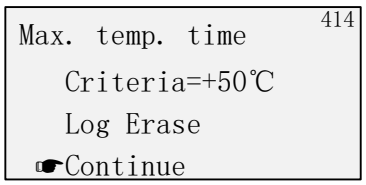
7.1.2.4. Maximum temperature time

Setting;
MENU > Diag & Alarms > Online diag. setup (4-1-)

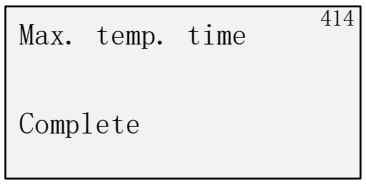
① Input the set value. Set value can be changed using buttons.



② Select the “Continue”, and push button

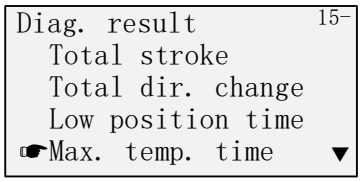


③ If the following is indicated, it’s finished.

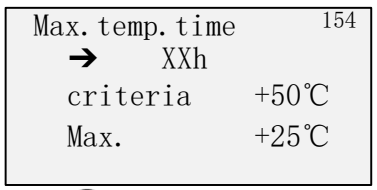


Check of result;
MENU > Information > Diag. result (1-5-)

① Select the “Max temp time”, and push button



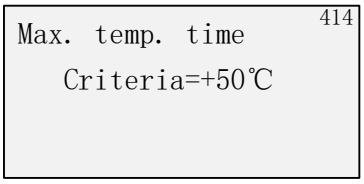
② The following screen is indicated, and present value (XX) and threshold value are also indicated.



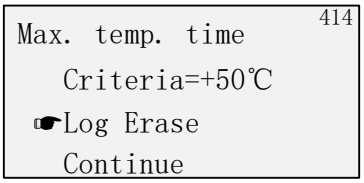
③ Push button, then go back to screen shown in ①.

Clear of result;
MENU > Diag & Alarms > Online diag. setup > Max temp time (4-1-3)

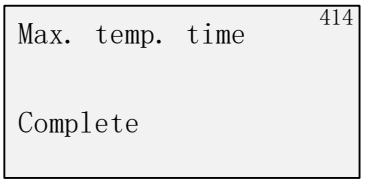
① Push ⇨ button and go to ②.



② Select the “Log Erase”, and push ⇨ button.



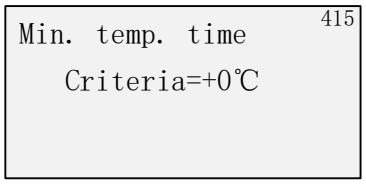
③ If the following is indicated, it’s finished.



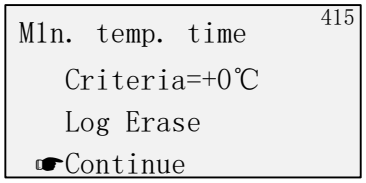
7.1.2.5. Minimum temperature time

Setting;
MENU > Diag & Alarms > Online diag. setup (4-1-)

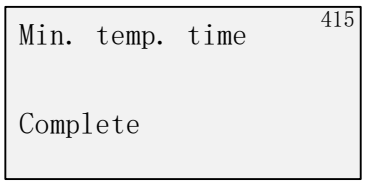
① Input the set value. Set value can be changed using buttons.



② Select the “Continue”, and push button

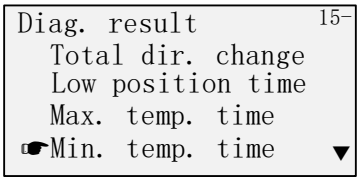


③ If the following is indicated, it’s finished.

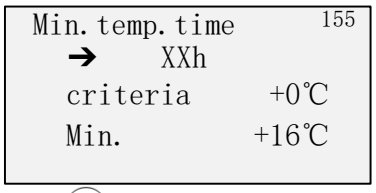


Check of result;
MENU > Information > Diag. result (1-5-)

① Select the “Min temp time”, and push button



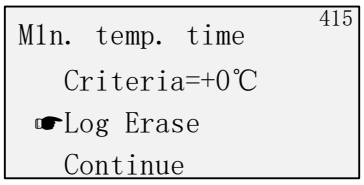
② The following screen is indicated, and present value (XX) and threshold value are also indicated.



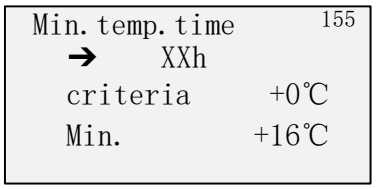
③ Push button, then go back to screen shown in ①.

Clear of result;
MENU > Diag & Alarms > Online diag. setup > Min temp time (4-1-3)

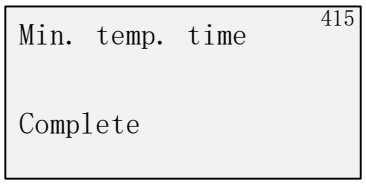
① Push ⇨ button and go to ②.



② Select the “Log Erase”, and push ⇨ button.



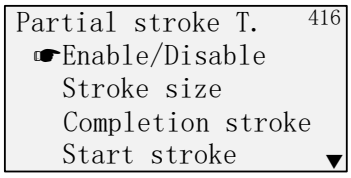
③ If the following is indicated, it’s finished.



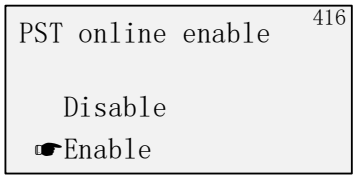
7.1.2.6. Partial stroke test

Setting;
MENU > Diag & Alarms > Online diag. setup (4-1-)

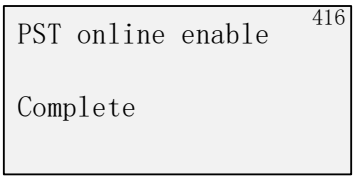
① Select the “Enable/Disable”, and push button.



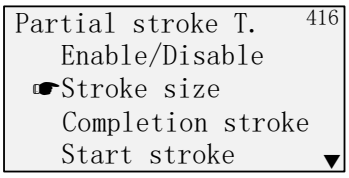
② Select the “Enable”, and push button.



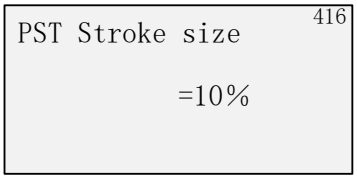
③ The following is displayed



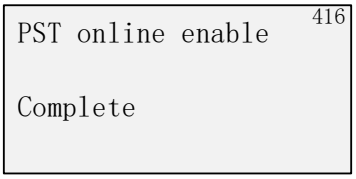
④ Select the “Stroke size”, and push button



⑤ Change the PST Stroke size threshold value by pressing button.



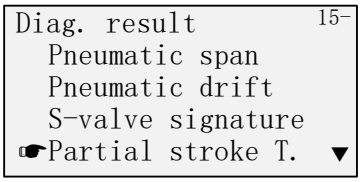
⑥ Press the Ent button. Then, the following is displayed..



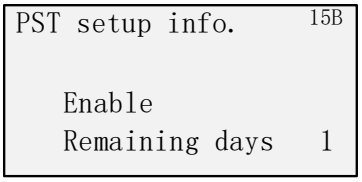
⑦ Set other items in the same way. See Table 7.1 Online Diagnostics / Partial Stroke Test / Settings for settings.

Check of result;
MENU > Information > Diag. result (1-5-)

① Select the "Partial stroke T.", and push button



② The following screen will be displayed, showing Enable and the number of days remaining ..

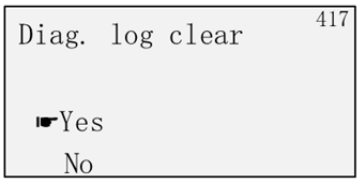


③ Push button, then go back to screen shown in ①.

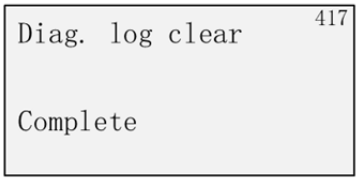
7.1.3. Clear of diagnosis logs

Clear of diagnosis logs;
MENU > Diag & Alarms > Online diag. setup > Diag. log clear (4-1-7)

① Select 'Yes' confirmation and press the right arrow key.



② If the following is indicated, it's finished.

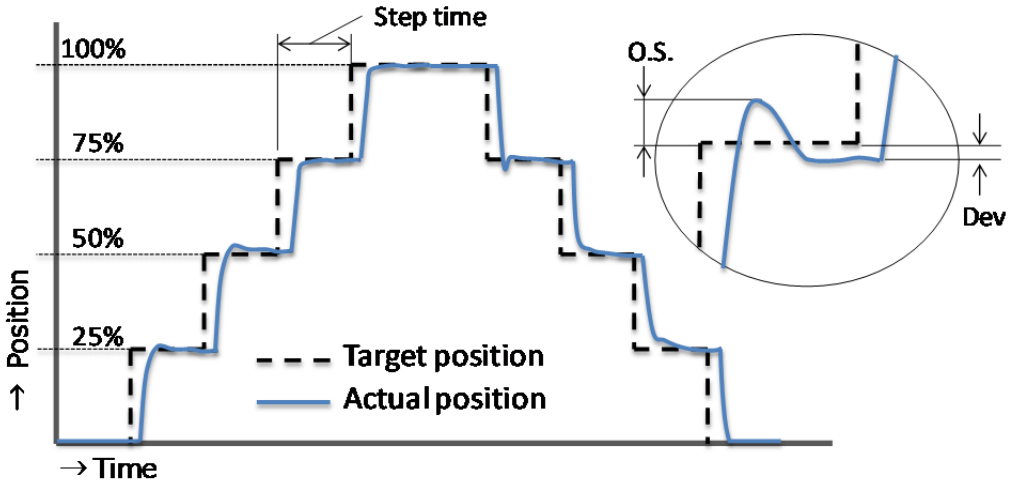
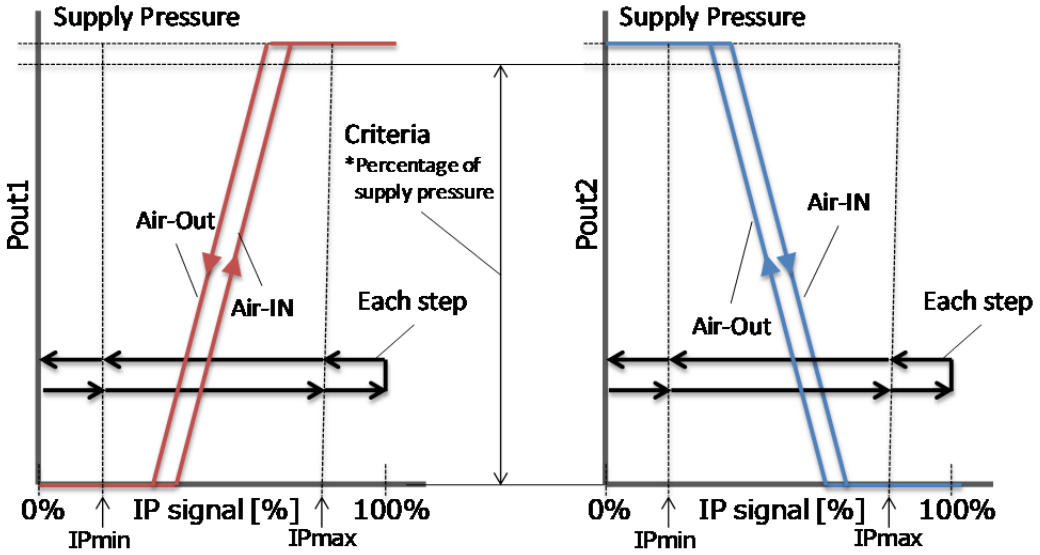


7.2. Offline diagnostics

7.2.1. Summary of offline diagnostics

Summary and set value of online diagnostics is indicated in Table 7.2.

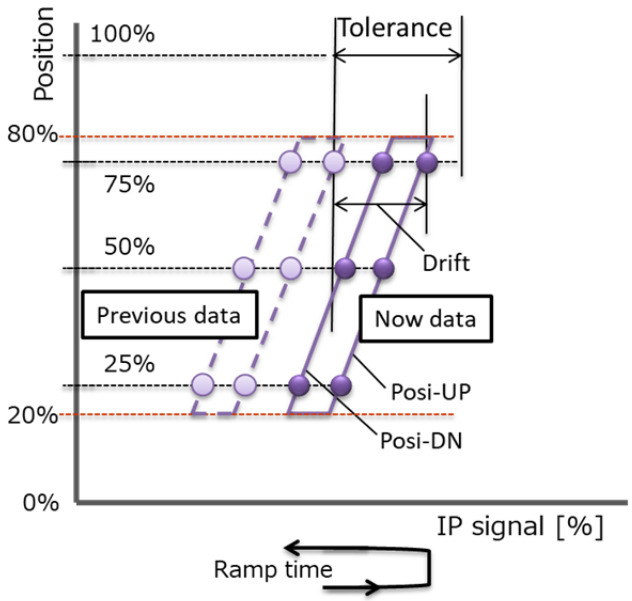
Table 7.2. Offline diagnostics

Items	Summary of offline diagnostics
25% step response	The 25% step response is executed, and the maximum overshoot (O.S.) and the final deviation (Dev.) are recorded. The degradation over time in step response can be checked by comparing initial values, previous values and present values.  Set value; Step time [s]: Set a waiting time per 1 step. Initial value: 60s
Pneumatic circuit span	Output pressure in the minimum value (IPmin) and the maximum value (IPmax) of the IP signal current used for control is measured, and it's checked whether the enough air pressure span is obtained or not. The degradation over time in a pneumatic circuit can be checked by comparing initial values, previous values and present values.  Set value; Step time [s]: Set a waiting time per 1 step. Initial value:20s Criteria [%]: Set a percentage of output width of output pressure to supply pressure Initial value: 95% ※Please set sufficient time for the position to become stable

Pneumatic circuit drift

IP signal current to control 25%, 50% and 75% position are measured, and it's checked whether the drift is in tolerance or not.

The degradation over time in a pneumatic circuit can be checked by comparing initial values, previous values and present values.



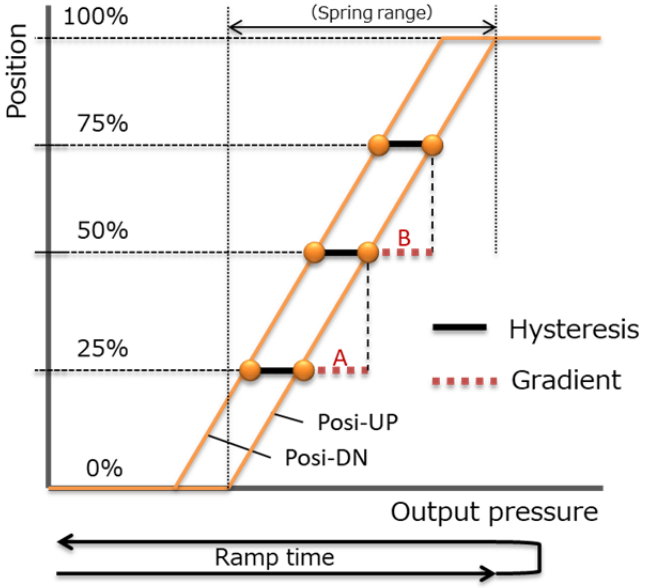
Set value; Ramp time [s]: Set a time to fully stroke by ramp input. Initial value: 30s
Tolerance [%]: Set a tolerance of drifts of IP current. Initial value: 15%

Simple valve signature

Output pressure at 25%, 50% and 75% position are measured, and a hysteresis and pressure gradient of control valve are calculated, and it's checked whether the values are in tolerance or not.

It'll be a simple version of general valve signature.

The degradation of packing and spring in control valve can be checked by comparing initial values, previous values and present values.



Reference) The approximate hysteresis of the actuator can be calculated in% by the following formula.

Single acting type actuator : $\dfrac{\text{Hysteresis}}{(\text{GradientA} + \text{GradientB}) \times 2}$

Double acting type actuator : $\dfrac{\text{Hysteresis}}{\text{Supply air pressure}}$

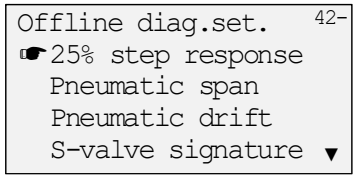
Set value;
Ramp time [s]: Set a time to fully stroke by ramp input. Initial value: 60s
Hysteresis limit [kPa,bar,psi]: Set limit of pressure hysteresis. Initial: 50kPa
Gradient limit H [kPa,bar,psi]: Set upper limit of pressure gradient(pressure difference)
Initial value: 80kPa

7.2.2. 25% step response

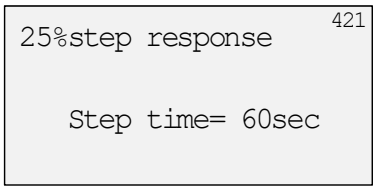
Setting;

MENU > Diag & Alarms > Offline diag. set. > 25% step response (4-2-1)

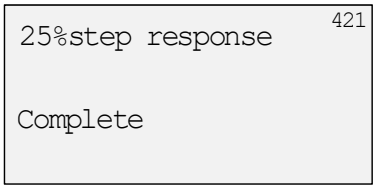
① Select the “25% step response”, and push button.



② Input the set value. Set value can be changed using buttons.



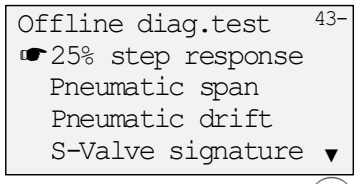
③ If the following is indicated, it’s finished.



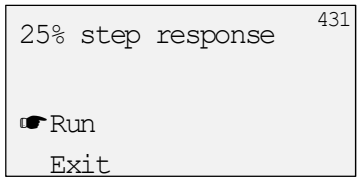
Execution;

MENU > Diag & Alarms > Offline diag. test > 25% step response (4-3-1)

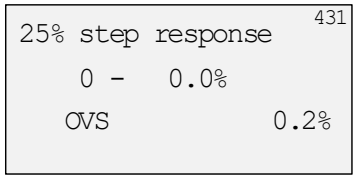
① Select the “25% step response”, and push button.



② Select the “Run, and push button.



③ After the following is indicated, tests will be started.



Indication changes in turn like below.

0%→25%→50%→75%→100%→75%→50%→25%→0%

④ After the test, the latest result is shown to the screen like below.

```
< Now > O.S.   Dev. 461
0         -      0.0%
0-25      1.0%   0.1%
25-50     1.2%   0.3%
50-75     0.8%   0.4%
75-100    0.2%   0.0%
100-75    0.2%   0.2%
75-50     0.5%   0.1%
```

O.S. : Overshoot, Dev. : Deviation

⑤ By pushing ⇩ button, a 50-25 step and a 25-0 step are indicated by scrolling

⑥ By pushing ⇨ button, the previous value (<Prev.>) and the initial value (<Init.>) can be shown.

```
<Init.> O.S.   Dev. 461
0         -      0.0%
0-25      1.0%   0.1%
25-50     1.2%   0.3%
50-75     0.8%   0.4%
75-100    0.2%   0.0%
100-75    0.2%   0.2%
75-50     0.5%   0.1%
```

7.2.3. Pneumatic circuit span

Setting;
MENU > Diag & Alarms > Offline diag. set. > Pneumatic span (4-2-2)

① Select the “Pneumatic span”, and push ⇨ button.

```
Offline diag.set.      42-
  25% step response
☛Pneumatic span
  Pneumatic drift
  S-valve signature    ▼
```

② Input the set value (Step time), and push ⇨ button. Set value can be changed using ⇧⇩ buttons.

```
Pneumatic span          422
   Step time= 20sec
```

③ Input the set value (Criteria), and push ⇨ button. Set value can be changed using ⇧⇩ buttons.

```
Pneumatic span          422
   Step time= 20sec
   Criteria = 95.0%
```

④ If the following is indicated, it's finished.

```
                                422
Pneumatic span

Complete
```

Execution;
MENU > Diag & Alarms > Offline diag. test > Pneumatic span (4-3-2)

① Select the "Pneumatic span", and push ⇨ button.

```
Offline diag.test              43-
  25% step response
☛Pneumatic span
  Pneumatic drift
  S-valve signature             ▼
```

② Select the "Run", and push ⇨ button.

```
Pneu. Span(kPa)                432


☛Run
  Exit
```

③ After the following is indicated, tests will be started.

```
Pneu. Span(kPa)                432
IP = 0%      Sup    400
  Po1      0 Po2    398
```

IP value changes in turn like below.

IP=0% → IPmin(AIn) → IPmax(AIn) → IP=100% → IPmax(AOut) → IPmin(AOut) → IP=0%

④ After the test, the latest result is shown to the screen like below.

```
Pneu. Span <Now>               463
Air-In
 IPmin P1 OK     0kPa
       P2 OK   398kPa
 IPmax P1 OK   400kPa
       P2 OK     0kPa
Air-Out
 IPmin P1 OK     0kPa
```

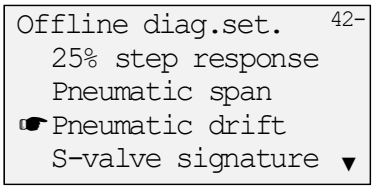
⑤ By pushing ⇩ button, result is indicated by scrolling

⑥ By pushing ⇨ button, the previous value (<Prev.>) and the initial value (<Init.>) can be shown.

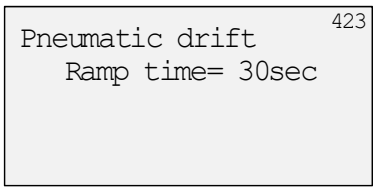
7.2.4. Pneumatic circuit drift

Setting;
MENU > Diag & Alarms > Offline diag. set. > Pneumatic drift (4-2-3)

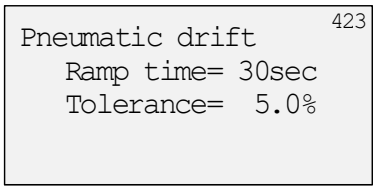
① Select the "Pneumatic drift", and push button.



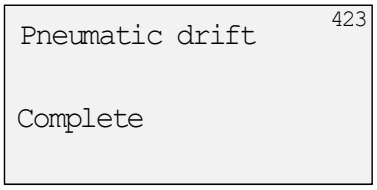
② Input the set value (Ramp time), and push button. Set value can be changed using buttons.



③ Input the set value (Tolerance), and push button. Set value can be changed using buttons.

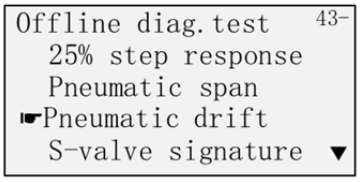


④ If the following is indicated, it's finished.

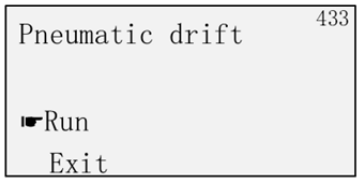


Execution;
MENU > Diag & Alarms > Offline diag. test > Pneumatic drift (4-3-3)

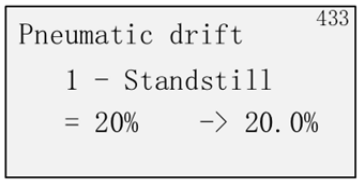
① Select the "Pneumatic drift", and push button.



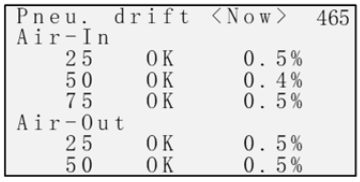
② Select the "Run", and push button.



③ After the following is indicated, tests will be started.



④ After the test, the latest result is shown to the screen like below.



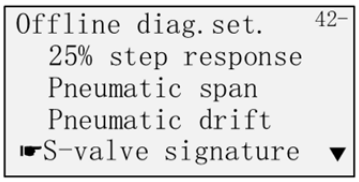
⑤ By pushing button, result is indicated by scrolling

⑥ By pushing button, the previous value (<Prev.>) and the initial value (<Init.>) can be shown.

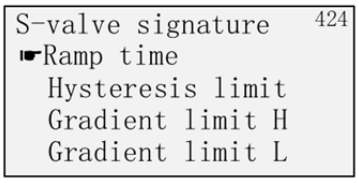
7.2.5. Simple valve signature

Setting;
MENU > Diag & Alarms > Offline diag. set. > S-valve signature (4-2-4)

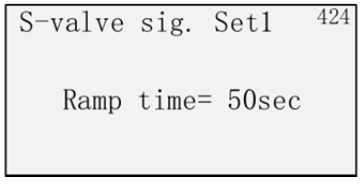
① Select the “S-valve signature”, and push button.



② Select the “Ramp time”, and push button.



③ Input the set value, and push button. Set value can be changed using buttons.



④ If the following is indicated, it’s finished.

```
S-valve sig. Set1   424

Complete
```

⑤ About the “Hysteresis limit”, “Gradient limit H”, “Gradient limit L”, by a procedure of ①,②,③, it’s also set.

Execution;
MENU > Diag & Alarms > Offline diag. test > S-valve signature (4-3-4)

① Select the “S-valve signature”, and push ⇨ button.

```
Offline diag.test   43-
  25% step response
  Pneumatic span
  Pneumatic drift
☛S-valve signature ▼
```

② Select the “Run”, and push ⇨ button.

```
S-valve signature   434


☛Run
  Exit
```

③ After the following is indicated, tests will be started.

```
S-valve signature   434
  1-Standstill   0.0%
   Pout1:        0kPa
   Pout2:        0kPa
```

④ After the test, the latest result is shown to the screen like below.

```
Valve sig.< Now >  467
Pressure-Hysteresis
  25      OK     10kPa
  50      OK     11kPa
  75      OK     10kPa
Pressure-Average
  25           110kPa
  50           140kPa
```

⑤ By pushing ⇩ button, result is indicated by scrolling

```
Valve sig.< Now >  467
Pressure-Average
  25      OK    110kPa
  50      OK    140kPa
  75      OK    170kPa
Pressure-Gradient
  25-50   OK     35kPa
  50-75   OK     35kPa
```

⑥ By pushing ⇨ button, the previous value (<Prev.>) and the initial value (<Init.>) can be shown.

7.2.6. Check and Save of online diagnostics results

In this section, confirmation and save of diagnostics results are explained. It'll be the same operation with each diagnostics. Therefore, for instance, the 25% step response is explained here.

Check of result;
MENU > Diag & Alarms > Diag.test data > Step res. result (4-6-1)

A list of result is indicated.

```
< Now > O.S.   Dev. 461
0          -       0.0%
0-25     1.0%    0.1%
25-50    1.2%    0.3%
50-75    0.8%    0.4%
75-100   0.2%    0.0%
100-75   0.2%    0.2%
75-50    0.5%    0.1%
```

It's possible to indicate a result from following menu.
MENU > Information > Diag. result > (1-5-)

Save of result;
MENU > Diag & Alarms > Diag.test data > Step res. save (4-6-2)

① Select the "25% step save", and push ⇨ button.
The following screen is indicated.

```
25% step save          462
 ☛No save
   Clear now of data
   To save Prev.data
   To save Init.data ▼
```

② If necessary, choose following commands, and push ⇨ button.

No save	:	No save is executed.
Clear now of data	:	Clear a <Now> data.
To save Prev. data	:	Save a <Now> data as <Prev.> data.
To save Init. Data	:	Save a <Now> data as <Init.> data.

8. HART COMMUNICATION

※Model KGP5003 only

8.1. Preparation for HART communication

According to explanation in section 2.6, connect the IN+ and IN- of this device to a communication tool like HART communicator or a terminal of host controller.

8.2. Operation using HART communication

This device can do the work of setting and adjustment by a communication tool of a HART communicator.

8.3. Confirmation of device

By using the following commands, this device can be checked from a HART communication tool.

Find Device;
Setting of whether this device replies or not to the Find Device command sent from a HART communication tool is done.
MENU > Maintenance > HART relation > Find device (3-5-1)

Not armed : dose not reply to the command
Armed : reply to the command

Squawk;
When receiving the Squawk command from a HART communication tool, the ″Squawk ON !!″ or " Squawk ONCE ON " is indicated(blinked) on a LCD screen of this device.

MENU > Maintenance > HART relation > Squawk (3-5-2)

9. TROUBLESHOOTING

When problems occurred at the operation starting or during operation, please refer to the following table and take an action appropriately.

Table 9.1 Trouble shooting

Phenomenon	Assumed cause	Action
Does not move **Move too slow** **Does not move fully**	Loss of electrical power, disconnection or miswiring	✓ Check input current ✓ Check wiring
	Drop of supply pressure or loss	✓ Check supply pressure ✓ Check air regulator
	Leak from air piping	✓ Check piping
	Actuator abnormality / Handle is in manual mode	✓ Set handle to auto mode
	Actuator abnormality / Packing sticking or wear out	✓ Replace packing
	Lack of actuator output	✓ Replace actuator
	Forced shut down by positioner alarm	✓ Check alarm status
	Mistake of setting	✓ Check setting parameters ✓ Check PID parameter ✓ Check mode of A/M-unit
	Adjustment difference	✓ Cleaning of restriction ✓ Cleaning of nozzle flapper ✓ Adjustment of torque motor
	Breakdown of positioner	Inquire to our office
Hunting **Overshoot**	Abnormality of positioner	✓ Cleaning of restriction ✓ Cleaning of nozzle flapper ✓ Check PID parameter
	Mismatch of PID parameter	✓ Retune ✓ Applying Response tuning ✓ Rank change
	Occurrence of limit cycle due to high friction	✓ Applying Dead band ✓ Increase the value of I by custom setting
Bad accuracy	Abnormal attachment	✓ Check there are no backlashes ✓ Check whether a feedback lever becomes horizontal at 50% position ✓ Readjust cross point
	Abnormal control	✓ Check PID parameter ✓ Check dead band setting
	Actuator abnormality / Packing sticking or wear out	✓ Replace packing
LCD does not work	Loss of electrical power, disconnection or miswiring	✓ Check input current ✓ Check wiring
	Temperature is too low	✓ Check indication in the LCD specification temperature range.
	Breakdown of positioner	Inquire to our office
Position transmitter signal does not output or drifts **※ Model KGP5003 only**	Loss of electrical power, disconnection or miswiring	✓ Check input voltage ✓ Check wiring
	Adjustment difference	✓ Implement position transmitter current calibration
Leak from valve seat of CVs	Lack of actuator output	✓ Increase actuator output (Raise actuator size)
	Corrosion, erosion or defect in valve seat	✓ Overhauling of valve

10. PARTS

10.1. Assembly and parts list

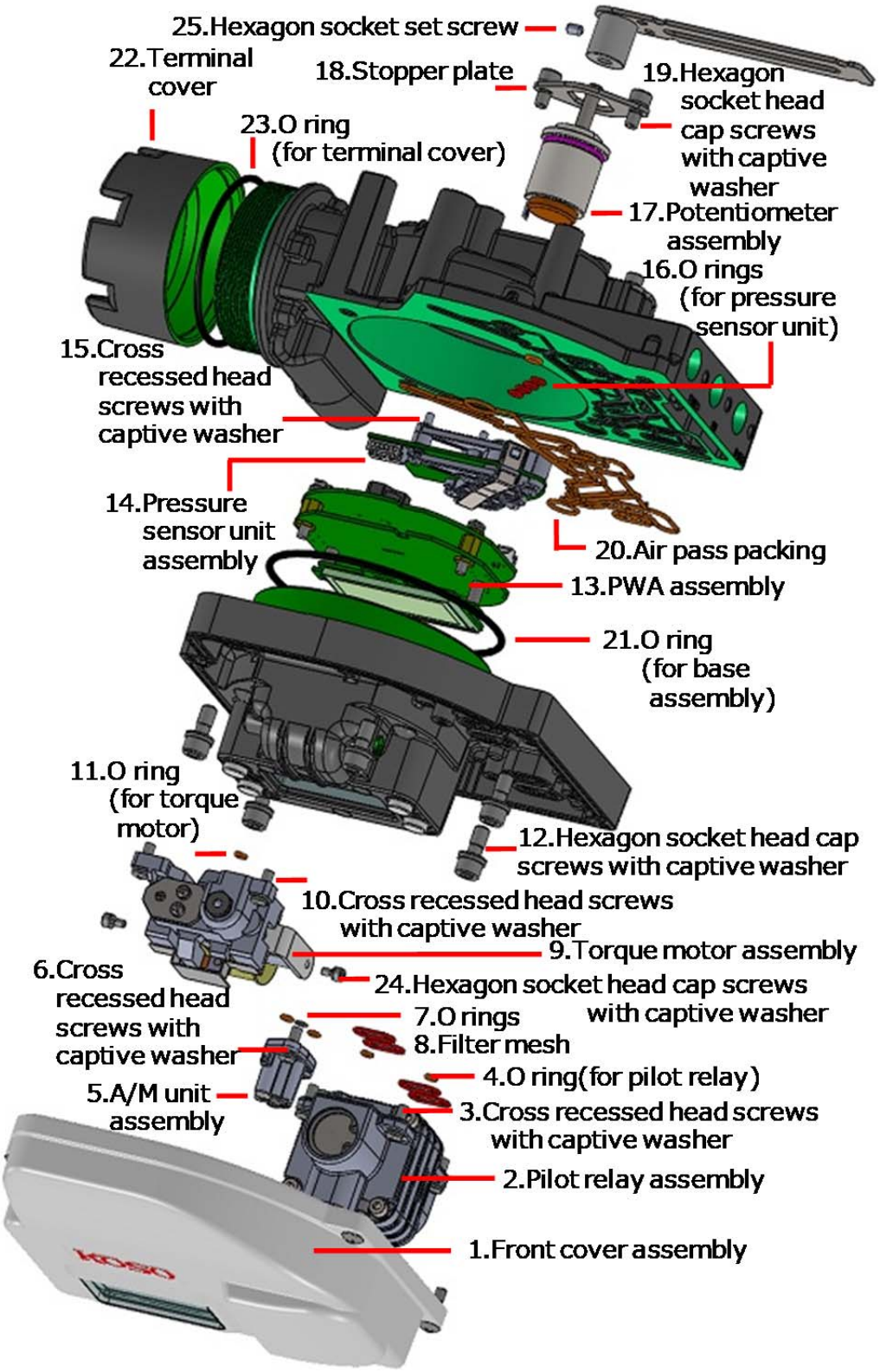


Fig. 10.1. KGP5000 assembly and parts No.

Table 10.1 Parts and units list

Parts No.	Title	Qty.	Notes
1	Front cover assembly	1	
2	Pilot relay assembly	1	
3	Cross recessed head screws with captive washer	4	M4-L12
4	O-rings (for pilot relay)	4,2	S-3, S-12.5
5	A/M unit assembly	1	
6	Cross recessed head screws with captive washer	2	M4-L12
7	O-rings (for A/M unit)	2,1	S-3, S-5
8	Filter mesh	1	
9	Torque motor assembly	1	
10	Cross recessed head screws with captive washer	2	M4-L12
11	O-ring (for torque motor)	1	
12	Hexagon socket head cap screws with captive washer	5	*Special screws for ex-proof M6-L15
13	PWA assembly	1	
14	Pressure sensor unit assembly	1	
15	Cross recessed head screws with captive washer	5	M3-L20
16	O-rings (for pressure sensor unit)	4	S-4
17	Potentiometer assembly	1	
18	Stopper plate	1	
19	Hexagon socket head cap screws with captive washer	2	* Special screws for ex-proof M5-L12
20	Air pass packing	1	
21	O-ring (for base assembly)	1	AS568-154
22	Terminal cover	1	
23	O-ring (for terminal cover)	1	AS568-145
24	Hexagon socket head cap screws with captive washer	2	* Special screws for ex-proof M3-L8
25	Hexagon socket set screw	1	*Special screws for ex-proof M4-L6

*Special technical consideration is required to disassemble or assemble procedure related to special screws for ex-proof, please inquire to the business office of this manual end.

10.2. Check cycle and Replacement cycle

Check points, recommended check cycle and recommended replacement cycle of the life-limited parts/units are shown in table 10.2. Please do periodic maintenance or replacement work according to the environment that it's installed and the operating condition.

Table 10.2.Life-limited parts/unit

Unit / Parts	Check points	Recommended check cycle (year)	Recommended replacement cycle (year)
Filter mesh (for A/M unit)	Clogging by accumulated dust	1	5
Nozzle flapper	Clogging by accumulated dust	1	-
Restriction	Clogging by accumulated dust	1	-
Pilot relay unit	Air leak	1	5
Pressure gauge	Air leak, Corruption	1	-
Feedback pin	Wear-out	1	-
Feedback lever	Wear-out	1	-
Potentiometer assembly Note1	Wear-out	10	10
Torque motor assembly Note1	Wear-out	Whenever abnormal force is applied.	

Note1. The check and the replacement require some specialized knowledge. To ensure safe operation, please consult with a sales representative.

10.3. Disposal of the products or parts

Please dispose of the products or the parts which became unnecessary with a law and regulation in an area.

10.4. Arrangements and question of maintenance parts

Please inquire about arrangements and details of the consumables for maintenance, the life-limited parts and the replacement parts by wear or damage to the business office of this manual end.

11. DIMENSIONS

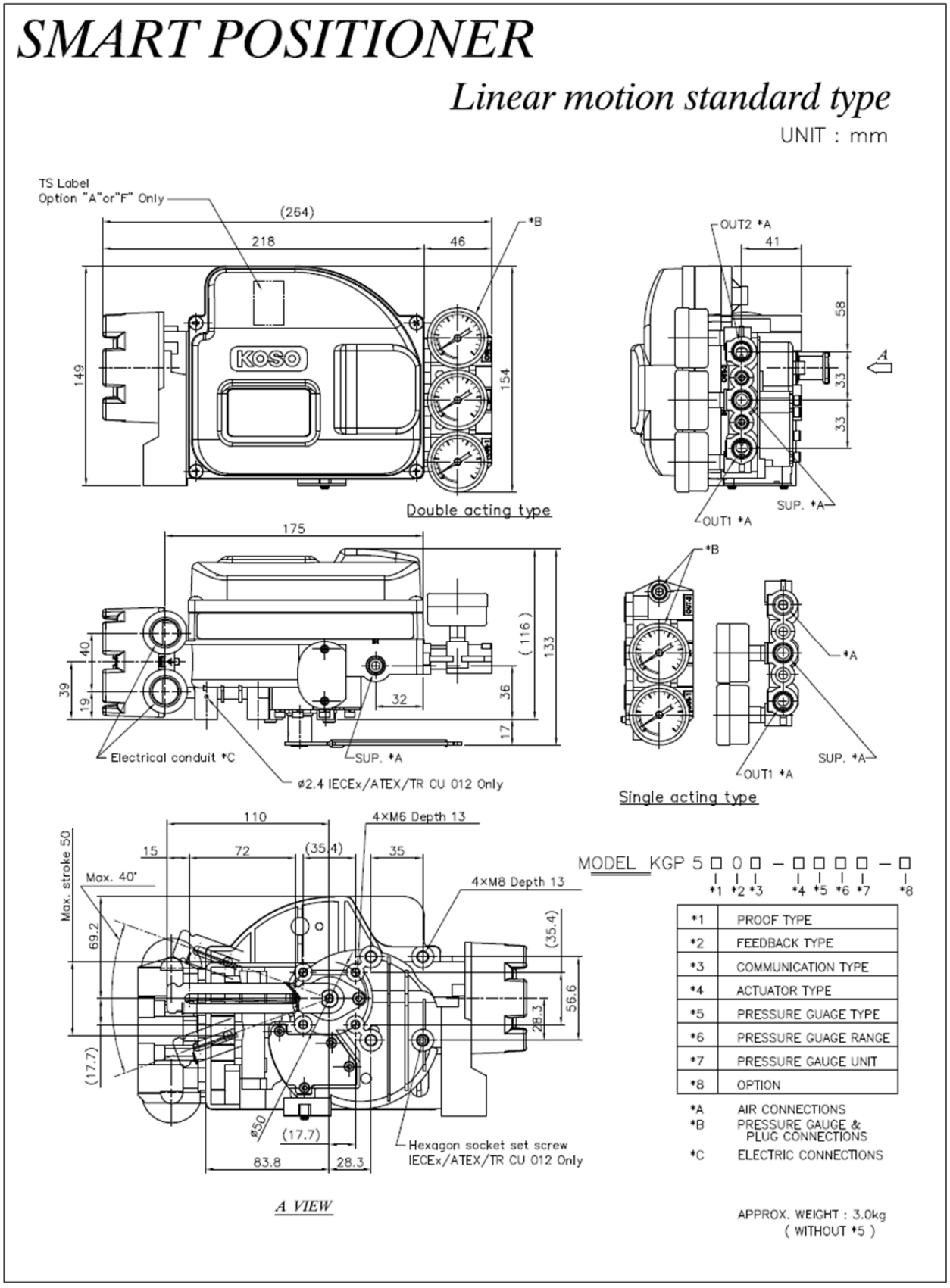


Fig. 11a Linear motion standard type

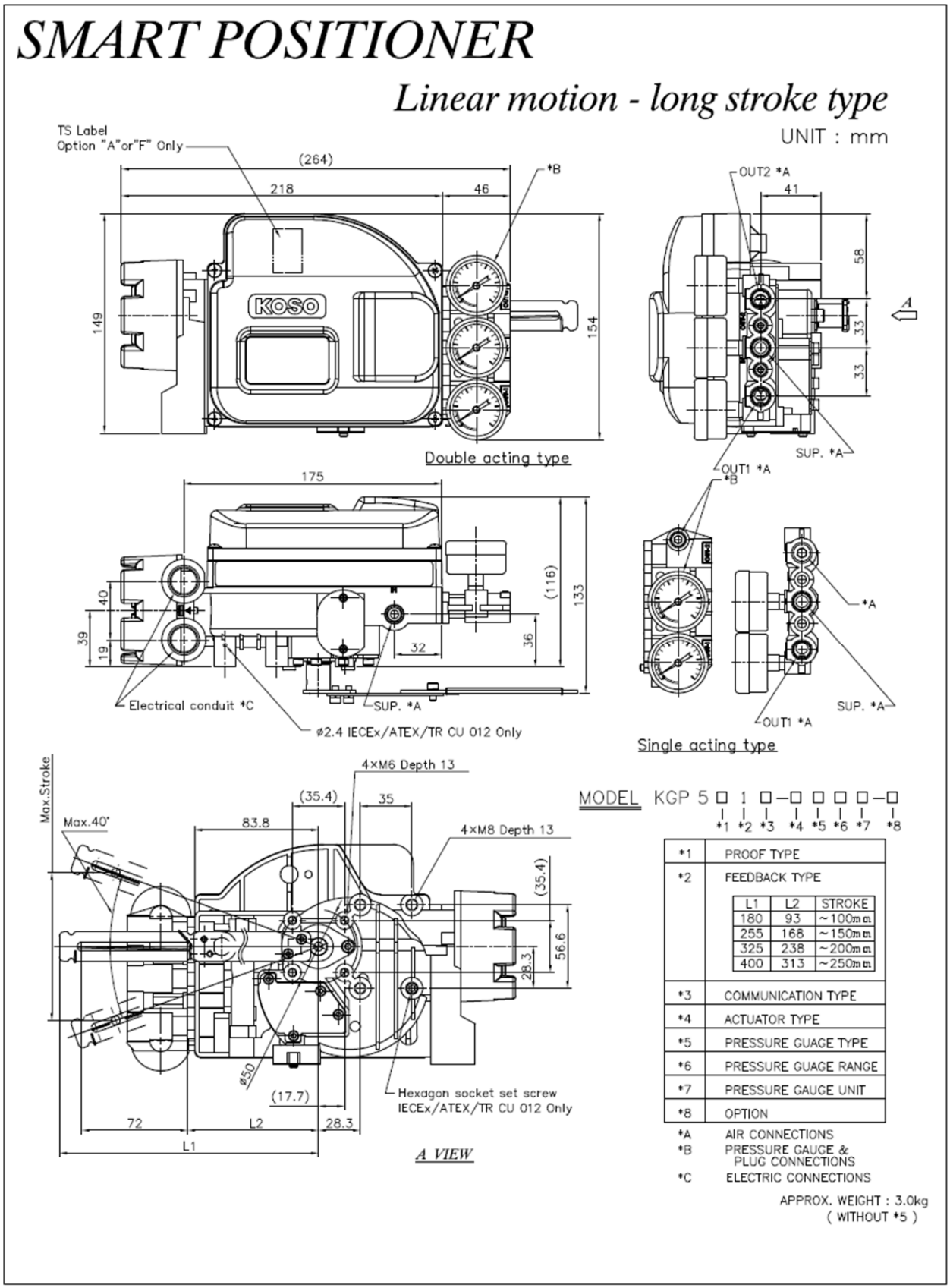


Fig. 11b Linear motion long stroke type

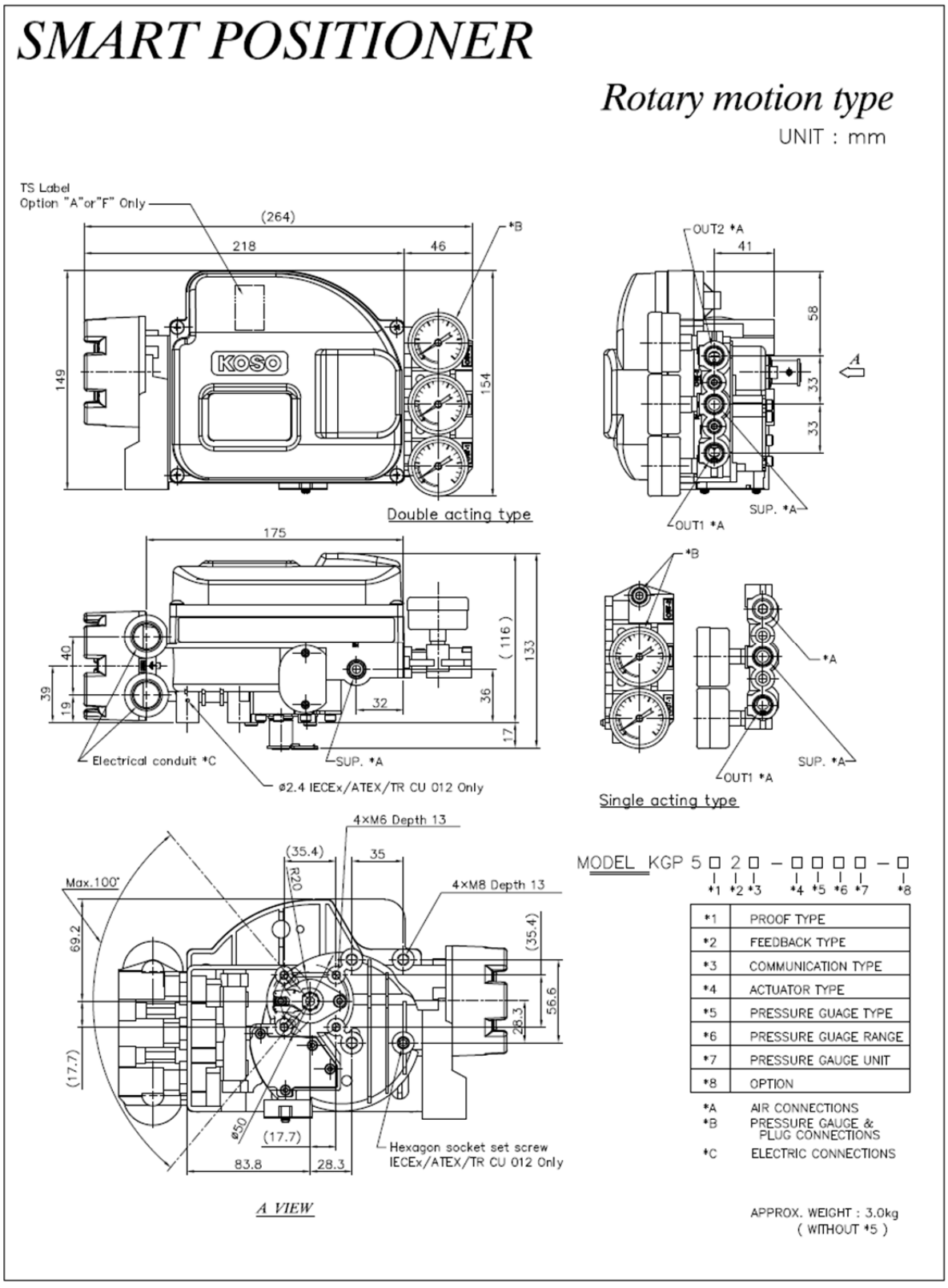


Fig. 11c Rotary motion type

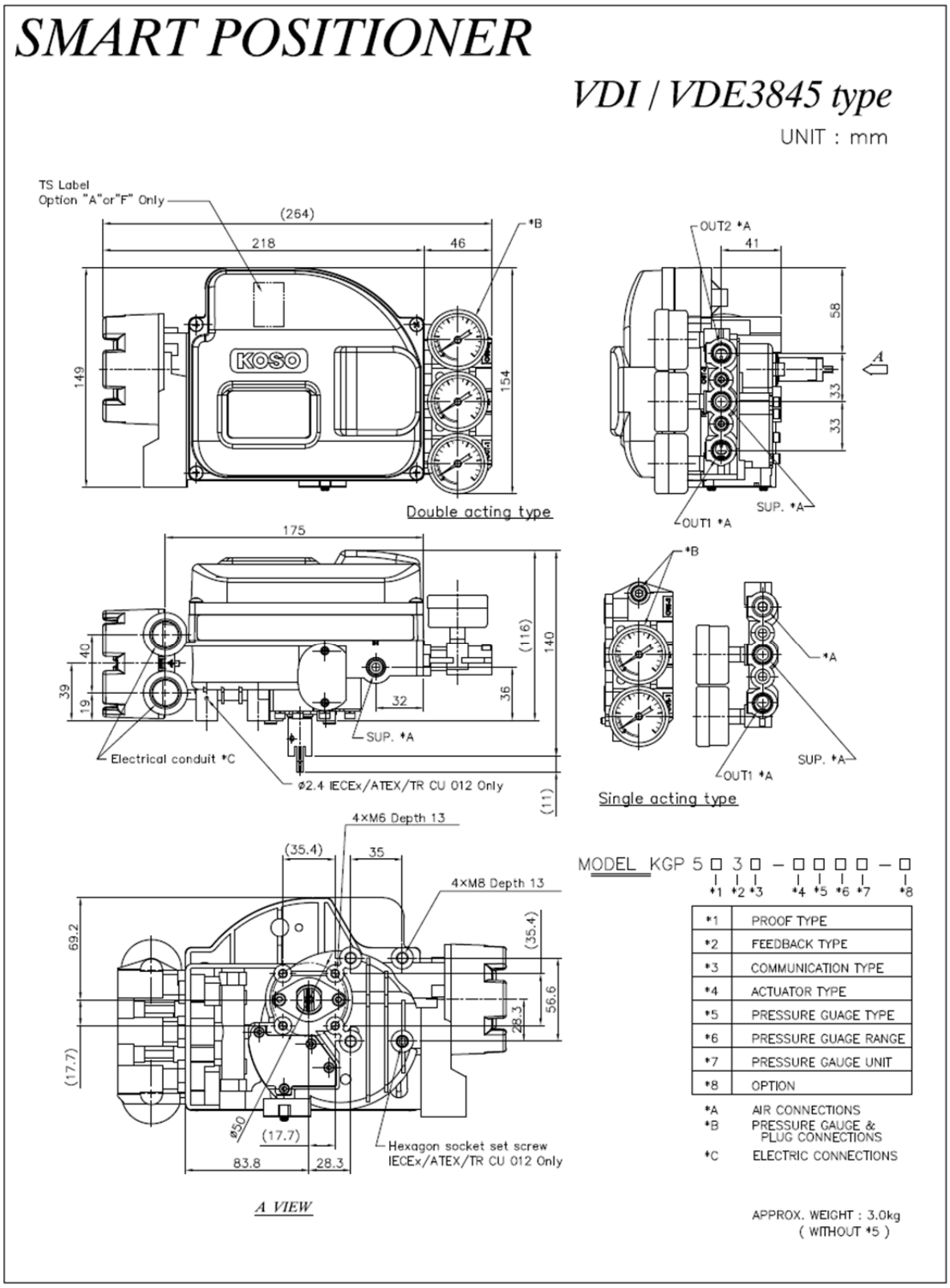


Fig. 11d Rotary motion VDI/VDE3845 type

A) APPENDIX / MODEL Selection and CODE number

Base model		K G P 5	①	②	③	–	④	⑤	⑥	⑦	–	⑧
① Proof type		Standard connections (options)										
Dust・water proof (Non-explosion protection)		Air: Rc1/4 (1/4NPT) *Note1 Electric: G1/2 (1/2NPT, M20)	0									
TIIS *Note2	Flameproof	Air: Rc1/4 Electric: G1/2	1									
CCC (NEPSI)	Flameproof	Air: 1/4NPT Electric: 1/2NPT	2									
KOSHA	Flameproof	Air: 1/4NPT Electric 1/2NPT	3									
IECEx ECAS TS(CNS)*Note4	Flameproof	Air 1/4NPT Electric 1/2NPT (M20)	4									
ATEX	Flameproof	Air 1/4NPT Electric 1/2NPT (M20)	5									
EAC	Flameproof (TR CU 012)	Air 1/4NPT Electric 1/2NPT (M20)	6									
	EMC (TR CU 020)		F									
② Feedback type												
Linear motion standard type (~50mm stroke)				0								
Linear motion- long stroke type (options)				1								
Rotary motion type				2								
Rotary motion- VDI/VDE3845 type				3								
③ Communication type												
4～20mA without HART & Without Position feedback					0							
4～20mA with HART & With Position feedback					3							
④ Actuator type												
Single acting actuator							S					
Double acting actuator							D					

Base model	K G P 5	①	②	③	–	④	⑤	⑥	⑦	–	⑧
⑤ Pressure gauge block type											
Without gauge block							0				
With gauge block							5				
⑥ Pressure gauge range											
200kPa / (0.2MPa) / (30psi/2bar) / (200kPa/ 2kgf／cm2) / (2bar/0.2MPa)								2			
400kPa / (0.4MPa) / (60psi/4bar) / (400kPa/ 4kgf／cm2) / (4bar/0.4MPa)								4			
1000kPa / (1.0MPa) / (150psi/10bar) / (1000kPa/ 10kgf／cm2) / (10bar/1.0MPa)								10			
⑦ Pressure gauge unit											
kPa									K		
MPa									M		
psi *Note3									P		
bar *Note3									R		
kPa & kgf／cm^2									G		
bar & Mpa									B		

⑧ Option		
No option		0
Linear motion- long stroke	～100mm stroke	1
	～150mm stroke	2
	～200mm stroke	3
	～250mm stroke	4
Housing connections	NPT connections (Electric 1/2NPT, Air 1/4NPT)	N
	M20 connections (Electric M20x1.5, Air 1/4NPT)	M
TS Label(No.TD04010D Applicant：Fortune Service Corporation) *Note4		F
Additional cable gland for TIIS		W
Heavy duty coating		L
Certificate of conformance & Inspection certificate		C
Special		X

Note1. When "N" or "M" is selected as an option, both air connection and electric connection will be the specifications specified in each option.
Note2. When two entries are used as shown Figure 2.6e, option “W” shall be selected.
Note3. The scale plate of the pressure gauge has dual scales in psi & bar.
Note4. Option "F" can be selected only when ① Structure is "TS(CNS)".

* When ordering, please check the latest specifications (standard specifications).

B) APPENDIX / Technical Support Checklist

KGP5000 Technical Support Checklist

Please have the following information ready before contacting our sales office.

1. Serial number on the plate of KGP5000 _____
2. Construction number stated in the delivery specifications _____
3. KGP5000 software version _____
4. Please let us know the current parameters below.

Input signal _____ mA

Pressure-sup. _____ kPa

Pressure-OUT1 _____ kPa

Pressure-OUT2 _____ kPa

Set point _____ % Position _____ %

5. If an alarm is issued, please let us know the type. _____
6. Please let us know the operating status of the positioner, actuator, and valve. _____

_____

7. Full auto tune result value（Tuning result）

Rank:XS～XL_____ Stroke sp.(up)_____ms (down)_____ms

Bias Value_____% IP signal_____%

8. Response tuning value（Response tuning）

Normal／Aggressive(+1～+9)／Stable(-1～-9)_____

■ **WORLD-WIDE NETWORK (Sales, Manufacturing, Services)**

Sales, Manufacturing, Services	TEL	FAX
Nihon Koso Co., Ltd., Tokyo Japan	Tel. (81) 3-5202-4300	Fax. (81) 3-5202-4301
Paris Office	Tel. (33) 1-73-75-23-1	Fax. (33) 1-73-75-23-1
Moscow Office	Tel. (7) 495-775-8531	Fax. (7) 495-787-2758
Abu Dhabi Branch	Tel. (971) 2-639-06-55	Fax. (971) 2-639-08-89
Koso M-Mac International Inc., CA, U.S.A.	Tel. (1) 661-942-4499	Fax. (1) 661-942-0999
Koso America Inc. Boston, U.S.A	Tel. (1) 774-517-5300	Fax. (1) 774-517-5230
Rexa Inc. Boston, U.S.A	Tel. (1) 508-584-1199	Fax. (1) 508-584-2525
Pacific Seismic Products.Inc., CA, U.S.A.	Tel. (1) 661-942-4499	Fax (1) 661-942-0999
Koso Kent Introl. Ltd., U.K.	Tel. (44) 0-1484-710311	Fax. (44) 0-1484-407407
Koso Control Engineering (Wuxi) Co., Ltd., China	Tel. (86) 510-85101567	Fax. (86) 510-85122498
Wuxi Koso Fluid Control Co., Ltd., China	Tel. (86) 510-85585118	Fax. (86) 510-85585119
Wuxi Koso Valve Casting Co., Ltd., China	Tel. (86) 510-85581109	Fax. (86) 510-85123093
Hangzhou Hangyang KOSO P & V Co., Ltd.	Tel. (86) 571-85869508	Fax. (86) 571-85343203
Koso-AACI (Anshan) Co., Ltd., China	Tel. (86) 412-8812686	Fax. (86) 412-8814582
Koso Control Instrument (Anshan) Co., Ltd., China	Tel. (86) 412-8829518	Fax. (86) 412-8968860
Korea Koso Co., Ltd., Seoul, Korea	Tel. (82) 2-539-9011	Fax. (82) 2-566-5119
Korea Koso Engineering Co., Ltd., Seoul, Korea	Tel. (82) 2-539-9018	Fax. (82) 2-566-5119
Koso Controls Asia Pte Ltd., Singapore	Tel. (65) 67472722	Fax. (65) 67467677
Koso India Private Limited	Tel. (91) 253-2383111	Fax. (91) 253-2384413
Koso Control Europe s.r.o. Czech	Tel. (420) 513-035-180	Fax. (420) 545-422-529
Koso Parcol S.r.l.	Tel. (39) 0331-413111	Fax. (39) 0331-404215
Koso Gulf	Tel. (968) 2443-7695	