SMART POSITIONER
TMP-3000 (New PCA and software)

PRODUCT MANUAL

rotork®

Rotork YTC Limited

VERSION 2.07

Contents

1 Introduction

1.1 General Information for the users

Thank you very much for purchasing our products. Our products are manufactured, inspected and delivered in uniform quality with strict regulations at the factory. To use this product correctly and efficiently, please read this manual carefully before installing and commissioning the product.

- Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly.
- The manual should be provided to the end-user.
- The contents of this manual are subject to change without prior notice. Product specifications, designs and parts are not immediately reflected in the manual when they are changed, but are reflected in the next revision.
- The meaning of the valve original point (Zero) in this manual is the position of the valve when the air pressure is completely out of positioner OUT1. That is, in the case of the linear direct acting type actuator, the stem of the actuator is raised when the air pressure is completely released from the OUT1 of the positioner. In the case of the linear reverse type actuator, when the air pressure is completely released from the OUT1 of the positioner, the stem of the actuator comes down and this is called original point (Zero).
- This manual cannot be reproduced or reused for any purpose without our approval.
- If any problem arises that is not described in this manual, please contact us immediately.
- This product is an accessory device of control valve. Be sure to read the instruction manual of the corresponding control valve before starting operation.

1.2 Safety precautions and Manufacturer Warranty

- When handling this product, for the protection and safety of the operator, the product and the system in which the product is installed, should follow the safety instructions mentioned in this manual. If you do not follow the safety instructions in this manual correctly, we cannot guarantee the safety of the operator.
- Any changes or repairs to the product are allowed only when described in this manual. If any changes or modifications are made by the customer without a prior consultation with Rotork YTC Limited, we will not compensate for any personal or material damage that may occur. If you need to change or modify the product, please contact us.
- The warranty period of the product is (18) months from the date of shipment unless stated otherwise. Date of shipment can be checked by providing the LOT NO. or SERIAL NO. to us.
- Any misuse, accident, alteration, modification, manipulation, negligence, improper installation, improper maintenance, repair, maintenance or service, or model or serial number change, manipulation, damage, disasters, power surges, or serious damage are not covered by the warranty.
- Please contact us for further information on product warranty.

2 Product Description

2.1 General

The TMP-3000 Smart Positioner not only precisely controls the valve opening according to the electric input signal from the controller or the central control room, but also performs the auto calibration by the computation action of the built-in high performance microprocessor and PD control. It is a highly reliable positioner that performs various powerful functions such as optimum control.

2.2 Main Features and Functions

- In case of Fail Freeze optional product, it maintains the current valve position without any additional equipment such as lockup valve or solenoid valve in case of power supply (24 V) failure.
- Back light function LCD is attached so you can check the status of the positioner directly in the field.
- Four adjustment buttons and unique functions of the buttons are applied in the same way throughout the firmware, so it is very easy to use.
- The initialization time is very short, which minimizes the change of valve stroke in case of temporary power failure and improves system stability.
- Very strong against vibration and can be used in extremely high vibration areas.
- The change in supply pressure during use has almost no effect on the adjustability of the positioner.
- Auto calibration is very simple, so first time users can handle the product easily.
- Compact size makes it easy to attach to small actuators.
- Very low air consumption which allows large plants to reduce their operating costs.
- The valve system can be stabilized by outputting an analog feedback signal.
- Different valve characteristics can be adjusted – Linear, Quick Open, Equal Percentage, and User Set which user can make 5 points or 21 points characterizations.
- You can minimize valve leakage by setting the sealing function of Tight Shut-Off / On.
- Half-interval control (Split Range) is available such as 4 ~ 12 mA and 12 ~ 20 mA etc..
- You can change Zero and Span freely through Hand Calibration function.
- By manual operation, valve can be operated arbitrarily irrespective of input signal, so it is easy to judge whether or not there is an abnormality of valve.
- Ingress protection of IP67.
- The product's enclosure is made of a material with excellent chemical resistance and moisture resistance, so it can be used stably for a long time even in a corrosive atmosphere.
- The internal structure is very simple and modular, so there is little possibility of failure and maintenance is simple.
- It is equipped with a foreign material prevention filter which is easy to maintain.
- Flow rate can be selected according to actuator size.
- Solenoid valve with superior durability of over 200 million cycles.
- Non-contact potentiometer has permanent wear resistance.

2.3 Label types and contents

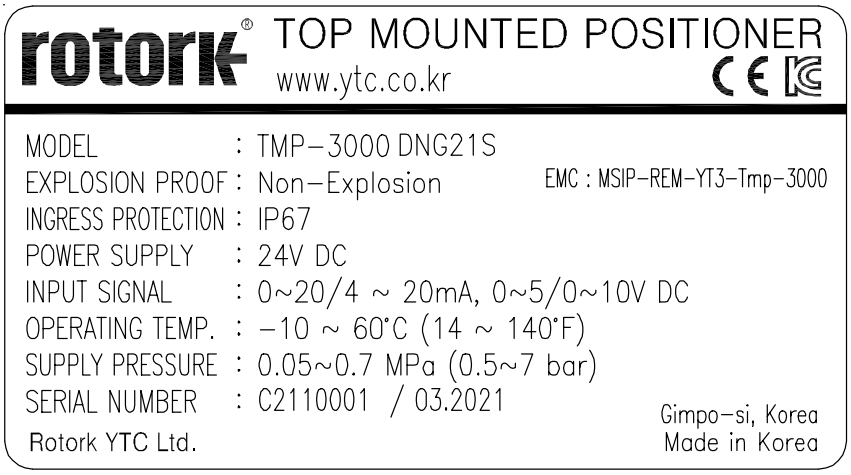


Fig. L-1 : TMP-3000 Label

- MODEL : Indicates the model number and additional symbols.
- EXPLOSION PROOF : Indicates certified explosion proof grade.
- INGRESS PROTECTION : Indicates IP protection level.
- POWER SUPPLY : Indicates the supply power applied to the product. 24 VDC ± 10 %
- INPUT SIGNAL : The range of the input current or voltage signal is indicated.
- OPERATING TEMP. : The ambient temperature range in which the positioner can operate is indicated.
- SUPPLY PRESSURE : Indicates the range of pneumatic pressure supplied to the positioner.
- SERIAL NUMBER : The unique serial number of the product.
- MONTH.YEAR : Indicates the month and of year manufacture of the product.

2.4 Product Code

TMP-3000 | 1 | 2 | 3 | 4 | 5 | 6 |

1	Pneumatic Output	S : Single Acting D : Double Acting
2	Explosion Protection	N : Non-Explosion
3	Conduit – Pneumatic Connection	G : M16x1.5P – G 1/8
4	Flow Capacity	1 : 20 LPM 2 : 50 LPM
5	Options	0 : None 1 : Internal Position Transmitter
6	Fail Option	F : Fail Freeze S : Fail Safe

2.5 Product Specification

Model	TMP-3000
Acting Type	Single / double
Power supply	24 V DC ± 10 %, DC 260 mA(@21.6 VDC)
Input Signal	0 ~ 20 mA / 4 ~ 20 mA / 0 ~ 5 V / 0 ~ 10 V
Impedance	0 ~ 20 mA / 4 ~ 20 mA : 164 Ω 0 ~ 5 V / 0 ~ 10 V : 561 kΩ
Power Consumption	< 5.8 W
Output Signal	4 ~ 20 mA (DC 9 ~ 28 V)
Fail Option (Power supply off)	Fail freeze(stay in current position), Fail safe (move to safe position)
Supply Pressure	0 ~ 0.7 MPa (0 ~ 7 bar)
Flow Capacity : 0.6MPa Supplied	20 LPM / 50 LPM
Air consumption	0 LPM
Filtering Size, particle size	5 Micron
Air Connection	G 1/8 (Ø6mm Tube)
Operating Temp.	-10 ~ 60 °C (14 ~ 140 °F)
Conduit	2-M16×1.5P
Stroke	5 ~ 40 mm
Ingress Protection	IP67
Output Characteristic	Linear, Quick Open, EQ%, User Set
Vibration	100 Hz @ No resonance up to 6 G
Body Material	PPS
Cover Material	PC (Transparent)
Weight	750 g (1.7 lb)

⚠ Tested under ambient temperature of 20 °C, absolute pressure of 760 mmHg, and humidity of 65 %.
Please contact Rotork YTC Limited for detailed testing specification.

2.6 Certificate and Approvals

➢ Electromagnetic Compatibility (EMC)

- EMC directive 2014/30/EC from April 2016
- EC Directive for CE conformity marking

2.7 Parts and Assembly (Exploded View)

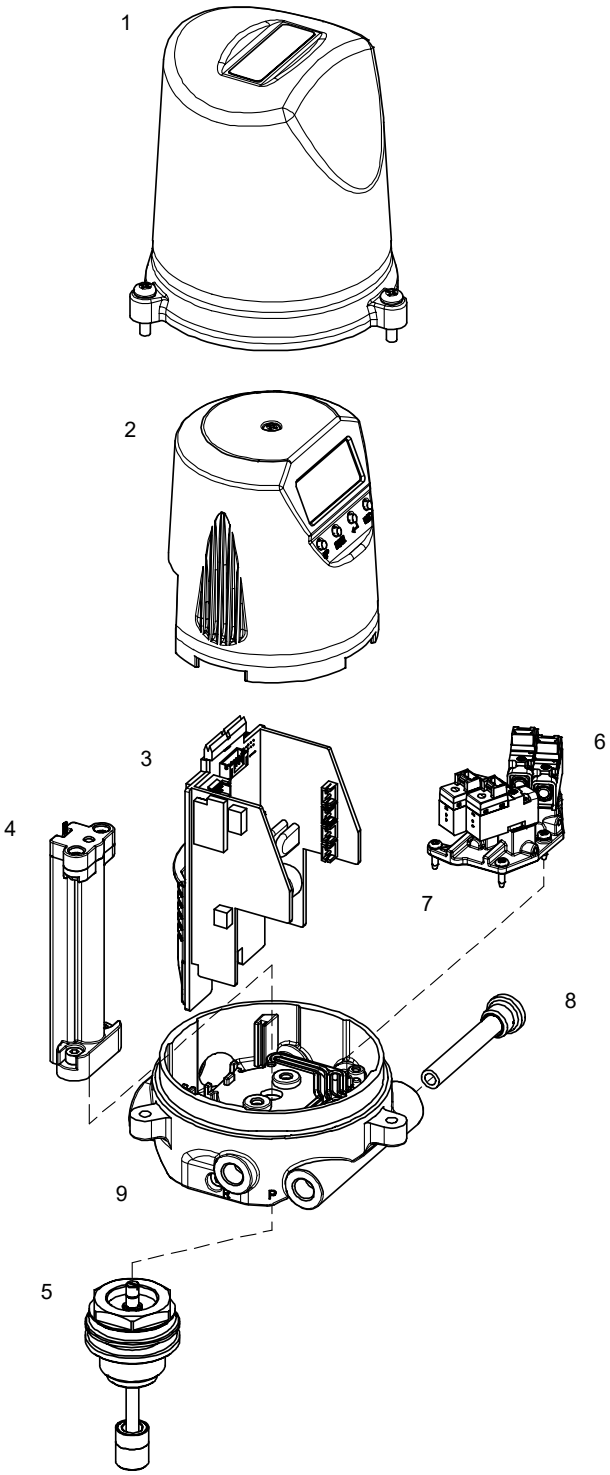


Fig. 2-1: TMP-3000 Exploded View

1. Base Cover
2. PCB Cover
3. Main PCB
4. Potentiometer
5. Feedback Shaft
6. Solenoid Valve
7. Manifold
8. Filter
9. Base Body

2.8 Exterior Parts and Description

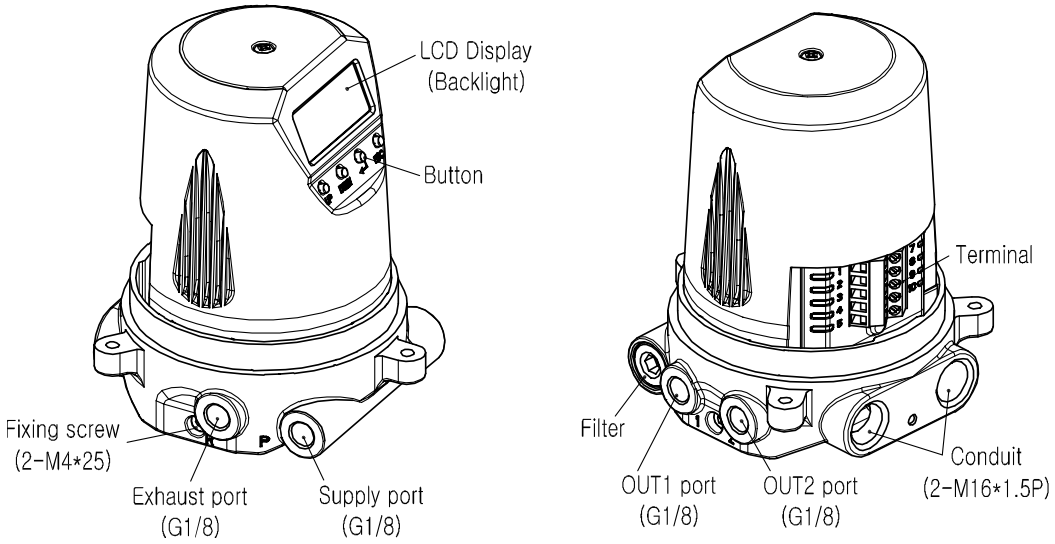


Fig. 2-2: TMP-3000 Exterior Parts and Description (Base Cover Removed)

2.9 Filter Cleaning

TMP-3000 has a built-in filter that filters foreign substances from the outside. During maintenance, please observe the followings to clean the filter.

- All input signals to valves, actuators, and other peripherals, pneumatics, etc. must be completely stopped.
- Disconnect the control valve from the system with a bypass valve or other similar device to prevent shutdown of the entire system.
- Make sure there is no air pressure in the actuator.
- Filter size is 5 micron.
- Please assemble carefully after disassembly and be careful of the direction of filter.
- Tool required for disassembly is 6mm wrench.

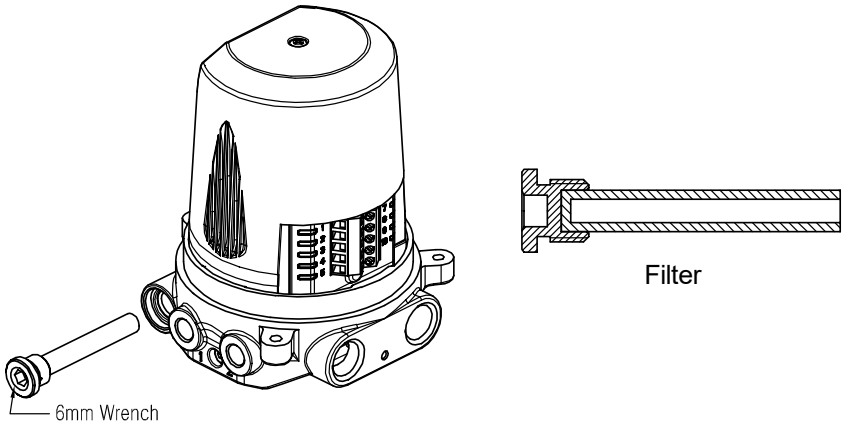


Fig. 2-3: TMP-3000 Filter Cleaning

2.10 Dimensions

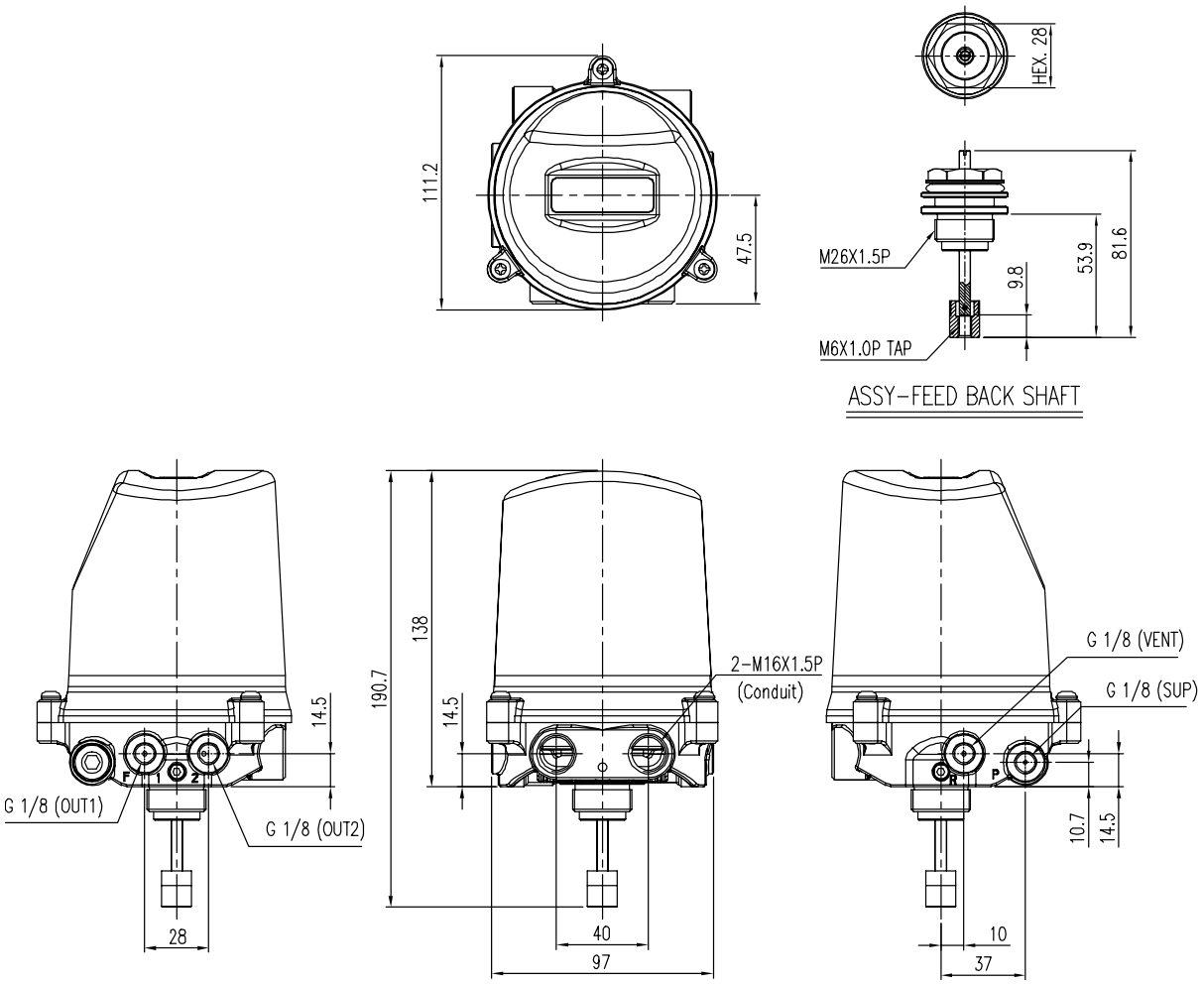


Fig. 2-4: TMP-3000 Dimensions

3 Installation

3.1 Safety

When installing the positioner, be sure to read and follow the safety instructions below.

- Ensure that all input signals to the valves, actuators and other peripherals, pneumatics, etc. are completely shut off and there is no pneumatic pressure left in the actuator.
- Disconnect the control valve from the system with a bypass valve or other similar device to prevent shutdown of the entire system.

3.2 Tools required for Installation

- Hexagonal wrench set
- (+), (-) Screw driver
- Spanner

3.3 TMP-3000 Installation

The TMP-3000 is used for linear motion valves. It is used for the angle valve in which the actuator stem is moved up and down linearly by using the spring return type diaphragm actuator or by using the piston actuator.

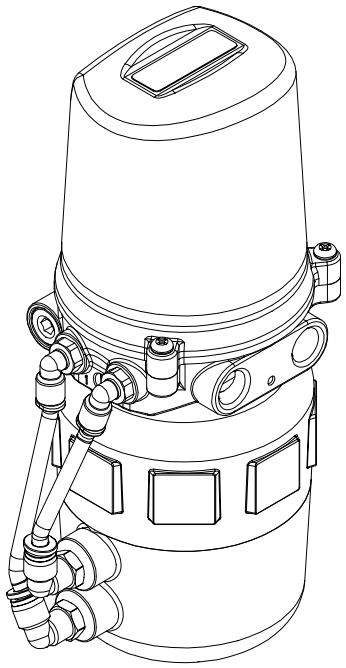


Fig. 3-1: TMP-3000 Installation Example

Make sure you have the following parts before proceeding with the installation.

- Positioner
- Feedback Shaft

3.3.1 Installing

1) Check actuator stroke (max. 40 mm) and screw size (M26x1.5P) on actuator.
   Please check if it is possible to assemble with the feedback shaft provided.
   The screw at the bottom of the feedback shaft is M6 with 8mm depth.

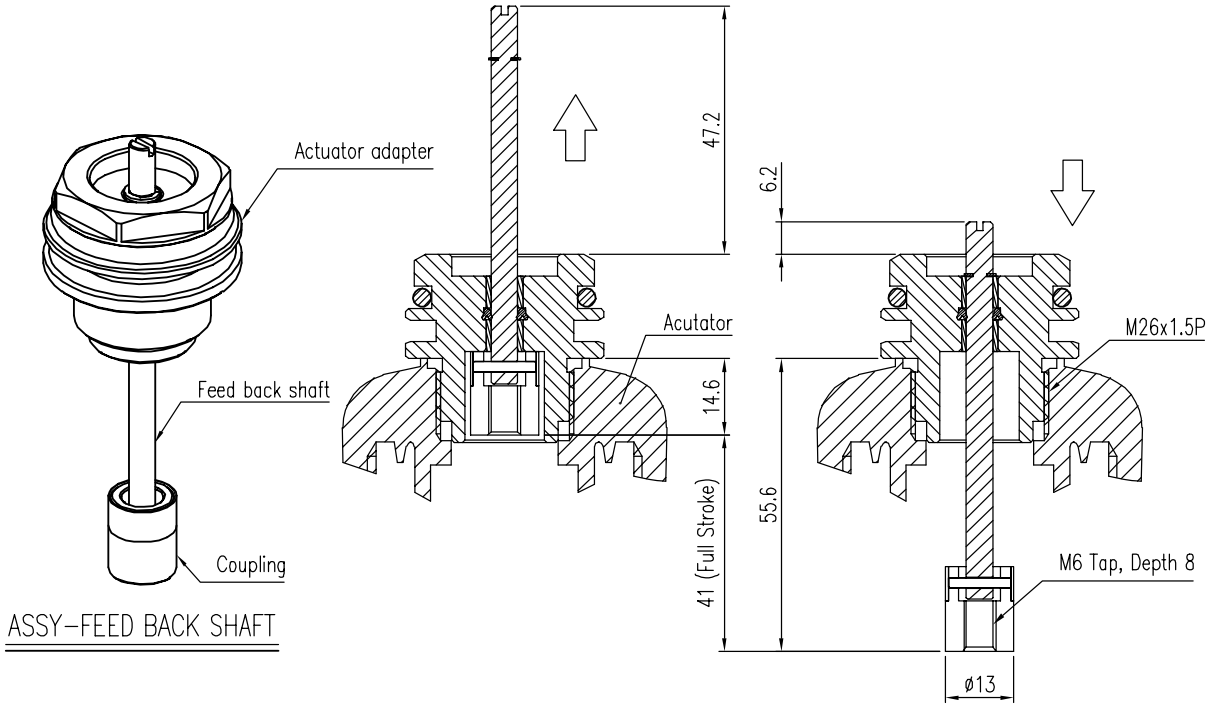


Fig. 3-2: TMP-3000 Feedback Shaft

2) Assemble the Actuator adapter on top of the actuator.

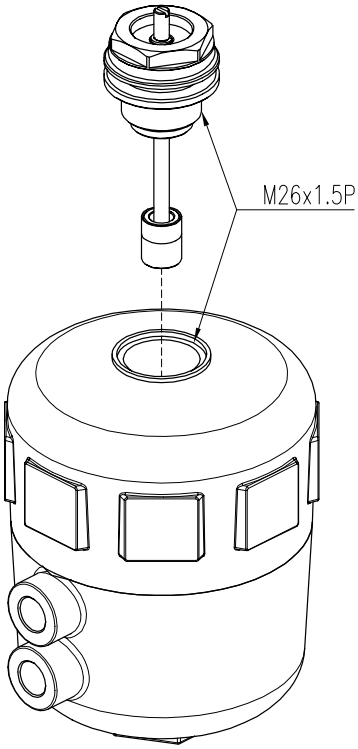


Fig. 3-3: TMP-3000 Feedback Shaft Assembly

3) Using a flat head screwdriver, tighten the M6x1.0P male thread of the actuator to the female thread of the coupling at the top end of the feedback shaft.

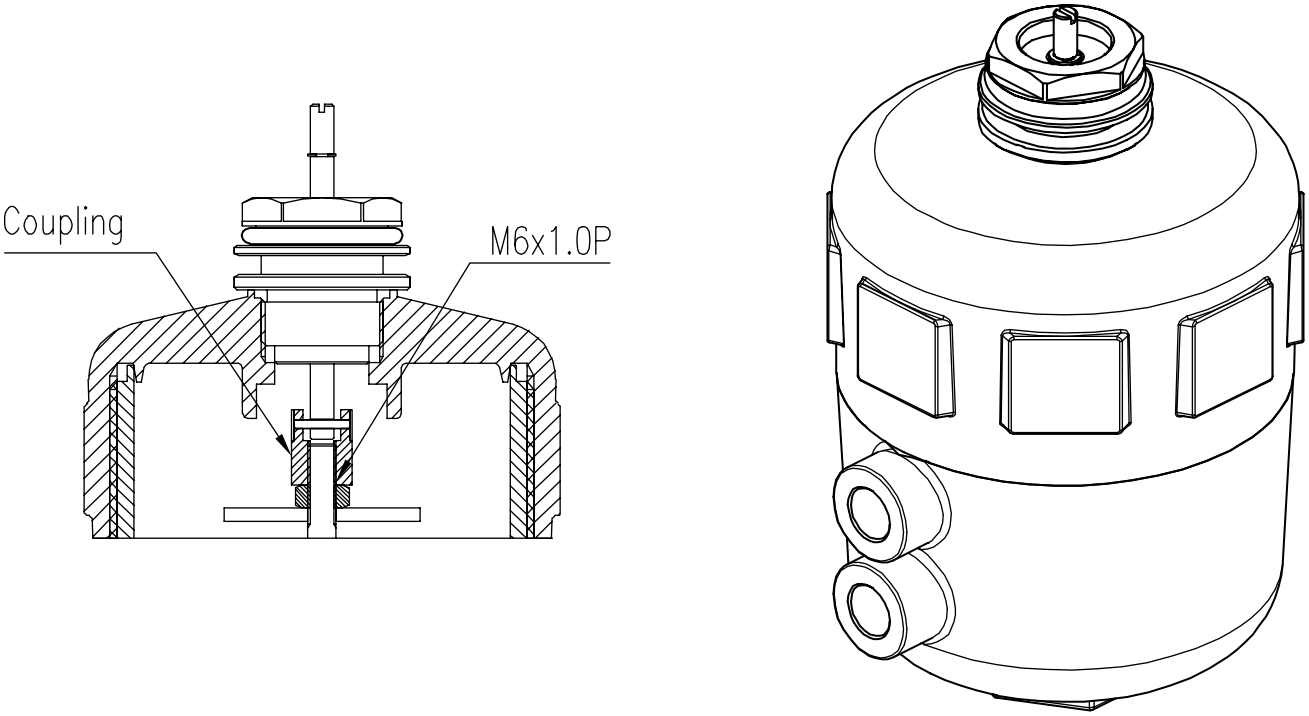


Fig. 3-4: TMP-3000 Fixing the Stem

4) Insert the TMP-3000 main body into the assembled actuator adapter, rotate it in the desired direction and tighten both wrench bolts. (The head of the wrench bolt is 3 mm.)

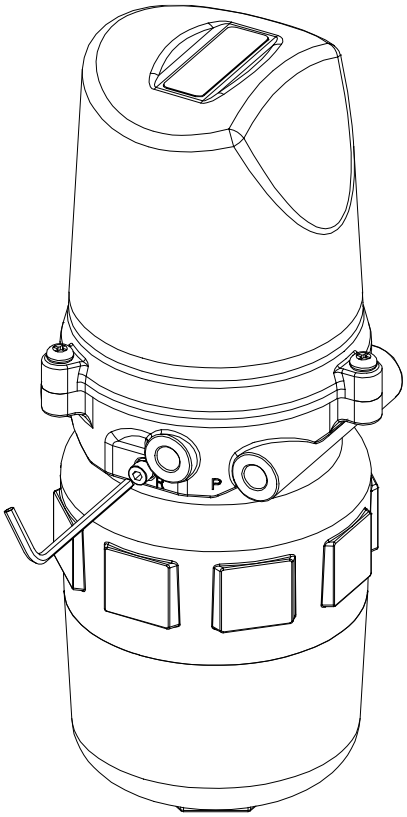


Fig. 3-5: TMP-3000 Fixing the Body

3.3.2 Warning

After installation, temporarily connect the pneumatic regulator directly to the actuator and operate the valve from 0 to 100 % stroke. At 0 % and 100 %, check if feedback shaft works smoothly.

4 Pneumatic Connections

4.1 Safety

- Be careful to select pneumatic compressors and pneumatic systems so that moisture, oil, foreign substances, etc. are not mixed in the pneumatic pressure used in the positioner.
- Prevent the entry of moisture, oil and foreign substances by attaching a separate filter to the positioner's supply port or applying a pneumatic regulator (such as YT-200) with a built-in filter.
- We have not tested the operation of the positioner using gases other than clean normal air. If you have additional questions, please contact us.

4.2 Supply Pressure Condition

- Use dry air with a dew point of at least 10 °C below the ambient temperature dew point.
- Filter out foreign substances with 5 micron filter.
- Do not include oil or lubricant in the air.
- Must comply with ISO 8573-1 or ISA 7.0.01.
- This positioner is intended for use in the pneumatic range of 0.05 to 0.7 MPa (0.5 to 7 bar). Do not use it outside this range.
- Set the pressure output from the regulator to 10 % higher than the operating pressure of the actuator or the spring range pressure of the actuator.

4.3 Piping Condition

- Remove any foreign substances inside the piping before installing for piping.
- The piping must be free of any pressed or damaged parts.
- The piping of the positioner and actuator connection at the time of piping should be free from leakage.
  Hunting occurs when there is a leakage, which also shortens product life.
- Use the one-touch fitting provided by our company to prevent leakage of piping.

4.4 Piping Connection of the Positioner and Actuator

4.4.1 Single Acting Actuator

Our positioner is set to use only OUT1 port for single acting type. Therefore, when using a single acting spring return type actuator, connect the OUT1 port to the actuator's pneumatic port.

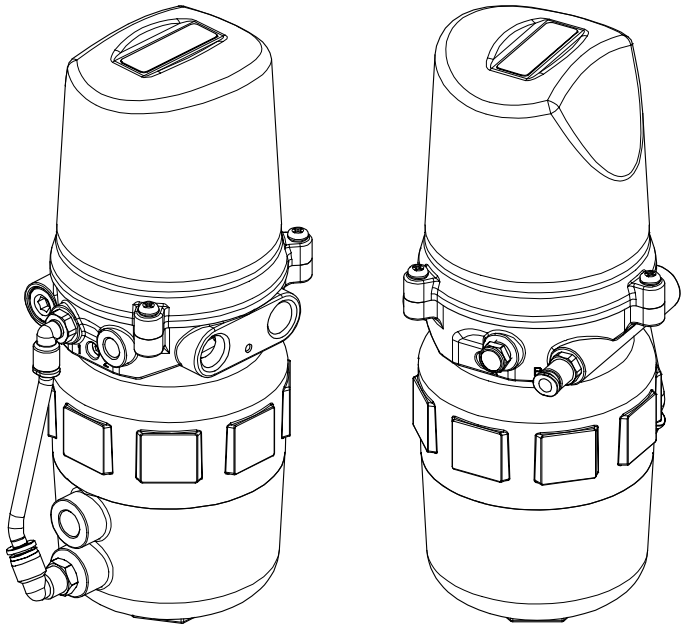


Fig. 4-1: Single Acting Actuator Pneumatic Piping Example

4.4.2 Double Acting Actuator

For double acting actuators, both OUT1 and OUT2 ports are used. If the electric input signal is increased, the air pressure is output from the OUT1 port. Refer to below and install the piping.

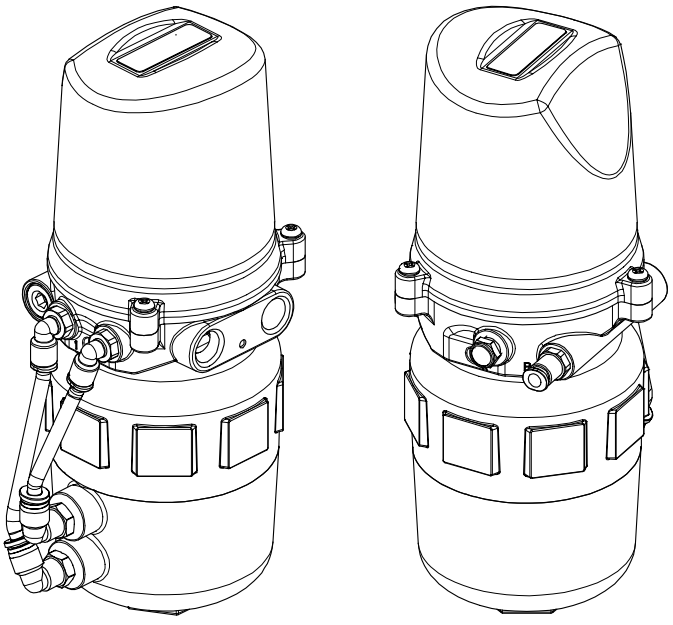


Fig. 4-2: Double Acting Actuator Pneumatic Piping Example

5 Power Connection

5.1 Warning

- Make sure power is off before connecting to the terminal.
- There are two conduit entries on the product. Conduit entry threads are M16x1.5P.
- The operating power supply uses DC 24 V and the input signal uses one of 4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 5 V and 0 ~ 10 V.
- When input signal is current source, compliance voltage of current source must be Min. 10 V and Max. 28 V. If the length of the supply cable between the current source and the positioner is long, or if there is a filter or safety barrier, then consider using a current source which could supply higher Compliance voltage.
- If PTM option is available, supply 9 ~ 28 V DC power separately.
  The maximum voltage must not exceed 30 V.

- **DO NOT connect Voltage source (9 ~ 28 V DC) to Input terminal (+IN, -IN) as it will cause PCB failure.**
- Plug an unused conduit entry with a plug to prevent foreign materials from entering.
- Do not install cables near noise-generating equipment such as high-capacity transformers or motors.

5.2 Terminal Connections

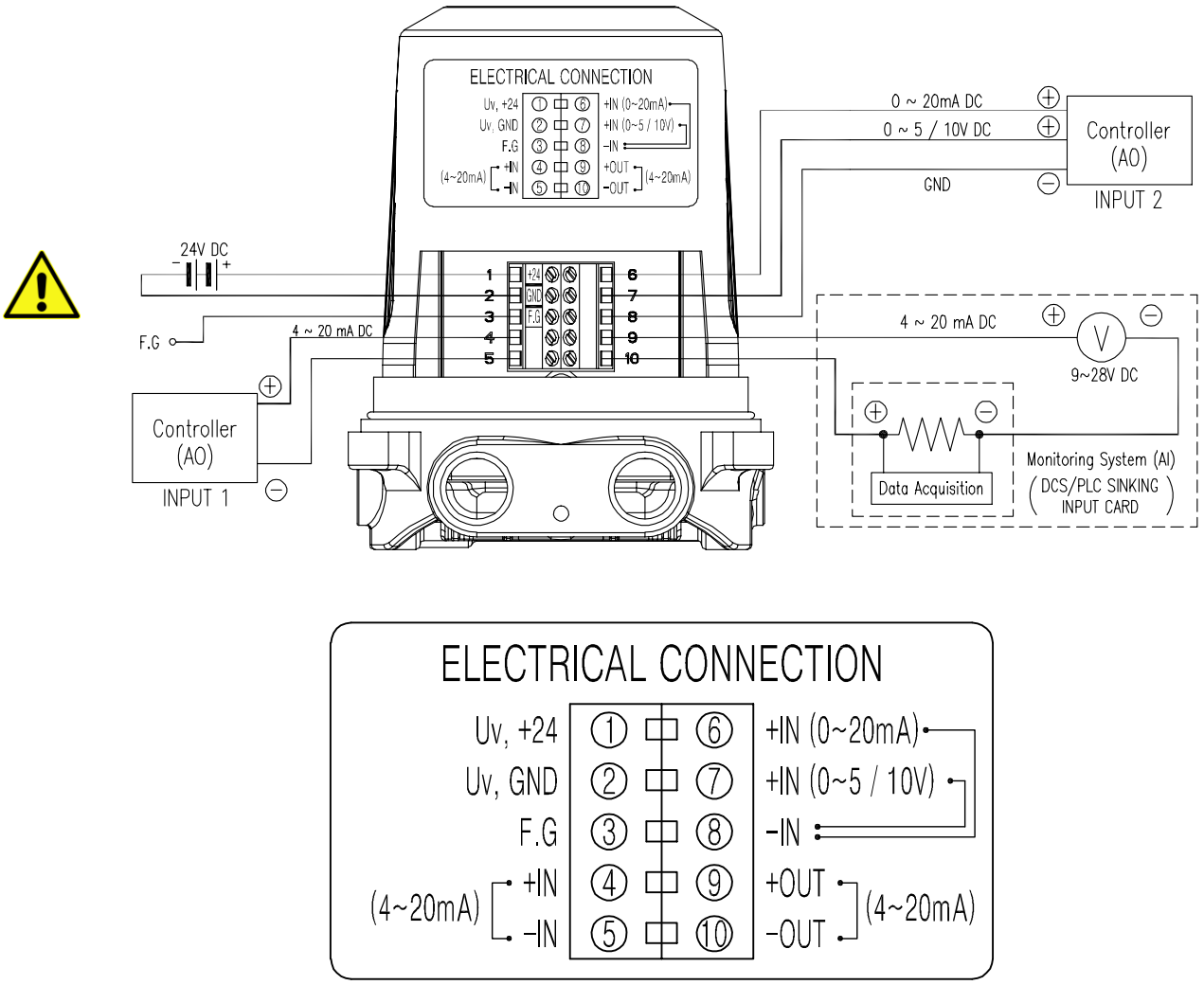


Fig. 5-1: TMP-3000's Terminal

5.3 Ground

1) Ground must be done before operating the positioner.
2) There is an internal ground “F.G” in the positioner.
   Please make sure that the resistance is less than 100 ohm.

6 Maintenance

6.1 Supply air

If Supply air pressure is not stable or Supply air is not clean, the positioner may not function properly. Air quality and pressure should be checked regularly to see if the air is clean and pressure set is normal.

6.2 Seals

Once a year, it is recommend to check if there are any damaged parts of the positioner. If there are damaged rubber parts such as diaphragms, o-rings and packings, replace with new ones.

7 Auto Calibration and How to Operate

(This manual is for new PCA revision 9.)

7.1 Warning

This operation will move the valve and actuator so that the valve must be disconnected from the entire system before auto-calibration to ensure that the entire process is not affected.

7.2 Button Description

There are total of four buttons in the positioner. You can use it to implement various functions.

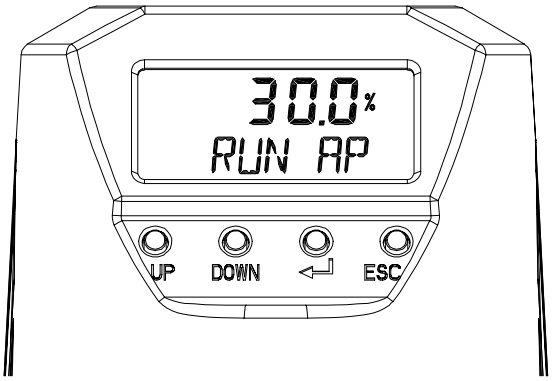


Fig. 7-1: <UP> & <DOWN >: Used to change parameter values in menu or move to other menu

< ↵ , ENTER>: Used to enter the main menu or submenu or to save parameter values

<ESC>: Used to return to the previous menu one level from the current menu

7.3 Menu levels

The basic menu structure consists of the RUN Mode Monitor and the Configuration/Operation. The Run Mode Monitor menu allows you to monitor the values of various variables. The Configuration/Operation menu provides calibration and tuning, manual operation, configuration of I/O port function, configuration and self-test of positioner, configuration of diagnostic function, and basic information of the positioner. See below for information on how to move between Run Mode Monitor menu and Configuration/Operation menu, and move within Run Mode Monitor menu.

Press <↵> for more than 3 seconds in Run Mode to go to Configuration/Operation.

Run Mode Monitor	
RUN AP	Actual Position
RUN TP	Target Position
RUN dV	Deviation Value
RUN MV	Manipulator Value
RUN IN	Input Current
RUN SP	Set Position

ESC <↵>

ESC+UP/DN

UP/DN

Configuration and Operation	
CALIb	Calibration
MAN OPER	Manual Operation
CTRL PARM	Control Parameter
IN CFG	Input Configuration
OUT CFG	Output Configuration
dEV CFG	Device Configuration
INFO	Information

Press the <↵> button to select the lower menu of the Configuration/Operation menu. Press the ESC button to return to parent menu after completing configuration. Pressing the ESC button anywhere in the menu structure several times returns the user to the uppermost menu, Run Mode Monitor menu.

7.4 RUN Mode Monitor

The RUN Mode Monitor is displayed on the LCD display when power is provided to the positioner. Pressing the UP/DOWN button scrolls through the various process variables shown in table below. A "30.0%" in the LCD display below indicates that the valve is in the 30 % position, and an "AP" indicates the abbreviation of "Actual Position".%. (Old software displays “RUN PV” and New software displays “RUN AP”.)

The status variables displayed in the RUN Mode Monitor are divided into nine types as shown below.

On LCD	Name	Description
RUN AP [%]	Actual Position	Actual position of the valve indicated as %.
RUN TP [%]	Target Position	Target position in %
RUN dV [%]	Deviation Value	Deviation between target position and actual position.
RUN MV	Manipulator Value	Digital input value applied to I/P converter
RUN IN [mA]	Input Current	Current input signal in mA
RUN TEMP[°C]	Temperature	Internal temperature of positioner in °C.
RUN SP [%]	Set Position	Input signal converted into %

7.5 Configuration and Operation

The Table below shows the eight Configuration/Operation menus, each submenu, ranges for each parameter, and initial factory settings. The words shown in [ ] for each menu represent the abbreviations of each word displayed when operating the LCD screen.

Level 1	Level 2	Range	Initial factory setting
Calibration [CALIb]	Acting Type	[SINGLE, dOUbLE]	
	Auto Calibration 1 [AUTO 1]		
	Auto Calibration 2 [AUTO 2]		
	Travel Zero [TVL ZERO]		
	Travel End [TVL ENd]		
Manual Operation [MAN OPER]			
Control Parameters [CTL PARM]	Dead Band [dEAdbANd]	0.1 ~ 10.0 [%]	
	[PT UP]	0.002 ~ (Period – 0.04)	
	[PT dN]	0.002 ~ (Period – 0.04)	
	[ESR UP]	(DeadBand + 0.2 %) ~ 10.0 %	
	[ESR dN]	(DeadBand + 0.2 %) ~ 10.0 %	
	[PR UP]	0 ~ 500	
	[PR dN]	0 ~ 500	
	Period [PERIOd]	0.012 ~ 0.200 [12 ~ 200 ms]	0.030 [30 ms]
	Auto Dead Band Mode [AUTO db]	oFF, [0 %]	oFF
Input Configuration [IN CFG]	Select Input Mode [SEL IN]	4 ~ 20 mA, 0 ~ 20 mA 0 ~ 10 V, 0 ~ 5 V [4.20 mA, 0.20 mA, 1.10, 0.5]	4 ~ 20 mA [4.20 mA]
	Signal Direction [SIG]	Normal, Reverse [NORM, REVS]	NORM
	Custom Split Range Zero [CST ZERO]	0 ~ 100 [%]	0 %
	Custom Split Range End [CST ENd]	0 ~ 100 [%]	100 %
	Characterization [CHAR]	Linear, Equal Percent, Quick Open, User Set 5P, User Set 21P [LIN, EQ, QO, U5, U21]	LIN
	User Set Characterization 5p [USER 5P]		0 %, 25 %, 50 %, 75 %, 100 %
	User Set Characterization 21p [USER 21P]		0 %, 5 %, 10 %, … 95 %, 100 %
	Tight Shut Open [TSHUT OP]	0.0 ~ 100 [%]	100.0 %
	Tight Shut Close [TSHUT CL]	0.0 ~ 100 [%]	0.3 %

Level 1	Level 2	Range	Initial factory setting
Output Configuration [OUT CFG]	Position Transmitter Direction [PTM]	[NORM, REVS]	NORM
	Position Transmitter Zero [PTM ZERO]	0 ~ 100.00 [%]	
	Position Transmitter End [PTM ENd]	0 ~ 100.00 [%]	
	Back Calculation [bACKCAL]	[oFF, on]	oFF
Device Configuration [dEV CFG]	Action Change [ACT]	[dIR, REVS]	REVS
	Write Protect [W]	[UNLOCK, LOCK]	UNLOCK
	View Mode [VI]	[NORM, REVS]	NORM
	Factory Reset [dEFAULT]		
	Self-Test [SELFTEST]		
Information [INFO]	Model Name [TMP 3000]		
	Firmware Version [SOFT VER] Download Date	*.*.** YYYYMMDD	Program current version Program input date
	Run Time [RT]	*.** RT *d	
	Upward Stroke Time [FULL OP]	***.*	
	Downward Stroke Time [FULL CL]	***.*	
	View counts [VI CNTS]	CYCL CNT, TVL ACUM, FOP CNT, FCL CNT, OVER CNT, SOL0 CNT, SOL1 CNT, [Cycle Count, Travel Accumulate, Full Open Count, Full Close Count, Over Current Count, Solenoid 0 Count, Solenoid 1 Count]	

7.6 Calibration (CALIb)

The calibration consists of five menus.

Calibration [CALIb]	Acting Type [SINGLE/ dOUbLE]	Set manually single or double acting by actuator type
	Auto Calibration 1 [AUTO 1]	Calibration on the zero and end points of the valve
	Auto Calibration 2 [AUTO 2]	Calibration on all parameters required to operate the valve
	Travel Zero [TVL ZERO]	Manually adjust the zero point of the valve
	Travel End [TVL ENd]	Manually adjust the endpoint of the valve

Auto Calibration simplifies calibration without having to go through complex gain tuning. Once the current input between 4 and 20 mA is applied, it takes approximately 2 ~ 3 minutes to complete the automatic calibration, which may vary depending on the size of the actuator. There are two types of Auto Calibrations as shown below so that you select and use them as required.

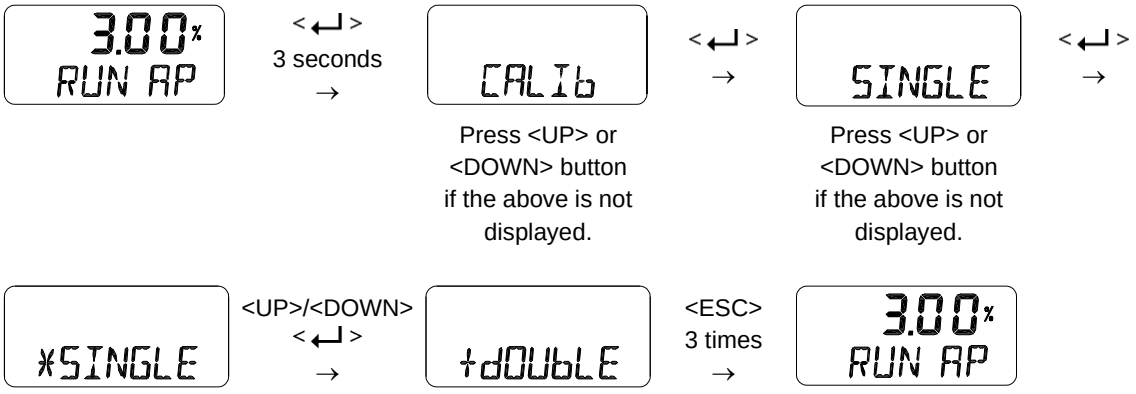
	ZERO	END	PT, ESR, PR	RA, DA
AUTO 1	O	O	X	X
AUTO 2	O	O	O	O

It is recommend to perform AUTO2 calibration for initial positioner setting.

7.6.1 Acting Type (SINGLE / dOUBLE)

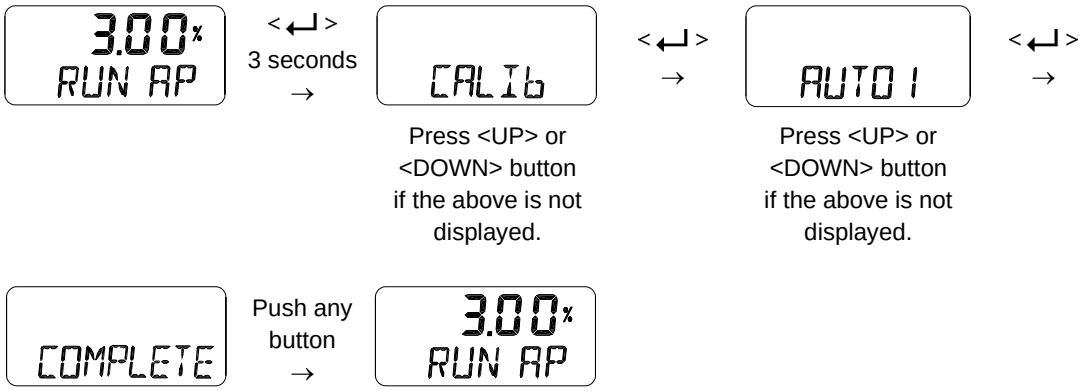
This is used to change the settings of the positioner to SINGLE or dOUBLE, depending on the actuator type. The setting of the SINGLE and dOUBLE affects the automatic calibration, so it must be set carefully considering the actuator type.

When the actual acting types of Actuator is different with the setting values, make sure to fit the actual acting type with the currently operating Actuator type as the certain performance troubles may incur.



7.6.2 Auto Calibration 1 (AUTO 1)

AUTO 1 is used to set only the origin and end points. It does not change other parameter values that already have been set. This is usually used when the origin and end points of the already calibrated positioner have changed slightly.

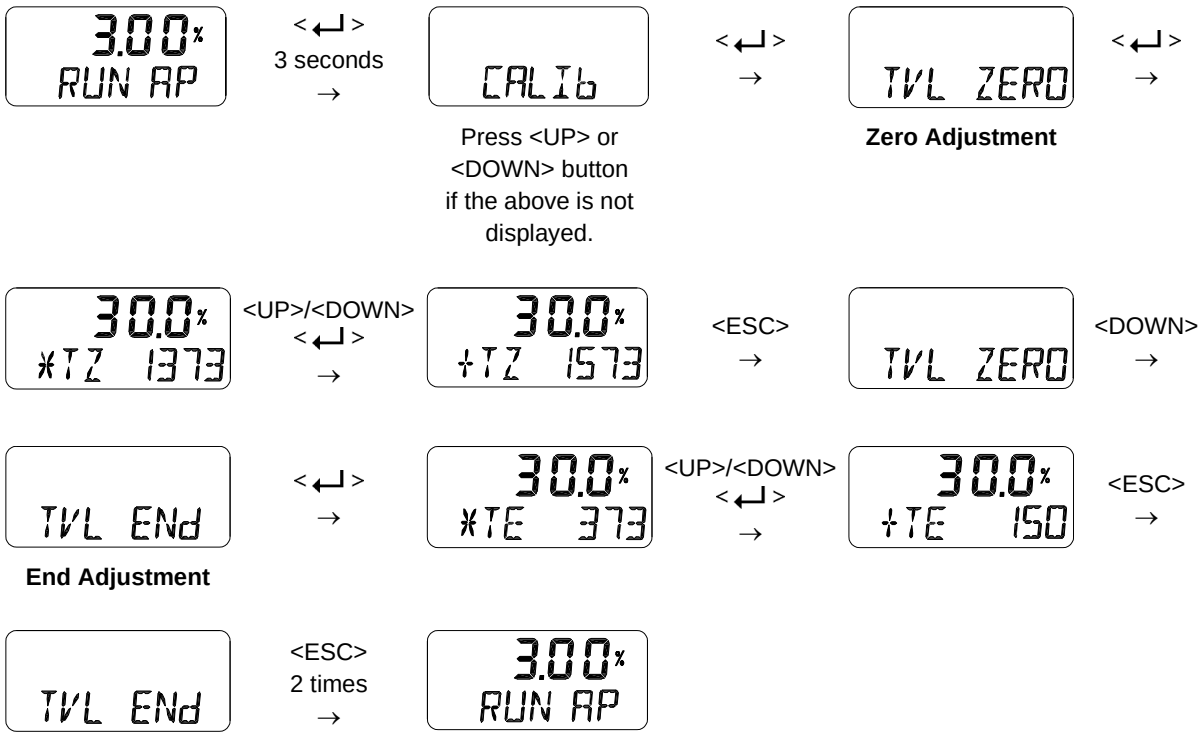


7.6.3 Auto Calibration 2 (AUTO 2)

AUTO 2 tunes up and then changes all parameters required for valve operation. Be sure to perform this AUTO 2 when installing the positioner on the valve for the first time or when reinstalling the positioner from the actuator.

7.6.4 Travel Zero (TVL ZERO) and Travel end (TVL ENd)

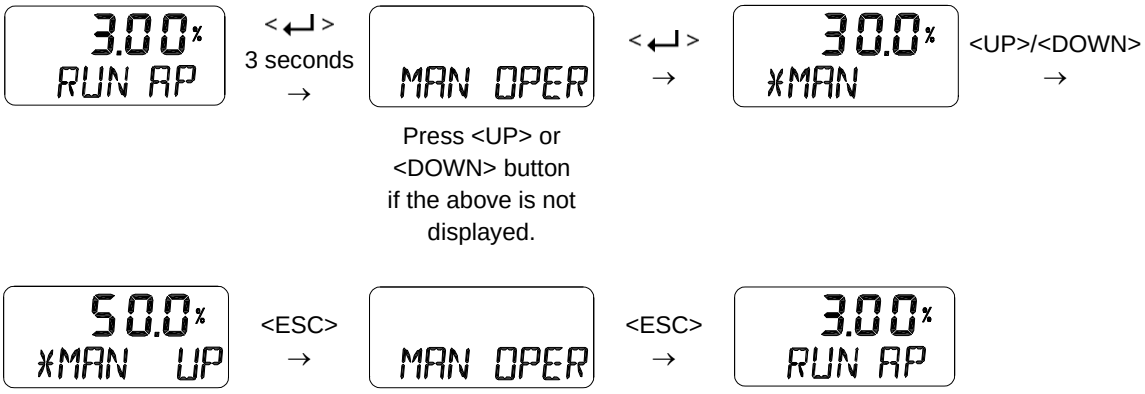
This is a manual adjustment of the zero point or endpoint of the valve after auto calibration. Once you enter the TRAVEL ZERO (or TRAVE END) setting, press the UP/DOWN button to change the zero point (or endpoint) of the valve, and then press the ENTER button to save it. The saved position is recognized as the zero (or endpoint) of the valve.



7.7 Manual Operation (MAN OPER)

It is used to manually raise or lower the valve stem by operating the UP or DOWN buttons. This can be used to observe the move of valve stem without any external input signals. When engaged, the current input signal to the positioner has no effect on the positioner.

Use the Manual only when the operation is suspended, or when no trouble is raised with the operation of Control Valve, as the execution of Manual Mode may interfere with the currently operating process.



7.8 Control Parameters (CTL PARM)

By performing auto-calibration, almost all valve actuator control can be performed optimally. However, in some cases, it may be difficult to optimally set the valve actuators for some special cases or auto-calibration when operating under special conditions.
At this time, you can adjust the parameter value to solve the problem.

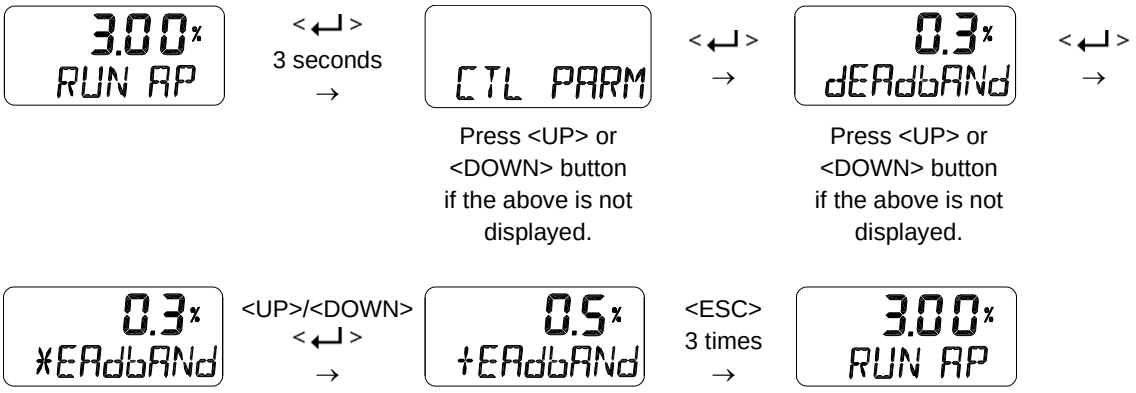
If you change the parameter value with the <UP><DOWN> button, the instantly changed value is applied to the positioner control. When the desired state is reached, you must press the <ENTER> button to save the value.

Followings are the values changeable at the Control Parameters Mode.

1) Dead Band (dEAdbANd)
2) PT parameter (PT UP, PT dN)
3) ESR parameter (ESR UP, ESR dN)
4) PR parameter (PR UP, PR dN)
5) Period Time (PERIOd)
6) Auto Dead band Mode (AUTO db)

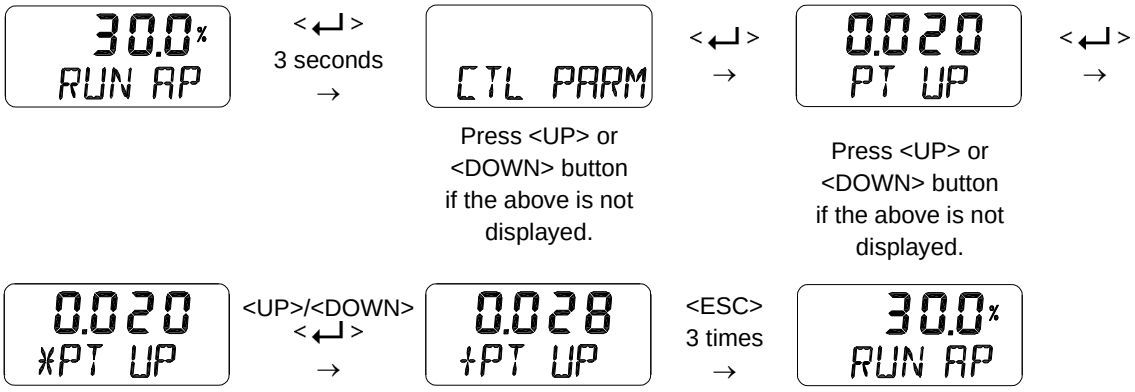
7.8.1 Dead Band (dEAdbANd)

Dead-Zone indicates the percentage of error allowance. In case of high level of packing friction, which may cause hunting, increasing the value of Dead-Zone can stable the valve operation.



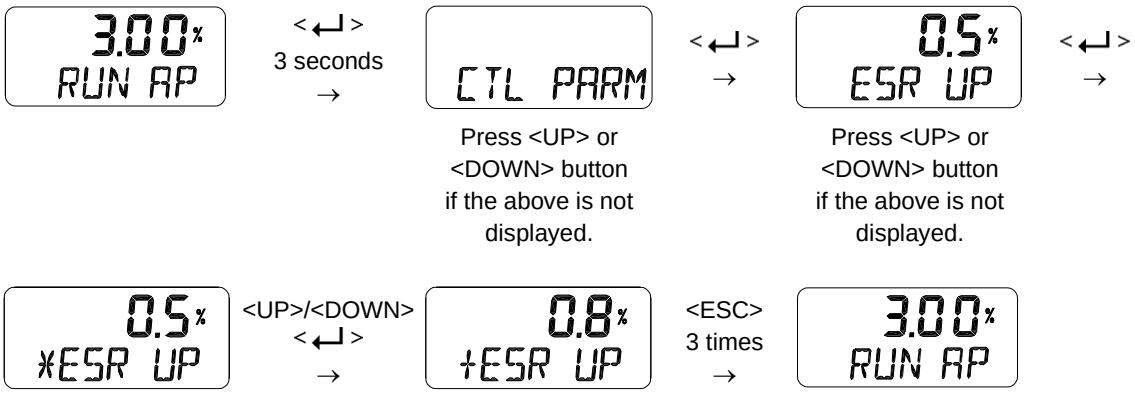
7.8.2 PT parameter (PT UP, PT dN)

The PT parameter is a value that indicates the minimum length of the internal signal to be controlled by the valve. PT UP indicates the PT parameter when the input signal is increased and PT dN indicates the PT parameter when the input signal is decreased. It is basically set at AUTO 2.



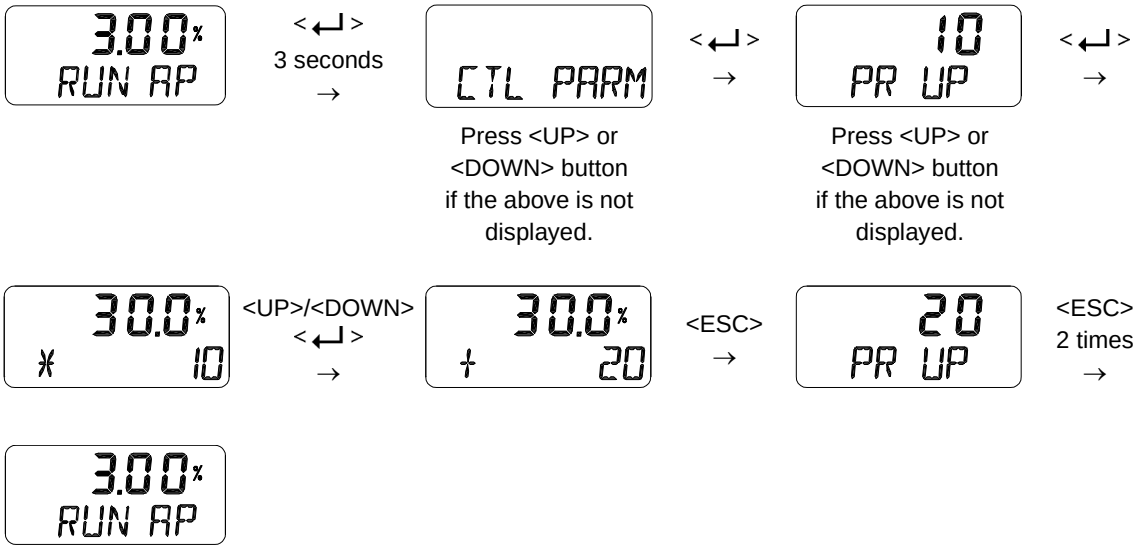
7.8.3 ESR parameter (ESR UP, ESR dN)

The ESR parameter is a range value that shortens the output control with the minimum period set by the PT parameter value within the error range. If the value is small, the speed of finding the target value is fast and overshooting may occur. On the other hand, if the value is large, the speed of finding the target value is slowed down, but the occurrence of overshooting can be suppressed.



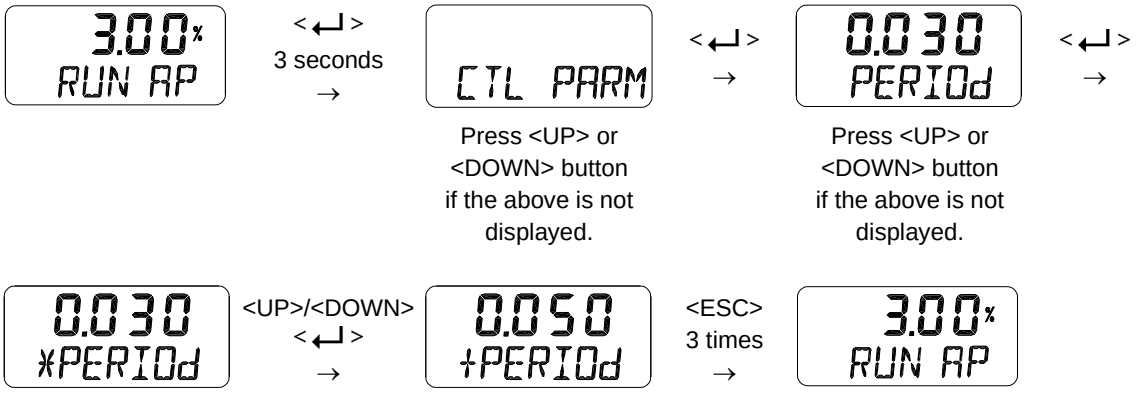
7.8.4 PR parameter (PR UP, PR dN)

The PR parameter is the proportional control value for the speed to compensate for the error that occurs during the delay time between the control signal and actual valve stem operation. Large values can cause oscillations.



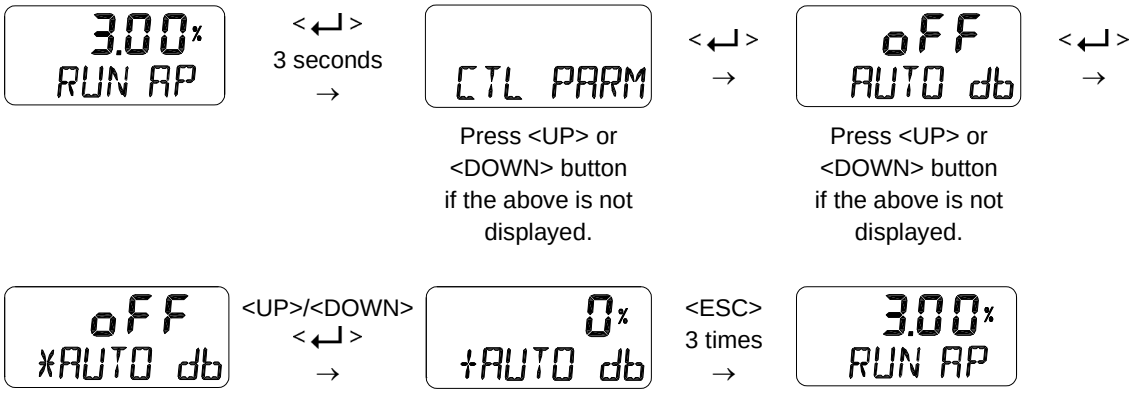
7.8.5 PERIOD Time (PERIOd)

It means the control cycle inside the positioner. Basically, it checks the current position and signal every 30 msec to control the valve.



7.8.6 Auto Dead band Mode (AUTO db)

This function is used to suppress a hunting for valves with high static friction. The initial value is OFF and it shall be set to 0 % to activate the auto dead band automatically. The value is changed to a proper value once this mode is activated.



7.9 Input Configuration (IN CFG)

Followings are the values changeable at the Input Configuration Mode.

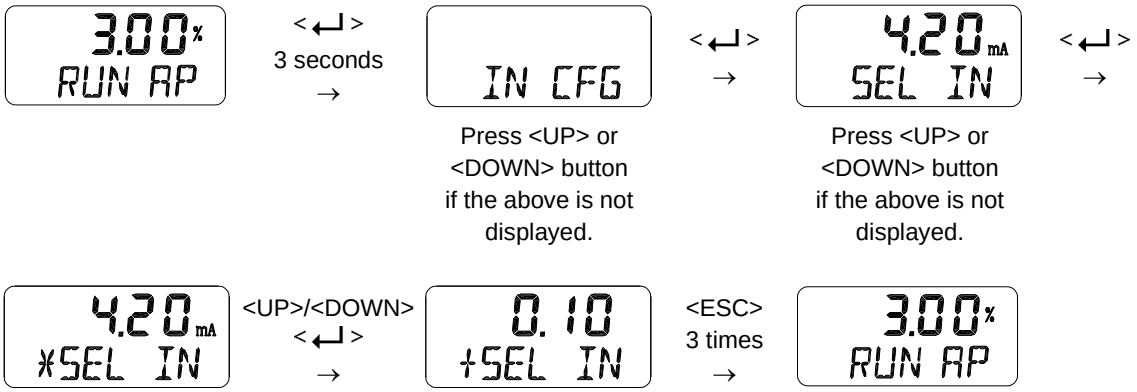
1) Selection Input Signal (SEL IN)
2) Signal Direction (SIG NORM / REVS)
3) Split Range Mode (SPLIT)
4) Custom Split Range Zero (CST ZERO)
5) Custom Split Range End (CST ENd)
6) Characterization Curves (CHAR)
7) User Set Characterization 5 Points (U5)
8) User Set Characterization 21 Points (U21)
9) Tight Shut Open (TSHUT OP)
10) Tight Shut Close (TSHUT CL)

7.9.1 Selection Input Signal (SEL IN)

Input signal is 0 ~ 20 / 4 ~ 20 mA or 0 ~ 5 / 0 ~ 10 V. Please select the input signal after wiring according to the desired input signal. The range of input signal according to its setting value is as follows:

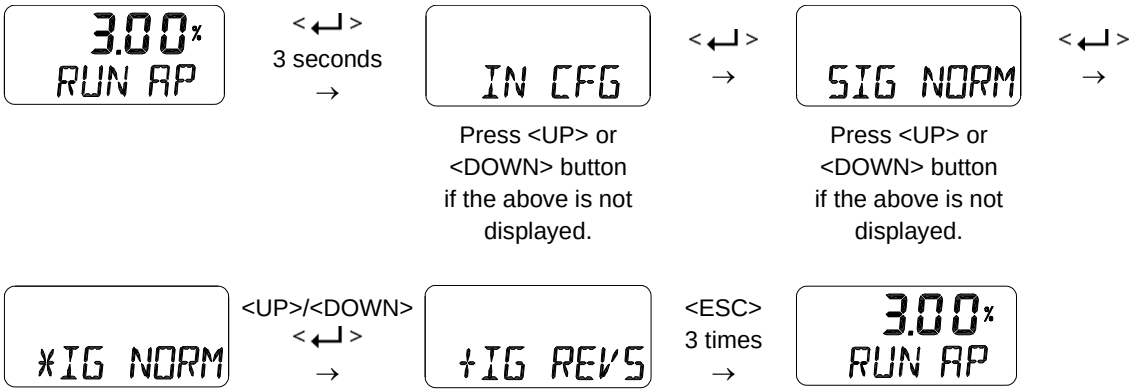
Selection input signal		0.20 mA SEL IN	0.10 SEL IN	0.5 SEL IN
Input signal	4 ~ 20 mA	0 ~ 20 mA	0 ~ 10 V	0 ~ 5 V

→ How to change 4 ~ 20 mA setting to 0 ~ 10 V setting



7.9.2 Signal Direction (SIG NORM / REVS)

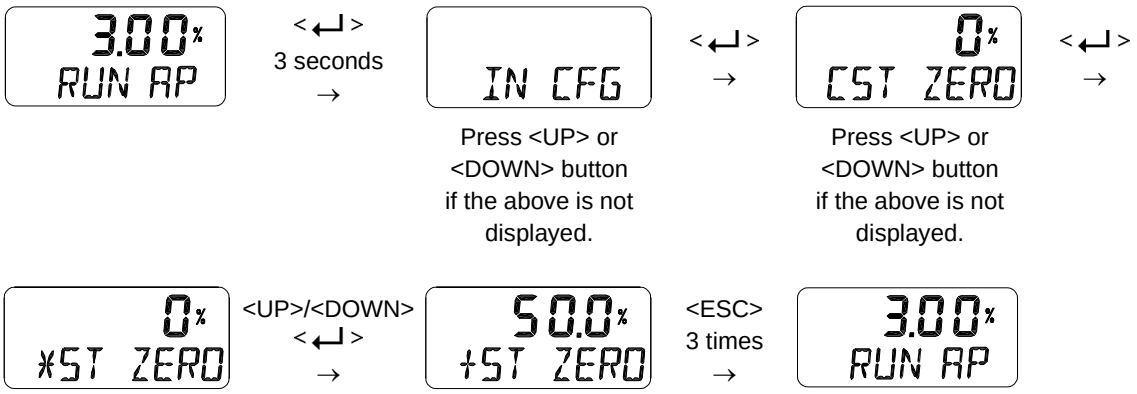
This function changes the action type of the valve, NORM or REV. if NORM is selected, the air is completely released through output port 1 of the positioner when 4mA is applied, and the maximum air pressure is loaded to the actuator through output port 1 when 20 mA is applied. If set to REV, the maximum air pressure is loaded to the actuator via output port 1 when an input current of 4 mA is applied to the positioner.



7.9.3 Custom Split Range Zero (CST ZERO)

CST ZERO is the value of the analog input signal corresponding to the starting point of the Set Value for Split Range Control, and the percentage value of the analog input signal (4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 5 V, 0 ~ 10 V) User can change setting randomly. For example, when the analog input signal is selected as “4~20mA”, if CST ZERO is changed from 0 % to 50 %, the valve opening operates 0 ~ 100 % in the range of 12 ~ 20 mA input signal.

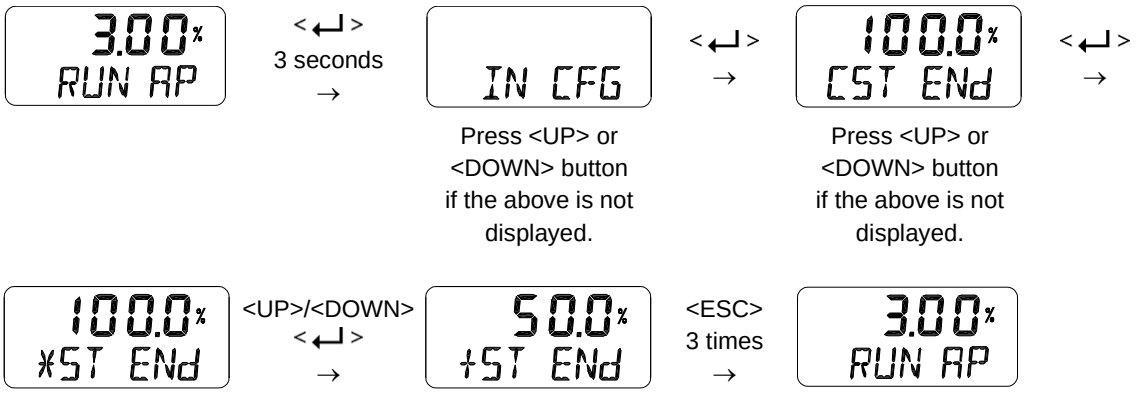
The deviation of the current between the zero point and the end point must be over at 25 %.



7.9.4 Custom Split Range End (CST ENd)

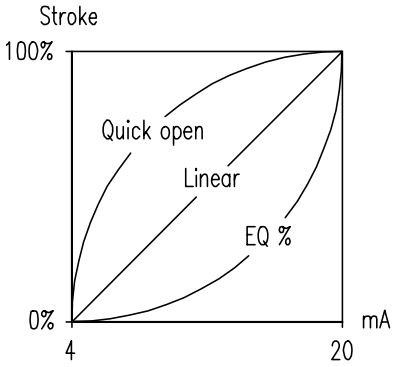
CST ENd is the value of the analog input signal corresponding to the ending point of the Set Value for Split Range Control, and the percentage value of the analog input signal (4 ~ 20 mA, 0 ~ 20 mA, 0 ~ 5 V, 0 ~ 10 V) User can change setting randomly. For example, when the analog input signal is selected as “4 ~ 20 mA”, if CST ENd is changed from 100 % to 50 %, the valve opening operates 0 ~ 100 % in the range of 4 ~ 12 mA input signal.

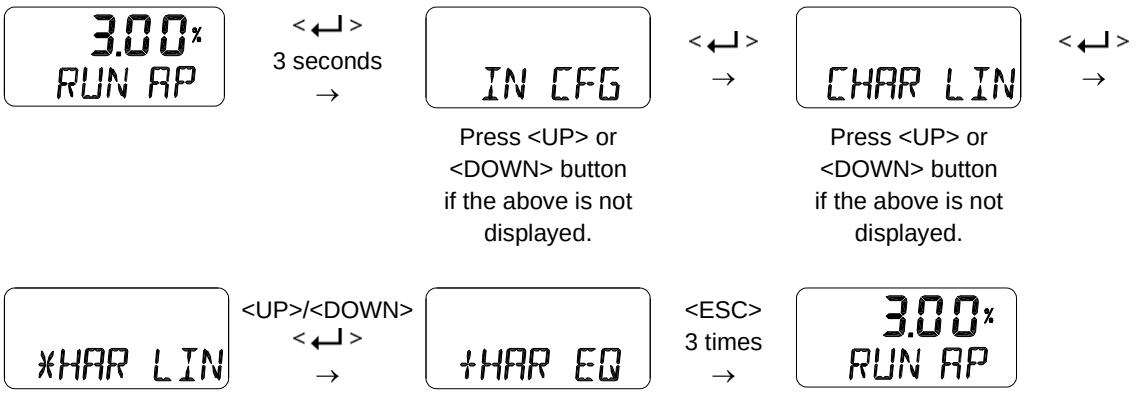
The deviation of the current between the zero point and the end point must be over at 25 %.



7.9.5 Valve Flow Characterization Curves (CHAR)

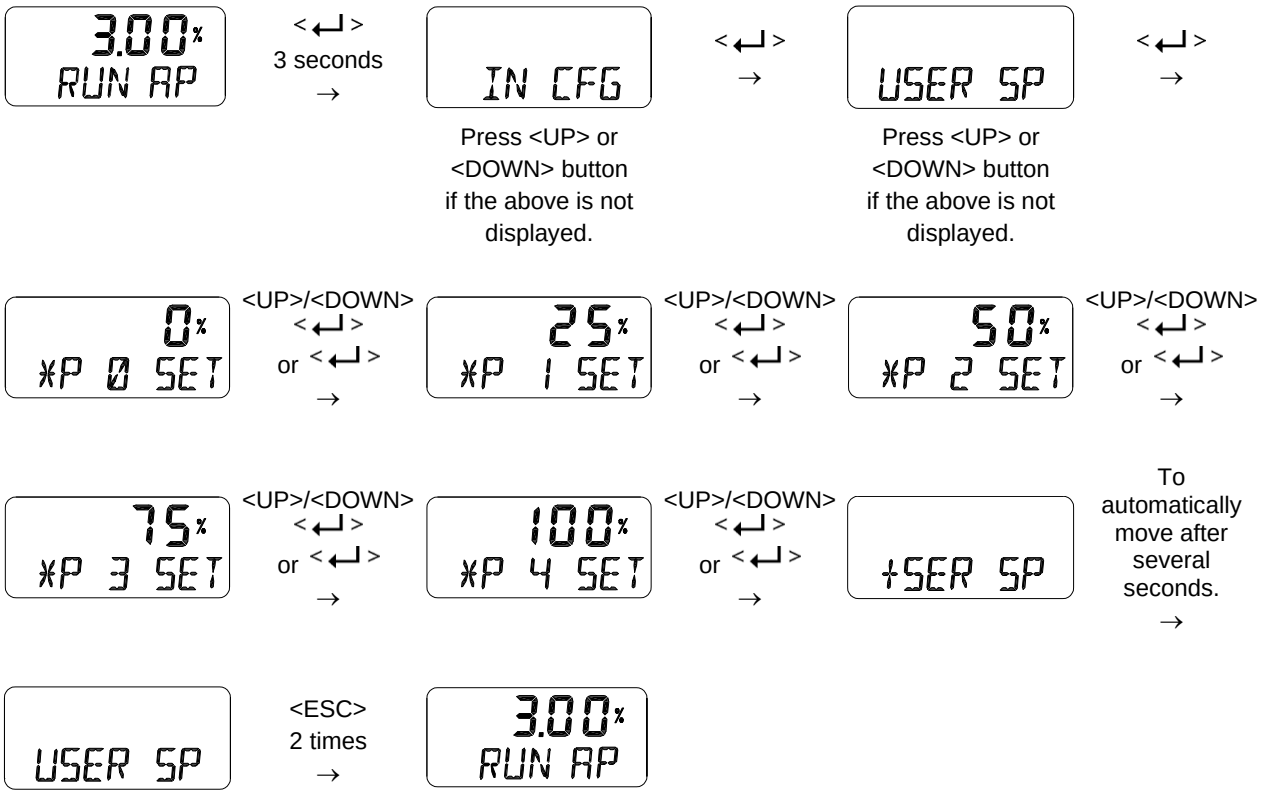
The flow characteristic curve of valve is available by selecting one of the following: Linear(LIN), Quick Open(QO), Equal Percentage(EQ), User Set Characterization 5 Points (U5), User Set Characterization 21 Points(U21).





7.9.6 User Set Characterization 5 Points (U5)

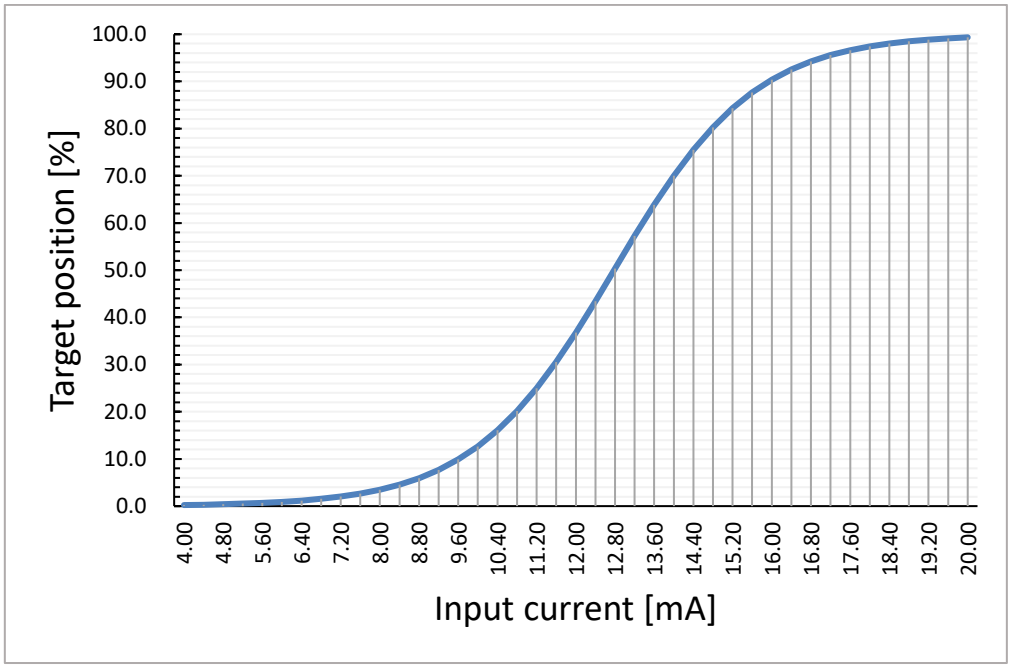
A total of 5 target positions are set every 4 mA intervals. When shipped from the factory, the initial positions are P0 (4 mA, 0 %), P1 (8 mA, 25 %), P2 (12 mA, 50 %), P3 (16 mA, 75 %), and P4 (20 mA, 100 %). User can change all 5 points or only change partially and exit the menu by pressing <ESC> button.

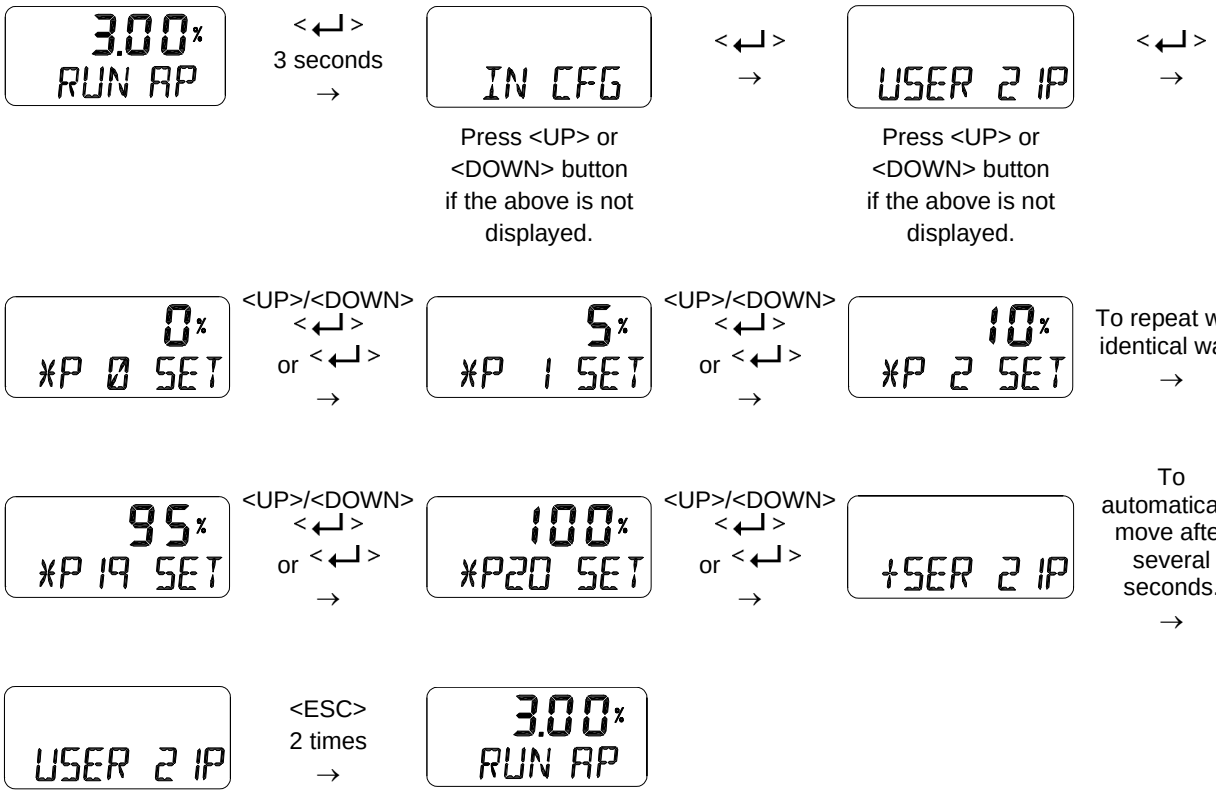


※ This function is activated by saving the Valve Flow Characterization Curves (CHAR) of above Section 7.9.5 as “U5”.

7.9.7 User Set Characterization 21 Points (U21)

A total of 21 target points can be set every 0.8 mA intervals. When shipped from the factory, the initial P0 (4 mA, 0 %), P1 (4.8 mA, 5 %), P2 (5.6 mA 10 %), - - -, P19 (19.2 mA, 95 %), and P20 (20 mA, 100 %). For example, a characteristic curve below can be made through the settings of P1 to P20. User can change all 21 points or only change partially and exit the menu by pressing <ESC> button.

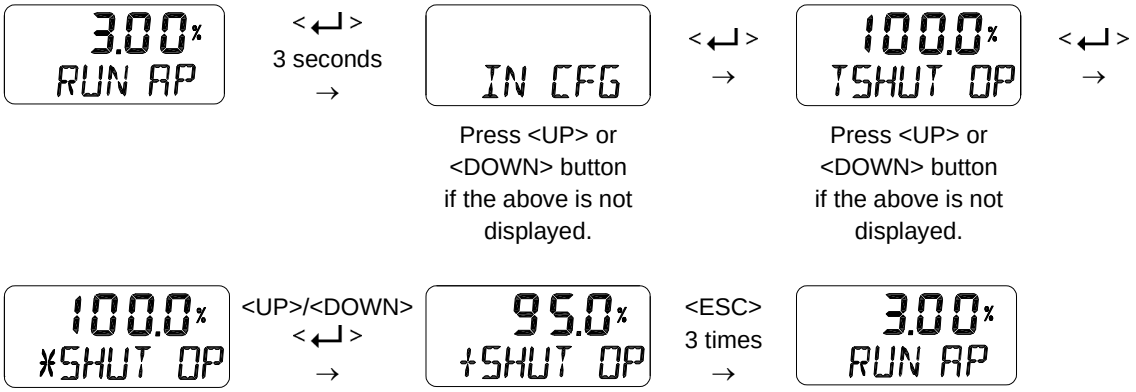




※ This function is activated by saving the Valve Flow Characterization Curves (CHAR) of above Section 7.9.5 as “U21”.

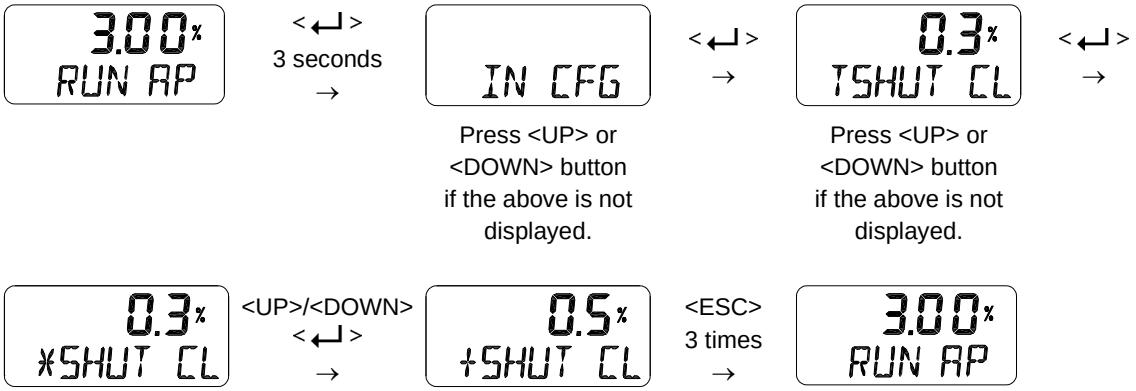
7.9.8 Tight Shut Open (TSHUT OP)

It is used to ensure that the valve is fully opened with a large force. When the input signal SP is greater than the value set in the TSHUT OP, all available force is applied to OUT 1 port to tightly open the valve. If the input current of 4 mA is 0 % of valve position and 20 mA is 100 % of valve position, and the Tight Shut Open value is set to any position less than 100 % (e.g. 95 %), then the valve stroke will be 100 % immediately when the input signal is over the set value (e.g. 95 %). A full supply pressure applied to the actuator via the OUT1 port prevents leakage of the valve by shutting the valve tightly. However, when the value is set to 100 %, Tight Shut Open function doesn't work.

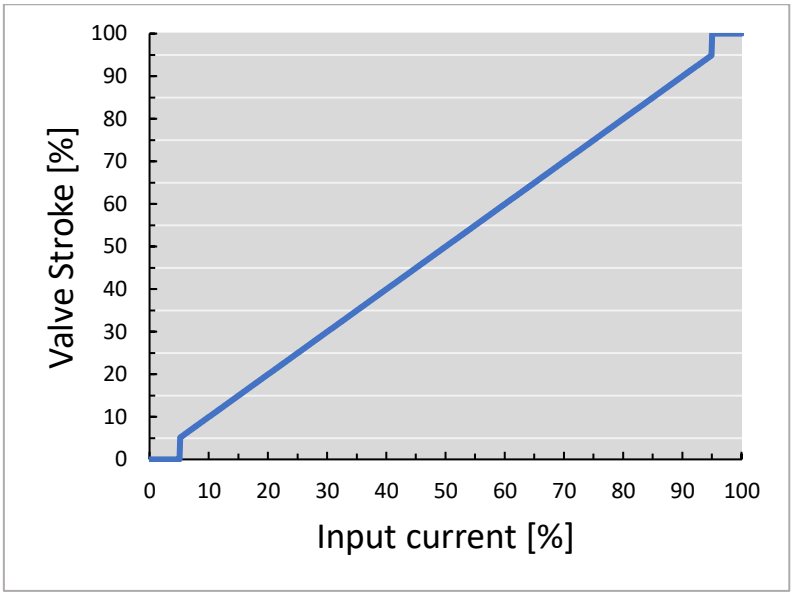


7.9.9 Tight Shut Close (TSHUT CL)

It is used to ensure that the valve is fully closed with a large force. When the input signal SP is smaller than the value set in the TSHUT CL, air pressure is vented through OUT 1 port to tightly close the valve. If the input current of 4 mA is 0 % of valve position and 20 mA is 100 % of valve position, and the Tight Shut Close value is set to any position larger than 0 % (e.g. 5 %), then the valve stroke will be 0 % immediately when the input signal goes below the set value (e.g. 5 %). The air venting from the actuator via the OUT1 port prevents leakage of the valve by shutting the valve tightly. However, when the value is set to 0 %, Tight Shut Close function doesn't work.



The following graph shows the operation of the valve stroke when the input signal corresponding to Tight Shut Open or Tight Shut Close is applied to the device.



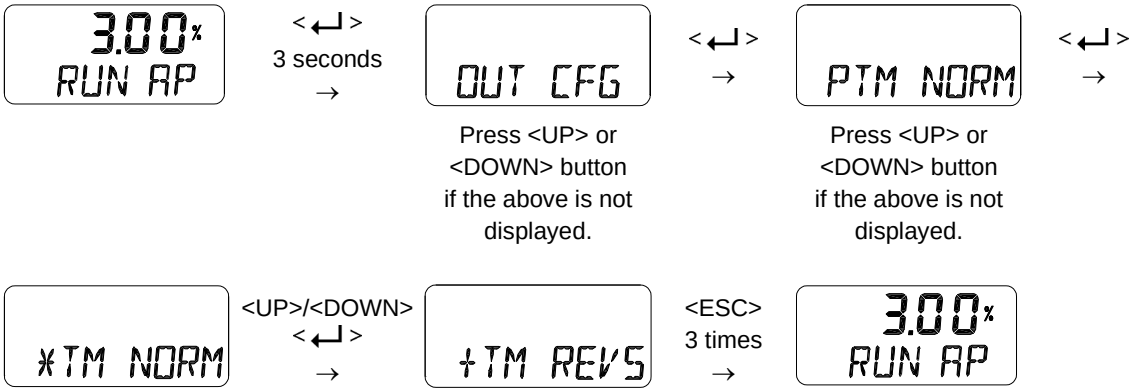
7.10 Output Configuration (OUT CFG)

Followings are the values changeable at the Output Configuration Mode.

1) Position Transmitter Direction (PTM NORM / REVS)
2) Position Transmitter Zero / End (PTM ZERO / ENd)
3) Back Calculation (bACKCAL oFF / on)

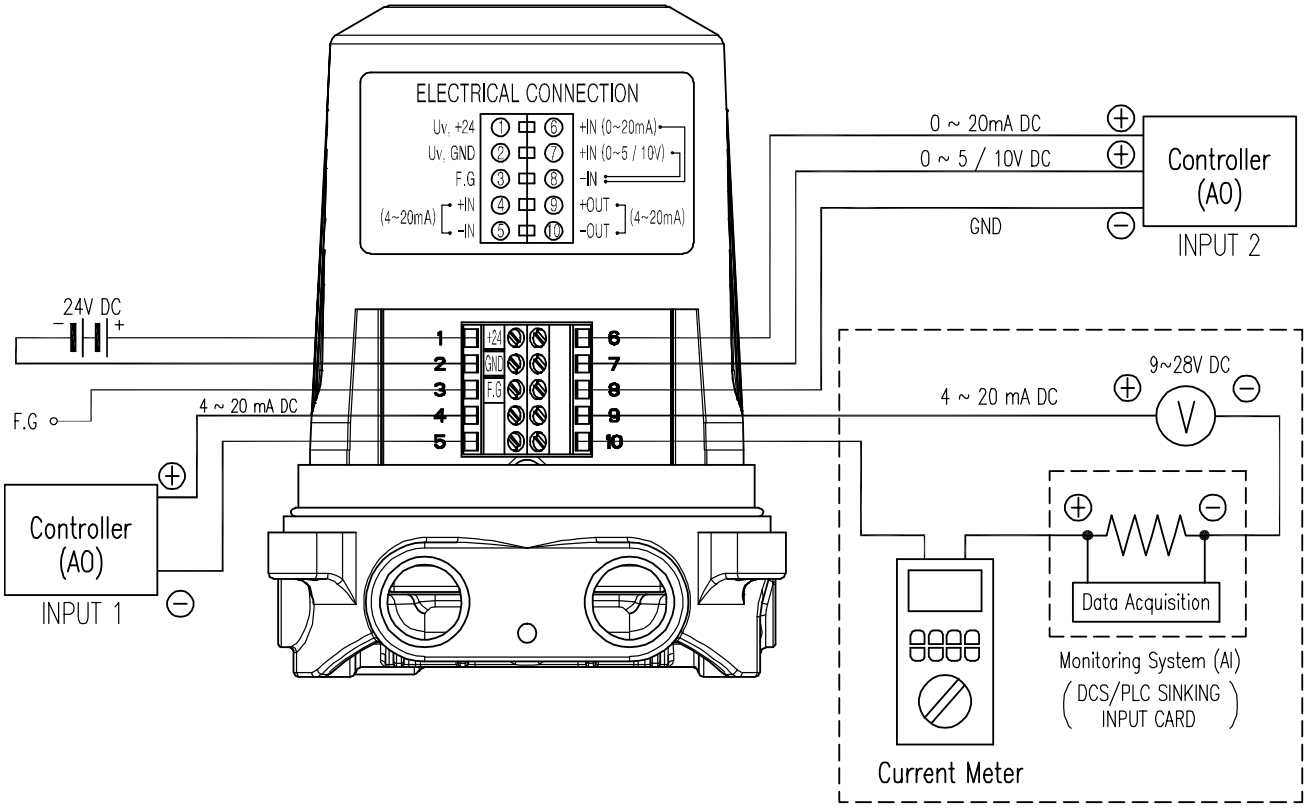
7.10.1 Position Transmitter Direction (PTM NORM / REVS)

The analog feedback signal from the positioner can be changed to normal (NORM) or reverse (REVS), which means they are the same or reversed direction as the actual position.



7.10.2 Position Transmitter Zero / End (PTM ZERO / ENd)

ZERO adjusts the zero point of the position transmitter (4mA feedback), and ENd adjusts the end point of the transmitter (20 mA feedback). This is used when the analog output signal needs to be feedbacked differently than the actual position of the valve, or to be adjusted a little. A measuring instrument such as an ampere meter is needed to view the analog output signal, and it should be connected as shown below.



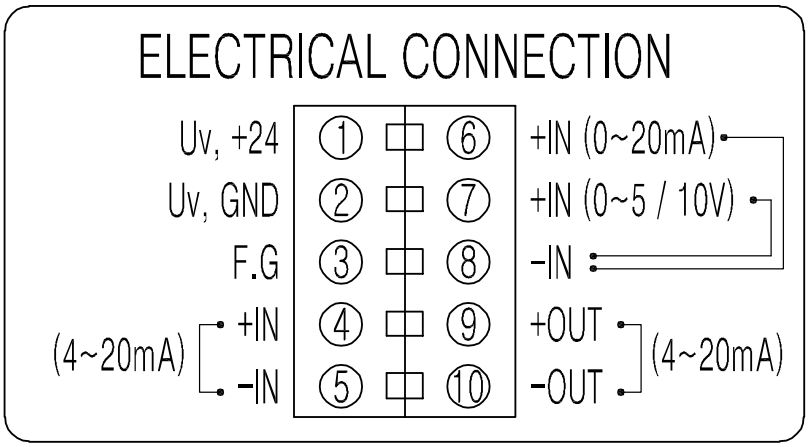
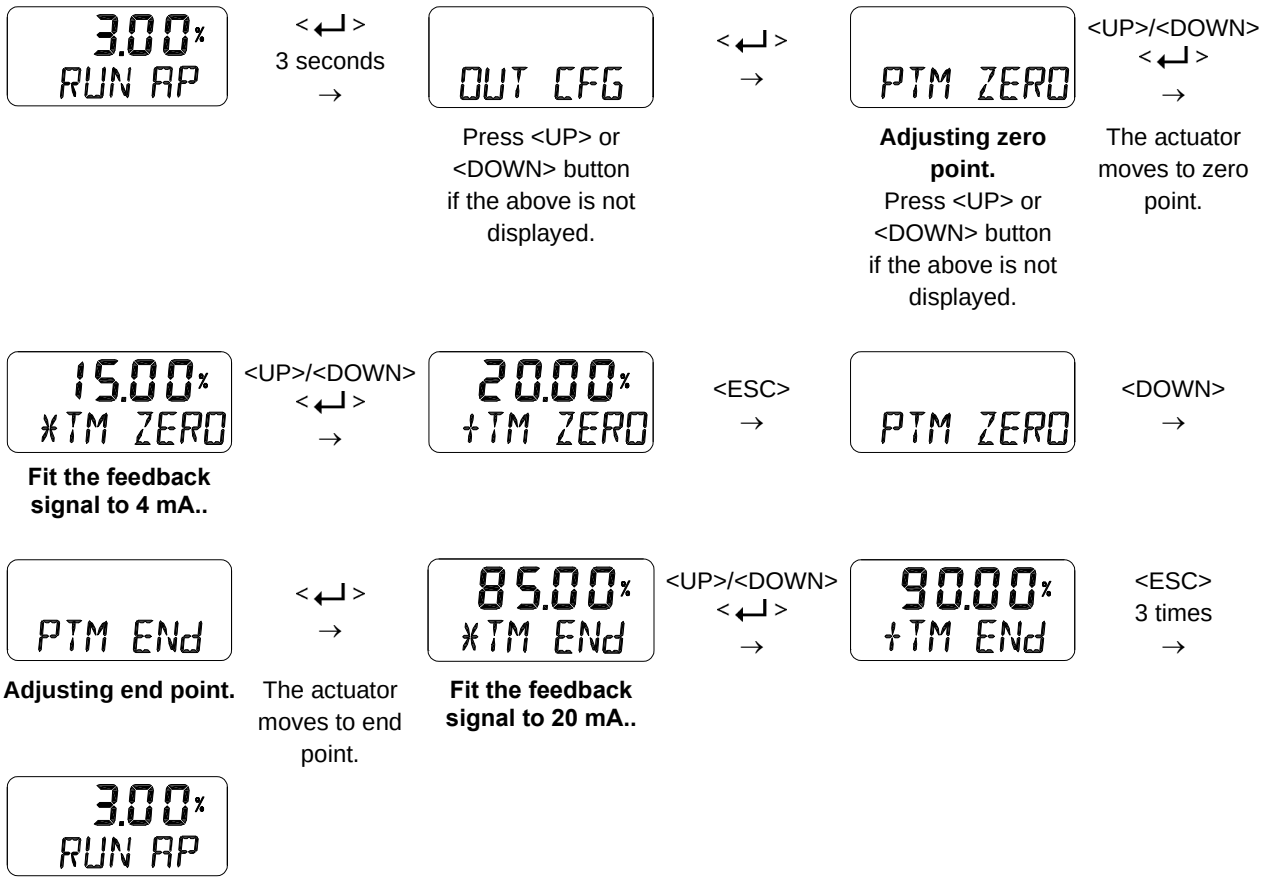
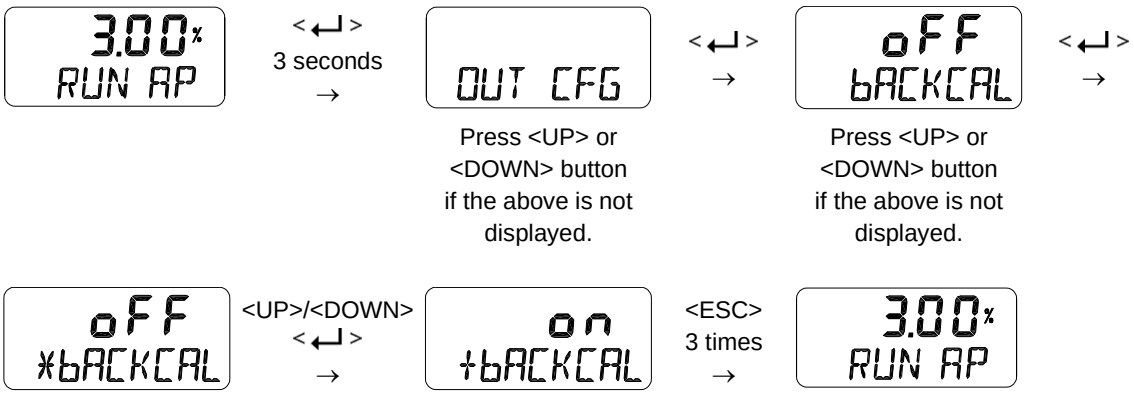


Fig. 7-2: Setting transmitter



7.10.3 Back Calculation (bACKCAL oFF / on)

This function recalculates the output "RUN AP" value changed by the flow characteristics setting mode to display it linearly proportional to actual input current. For example, if the flow characteristic mode is set from "LIN" to "EQ", when an input current value of 8 mA (25 %) is applied, the target position is changed to 6.25 % and "RUN AP" is displayed as 6.25 % after the move. If you change the bACKCAL from OFF to ON, the "RUN AP" is displayed as 25 %.



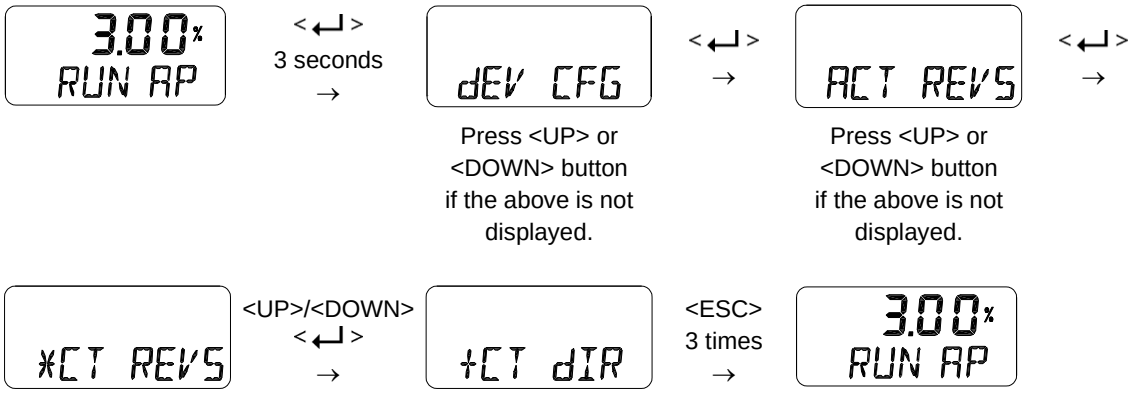
7.11 Device Configuration (dEV CFG)

Followings are the values changeable at the dEV CFG Mode.

1) Action Setting (ACT REVS / dIR)
2) Lock of Parameters (Write Protect, W UNLOCK / LOCK)
3) Actual Position View Mode (View Mode, VI NORM / dIZ / REVS)
4) Factory Reset (dEFAULT oFF / on)
5) Positioner Self-Test (SELFTEST)

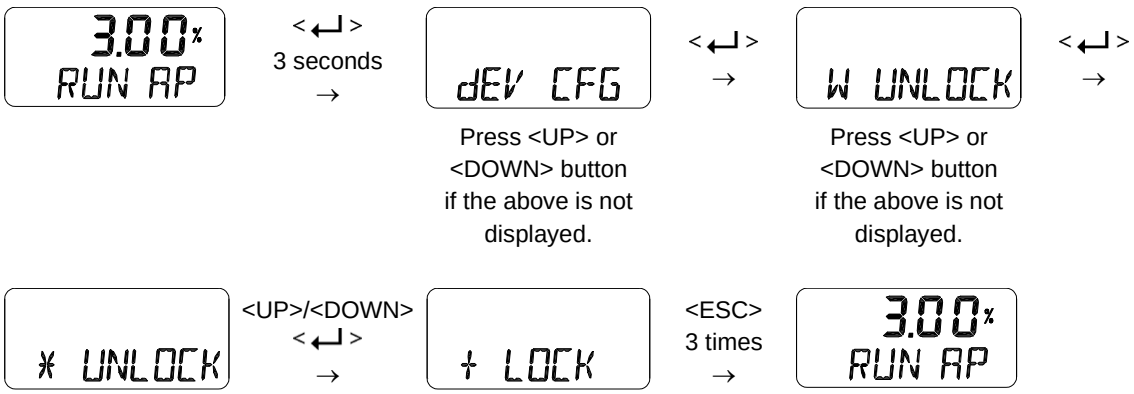
7.11.1 Action Setting (ACT)

Reverse Action (REVS) or Direct Action (dIR) are automatically set by performing “AUTO 2” within the Auto Calibration function. However, this function is used when the user requires to change ACT REVS or ACT dIR to other action. Changing the action from Reverse Action (REVS) to Direct Action (dIR) or Direct Action (dIR) to Reverse Action (REVS) will also change the Signal Direction (SIG), Position Transmitter Direction (PTM) and View Mode (VI).



7.11.2 Lock of Parameters (Write Protect, W UNLOCK / LOCK)

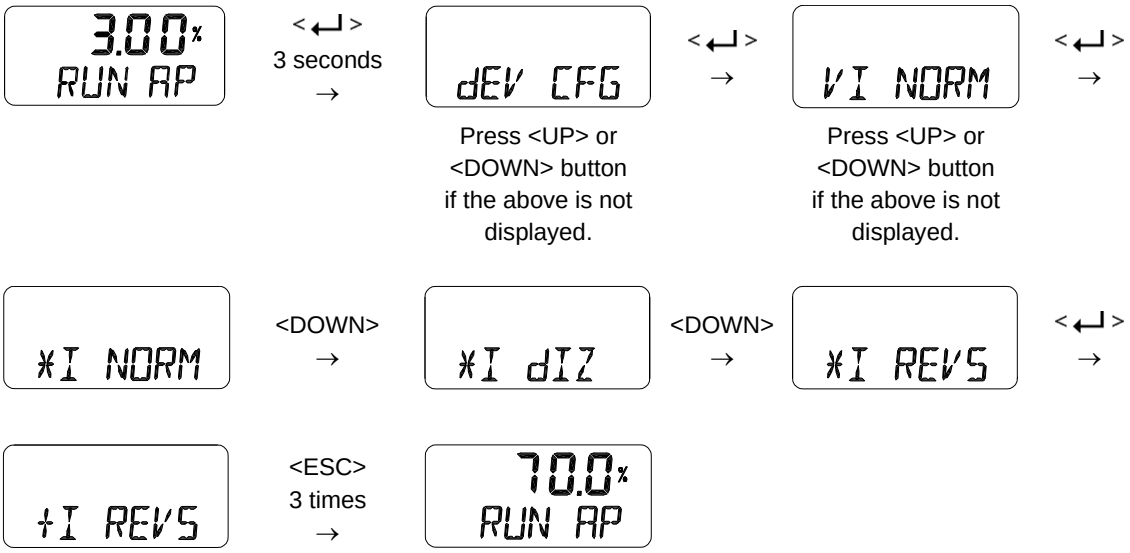
This function is used to set (LOCK) or disable (UNLOCK) the lock for the parameters. Used to prevent the stored parameters from being changed.



7.11.3 Actual Position View Mode (View Mode, VI NORM / dIZ / REVS)

This function is used to set the "RUN AP" value on the LCD to be displayed as direct (NORM) or raw data (dIZ) or reversely (REVS) as the actual position of the valve.

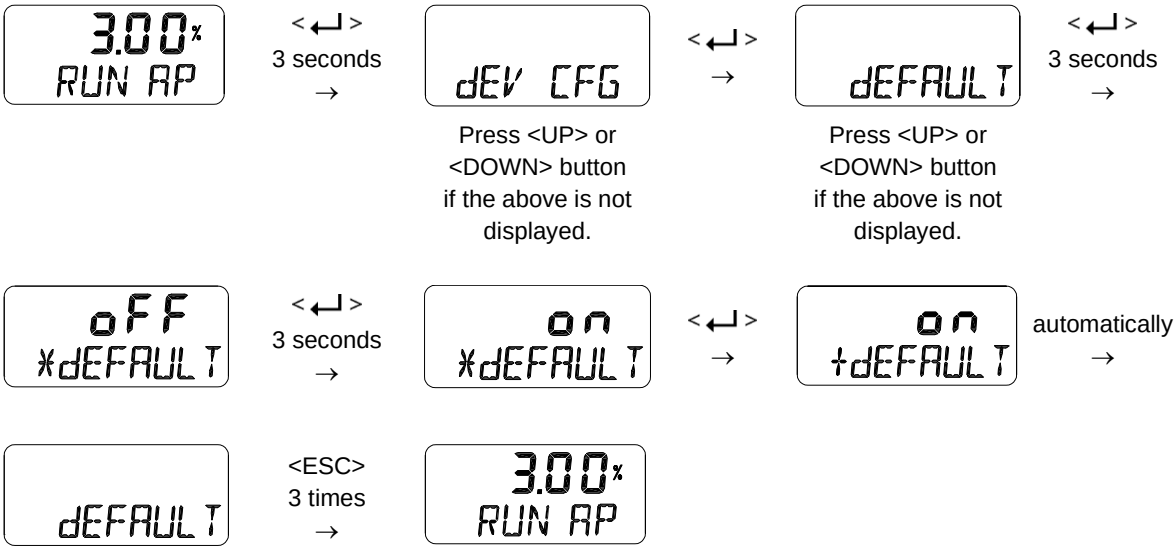
※ Raw Data (dIZ) : Pure digital value of position of sensor position as unprocessed data



7.11.4 Factory Reset (dEFAULT oFF / on)

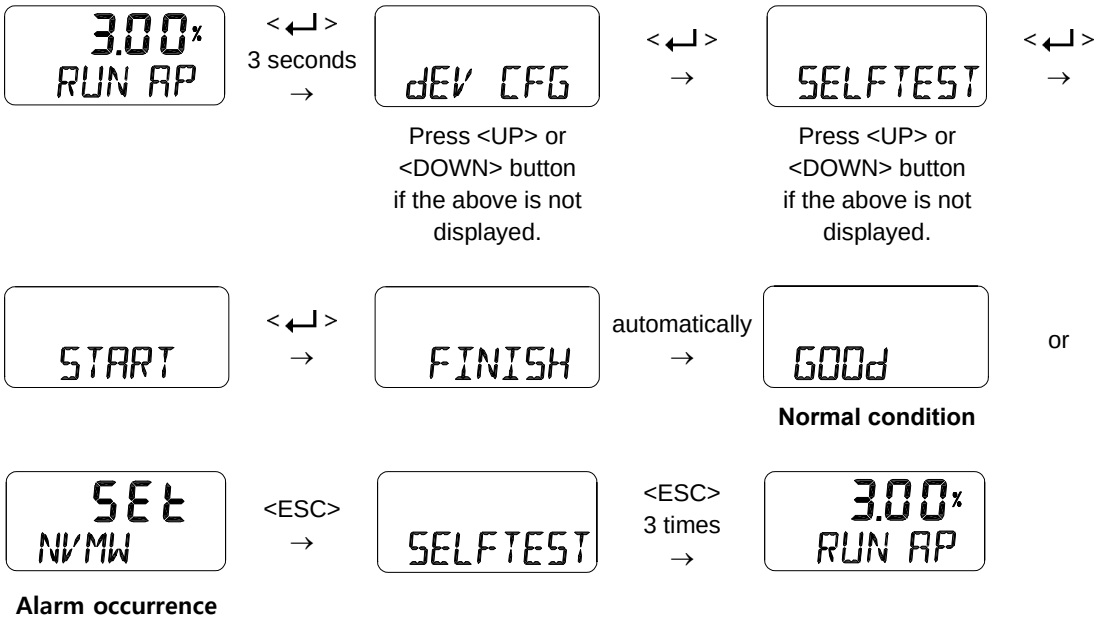
This function initializes all parameters stored in the positioner to initial factory setting. In the dEFAULT mode, pressing the Enter button for approximately 3 seconds enables ON/OFF setting mode and then setting it to ON resets all parameters.

Pay attention when using this mode as all the parameter values will be changed to the factory settings.



7.11.5 Positioner Self-Test (SELFTEST)

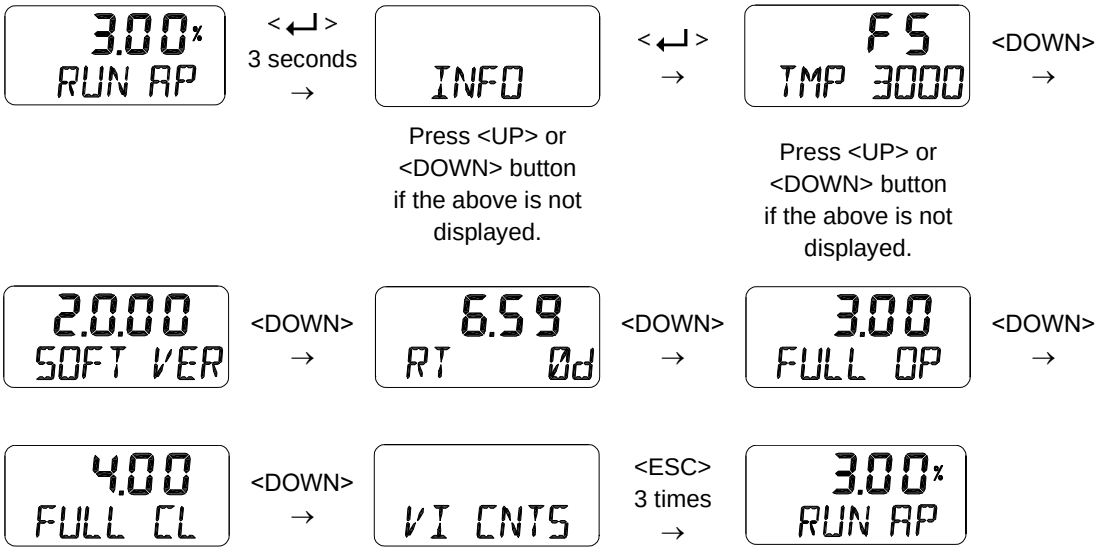
This function is used to diagnose the operation of the memory (RAM or NVM) inside the positioner. If no error is found during SELFTEST, the SELFTEST menu is displayed after FINISH is displayed, and if abnormalities are detected, the message "Set" is displayed.



Alarm occurrence	Alarm name	Content and action
SEt NVMW	Non-Critical NVM Defect	A problem has occurred with the nonvolatile memory of the motherboard. Please execute AUTO2 function after initializing the product using the Default function (refer to Section 7.11.4). If occurs again after AUTO2 operation, contact a seller to replace the circuit board.

7.12 Position information (INFO)

The diverse Positioner information is provided in the INFO Mode.



LCD display	Description
TMP 3000	Upper “FS” indicates Fail Safe and “FF” indicates Fail Freeze. Lower is positioner model name TMP-3000.
2.0.00 **SOFT VER** **/** **2020DC31**	Software Version [SOFT VER] “2.0.00” (New type: 2. X. XX) Software Input date : “2020 December(DC) 31” (January JA, February FB, March MR, April AR, May MY, June JN, July JL, August AG, September SP, October OT, November NV, December DC) At SOFT VER status if < ↵ > button is pressed, the date will be displayed and then if < ↵ > button is pressed again, SOFT VER is displayed again.
4.18 **RT 0d**	Run Time [RT] Total usage time of the product Upper “4.18” indicates 4 hours and 18 minutes. Lower “0d” indicates days used. Interval to store time is one hour.
3.12 **FULL OP**	Upward Full Stroke Time [FULL OP] This value is stored automatically after executing AUTO 2 calibration, and indicates the time in seconds it takes for the valve to fully open from fully closed.
2.97 **FULL CL**	Downward Full Stroke Time [FULL CL] This value is stored automatically after executing AUTO 2 calibration, and indicates the time in seconds it takes for the valve to fully closed from fully open.
VI CNTS	It is used to view the accumulated data information for valve movement up to now. → Refer to 7.12.1 View Monitoring Counts, VI CNTS.

7.12.1 View Monitoring Counts (VI CNTS)

Counter Name	Abbreviation [unit]	Function
Cycle Count	CYCL CNT	The accumulated number of times the valve has changed its direction. It is accumulated only when the valve change direction while Cycle Count Deadband is exceeded.
Travel Accumulator	TVL ACUM [%]	The total valve travel accumulated whenever Travel Accumulator Deadband is exceeded.
Fully Open Count	FOP CNT	The accumulated number of times the valve has been fully open.
Fully Closed Count	FCL CNT	The accumulated number of times the valve has been fully closed.
Over Input Count	OVER IN	It is cumulated the number of times when a current of 23 mA /11 V or more occurs at the demand input terminal.
Solenoid Up Count	SOL UP	The number accumulated of solenoid movements in the direction the valve opens.
Solenoid Down Count	SOL DOWN	The number accumulated of solenoid movements in the direction the valve closes.

8 Error Code

If there is something wrong with the product during Auto calibration or operating, error code displays on LCD.

When it occurs, the positioner may not be controlled or malfunction or accuracy may become worse.

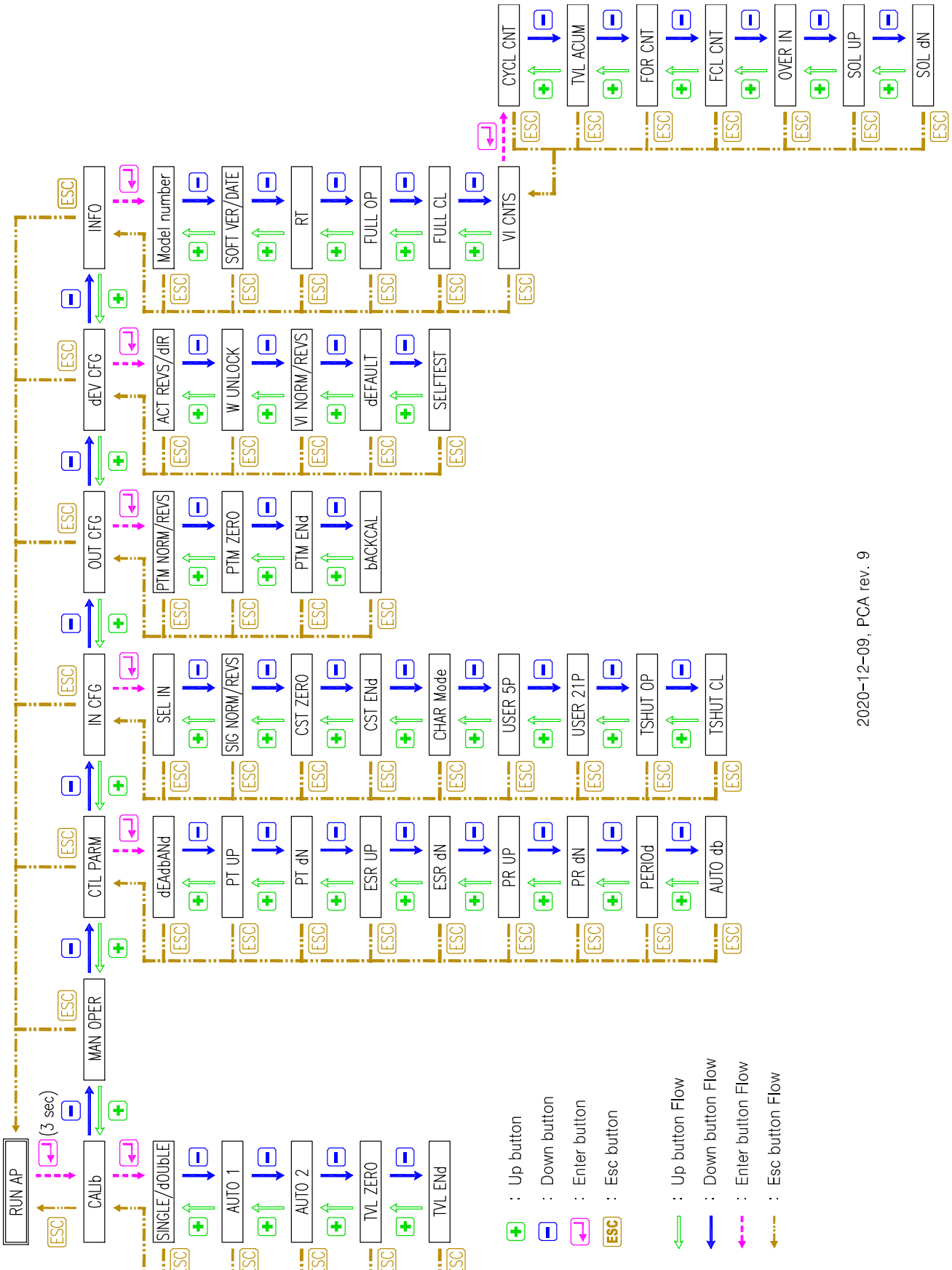
8.1 Error Code during Auto calibration

Error Code	Contents and cause of error	Measure
CHK AIR	➢ Valve does not move even though the positioner gives Full Open signal during auto calibration. ➢ When an error occurs, Auto Calibration stops and this message is immediately displayed on the LCD window.	➢ Make sure air pressure is being supplied to the positioner properly.
RNG ERR	➢ If the operation length of the feedback lever is too small due to mounting failure. ➢ When an error occurs, Auto Calibration stops and this message is immediately displayed on the LCD window.	➢ Check that the feedback shaft is working smoothly.
CHK LEAK	➢ If the valve continues to move even with the stop signal applied	➢ Check is there is a leakage in piping area.
ERR STRK	➢ When the stroke time of the whole section exceeds 5 minutes in auto-calibration	➢ Make sure air pressure is being supplied to the positioner properly. ➢ Make sure that the valve and actuator have normal friction.

8.2 Error Code during operating

Error Code	Contents and cause of error	Measure
OVER CUR	➢ If 23 mA or above current is detected on the demand input terminal, LCD texts will blink and an error message is displayed ➢ Button operation cannot be performed while error message has been displayed. ➢ This code has been applied since Firmware version 1.6.03.	➢ Check the connection status of the demand input (wrong wiring, overcurrent input etc.).
OVER VLT	➢ If voltage higher than 11 V is detected on the demand input terminal, LCD texts will blink and an error message is displayed. ➢ Button operation cannot be performed while error message has been displayed. ➢ This code has been applied since Firmware version 1.6.03.	➢ Check the connection status of the demand input (wrong wiring, overcurrent input etc.)

9 Main Software Map



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