



Operation Manual

PRODUCT NAME

Electro-Pneumatic Regulator

MODEL / Series / Product Number

ITV1^{***}/2^{***}/3^{***} Series

SMC Corporation

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E-P Regulator Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “**Caution**,” “**Warning**” or “**Danger**.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)^{*)}, and other safety regulations.

*) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
etc.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.



Warning

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Caution

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.



E-P Regulator Safety Instructions

Caution

We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing business.

Use in non-manufacturing business is not covered.

Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty

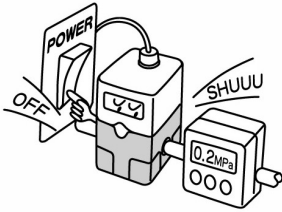
Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

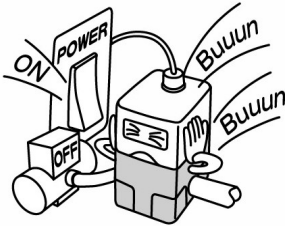
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Handling precautions

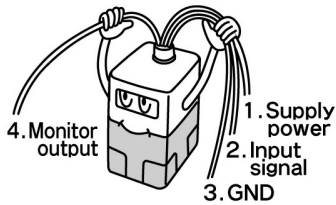
⚠ Caution



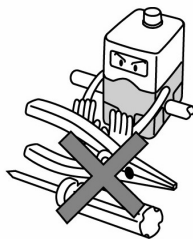
If power to this product is cut off due to a power failure, etc. when it is in a controlled state, residual pressure will be retained temporarily.
Handle carefully when operating with output pressure released to the atmosphere, as air will continue to flow out.



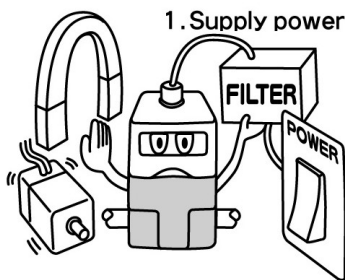
If supply pressure to this product is interrupted shut off, while the power is still on, the internal solenoid valve will continue to operate and a humming noise may be generated.
Since the life of the product may be shortened, shut off the power supply also when supply pressure is interrupted shut off.



The optional cable connector is a 4 wire type.
When the monitor output (analogue output or switch output) is not being used, prevent it from touching the other wires as a malfunction could occur.

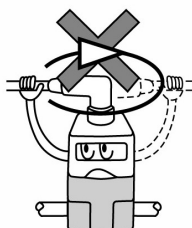


This product is adjusted for each specification at the time of shipment from the factory. Avoid careless disassembly or removal of parts, as this can lead to malfunction.



Take the following steps to avoid malfunction due to noise.

1. Install a line filter etc. to the AC power line to reduce / eliminate power supply noise.
2. Avoid malfunction due to noise by installing this product and its wiring away from strong electric fields, such as those of motors and power line, etc.
3. Be sure to implement protective measures against load surge for induction loads (solenoid valves, relays etc.).
4. Turn off the power supply before installing or removing the connector.



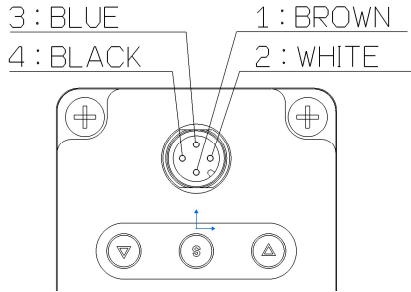
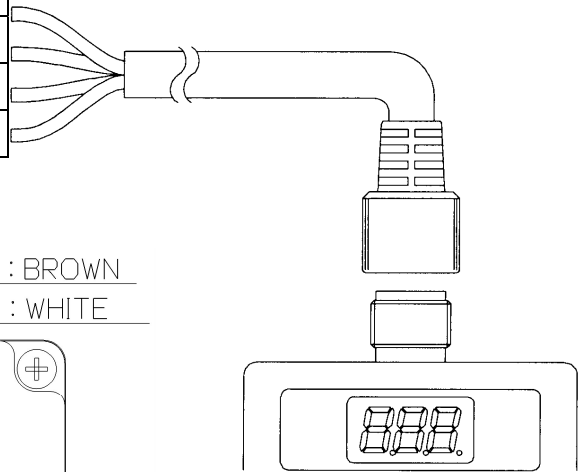
Please note that the right angled cable connector does not rotate and is limited to only one entry direction.

Wiring method [Power supply and input signal]

⚠ Caution

1. Proceed carefully, as incorrect wiring can cause damage.
2. Use DC power supply with sufficient capacity and a low ripple (1% or less).
3. Turn off the power supply to remove and insert the connector.
4. Never turn the right angled type connector as it is not designed to turn.

1	Brown	Power supply
2	White	Input signal
3	Blue	GND (COMMON)
4	Black	Monitor output



Note) The wire color is for when optional cable is used.

Wiring diagram (Power supply and input signal)

Current/Voltage type (ITV****-0, ITV****-1, ITV****-2, ITV****-3)

Power supply	24VDC	(ITV****-*)
	12 to 15VDC	(ITV****1-*)
Input signal	4 to 20mADC	(ITV****-0)
	0 to 20mADC	(ITV****-1)
	0 to 5VDC	(ITV****-2)
	0 to 10VDC	(ITV****-3)

Preset input type (ITV****-40)

Power supply	24VDC	(ITV****0-40)
	12 to 15VDC	(ITV****1-40)

Fig.1 Relation between preset pressure and switch

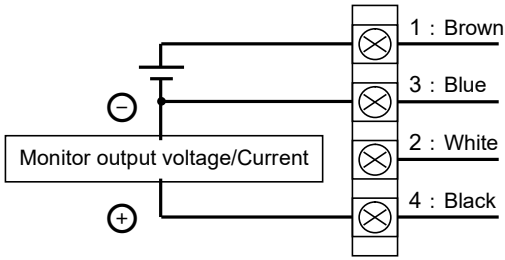
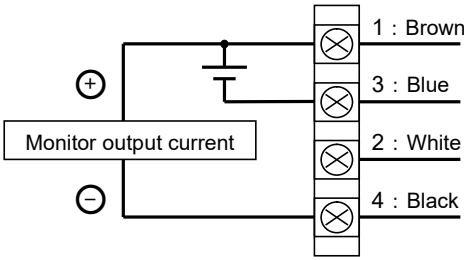
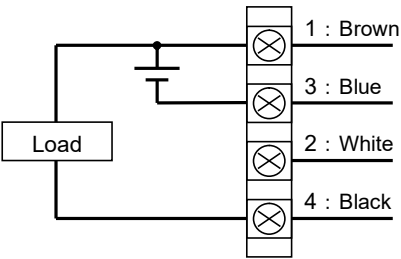
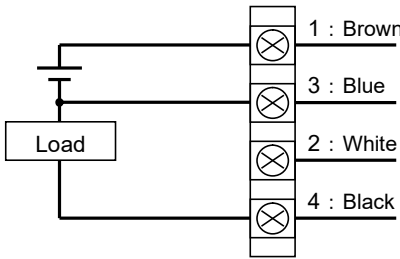
Preset Pressure	P 1	P 2	P 3	P 4
S1	OFF	ON	OFF	ON
S2	OFF	OFF	ON	ON

Wiring method [Monitor output]

⚠ Caution

When the monitor output is not being used, prevent it from touching the other wires as this can cause a malfunction.

Wiring diagram (Monitor output)

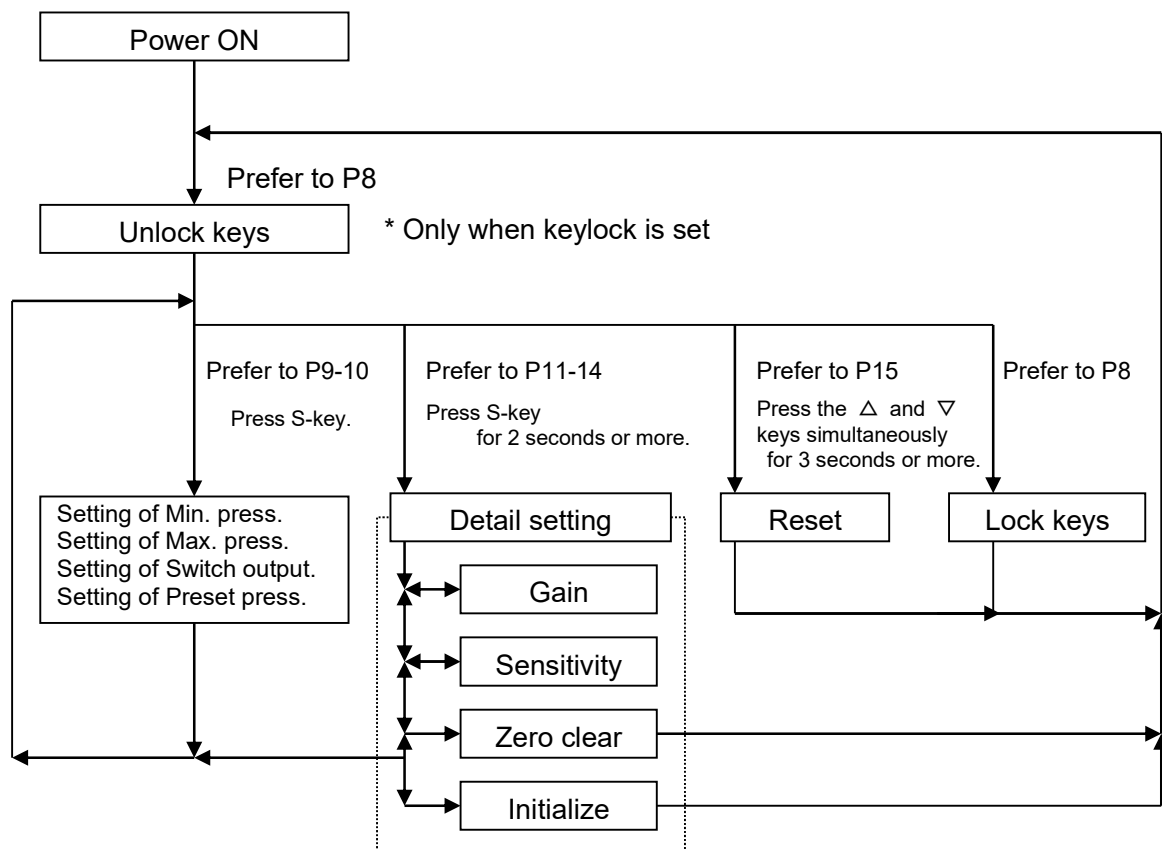
<p>Analogue output·Voltage type (ITV****_*1) Analogue output·Current (Source) type (ITV****_*5)</p>	<p>Analogue output·Current (sink) type (ITV****_*4)</p>
 <p>Voltage type Only use equipment with a minimum load impedance of 100kΩ.</p> <p>Current (Source) type Please use the load impedance of the instrument to be connected within the following range.</p> <p>50~600Ω (ITV****_0 24VDC) 50~300Ω (ITV****_1 12 to 15VDC)</p>	 <p>Current (sink) type Only use equipment with a maximum load impedance of 250Ω.</p>
<p>Switch output·NPN type (ITV****_*2)</p>	<p>Switch output·PNP type (ITV****_*3)</p>
 <p>When a current of approx.150mADC or more is applied, the over current circuit is archived, "Er.5" is displayed and the operation stops. Please use with installing the load that the output current becomes to 80mADC or less.</p>	 <p>When a current of approx.150mADC or more is applied, the over current circuit is archived, "Er.5" is displayed and the operation stops. Please use with installing the load that the output current becomes to 80mADC or less.</p>

Setting method

⚠ Caution

- (1) If the incorrect key is pressed or incorrect information is displayed during setting, power must be shut off and the procedure started again.
- (2) It is recommended that the settings are changed without supply pressure.
The product operates immediately maximum and minimum pressures are set and the S-key is pressed.
- (3) Even if no input signal is input, when air is supplied to the inlet, the pressure set to "Min. pressure" will be output to the secondary side, so be careful.
- (4) Output pressure from this product and state of operation are changed by changing of each setting and function.
Each setting and function should be operated by trained and experienced operator.

Flow of the setting



(Note1) Please refer to each content about operation method.

(Note2) The function of the setting of preset pressure is preset input type (ITV****-40) only.

(Note3) The function of the setting of switch output is switch output type (ITV****-*2 or -*3) only.

LED display

The range of the LED pressure display is different according to the pressure range and the unit of the display.

Unit	ITV**1*	ITV**3*	ITV**5*	ITV209*
MPa	。020~.120	。100~.600	。180~.A80	-
Kgf/cm ²	0。20~.120	1。00~6.00	1。80~A.80	-
bar	0。20~.120	1。00~6.00	1。80~A.80	-
PSI	3。0~18.0	14。0~84.0	-26~156	-
kPa	-20~120	-100~600	-180~A80	16~-96

(note1) The mark "。" is blinking the decimal point, and it is shown a minus.

(note2) When the digit overflows, the following of "9" are substituted by "A".

(Ex.) A00 [kPa] is displayed next to 999 [kPa], meaning 1000 [kPa].

(note3) When the display exceeds the lower bound value, "LLL" is displayed.

(note4) When the display exceeds the upper bound value, "HHH" is displayed.

(note5) Vacuum specification is ITV209* only.

Key locking function

Caution

The keys are locked after turning the power on and cannot be operated.

Unlocking the keys

No	Key operation	LED Display
(1)		(current) pressure is displayed
(2)	Press ▽ key for 2 seconds or more.	L O C is displayed
(3)		L O C flashes on the display
(4)	Press S-key	
(5)		u n l is displayed for approx. 1 second
(6)	Key lock is released	(current) pressure is displayed

* (4) Press △ key to cancel.

Locking the keys

No	Key operation	LED Display
(1)		(current) pressure is displayed
(2)	Press △ key for 2 seconds or more.	u n l is displayed
(3)		u n l flashes on the display
(4)	Press S-key	
(5)		L O C is displayed for approx. 1 second
(6)	Keys are locked	(current) pressure is displayed

* (4) Press ▽ key to cancel.

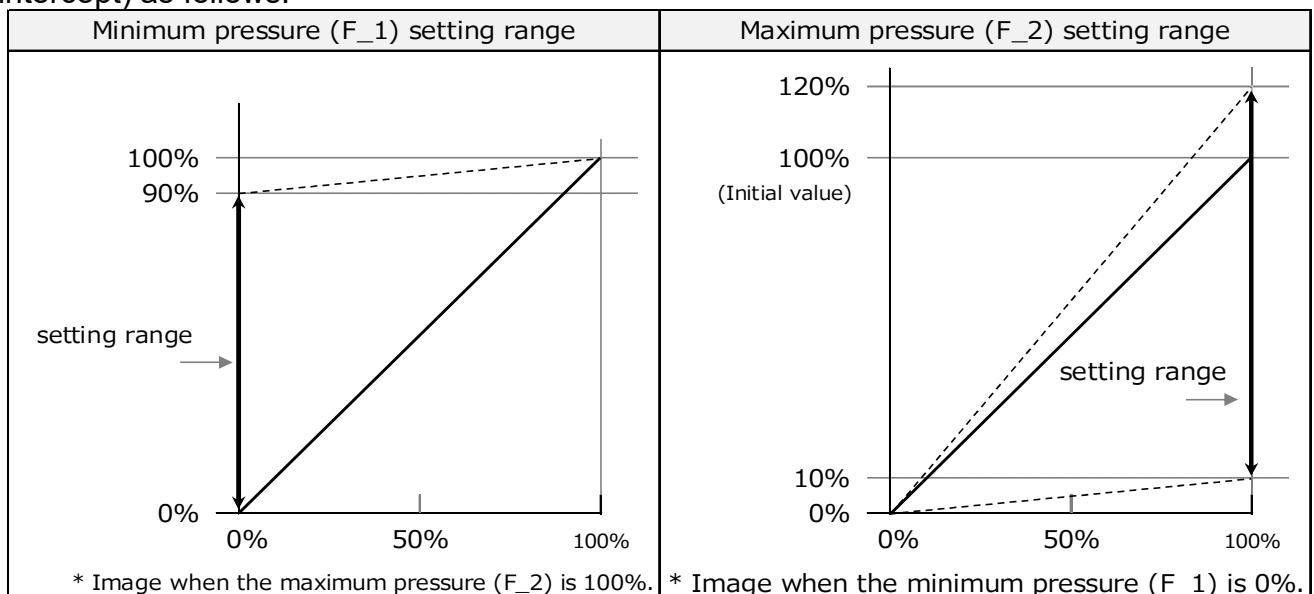
Setting of Min. pressure, Max. pressure and switch output [current/voltage input type only]

It is possible to change the minimum pressure (hereinafter referred to as "F_1") and the maximum pressure (hereinafter referred to as "F_2").

In normal use, use the product in the condition when shipped, it is not always necessary to adjust the setting of minimum pressure, and the setting of maximum pressure.

No	Key operation	LED Display
(1)	Unlock keys (refer to P8).	
(2)	Press S-key	
(3)	Set the minimum pressure by using the Δ and ∇ keys.	$F_1 \leftrightarrow .0000$ (displayed alternately) *Adjusting range: Refer to note 1 to 6
(4)	Press S-key	
(5)	Set the maximum pressure by using the Δ and ∇ keys.	$F_2 \leftrightarrow .9000$ (displayed alternately) *Adjusting range: Refer to note 1 to 6
(6)	Go to No. (11) for monitor output: analogue output (voltage and current) type.	
(7)	Press S-key	
(8)	Set the "P_1" by using the Δ and ∇ keys (refer to P10).	$P_1 \leftrightarrow .0000$ (displayed alternately)
(9)	Press S-key	
(10)	Set the "P_2" by using the Δ and ∇ keys (refer to P10).	$P_2 \leftrightarrow .9000$ (displayed alternately)
(11)	Press S-key	Return to (current) pressure display.
(12)	Lock keys (refer to P8).	

You can change the relationship between the signal and the output pressure (slope and intercept) as follows.



(Note 1) F_1 is adjustable in a range from 0% to 90% of the rated value. (Default value: 0%)

(Note 2) The pressure of less than 0% is not output, even if F_1 is adjusted to less than 0%.

(Note 3) F_2 is adjustable in a range from 10 to 120% of the rated value. (Default value: 0%)

(Note 4) Do not input the signal as like output the pressure of more than 100%.

Please use in a range of rating.

(Note 5) The difference between F_1 and F_2 is adjustable in a range of 10% of the rated value.

(Note 6) The adjustment like making the relation of $F_1 > F_2$ is not available.

(Note 7) Please enter pressure values in F_1/F_2 and P_1/P_2. (In case of 0.9MPa $.9000$)

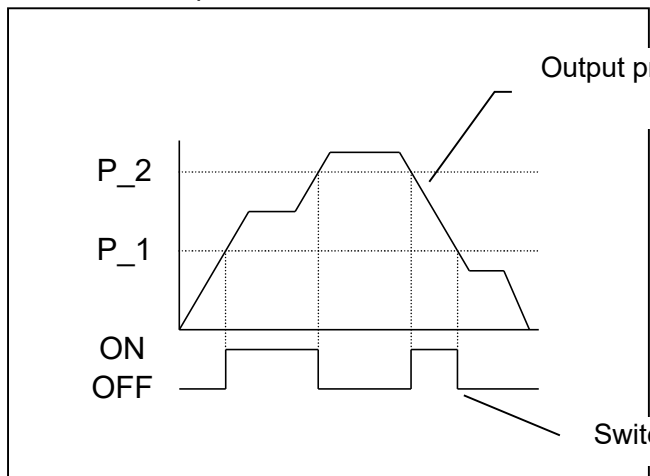
Output mode of switch output

The following three types of operations are possible by setting P_1 and P_2.

This function is available only for monitor output : switch output type (ITV****-2, ITV****-3).

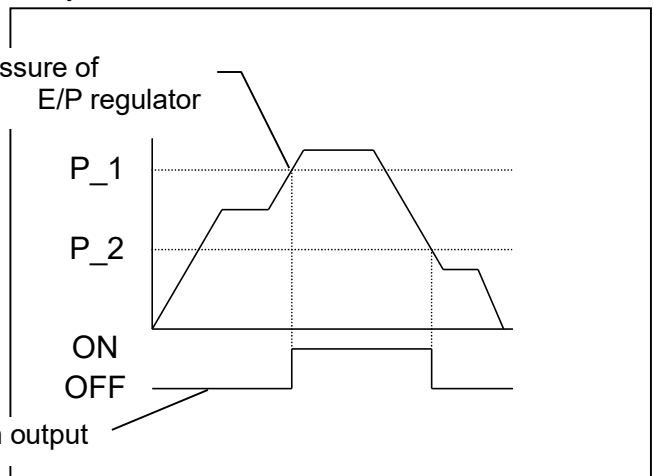
■P_1 < P_2:

Window comparator mode

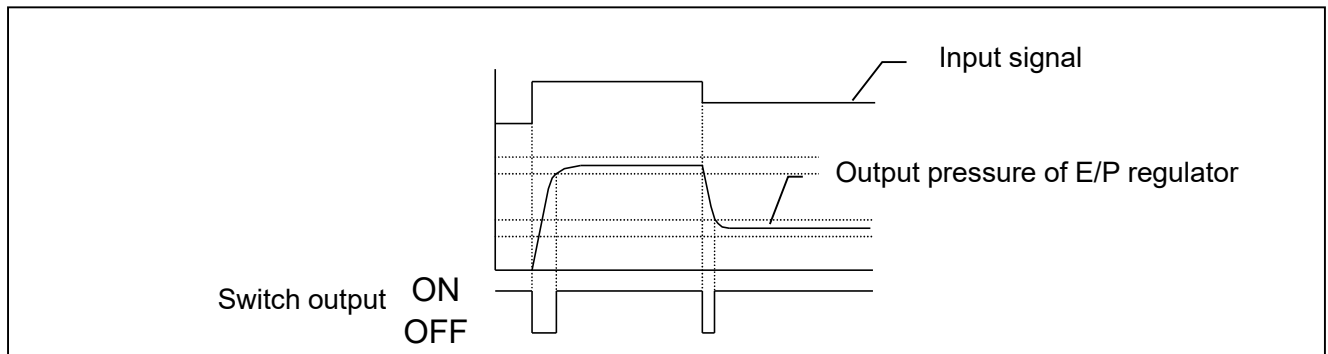


■P_1 ≥ P_2:

Hysteresis mode



■P_1 = P_2 = 0: Out of range mode (The switch output turns on when set pressure is achieved.)



Setting of preset pressure [Preset input type only]

No	Key operation	LED Display
(1)	Unlock keys (refer to P8).	
(2)	Press S-key	
(3)	Set the "P_1" by using the Δ and ∇ keys.	$P_1 \leftrightarrow .0000$ (displayed alternately)
(4)	Press S-key	
(5)	Set the "P_2" by using the Δ and ∇ keys.	$P_2 \leftrightarrow .0000$ (displayed alternately)
(6)	Press S-key	
(7)	Set the "P_3" by using the Δ and ∇ keys.	$P_3 \leftrightarrow .0000$ (displayed alternately)
(8)	Press S-key	
(9)	Set the "P_4" by using the Δ and ∇ keys.	$P_4 \leftrightarrow .0000$ (displayed alternately)
(10)	Press S-key	Return to (current) pressure display.
(11)	Lock keys (refer to P8).	

(Note1) P_1 to P_4 can be set in the range of 0% to 100%.

(Note2) Considering safety, we recommend setting 0 MPa as one of the preset pressures.

(Note3) Please enter pressure values for preset pressures P_1 to P_4. (In case of 0.9MPa $.900$)

Detail setting mode

No	Key operation and LED display
(1)	Unlock keys (refer to P8).
(2)	Press S-key for 2 seconds or more.
(3)	<pre> graph TD S1["F01 ↔ 0L.9"] -- "Δkey ↑" --> S2["F02 ↔ 5L.0"] S2 -- "Δkey ↓" --> S1 S2 -- "∇key ←" --> S3["F03 ↔ 0cL"] S3 -- "∇key →" --> S4["F99 ↔ in.1"] S4 -- "Δkey ↑" --> S1 </pre> <p>(displayed alternately) Press S-key To "Gain setting" (refer to P12)</p> <p>(displayed alternately) Press S-key To "Sensitivity setting" (refer to P13)</p> <p>(displayed alternately) Press S-key To "Zero clear" (refer to P13)</p> <p>(displayed alternately) Press S-key To "Initialize" (refer to P14)</p>
(4)	In state of (3), press S-key for 2seconds or more.
(5)	Return to (current) pressure display.
(6)	Lock keys (refer to P8).

Gain setting

The response time can be changed by tuning the gain.

If the over-shoot is large, decreasing the gain tends to improve it, but the responsiveness becomes slower.

Conversely, when the gain is increased, the response time tends to be faster, but stability will be lost, which may cause hunting (unstable pressure).

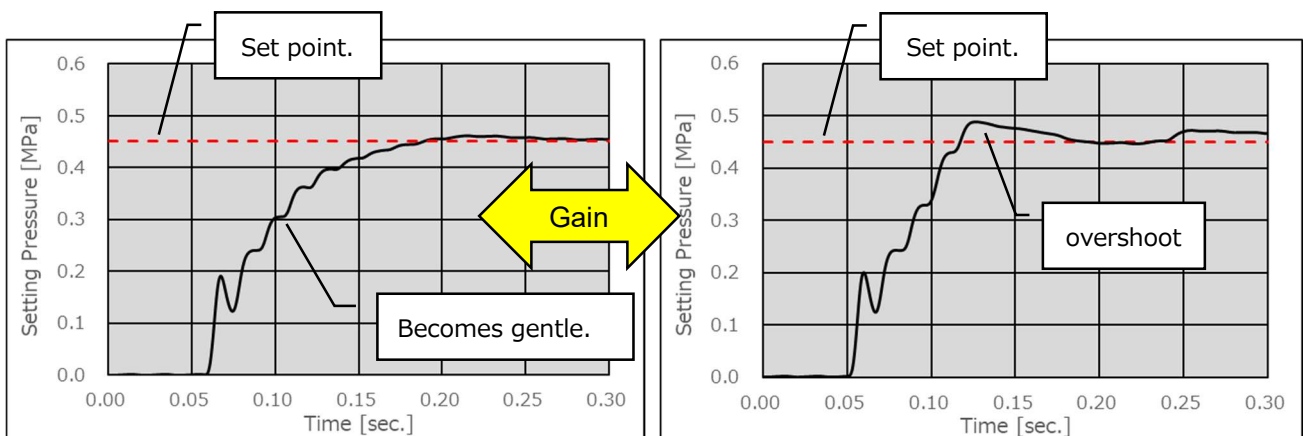
In normal use, use the product in the condition when shipped, it is not always necessary to adjust the gain.

No	Key operation	LED Display
(1)	Unlock keys (refer to P8).	
(2)	Press S-key for 2 seconds or more, then go to detail setting mode.	
(3)	To the "F01" by using the Δ and ∇ keys.	F01 \leftrightarrow 0L9 (displayed alternately)
(4)	Press S-key.	
(5)	Set the "Gain" by using the Δ and ∇ keys.	0L9 (Blink and change the rightest digit)
(6)	Press S-key.	F01 \leftrightarrow 0L9 (displayed alternately)
(7)	Press S-key for 2 seconds or more, then go out from detail setting mode. (Select the menu with Δ or ∇ keys, then jump to another item.)	
(8)	Lock keys (refer to P8).	

Relation between setting of gain and response time

Response	Slow											Quick
Setting of Gain	0L0	0L1	0L2	to	0L8	0L9	0LA	0Lb	0Lc	0Ld	0LE	0LF

* Indicates the initial value. 0L9



Sensitivity setting

Adjusting the sensitivity changes the pressure correction operation near the set pressure point. When the load capacity on the secondary side is large and hunting (unstable pressure) occurs, decreasing the sensitivity tends to improve the hunting. However, as the pressure correction is reduced, moderate pressure instability may occur.

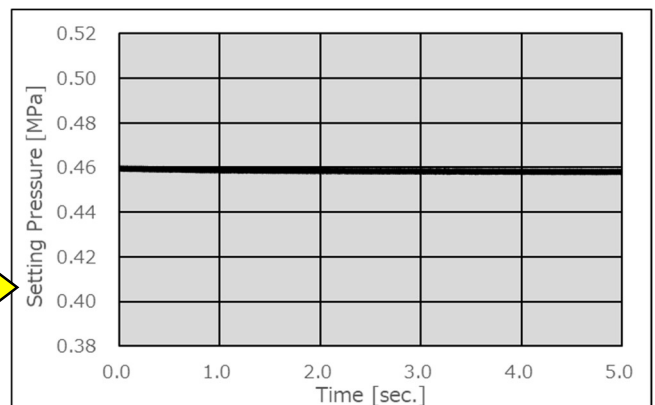
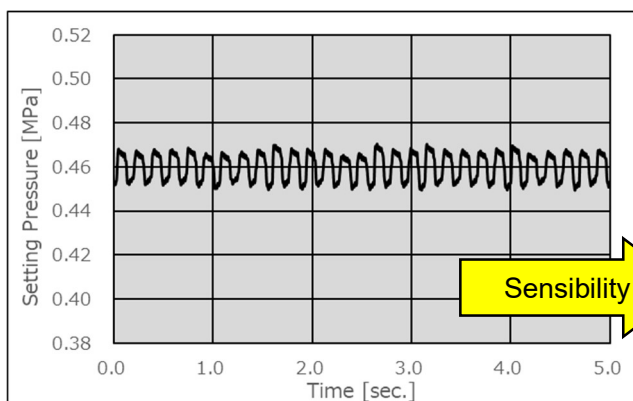
In normal use, use the product in the condition when shipped, it is not always necessary to adjust the sensitivity.

No	Key operation	LED Display
(1)	Unlock keys (refer to P8).	
(2)	Press S-key for 2 seconds or more, then go to detail setting mode.	
(3)	To the "F02" by using the Δ and ∇ keys.	F02 \leftrightarrow 5L0 (displayed alternately)
(4)	Press S-key.	
(5)	Set the "Sensitivity" by using the Δ and ∇ keys.	5L0 (Blink and change the rightest digit)
(6)	Press S-key.	F02 \leftrightarrow 5L0 (displayed alternately)
(7)	Press S-key for 2 seconds or more, then go out from detail setting mode. (Select the menu with Δ or ∇ keys, then jump to another item.)	
(8)	Lock keys (refer to P8).	

Relation between setting and sensitivity

Sensitivity	Sharp \leftarrow \rightarrow Dull							
Setting of sensitivity	5L-	5L-	5L0	5L1	5L2	5L3	5L4	5L5

* Indicates the initial value. 5L0



Zero clear

The display can be set to zero again by executing "zero clear".

When "zero clear" is executed with residual pressure in the secondary piping, the pressure is assumed to be zero. Please execute the operation of "zero clear" with the supply pressure is intercepted, and the piping of the second side removed.

No	Key operation	LED Display
(1)	Unlock keys (refer to P8).	
(2)	Press S-key for 2 seconds or more, then go to detail setting mode.	
(3)	To the "F03" by using the \triangle and ∇ keys.	F03 \leftrightarrow 0cL (Displayed alternately)
(4)	Press S-key.	0cL flashes on the display
(5)	Press \triangle and ∇ keys for 3 seconds or more. (Press S-key to (3))	0cL is displayed
(6)	"Zero clear" is executed, after 3 seconds. (Release keys till less than 3 seconds to (4))	cLr is displayed for approx. 1 second.
(7)	Returned to the condition before power was supplied (keys are locked).	

(note) The adjustable range is within $\pm 5\%$ F.S. from the state of the factory shipment.

When more than this range, Er5 is displayed and zero-clear is not executed.

Initialize

"Initialize" is a function to return all the settings that the internal control constant is included to an initial value. Please execute "initialize" only when the error is displayed, and this product doesn't operate at all.

Please execute the "reset" function, when you want to return the pressure setting and the switch setting to an initial value (refer to P15).

No	Key operation	LED Display
(1)	Unlock keys (refer to P8).	
(2)	Press S-key for 2 seconds or more, then go to detail setting mode.	
(3)	To "F99" by using the \triangle and ∇ keys.	F99 \leftrightarrow 117 I (Displayed alternately)
(4)	Press S-key.	117 I flashes on the display
(5)	Press \triangle and S keys for 5 seconds or more. (Press S-key to (3))	117 I is displayed
(6)	"Initialize" is executed, after 5 seconds. (Release keys till less than 5 seconds to (4))	Turning off for 1 second
(7)	Returned to the condition before power was supplied (keys are locked).	

Reset function

Clears the setting values for the reset contents items below.

No	Key operation	LED Display
(1)	Unlock keys (refer to P8).	
(2)	Press the \triangle and ∇ keys simultaneously for 3 seconds or more.	(current) pressure is displayed
(3)		$\overline{E} \overline{r} \overline{E}$ is displayed for approx. 1 second
(4)	The settings are reset and returned to the condition before power was supplied. (keys are locked).	

Reset contents.

Item	Reset contents	Applicable model
F_1	0%F.S.	Current/Voltage type
F_2	100%F.S.	Current/Voltage type
P_1, P_2	100%F.S.	Switch output type
P1~P_4	0%F.S.	Preset input

*(Note) Gain (G.L.) and sensitivity (S.L.) are not reset.

Error indicating function

Error name	LED display	Contents of error	Countermeasure
Over range of input signal	$\overline{E} \overline{r} \overline{1}$	Input signal exceeds the rated value range.	Reduce input signal to within the rated range and restart the power supply.
System error	$\overline{E} \overline{r} \overline{2}$	Reading or writing errors occurred in EEPROM.	Please execute "Initialize (refer to P14)" when ITV do not operate normally after restarting the power supply. Please contact us, when ITV do not operate normally after "Initialize".
	$\overline{E} \overline{r} \overline{3}$	Reading and writing errors occurred in memory.	Please contact us when ITV do not operate normally after restarting the power supply.
Solenoid valve error	$\overline{E} \overline{r} \overline{4}$	Solenoid valve failure.	Replace the solenoid valve. For the replacement procedure contact SMC.
Residual pressure error	$\overline{E} \overline{r} \overline{5}$	Out of range error of zero clear	Please operate "Zero clear" within the range of 5% F.S.. Please operate "Zero clear" after the secondary pressure of ITV is became to atmosphere.

Refer to the SMC website (URL <http://www.smcworld.com>) for more information about troubleshooting. This operation manual refers to all standard types and is partially applicable to special models.

Revision history

A : Delete address (Feb.15 2024)

SMC Corporation

Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362

URL <https://www.smcworld.com>

Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.

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