



# Operation Manual

PRODUCT NAME

IO-Link/ELECTRO-PNEUMATIC REGULATOR

MODEL / Series / Product Number

**ITV1000/2000/3000/2090-IL series**

**SMC Corporation**

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# 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)\*<sup>1)</sup>, and other safety regulations.

\*1) 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.



# 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 industries.**

**Use in non-manufacturing industries 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

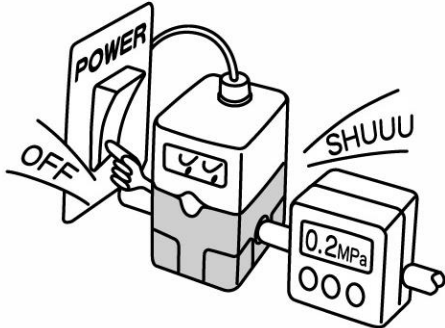
### Compliance Requirements

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.

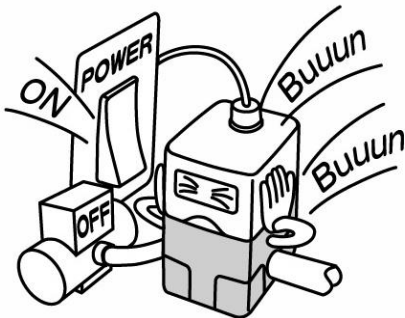
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and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

## Handling precautions

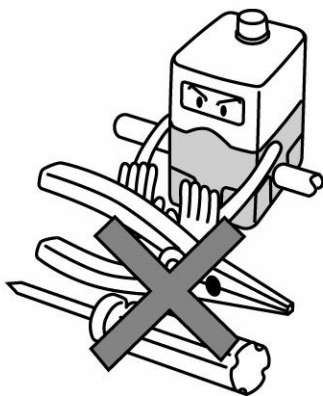
### Caution



If the power supply to this product is turned off due to a power failure during normal operation, the output on the secondary side will be held and air will flow continuously.

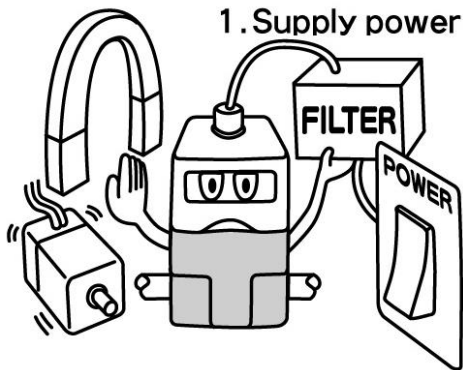


If supply pressure to this product is interrupted or shut off, while the power is still on, the internal solenoid valve will continue to operate and a humming noise will be generated. Turn off the power supply when supply pressure is interrupted or shut off, since the life of the product may be shortened.



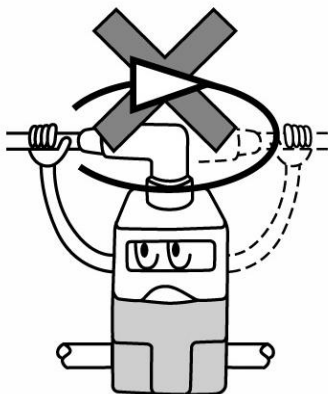
This product is adjusted to specification at the time of shipment from the factory. Avoid careless disassembly or removal of parts, as this can lead to malfunction.

**⚠ Caution**



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 cables, etc.
3. Be sure to implement protective measures against load surge for inductive loads (solenoid valves, relays etc.).
4. Turn off the power supply before inserting or removing the connector.



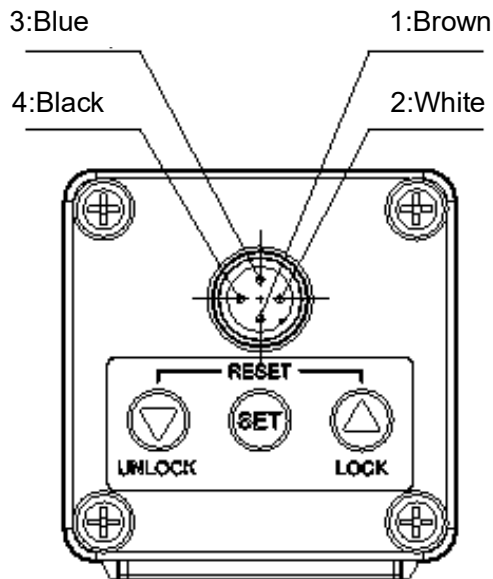
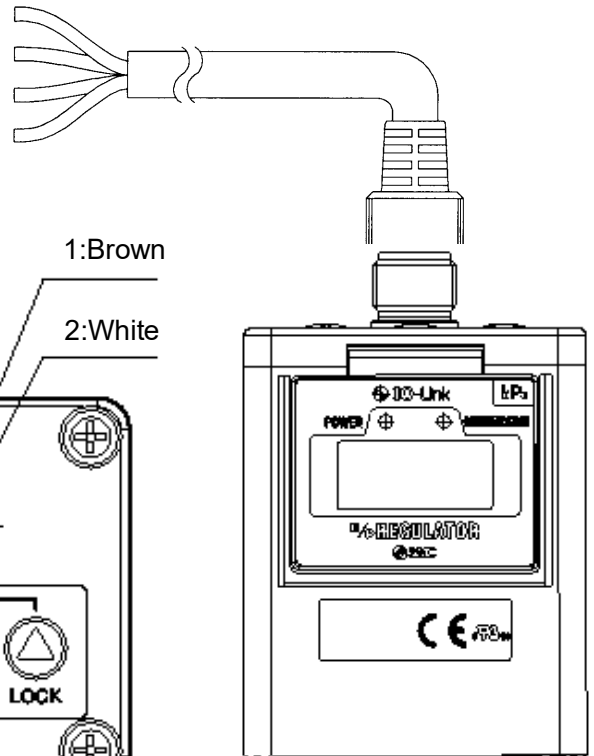
Please note that the right angled cable connector does not rotate and is limited to only one entry direction.

# Wiring method

## ⚠ Caution

- ① Proceed carefully, as incorrect wiring can cause damage.
- ② Use DC power supply with sufficient capacity and a low ripple.
- 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 (L+)
2	White	No Connect
3	Blue	GND (L-)
4	Black	IO-Link communication data (C/Q)



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

# IO-Link Specifications

## ■Outline of IO-Link functions

### ○ Communication Function

This product can check the pressure adjustment and diagnostic information using cyclic data communication via the IO-Link system.

### ○ Product status monitoring function

This function monitors the product status via the IO-Link communication.

- Multiple errors (e.g. internal hardware errors) can be detected.
- Multiple alarms can be detected (e.g., low pressure, over-voltage).
- Multiple notifications can be detected (e.g., specified operation cycle of the solenoid valve has been reached).

### ○ Output of fault status

The output status (Hold/Clear) when a communication error occurs can be set.

### ○ Data storage function

The data storage function stores the IO-Link device parameter settings to the IO-Link master.

With the IO-Link data storage function, the IO-link device can be replaced easily without re-setting the equipment construction or setting parameters.

When the device parameters are set and downloaded to the device using the IO-Link setting tool, the parameters in the downloaded device will be activated. After that, these parameters are uploaded to the data storage in the master by stem command (back-up communication command).

When the device is replaced with the same type of IO-Link device due to failure, the parameter settings stored in the master are download automatically, device can be operated with the parameter settings of the previous device.

Three levels of back up can be set for each port of the master device ("Disabled," "back-up/restore," and "restore").

"Back-up" implies the activation of upload and "restore" implies download.

## ■Communication specifications

Item	Specifications	Note
IO-Link type	Device	
version	Version 1.1	
Communication speed	230.4 kbps (COM3)	
Minimum cycle time	1.5 msec	
IO-Link port	Class A	
Process data length	4 BYTE IN 2 BYTE OUT	Resolution 12 Bit
On request data communication	Available	
Data storage function	Available	
Event function	Available	

**■Process data**

Process data is the cyclic data which is exchanged periodically between the base module and device.

Process data consists of PD\_IN (process data input); 4 BYTE and PD\_OUT (process data output); 2 BYTE as shown below.

- The process data of this product is Big-Endian type.

When the transmission method of the upper communication is Little-Endian type, the BYTE order will be changed.

Refer to the table below for the Endian type of the major upper communication.

Endian type	Upper communication protocol
Big-Endian type	PROFIBUS and PROFINET
Little-Endian type	EtherNET/IP, EtherCAT and CC-Link IE Field.

**Process data input: 4 BYTE (device (ITV) --> base module)**

Bit offset	Item	Note
0	SSC1	Turns ON when the output pressure is within +/-10%F.S. of the set pressure.
1 and 2	Disabled	Not used. The value is not reflected.
3	Diagnostic information (notification)	0: Normal, 1: Notification (defined per Bit) *: Refer to the table for Diagnostic information
4 to 10	Diagnostic information (warning)	0: Normal, 1: Notification (defined per Bit) *: Refer to the table for Diagnostic information
11 to 15	Diagnostic information (abnormal)	0: Normal, 1: Abnormal (defined per Bit) *: Refer to the table for Diagnostic information
16 to 31	Output pressure	No symbol, 16-Bit *: Refer to the table for Output pressure

**Output pressure**

Output pressure of the product is sent.

0								1								BYTE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	Bit
Output pressure(16Bit)																Value

**Monitoring of output pressure**

The output pressure can be monitored by the PLC receiving the output data from the regulator where the output pressure is 13-Bit. (The upper 3 Bit (29th to 31th) are 0).

<Relation between the output pressure value (16-Bit) and output pressure>

Output pressure value	0x0000	0x0FFF
Output pressure	0%	100%

Check the values from the 16th to 28th Bit of the 32-Bit (4-BYTE) process data. (When F\_1=0%F.S. and F\_2=100%F.S.)

(Ex.) When the output pressure is 100%, the output pressure value is 0x0FFF.

## Diagnostic information

This product can detect the device error by diagnostic Bit in the process data.

2								3							BYTE	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit
Abnormal				Warning								Notifi cation	Disabled		SSC1	Value

Bit offset	Item	Details
0	SSC1	1: Output pressure value is within +/-10% of the target value. 0: Other than the above case.
1	Disabled	Vacant. Becomes 0.
2	Disabled	Vacant. Becomes 0.
3	Notification of the accumulated energizing time	Becomes 1 when the accumulated energizing time reaches the set value. 0: Other than the above case.
4	Residual pressure error	Becomes 1 when the output pressure value exceeds the specified value at the time of zero-clear.
5	Target value over range	Becomes 1 when the target value exceeds the specified value.
6	Pressure value under range (LLL)	Becomes 1 when the output pressure value is below the specified value.
7	Pressure value over range (HHH)	Becomes 1 when the output pressure value exceeds the specified value.
8	Decline in the power supply voltage	Becomes 1 when the power supply voltage is below the specified value.
9	Excessive power supply voltage	Becomes 1 when the power supply voltage exceeds the specified value.
10	Alarm generation	"0" is displayed when Bit 4 to 9 of the Bit offset are "0." "1" is displayed when any other part of the Bit offset is "1."
11	Internal communication error	"1" is displayed when an error is generated in processing the internal communication.
12	Built-in solenoid valve error	"1" is displayed when an error is generated in the built-in solenoid valve.
13	Internal system error	"1" is displayed when an internal system error is generated.
14	EEPROM error	"1" is displayed when an EEPROM error is generated.
15	Error	"0" is displayed when Bit 11 to 14 of the Bit offset are "0." "1" is displayed when any other part of the Bit offset is "1."

**Process data output: 2 BYTE (base module --> device (ITV))**

The product adjusts the pressure to the set value.

0								1								BYTE
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit
Set pressure value. (16Bit)															Value	

\* Data is adjustable up to 120%F.S. (Max. guaranteed output pressure accuracy is 100%F.S.)

**Pressure setting mode**

The pressure can be set by sending input data from the base PLC to the regulator where the full span is 12-Bit. Do not use values outside of the specification range (including Bit 13th to 15th). They are recognized as large values which could cause an error (Er1).

<Relation between the set pressure value (16-Bit) and output pressure>

Set pressure value	0x0000	0x0FFF
Output pressure	0%	100%

Input data shall be entered from Bit 0 to Bit 12 of the 16-Bit process data (2 BYTE).

(When F\_1=0%F.S. and F\_2=100%F.S.)

(Ex.) When the set pressure value is 0x0FFF, the output pressure is 100%.

**■ IO-Link parameter setting**

● IODD file

IODD (I/O Device Description) is a definition file which provides all properties and parameters required for establishing functions and communication of the device.

The IODD includes the main IODD file and a set of image files such as vendor logo, device picture and device icon.

The IODD file is shown below.

Product No.	Communication speed	Process data size	IODD file <sup>※</sup>
ITV*0*0 -IL ***** _*****	COM3 (230.4 kbps)	4-BYTE input / 2-BYTE output	SMC-ITV-IL-yyyy mm dd-IODD1.1

\*: "yyyymmdd" indicates the file preparation date of the file. yyyy is the year, mm is the month and dd is the date.

- Data storage

The data storage function stores the IO-Link device parameter settings to the IO-Link master. If the index and sub-index of a single parameter of an electro-pneumatic regulator are specified (changed) and the parameters are uploaded (stored) to the IO-Link base data storage server, the system command "ParamDownloadStore" of the communication instruction must be manually sent to the electro-pneumatic regulator for back up.

When the block parameter function of the IO-Link tool is used for setting all parameters in batch, "ParamDownloadStore" is automatically sent to the system command as part of the block parameter sequence. The customer does not need to manually issue a system command.

When the electro-pneumatic regulator is replaced with the same type of regulator, the parameters stored in the IO-Link base is automatically downloaded to the electro-pneumatic regulator and the factory settings will be rewritten.

- Service data

The tables below indicate the parameters which can be read or written by simple access parameter (direct parameters page) and ISDU parameters which are applicable to various parameters and commands.

#### Direct parameters page 1

Address	Access <sup>*1</sup>	Parameter name	Default (decimal number)
0x07	R	Vendor ID	0x0083(131)
0x08			
0x09	R	Device ID	0x0219(537)
0x0A			
0x0B			

\*1: R means Read

## ISDU parameters

ISDU		Access *1	Parameter name	Data storage *2	Value
Index (decimal number)	Subindex				
0x0002 (2)	0	W	System Command	N	For more details, refer to "System command." (Page 13)
0x000C (12)	0	R/W	Device Access Locks	N	For more details, refer to "Device access lock parameter." (Page 14)
0x0010 (16)	0	R	Vendor Name	N	SMC Corporation
0x0011 (17)	0	R	Vendor Text	N	www.smcworld.com
0x0012 (18)	0	R	Product Name	N	ITV-IL
0x0013 (19)	0	R	Product ID	N	ITV-IL
0x0014 (20)	0	R	Product Text	N	IO-Link/Electro Pneumatic Regulator
0x0015 (21)	0	R	Serial Number	N	"xxxxxxxx" *3
0x0016 (22)	0	R	Hardware Revision	N	HW-Vx.y *4
0x0017 (23)	0	R	Software Revision	N	FW-Vx.y *4
0x0018 (24)	0	R/W	Application Specific Tag	Y	***** ***** *5
0x0024 (36)	0	R	Device Status	N	For more details, refer to "Device status parameter." (Page 14)
0x0025 (37)	1..11	R	Detailed Device Status	N	For more details, refer to "Device details status parameter." (Page 14)

\*1: R means Read and W means Write.

\*2: Y is included in data storage, N is not included in data storage.

\*3: 8 octets fixed character string.

\*4: "x" represents a major revision number. "y" represents a minor revision number.

\*5: Character string of 16 to 32 octets.

## System command (Index 2)

In the ISDU index 0x002 System Command, the command shown in the table below will be issued.

The button of each system command is displayed on the IO-Link setting tool (excluding "Param Download Store").

Click the button to send the system command to the E-P regulator.

This is system command configuration.

Command (decimal number)	Command name	Details
0x05 (5)	Param Download Store	Back-up of the parameter set data. When the electro-pneumatic regulator receives a command, it starts uploading the parameter settings to the master.
0x80 (128)	Device reset	Corresponds to power ON/OFF. Restart the system.
0x81 (129)	Application reset*1	Reset function Reset the minimum / maximum value and key lock function.
0x82 (130)	Restore factory settings*2	Initialization function. All parameter settings are returned to the factory settings. All settings are cleared.
0xA0 (160)	Zero Clear*3	Execute a zero-clear function.

\*1 to 3: Same definition as button operation.

### Device access lock parameter (Index 12)

Refer to device access lock conditions below.

Data type: 16 Bit Record

Value	Details
0	Key lock de-activated, DS lock de-activated (initial value)
2	Key lock de-activated, DS lock
8	Key lock, DS lock de-activated
10	Key lock, DS Lock

### Key-lock:

Performs the key lock using button operation.

When the keys are locked, setting changes or restoration by data storage (rewriting of parameter settings) through communication can still be performed.

### Lock the data storage:

ITV data storage function" is disabled by locking the "Data storage".

In this case, access is rejected for data storage backup (reading of parameter settings) and restoration (rewriting of parameter settings).

### Device status parameter (Index 36)

Readable device status is as follows.

Data type: 8-Bit UInteger

Value	Definition of status	Details
0	Normal operation	-
1	Maintenance is required	The energizing time has reached the set value.
2	Out of spec.	Warning
3	Check the functionality.	Not available
4	Failure	Abnormal

### Device details status parameter (Index 37)

Event details of the readable device status are as follows.

Subindex	Event	Event class		Event code
		Definition	Value	
1	EEPROM error	Error	0xF4	0x1810
2	Internal system error	Error	0xF4	0x1811
3	Built-in solenoid valve error	Error	0xF4	0x1812
4	Internal communication error	Error	0xF4	0x1813
5	Excessive power supply voltage error	Warning	0xE4	0x5110
6	Low power supply voltage error	Warning	0xE4	0x5111
7	Pressure value over range error	Warning	0xE4	0x8c10
8	Pressure value under range error	Warning	0xE4	0x8c30
9	Target value over range error	Warning	0xE4	0x1820
10	Residual pressure error	Warning	0xE4	0x1821
11	Notification of the accumulated energizing time reached	Notification	0x54	0x1830

## Product individual parameters

Index (decimal number)	Subindex	Access *1	Parameter name	Data type *2	Initial value	Data storage *3	Details
0x41 (65)	0	R/W	Hold/clear	U8	{0}	Y	Pressure control setting when an IO-Link communication error occurs. When {0} is set, output pressure is cleared. When {1} is set, output pressure is held.
0x42 (66)	0	R/W	Gain	U8	{9}	Y	The gain for the electro-pneumatic regulator can be adjusted in the range from 0 to 16.
0x43 (67)	0	R/W	Sensitivity	U8	{2}	Y	The sensitivity of the electro-pneumatic regulator can be adjusted in the range from 0 to 8.
0x46 (70)	0	R/W	Minimum pressure	U16	{0}	Y	Set setting pressure zero point. (can be set in the range from 0 to 90%. *4)
0x47 (71)	0	R/W	Maximum pressure	U16	{4095}	Y	Set setting pressure span point. (can be set in the range from 10 to 120%. *4)
0x48 (72)	0	R	Accumulated energizing time	U32	{0}	Y	Displays accumulated energizing time.
0x49 (73)	0	R/W	Notification setting of the accumulated energizing time	U32	{0}	Y	Set notification of the accumulated energizing time.
0xA0 (160)	0	R	Product number	STR64	{Product number}	N	Displays the product number.

\*1: R means Read and W means Write.

\*2: Refer to the table below for the symbol.

Symbol	Data type (IO-Link standard)	Data length Bit [BYTE]	Description
U8	UIntegerT	8 [1]	Unsigned integer (unsigned integer)
U16		16 [2]	
U32		32 [4]	
STR64	StringT	-	Up to 64-BYTE character string (String)

\*3 "Y" indicates that the parameter setting data is saved to the master, and "N" indicates that the parameter is not saved.

\*4 Cannot be set to a value where "maximum pressure - minimum pressure < 10%"

<b>Parameter index</b>	<b>0x41</b>		
<b>Parameter name</b>	<b>Hold/Clear setting</b>		
<b>Function</b>	Sets the output setting when communication error occurs. 0: Exhaust completely (Clear). 1: Output pressure is maintained (Hold). Default value: Clear		
<b>Bit</b>	<b>0x41</b>		
<b>Value</b>	<b>Bit</b>	<b>0</b>	<b>Setting</b>
	*	<b>0</b>	<b>Clear</b>
		<b>1</b>	<b>Hold</b>

\* indicates the initial shipping value.

<b>Parameter index</b>	<b>0x42</b>					
<b>Parameter name</b>	<b>Gain tuning function</b>					
<b>Function</b>	The response time can be changed by tuning the gain. When the gain is increased, the response time tends to be faster, but stability will be lost, which may cause hunting (unstable pressure). Default: Gain 9					
<b>Bit</b>	<b>Bit 3, 2, 1, 0</b>					
<b>Value</b>	<b>Bit</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>Setting</b>
		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>Gain 0</b>
		<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>Gain 1</b>
		<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>Gain 2</b>
		<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>Gain 3</b>
		<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>Gain 4</b>
		<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>Gain 5</b>
		<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>Gain 6</b>
		<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>Gain 7</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>Gain 8</b>
	*	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>Gain 9</b>
		<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>Gain A</b>
		<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>Gain B</b>
		<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>Gain C</b>
		<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>Gain D</b>
		<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>Gain E</b>
		<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>Gain F</b>

\* indicates the initial shipping value.

<b>Parameter index</b>	<b>0x43</b>					
<b>Parameter name</b>	<b>Sensitivity tuning function</b>					
<b>Function</b>	Changing the sensitivity will change the pressure correction operation near the set pressure point. When the sensitivity is increased, hunting may occur. When the sensitivity is decreased, hunting will be reduced, but the pressure correction will be reduced, so there may be a moderate pressure instability. Default value : Sensitivity 0					
<b>Bit</b>	<b>Bit 2, 1, 0</b>					
<b>Value</b>	<b>Bit</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>Setting</b>	
		<b>0</b>	<b>0</b>	<b>0</b>	<b>Sensitivity -</b>	
		<b>0</b>	<b>0</b>	<b>1</b>	<b>Sensitivity -</b>	
		*	<b>0</b>	<b>1</b>	<b>0</b>	<b>Sensitivity 0</b>
		<b>0</b>	<b>1</b>	<b>1</b>	<b>Sensitivity 1</b>	
		<b>1</b>	<b>0</b>	<b>0</b>	<b>Sensitivity 2</b>	
		<b>1</b>	<b>0</b>	<b>1</b>	<b>Sensitivity 3</b>	
		<b>1</b>	<b>1</b>	<b>0</b>	<b>Sensitivity 4</b>	
		<b>1</b>	<b>1</b>	<b>1</b>	<b>Sensitivity 5</b>	

\* indicates the initial shipping value.

<b>Parameter index</b>	<b>0x46</b> (Zero adjusting), <b>0x47</b> (Span adjusting)																			
<b>Parameter name</b>	<b>Zero adjusting , Span adjusting</b>																			
<b>Function</b>	Zero adjusting (hereinafter referred to as F_1) corresponds to set the minimum pressure, Span adjusting (hereinafter referred to as F_2) to set the maximum pressure. F_1 and F_2 have setting ranges of 0-90%F.S. and 10-120%F.S., respectively. However, the set pressure exceeds rated output; 100%F.S. is out of warranty. (refer to Fig.2,3) Also, it cannot be set to $F_2 - F_1 < 10\%$ . <b>Default of Zero adjusting: 0x0000</b> <b>Default of Span adjusting: 0x0FFF</b>																			
<b>Bit</b>	<b>Bit 13 (It is Bit 12 up to 100%.)</b>																			
<b>Value</b>	Relationship between F1/F2 and the set pressure (Hexadecimal Number) <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Zero adjusting F_1</th> <th colspan="2">Span adjusting F_2</th> </tr> <tr> <th>Minimum</th> <th>Maximum</th> <th>Minimum</th> <th>Maximum</th> </tr> </thead> <tbody> <tr> <td>Input value</td> <td>0x0000</td> <td>0x0E66</td> <td>0x019A</td> <td>0x1332</td> </tr> <tr> <td>Set pressure</td> <td>0%F.S.</td> <td>90%F.S.</td> <td>10%F.S.</td> <td>120%F.S.</td> </tr> </tbody> </table>		Zero adjusting F_1		Span adjusting F_2		Minimum	Maximum	Minimum	Maximum	Input value	0x0000	0x0E66	0x019A	0x1332	Set pressure	0%F.S.	90%F.S.	10%F.S.	120%F.S.
	Zero adjusting F_1		Span adjusting F_2																	
	Minimum	Maximum	Minimum	Maximum																
Input value	0x0000	0x0E66	0x019A	0x1332																
Set pressure	0%F.S.	90%F.S.	10%F.S.	120%F.S.																

(Ex.) If you want to set F\_2 to 0.6 MPa with  $ITV \times 050$ , set  $F_2 = 0.6 \text{ MPa} / 0.9 \text{ MPa} \times 0x0FFF \doteq 0x0AAA$ .

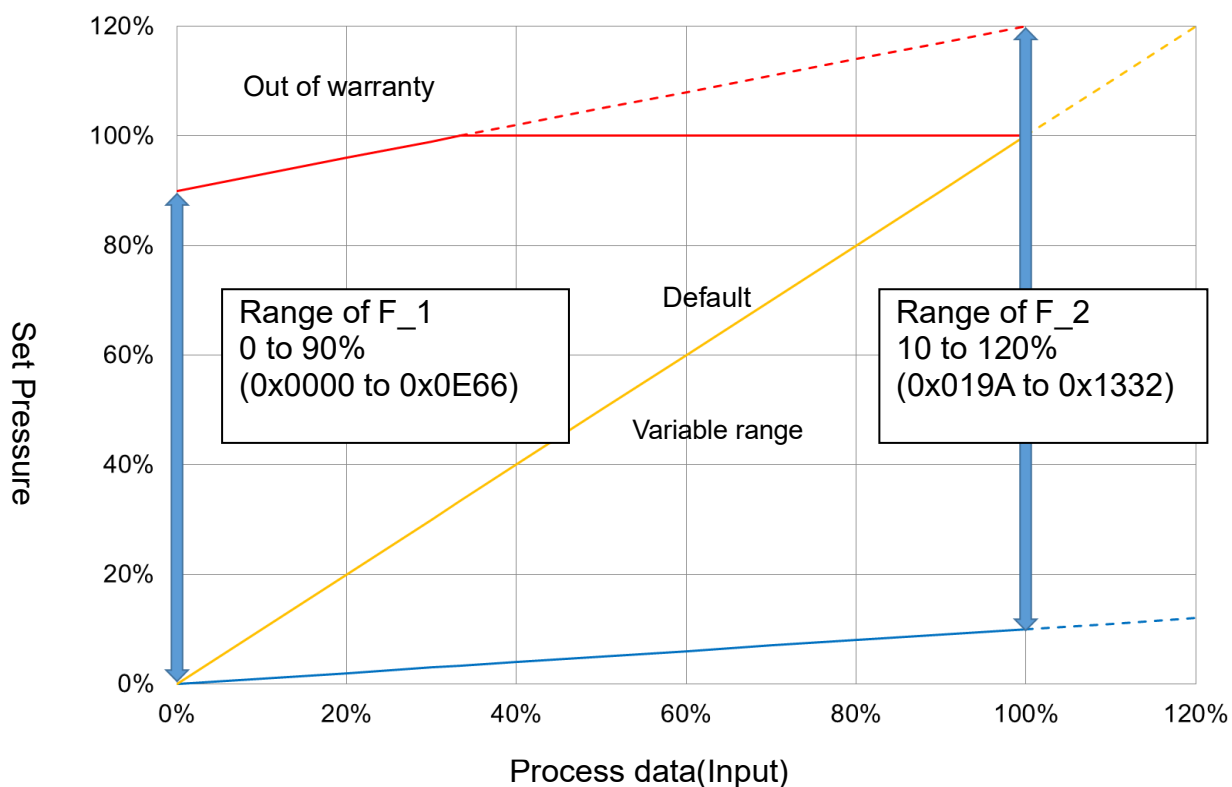
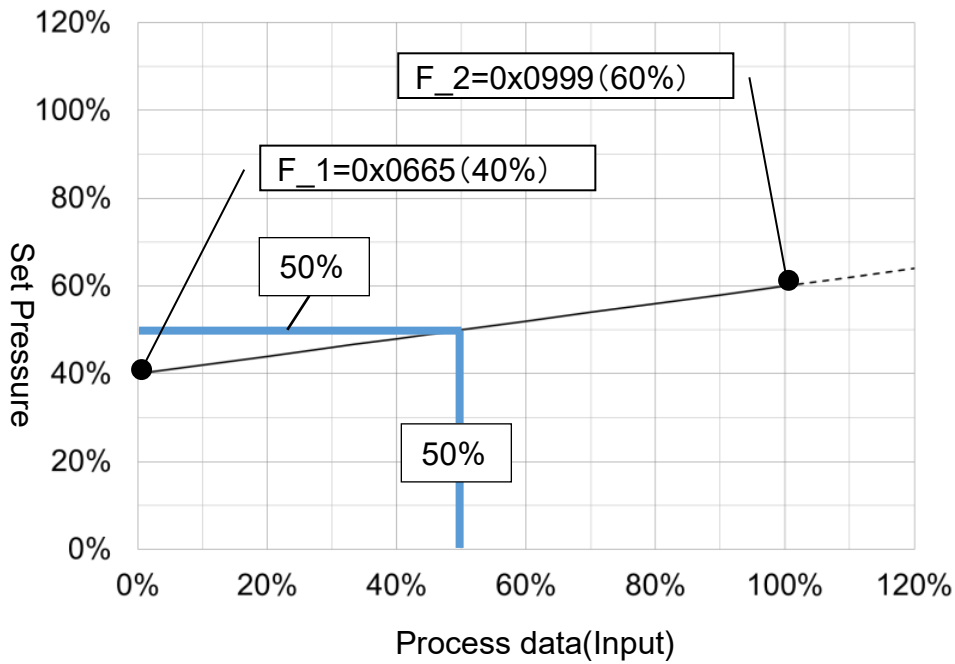


Fig.2 Range of F\_1 and F\_2

- When F\_1 = 40% and F\_2 = 60%  
The set pressure output 50% when the process data input 50%



- When F\_1 = 40% and F\_2 = 50%  
The set pressure output 45% when the process data input 50%

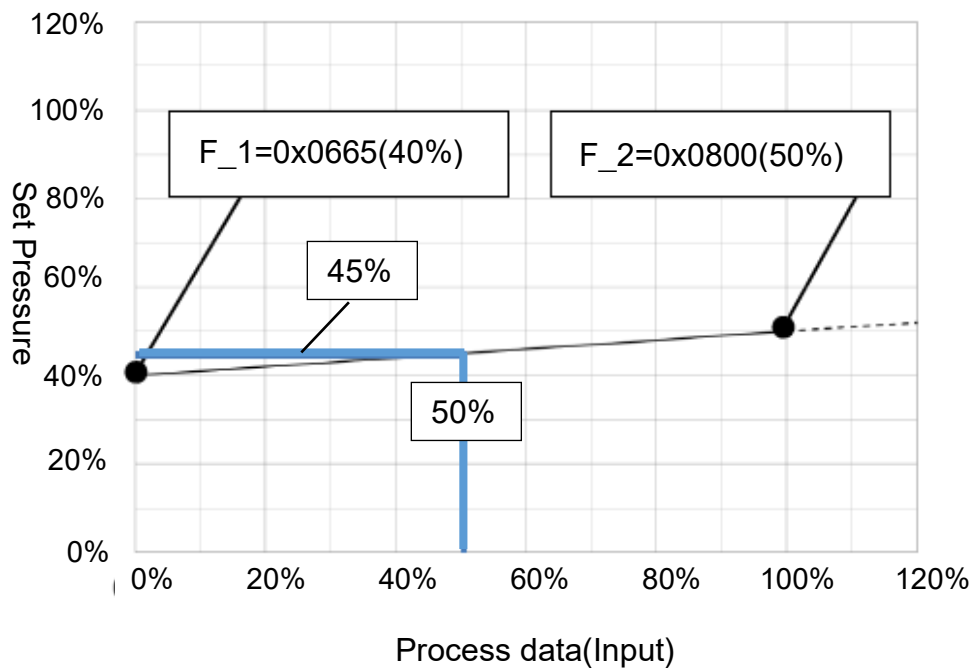


Fig.3 F\_1 and F\_2 usage example

<b>Parameter index</b>	<b>0x48 (energizing time)</b>
<b>Parameter name</b>	<b>Energizing time</b>
<b>Function</b>	Displays the accumulated energizing time of the electro pneumatic regulator. Please note that the number indicates hours and is refreshed every hour.
<b>Bit</b>	<b>Bit 31 to 0</b>
<b>Value</b>	If the Bit are 1111 1111 1111 1111 1111 1111 1111 1111, this indicates approximately 4 billion hours.

\* Default value is 0.

<b>Parameter index</b>	<b>0x49 (Notification setting of accumulated energizing time)</b>
<b>Parameter name</b>	<b>Notification setting of the accumulated energizing time</b>
<b>Function</b>	This function uses process data to notify the user that the accumulated energizing time of the electro-pneumatic regulator reached the time set with this function. The default value is "0," which means no notification is output. If a value is "1" or greater, the notification setting is enabled.
<b>Bit</b>	<b>Bit 31 to 0</b>
<b>Value</b>	Setting the Bit to 1111 1111 1111 1111 1111 1111 1111 1111 sets it to approximately 4 billion hours. Setting the Bit to 0000 0000 0000 0000 0010 0010 0011 1000 sets it to approximately 8,760 hours (equivalent to 1 year: 24 hours x 365 days).

\* The default value is "0," which means that the notification is disabled.

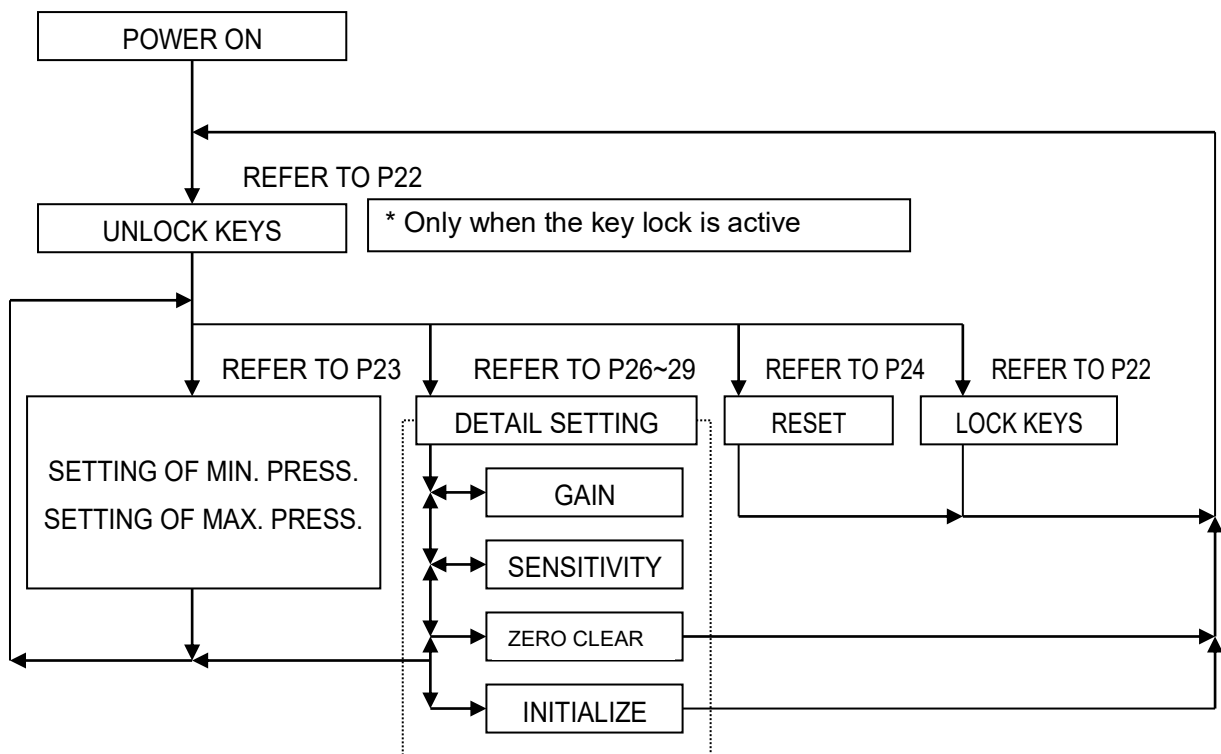
<b>Parameter index</b>	<b>0xA0 (Product number)</b>
<b>Parameter name</b>	<b>Product number</b>
<b>Function</b>	Displays the product number of the electro-pneumatic regulator.
<b>Bit</b>	<b>BYTE 64 (Maximum)</b>
<b>Value</b>	The Bits 49 54 56 32 30 33 30 2D 49 4C 32 42 4E (hexadecimal number) indicate "ITV2030-IL2BN." (ASCII code)

# Setting using buttons

## ⚠ 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 It is recommended that the minimum pressure is output when air is supplied to the inlet, even if the input signal has not been entered.
- 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.
- ⑤ Do not configure settings using the button operation and IO-Link communication at the same time. If settings are made by both methods, unintended settings may be configured.

### Flow of the setting



(Note 1): Please refer to each contents about operation method.

## Key locking function

### Caution

The key lock function is preserved in the EEPROM (non-volatile memory). Its settings are reflected even after power cycling. (The key lock is deactivated by default at shipment). This setting interlocks with the key lock for the IO-Link parameter: Device access lock (Index 12) and can also be set via IO-Link. However, when buttons are operated, the button operations take priority and the settings via IO-Link are processed exclusively.

### Unlocking the keys

No	Key operation	LED Display
(1)		(current) pressure is displayed
(2)	Press ▽ key for 2 seconds or more.	$\overline{L} \square \square$ is displayed
(3)		$\overline{L} \square \square$ flashes on the display
(4)	Press S-key	
(5)		$\square \square \overline{L}$ is displayed for approx. 1 second
(6)	Key lock is released	(current) pressure is displayed

\*(4) Press △ key to cancel.

### Locking the keys

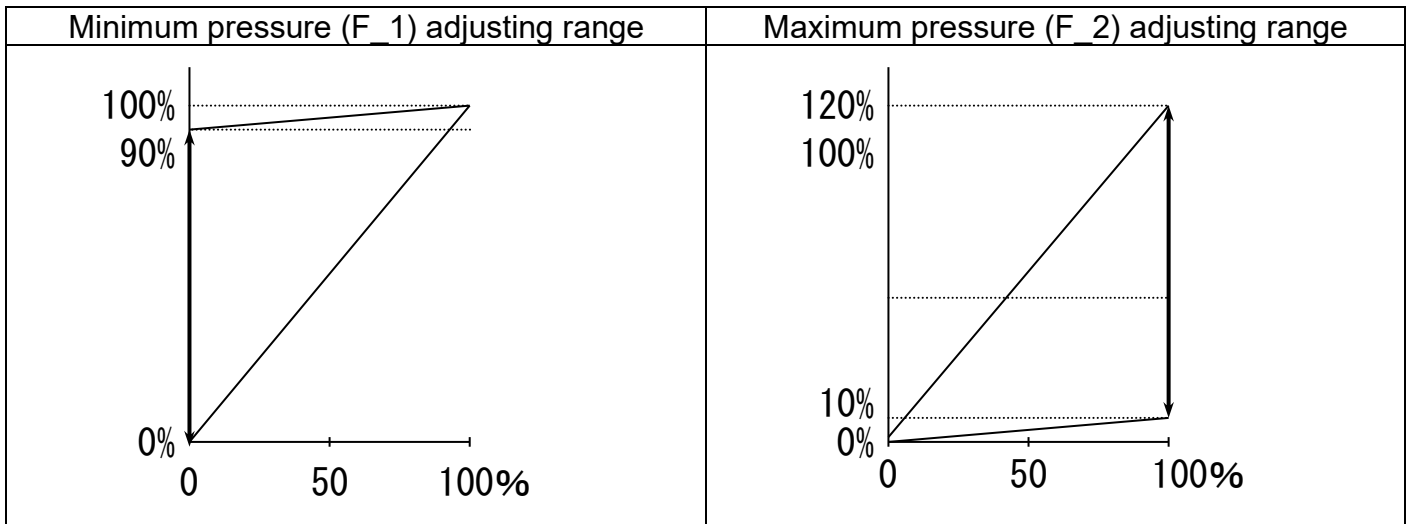
No	Key operation	LED Display
(1)		(current) pressure is displayed
(2)	Press △ key for 2 seconds or more.	$\square \square \overline{L}$ is displayed
(3)		$\square \square \overline{L}$ flashes on the display
(4)	Press S-key	
(5)		$\overline{L} \square \square$ is displayed for approx. 1 second
(6)	Keys are locked	(current) pressure is displayed

\*(4) Press ▽ key to cancel.

## Setting of min. pressure, max. pressure

Interlocking with an IO-Link parameter.

No	Key operation	LED Display
(1)	Deactivate the key lock if necessary (see page 22).	
(2)	Press S-key	
(3)	Set the minimum pressure by using the $\Delta$ and $\nabla$ keys.	$F\_1 \leftrightarrow .000$ (displayed alternately) *Adjusting range: Refer to note 1 to 6
(4)	Press S-key	
(5)	Set the maximum pressure by using the $\Delta$ and $\nabla$ keys.	$F\_2 \leftrightarrow .900$ (displayed alternately) *Adjusting range: Refer to note 1 to 6
(6)	Activate the key lock if necessary (see page 22).	



(Note 1): F<sub>1</sub> 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<sub>1</sub> is adjusted to less than 0%.

(Note 3): F<sub>2</sub> is adjustable in a range from 10 to 120% of the rated value.  
(DEFAULT VALUE: 100%)

(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<sub>1</sub> and F<sub>2</sub> is adjustable in a range of 10% of the rated value.

(Note 6): The adjustment like making the relation of F<sub>1</sub>>F<sub>2</sub> is not available.

## Reset function

Clears the minimum and maximum pressure settings. This function is the same as the function via IO-Link.

### Operation

No	Key operation	LED Display
(1)	Deactivate the key lock if necessary (see page 22).	
(2)	Press the $\Delta$ and $\nabla$ keys simultaneously for 3 seconds or more.	(current) pressure is displayed
(3)		$\overline{r}$ $\overline{E}$ $\overline{S}$ is displayed for approx. 1 second
(4)	The settings are reset and returned to the condition before power was supplied. Activate the key lock if necessary (see page 22).	

### Reset content

Item	Reset content
F_1	0%F.S.
F_2	100%F.S.

\*(Note): Gain (GL) and sensitivity (SL) are not reset.

## Error indicating function

Error name	LED display	Contents of error	Countermeasure
Over range of input signal	E1.1	Input signal exceeds the rated value range. Event code 0x1820(See P14)	Reduce input signal to within the rated range and restart the power supply.
System error	E1.2	Reading or writing errors occurred in EEPROM. Event code 0x1810(See P14)	Please execute "initialize (refer to P30)" when ITV do not operate normally after restarting the power supply. Please contact us, when ITV do not operate normally after initialize.
	E1.3	Reading and writing errors occurred in memory. Event code 0x1811(See P14)	Please contact us when ITV do not operate normally after restarting the power supply.
Solenoid valve error	E1.4	Solenoid valve failure. Event code 0x1812(See P14)	Replace the solenoid valve. For the replacement procedure contact SMC.
Residual pressure error	E1.5	Out of range error of zero clear Event code 0x1821(See P14)	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.

## Detail setting mode

No	Key operation and LED display
(1)	Deactivate the key lock if necessary (see page 22).
(2)	Press S-key for 2 seconds or more.
(3)	<p>(displayed alternately) Press S-key To "GAIN" (refer to P27)</p> <p>(displayed alternately) Press S-key To "SENSITIVITY" (refer to P28)</p> <p>(displayed alternately) Press S-key To "ZERO CLEAR" (refer to P29)</p> <p>(displayed alternately) Press S-key To "INITIALIZE" (refer to P30)</p>
(4)	In state of 3, press S-key for 2seconds or more.
(5)	Return to (current) pressure display.
(6)	Activate the key lock if necessary (see page 22).

## Gain setting

Interlocked with the IO-Link parameter.

Normal operation does not require the adjustment of gain.

This product can change the response with this gain setting.

When the gain is changed to larger, the response become quickly, but there is a possibility that stability is lost.

No	Key operation	LED Display
(1)	Deactivate the key lock if necessary (see page 22).	
(2)	Press S-key for 2 seconds or more, then go to detail setting mode.	
(3)	To "F01" by using the $\Delta$ and $\nabla$ keys.	F01 $\leftrightarrow$ GL9 (displayed alternately)
(4)	Press S-key.	
(5)	Set the GAIN by using the $\Delta$ and $\nabla$ keys.	GL9 (blink and change the rightest digit)
(6)	Press S-key.	F01 $\leftrightarrow$ GL9 (displayed alternately)
(7)	Press S-key for 2 seconds or more, then go out from detail setting mode. (Select the menu with $\Delta$ or $\nabla$ keys, then jump to another item.)	
(8)	Activate the key lock if necessary (see page 22).	

### Relation between setting of gain and response time

Response	Slow $\leftarrow$ $\rightarrow$ Quick												
Setting of GAIN	GL0	GL1	GL2	to	GL7	GL8	GL9	GLA	GLb	GLc	GLd	GLE	GLF

\* Default: GL9



## Zero clear

This function is the same as the function via IO-Link.

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)	Deactivate the key lock if necessary (see page 22).	
(2)	Press S-key for 2 seconds or more, then go to detail setting mode.	
(3)	To "F03" by using the $\Delta$ and $\nabla$ keys.	$F03 \leftrightarrow 0cL$ (displayed alternately)
(4)	Press S-key.	$0cL$ flashes on the display
(5)	Press $\Delta$ and $\nabla$ 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))	$0cL$ is displayed for approx. 1 second.
(7)	Returns to the state immediately after turning on of the power supply. Activate the key lock if necessary (see page 22).	

(note): The adjustable range is within  $\pm 5\%$ F.S from the state of the factory shipment. When more than this range,  $Err$  is displayed and zero-clear is not executed.  
Event code 0x1821(See P14)

## Initialize

This function is the same as the function via IO-Link.

"Initialize" is a function to return all the settings that the internal control constant are 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.

No	Key operation	LED Display
(1)	Deactivate the key lock if necessary (see page 22).	
(2)	Press S-key for 2 seconds or more, then go to detail setting mode.	
(3)	To "F99" by using the $\Delta$ and $\nabla$ keys.	$\overline{F99} \leftrightarrow \overline{117}$ (displayed alternately)
(4)	Press S-key.	$\overline{117}$ flashes on the display)
(5)	Press $\Delta$ and S keys for 5 seconds or more. (press S-key to (3))	$\overline{117}$ is displayed
(6)	"Initialize" is executed, after 5 seconds. (Release keys till less than 5 seconds to (4))	Turning off for 1 second
(7)	Returns to the state immediately after turning on of the power supply. Activate the key lock if necessary (see page 22).	

## LED display

The meaning of LED indications are as shown in the table below.

Items	ON	Flashing	OFF
POWER	Normal (normal operation)	Communication system error	Communication EEPROM error / Stop the power supply.
COMMUNICATION	IO-Link communication is not established (SIO mode)	IO-Link communication is established	Stop the power supply.

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

unit	ITV*01*	ITV*03*	ITV*05*	ITV209*
MPa	.020 to .120	.100 to 600	.180 to .A80	-
Kgf/cm <sup>2</sup>	0.20 to .120	1.00 to 6.00	1.80 to A.80	-
bar	0.20 to .120	1.00 to 6.00	1.80 to A.80	-
PSI	3.0 to 18.0	14.0 to 84.0	-26 to 156	-
kPa	-20 to 120	-100 to 600	-180 to A80	16 to -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".

(example: The following of 999(kPa) are displayed as A00(kPa), and it shows 1000 kPa.)

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

Event code 0x1830(See P14)

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

Event code 0x1810(See P14)

## Maintenance

- Before performing maintenance, turn off the power supply, stop the air supply, exhaust the residual compressed air in the piping, and verify the release of air.
- Foreign matter caught in the inlet or exhaust piping may interfere with normal operation. Periodic cleaning is necessary.
- Do not use solvents such as benzene, thinner, etc., to clean the product including the switch cover. Use a soft dry cloth to remove stains.

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: Revision of Safety Instructions  
B: Correction of errors  
(P8,P10,P11,P14,P18,P19,P25,P29,P31)

## SMC Corporation

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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