CKD

Small Size Flow Controller

RAPIFLOW™ FCM Series
IO-Link Type

INSTRUCTION MANUAL

SM-A19060-A/3

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's "**RAPIFLOW™ FCM Series IO-Link Type" compact flow rate controller**.
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, piping, electricity, and mechanisms of pneumatic components. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the pneumatic or water control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

ISO 4414, JIS B 8370, JFPS 2008 (the latest edition of each standard), the High Pressure Gas Safety Act, the Industrial Safety and Health Act, other safety rules, organization standards, relevant laws and regulations.

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.

The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Do not handle the product or remove pipes and devices until confirming safety.

- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Precautions on Working Fluid

⚠DANGER

Do not flow gas with a concentration that falls within the explosion limits.

There is a risk of explosion.

Purge gas inside the pipes with inert gases such as nitrogen or argon before flowing a combustible gas.

There is a risk of explosion if the product is used without purging the pipes with inert gases.

Do not flow oxygen gas in models not designed for oxygen.

There is a risk of fire accident. Even if the product is an oxygen model, once the product is used with gas other than oxygen gas, do not ever use that product with oxygen gas.

⚠ WARNING

Do not use the product as a meter for commercial transactions.

The product does not comply with the Measurement Act (of Japan) or equivalent measurement acts of any country and cannot be used for commercial transactions.

Use the product within the fluid temperature range of 0°C to 50°C.

Even if the temperature is within the specified range, do not use the product in places where sudden changes in the temperature may cause condensation.

Use only applicable fluids.

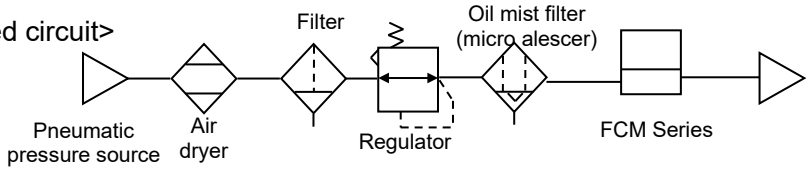
The FCM Series is designed for the gas types specified in the model number. When used with fluids other than the applicable fluids, performance such as accuracy and controllability are not guaranteed. Especially, if hydrogen or helium gas flows into a product not designed for hydrogen or helium gas, the product may not operate due to the safety circuit of the sensor. (Once the safety circuit is activated, the flow rate cannot be measured or controlled until the power is turned off.)

Make sure that the cleanliness of fluid is sufficient.

- Use clean and dry gas that does not contain corrosive chemicals (such as chlorine, sulfur, or acid), dusts, and oil mists.
- If a fluid is left in the product for a long period, the fluid quality may negatively affect the product performance. Do not leave the fluid enclosed in the pipes for a long time.
- If foreign matters such as dusts, water drops, and oil mists in the pipes enter the product, the accuracy and the controllability may deteriorate or the product may fail. If there is a possibility of foreign matters entering the product, install a filter, an air dryer, or an oil mist filter (micro alescer) on the primary side (upstream) of the product.
- When using compressed air, use clean air that is in accordance with JIS B 8392-1:2012 (ISO 8573-1:2010) [1:1:1 to 1:6:2].
- Compressed air from the compressor contains drainage such as water, oxidized oil, and foreign matters. Install a filter, an air dryer, or an oil mist filter (micro alescer) on the primary side (upstream) of the product.

Note that the mesh (metal) provided in the product is used to rectify the flow in the piping. It is not a filter for removing foreign matters.

<Recommended circuit>



Use the product after checking that the fluid pressure is within the operating differential pressure range.

- If the pressure exceeds the proof pressure or is outside the operating differential pressure range, the product may fail.
- If the primary pressure is low or the secondary side pressure is high, the fluid will not flow due to insufficient differential pressure.

Check the flow characteristics of the regulator on the primary side.

Depending on the flow characteristics of the regulator, the pressure may become unstable when a certain amount of fluid flows and the output from the product may fluctuate.

Use a valve with an oil-prohibited specification and install a filter when using a valve on the primary side of the product.

The product may malfunction or fail due to the grease or oil splattering or the abrasion powder generated from the valve.

Vaporize liquefied gases such as propane gas before use.

Flowing liquefied gas into the product may cause failures.

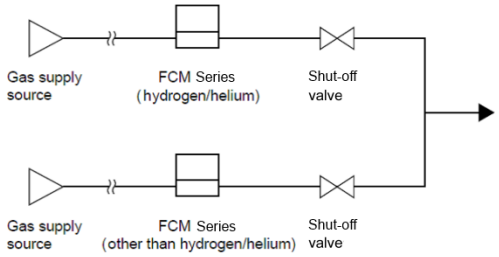
Design the arrangement of the product and the piping so that the backfire is prevented and the product is protected from damage even if a backfire occurs when using the product for burner air-fuel ratio control.

A rise in the internal pressure in the pipes and a fire caused by a burner's backfire may cause failures.

⚠WARNING

When using a mixture of hydrogen or helium gas and other gases, make sure not to let gases used in each FCM Series controller to flow into other FCM Series controllers.

For use in a parallel circuit as shown in the figure below, if hydrogen or helium gas flows into a product not designed for hydrogen or helium gas, the product may not operate due to the safety circuit of the sensor. Take measures to prevent this inflow. (Once the safety circuit is activated, the flow rate cannot be measured or controlled until the power is turned off.) When shutting off the gas, install a shut-off valve for each product as shown in the figure below to prevent the backflow of gas.



Precautions on Maintenance

⚠CAUTION

Do not use materials such as solvents, alcohol, and detergents to remove dirt and stains.

The case is made of resin and resin can be damaged by these materials. Soak a waste cloth in a diluted neutral detergent and wring it out well. Use this cloth to wipe off dirt.

Check the flow rate accuracy periodically.

It is recommended to check the flow rate accuracy periodically. The accuracy may change from the initial state depending on the condition of use and the environment. Also, when the product is used for a long period, the accuracy may change due to a deterioration of the sensor chip.

The flow rate displayed on the product is the volumetric flow converted from the mass flow. The measured mass flow is converted to the volumetric flow rate at 20°C, 1 atmospheric pressure (101 kPa), and 65% RH.

CONTENTS

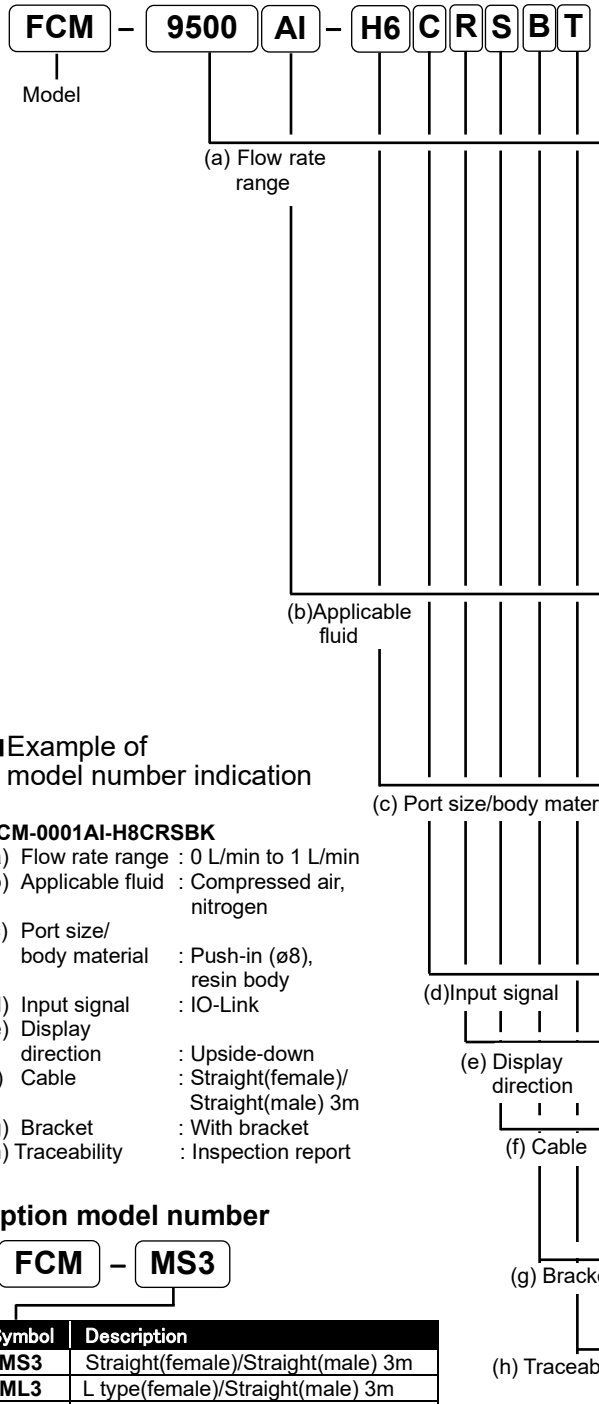
PREFACE ..... **i**
SAFETY INFORMATION ..... **ii**
Precautions on Product Use iii
Precautions on Working Fluid iii
Precautions on Maintenance v
CONTENTS ..... **vi**
1. PRODUCT OVERVIEW **1**
1.1 Model Number Indication 1
1.1.1 General gas model 1
1.1.2 Hydrogen/helium model 2
1.1.3 Optional parts 3
1.2 Specifications 4
1.2.1 General gas model 4
1.2.2 Hydrogen/helium model 7
1.3 Communication specifications 9
1.3.1 General 9
1.3.2 On demand data 10
1.3.3 Parameter and commands 11
1.3.4 Process data IN 15
1.3.5 Process data OUT 16
1.3.6 Observation 17
1.3.7 Diagnosis 18
1.4 Dimensions 19
1.4.1 Resin body 19
1.4.2 Stainless steel body 20
1.5 Functions 23
1.5.1 Names and Functions of Display and Operation Panel 25
2. INSTALLATION **26**
2.1 Environment 26
2.2 Mounting 28
2.3 Piping 29
2.3.1 Pipe cleaning 29
2.3.2 Seal material 29
2.3.3 Piping direction 29
2.3.4 Tightening 30
2.4 Wiring 31
2.4.1 M12 connector 33
2.4.2 Cable connection 34
3. USAGE **35**
3.1 Flow rate control 37
3.1.1 Controlling the flow rate using the direct memory function 37
3.1.2 Controlling the flow rate using the preset input function 40
3.1.3 Setting change using shortcut keys (only when using direct memory and preset input functions) 42
3.1.4 Controlling the flow rate using the normal mode input function (IO-Link communication only) 43
3.2 Flow rate integration 45
3.2.1 How to display integrated flow 45
3.2.2 Closing the proportional solenoid valve at the set integrated flow rate 47
3.2.3 Outputting integrated pulse 49

3.2.4 Turning the switch ON with the set integrated flow rate 50
3.3 Switch output function 52
3.3.1 Using tolerance mode 52
3.3.2 Using the designated range mode 54
3.4 Operation Flow 56
4. TROUBLESHOOTING 63
4.1 Problems, Causes, and Solutions 63
4.2 Error Code 65
5. WARRANTY PROVISIONS 66
5.1 Warranty Conditions 66
5.2 Warranty Period 66

1. PRODUCT OVERVIEW

1.1 Model Number Indication

1.1.1 General gas model



■Example of model number indication

FCM-0001AI-H8CRSBK

(a) Flow rate range : 0 L/min to 1 L/min
(b) Applicable fluid : Compressed air, nitrogen
(c) Port size/ body material : Push-in (ø8), resin body
(d) Input signal : IO-Link
(e) Display direction : Upside-down
(f) Cable : Straight(female)/ Straight(male) 3m
(g) Bracket : With bracket
(h) Traceability : Inspection report

Option model number

Symbol	Description
MS3	Straight(female)/Straight(male) 3m
ML3	L type(female)/Straight(male) 3m
MM3	One side straight(female) 3m
LB1	Bracket

Symbol	Description						
(a) Flow rate range							
Applicable fluid			**AI**	**AR**	**O2**	**LN**	**C1**	**C3**
9500	Standard differential pressure type	0 L/min to 0.5 L/min	●	●	●	●	●	●
0001		0 L/min to 1 L/min	●	●	●	●	●	●
0002		0 L/min to 2 L/min	●	●	●	●	●	●
0005		0 L/min to 5 L/min	●	●	●	●	●	●
0010		0 L/min to 10 L/min	●	●	●	●	●	●
0020		0 L/min to 20 L/min	●	●				
0050		0 L/min to 50 L/min	●	●				
0100		0 L/min to 100 L/min (resin body only)	●					
L9500	Low differential pressure type (stainless steel only)	0 L/min to 0.5 L/min	●		●	●	●	●
L0001		0 L/min to 1 L/min	●		●	●	●	●
L0001		0 L/min to 2 L/min	●		●	●	●	●
L0005		0 L/min to 5 L/min	●		●	●	●	●
L0010		0 L/min to 10 L/min	●		●	●	●	●

(b) Applicable fluid	
AI	Compressed air, nitrogen
AR	Argon
O2	Oxygen (oil-prohibited specification)
LN	City gas (13A)
C1	Methane (CH4)
C3	Propane (C3H8)

(c) Port size/body material							
Port size/body material		**AI**	**AR**	**O2**	**LN**	**C1**	**C3**
H6	Push-in (ø6), resin body (excluding flow rate ranges 50 L/min and 100 L/min)	●					
H8	Push-in (ø8), resin body	●					
8A	Rc1/4, stainless steel body	●	●	●	●	●	●
UF Note 1	9/16-18UNF, stainless steel body	●	●	●	●	●	●

(d) Input signal	
C	IO-Link

(e) Display direction	
Blank	Normal direction
R	Upside-down

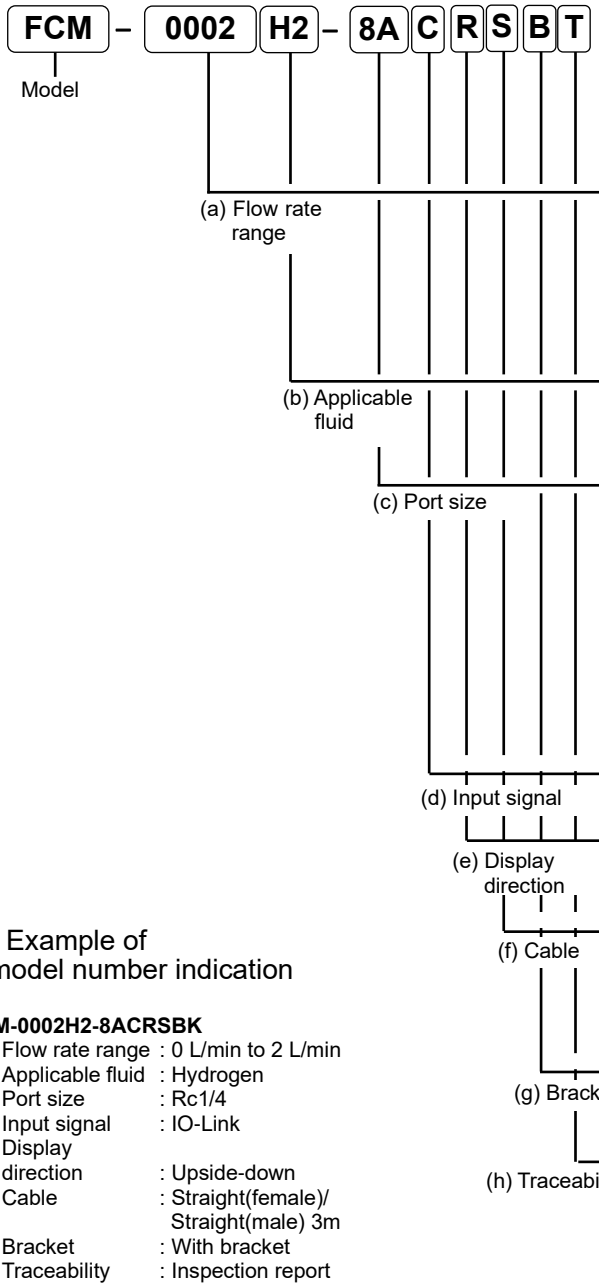
(f) Cable Note 2	
Blank	None
S	Straight(female)/ straight (male) 3m
L	L type(female)/ straight (male) 3m
M	One side straight(female) 3m

(g) Bracket Note 2	
Blank	None
B	With bracket

(h) Traceability Note 2	
Blank	None
T	Traceability certificate, system diagram, inspection report
K	Inspection report

Note 1: Refer to “1.4 Dimensions” for the 9/16-18UNF screw shape.
Note 2: Items (f), (g), and (h) are delivered with the product when selected.

1.1.2 Hydrogen/helium model



Symbol	Description		
(a) Flow rate range			
Applicable fluid		**H2**	**HE**
0002	0 L/min to 2 L/min	●	●
0005	0 L/min to 5 L/min	●	●
0010	0 L/min to 10 L/min	●	●
0020	0 L/min to 20 L/min	●	●

(b) Applicable fluid	
H2	Hydrogen
HE	Helium

(c) Port size			
Port size		**H2**	**HE**
8A	Rc1/4	●	●
UF Note 1	9/16-18UNF	●	●
4S	1/4-inch double bite-type fitting	●	●
4RM	1/4-inch JXR male fitting	●	●

(d) Input signal	
C	IO-Link

(e) Display direction	
Blank	Normal direction
R	Upside-down

(f) Cable Note 2	
Blank	None
S	Straight(female)/ straight (male) 3m
L	L type(female) / straight (male) 3m
M	One side straight(female) 3m

(g) Bracket Note 2	
Blank	None
B	With bracket

(h) Traceability Note 2	
Blank	None
T	Traceability certificate, system diagram, inspection report
K	Inspection report

■ Example of model number indication

FCM-0002H2-8ACRSBK
(a) Flow rate range : 0 L/min to 2 L/min
(b) Applicable fluid : Hydrogen
(c) Port size : Rc1/4
(d) Input signal : IO-Link
(e) Display direction : Upside-down
(f) Cable : Straight(female)/ Straight(male) 3m
(g) Bracket : With bracket
(h) Traceability : Inspection report

Note 1: Refer to “1.4 Dimensions” for the 9/16-18UNF screw shape.
Note 2: Items (f), (g), and (h) are delivered with the product when selected.

Option model number

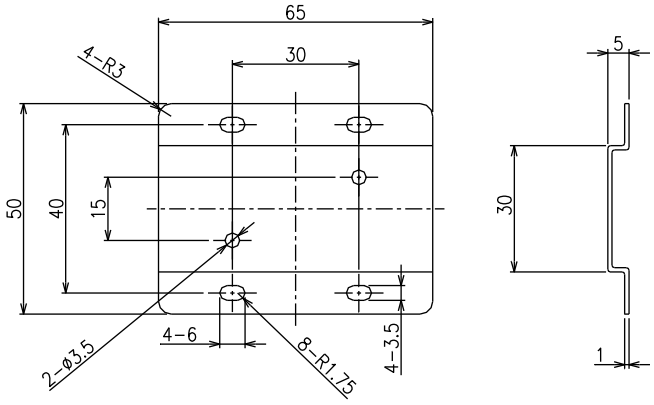
FCM – MS3

Symbol	Description
MS3	Straight(female)/Straight(male) 3m
ML3	L type(female)/Straight(male) 3m
MM3	One side straight(female) 3m
LB1	Bracket

1.1.3 Optional parts

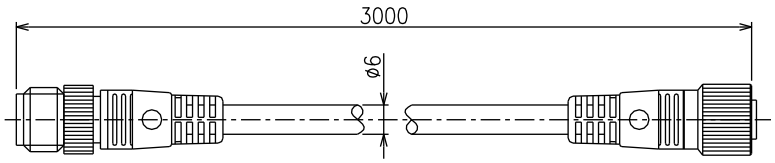
■ Dedicated bracket

Model number：FCM-LB1



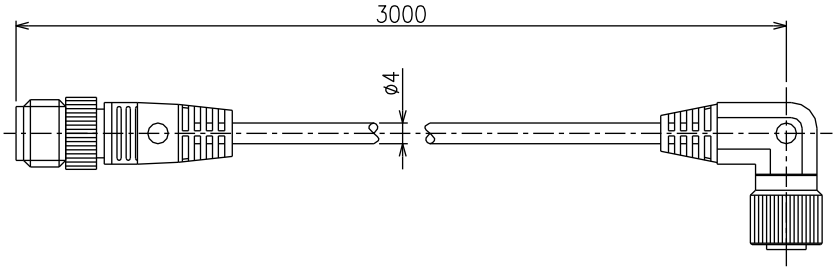
■ Optional cable (M12 Straight(female) / M12 Straight(male))

Model number: FCM-MS3



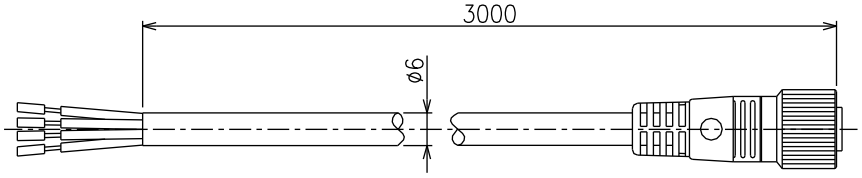
■ Optional cable (M12 L Type(female) / M12 Straight(male))

Model number: FCM-ML3



■ Optional cable (M12 One side straight(female))

Model number: FCM-MM3



1.2 Specifications

1.2.1 General gas model

Descriptions \ Model no.				FCM-[(a)][(b)]-[(c)]C						
Valve actuation				Proportional solenoid valve: Closed when not energized						
				Full-scale flow rate	AI (Air, nitrogen)	AR (Argon)	O2 (Oxygen)	LN (City gas)	C1 (Methane)	C3 (Propane)
Flow rate range Note 1	(a)	Standard differential pressure type	9500	500mL/min	Y	Y	Y	Y	Y	Y
			0001	1L/min	Y	Y	Y	Y	Y	Y
			0002	2L/min	Y	Y	Y	Y	Y	Y
			0005	5L/min	Y	Y	Y	Y	Y	Y
			0010	10L/min	Y	Y	Y	Y	Y	Y
			0020	20L/min	Y	Y				
			0050	50L/min	Y	Y				
			0100	100L/min(resin body only)	Y					
		Low differential pressure type (Stainless steel only)	L9500	500mL/min	Y		Y	Y	Y	Y
			L0001	1L/min	Y		Y	Y	Y	Y
			L0002	2L/min	Y		Y	Y	Y	Y
			L0005	5L/min	Y		Y	Y	Y	Y
			L0010	10L/min	Y		Y	Y	Y	Y
Applicable fluid Note 2	(b)		AI	Compressed air, nitrogen	Y					
			AR	Argon		Y				
			O2	Oxygen (oil-prohibited specification)			Y			
			LN	City gas (13A) Note 3				Y		
			C1	Methane (CH4 100%)					Y	
			C3	Propane (C3H8 100%)						Y
Port size/ body material	(c)		H6	Push-in (ø6), resin body (excluding flow rate ranges 50 L/min and 100 L/min)	Y					
			H8	Push-in (ø8), resin body	Y					
			8A	RC1/4, stainless steel body	Y	Y	Y	Y	Y	Y
			UF	9/16-18UNF, stainless steel body	Y	Y	Y	Y	Y	Y
Control	Control range			3%FS to 100%FS						
	Response time	(a)	9500 to 0020	Within 0.5 sec at setting ± 5%FS (TYP)						
			0050 to 0100	Within 1 sec at setting ± 5%FS (TYP)						
	Accuracy			± 3%FS or less						
	Repeatability			± 1%FS or less						
	Temperature characteristics			± 0.2%FS/°C or less (reference temperature: 25°C)						
	Pressure characteristics			± 1%FS or less per 98 kPa (reference: standard differential pressure)						
Pressure specification	Standard differential pressure			Refer to the separate table.						
	Operating differential pressure			Refer to the separate table.						
	Max. working pressure			Refer to the separate table.						
	Proof pressure	(c)	H6/H8	490kPa						
			8A/UF	980kPa						
Operating ambient temperature, humidity				0°C to 50°C, 90% RH or less (no condensation)						

Note 1: Converted to volumetric flow rate at 20°C, 1 atmospheric pressure (101 kPa), and 65% RH. Full-scale is the maximum value in the flow rate range.

Note 2: Use clean and dry gas that does not contain corrosive chemicals (such as chlorine, sulfur, or acid), dusts, and oil mists.
When using compressed air, use clean air that is in accordance with JIS B 8392-1:2012 (ISO 8573-1:2010) [1:1:1 to 1:6:2]. Compressed air from the compressor contains drainage such as oxidized oil and foreign matters. Install a filter, an air dryer (minimum pressure dew point 10°C or less), or an oil mist filter (maximum oil concentration 0.1 mg/m^3) on the primary side (upstream) of the product.

Note 3: City gas (13A) represents a gas that is 88% methane (CH4) generated from LNG.

項目 ＼ 形番				FCM-[(a)][(b)]-[(c)]C
Input			C	IO-Link
Flow rate display	Display method			3-digit 7-segment LED, display accuracy: control accuracy ± 1 digit
	Display range and resolution			Refer to the separate table.
Integration				Refer to the separate table.
Power	Power supply voltage			24 VDC ± 10% (stabilized power supply with ripple rate 1% or less)
	Current consumption Note 4			200 mA or less(Port type A)
Mounting orientation				No restriction
Wetted part material		(c)	H6/H8	Polyamide resin, fluoro rubber, stainless steel, alumina, semiconductor silicon, solder
			8A/UF	Stainless steel, fluoro rubber, alumina, semiconductor silicon, solder
Weight		(c)	H6/H8	Approx. 200 g
			8A/UF	Approx. 480 g
Weight				Equivalent to IP40 (IEC standard)
Protection circuit Note 5				Power reverse connection protection
EMC directive				EN 55011、EN 61000-6-2、EN 61000-4-2/3/4/6/8

Note 4: Use the power supply unit that have the power supply ability sufficiently to each port of IO-Link master.
Note 5: The protection circuit is only effective against the specified reverse connections, and not against all incorrect connections.

■ Standard differential pressure type: Pressure specifications Note 6, Note 7

			Flow rate range (a)							
			9500	0001	0002	0005	0010	0020	0050	0100
Applicable fluid (b)	AI	Standard differential pressure (kPa)	50	100	100	100	100	150	200	300
		Operating differential pressure (kPa)	20 to 150	50 to 200	50 to 250	50 to 250	50 to 250	100 to 300	150 to 300	250 to 350
		Max. working pressure (kPa)	150	200	250	250	250	300	300	350
	AR	Standard differential pressure (kPa)	50	100	100	100	100	150	200	
		Operating differential pressure (kPa)	20 to 150	50 to 200	50 to 250	50 to 250	50 to 250	100 to 300	150 to 300	
		Max. working pressure (kPa)	150	200	250	250	250	300	300	
	O2	Standard differential pressure (kPa)	50	100	100	100	100			
		Operating differential pressure (kPa)	20 to 150	50 to 200	50 to 250	50 to 250	50 to 250			
		Max. working pressure (kPa)	150	200	250	250	250			
	LN/C1	Standard differential pressure (kPa)	50	50	50	50	50			
		Operating differential pressure (kPa)	20 to 150	20 to 150	20 to 150	20 to 150	30 to 150			
		Max. working pressure (kPa)	150	150	150	150	150			
	C3	Standard differential pressure (kPa)	50	50	50	50	50			
		Operating differential pressure (kPa)	20 to 150	20 to 150	20 to 150	20 to 150	30 to 150			
		Max. working pressure (kPa)	150	150	150	150	150			

Note 6: The standard differential pressure is the differential pressure when the product is calibrated at the factory (with the secondary side opened to the atmosphere).

Note 7: The operating differential pressure is required to operate the product normally. It varies depending on the flow rate range and the applicable fluid.
The minimum operating differential pressure is required to flow the full-scale flow rate with the secondary side opened to the atmosphere.
The maximum working pressure (the maximum value of the operating differential pressure) is the maximum value of the primary side pressure. If larger pressure is applied, the control will become unstable or the maximum flow rate will become uncontrollable.

■ Low differential pressure type: Pressure specifications

			Flow rate range (a)				
			L9500	L0001	L0002	L0005	L0010
Applicable fluid (b)	AI/O2 LN/C1 C3 Note 8	Standard differential pressure (kPa)	20	20	20	20	20
		Operating differential pressure (kPa)	5 to 50	5 to 50	5 to 50	5 to 50	10 to 50
		Max. working pressure (kPa)	50	50	50	50	50

Note 8: For the low pressure line (1 kPa to 2.5 kPa) of city gas, the operating differential pressure will be outside the range.

■ Flow rate display and integration

		Flow rate range (a)							
		9500 L9500	0001 L0001	0002 L0002	0005 L0005	0010 L0010	0020	0050	0100
Flow rate display	Display range	0 to 500 mL/min	0.00 to 1.00 L/min	0.00 to 2.00 L/min	0.00 to 5.00 L/min	0.0 to 10.0 L/min	0.0 to 20.0 L/min	0.0 to 50.0 L/min	0 to 100 L/min
	Display resolution	1 mL/min	0.01 L/min	0.01 L/min	0.01 L/min	0.1 L/min	0.1 L/min	0.1 L/min	1 L/min
Integration Note 9	Display range	999999 mL	9999.99 L	9999.99 L	9999.99 L	99999.9 L	99999.9 L	99999.9 L	999999 L
	Display resolution	1 mL	0.01 L	0.01 L	0.01 L	0.1 L	0.1 L	0.1 L	1 L
	Pulse output rate	5 mL	0.01 L	0.02 L	0.05 L	0.1 L	0.2 L	0.5 L	1 L

Note 10: The integrated flow rate is a calculated (reference) value. The value is reset when the power is turned off.
If you want to start the flow integration after turning on the power, set the “Flow integration stop” and “Flow integration reset” bits in Process Data OUT to “0”.

1.2.2 Hydrogen/helium model

Descriptions \ Model no.			FCM-[(a)][(b)]-[(c)]C		
Valve actuation			Proportional solenoid valve: Closed when not energized		
			Full-scale flow rate	Hydrogen (H2)	Helium (HE)
Flow rate range Note 1	(a)	0002	2 L/min	Y	Y
		0005	5 L/min	Y	Y
		0010	10 L/min	Y	Y
		0020	20 L/min	Y	Y
Applicable fluid Note 2	(b)	H2	Hydrogen	Y	
		HE	Helium		Y
Port size	(c)	8A	Rc1/4	Y	Y
		UF	9/16-18UNF	Y	Y
		4S	1/4-inch double bite-type fitting	Y	Y
		4RM	1/4-inch JXR male fitting	Y	Y
Control	Control range		3%FS to 100%FS		
	Response time		Within 0.5 sec at setting ± 5%FS (TYP)		
	Accuracy		± 3%FS or less		
	Repeatability		± 1%FS or less		
	Temperature characteristics		± 0.2%FS/°C or less (reference temperature: 25°C)		
	Pressure characteristics		± 1%FS or less per 98 kPa (reference: standard differential pressure)		
Pressure specification	Standard differential pressure		Refer to the separate table.		
	Operating differential pressure range		Refer to the separate table.		
	Max. working pressure		Refer to the separate table.		
	Proof pressure		980 kPa		
Operating ambient temperature, humidity			0°C to 50°C, 90% RH or less (no condensation)		
External leakage Note 3			1 x 10^{-6} Pa·m^3/s (helium leakage rate) or less		
Input		C	IO-Link		
Flow rate display	Display method		3-digit 7-segment LED, display accuracy: control accuracy ± 1 digit		
	Display range and resolution		Refer to the separate table.		
Integration			Refer to the separate table.		
Power	Power supply voltage		24 VDC ± 10% (stabilized power supply with ripple rate 1% or less)		
	Current consumption Note 4		220 mA or less (Port type A)		

Note 1: Converted to volumetric flow rate at 20°C, 1 atmospheric pressure (101 kPa). Full-scale is the maximum value in the flow rate range.
Note 2: Use clean and dry gas that does not contain corrosive chemicals (such as chlorine, sulfur, or acid), dusts, and oil mists.
Note 3: The internal valve of the product cannot be used as a stop valve (a valve which does not allow leakage). Leakage is allowed to some degree for the internal valve.
Note 4: Use the power supply unit that have the power supply ability sufficiently to each port of IO-Link master.

Descriptions \ Model no.			FCM-[(a)][(b)]-[(c)]C
Mounting orientation			No restriction
Wetted part material			Stainless steel, fluoro rubber, alumina, semiconductor silicon, solder
Weight	(c)	8A/UF	Approx. 480 g
		4S/4RM	Approx. 560 g
Degree of protection			Equivalent to IP40 (IEC standard)
Protection circuit Note 5			Power reverse connection protection
EMC directive			EN 55011, EN 61000-6-2, EN 61000-4-2/3/4/6/8

Note 5: The protection circuit is only effective against the specified reverse connections, and not against all incorrect connections.

■ Pressure specifications Note 6, Note 7

			Flow rate range (a)			
			0002	0005	0010	0020
Applicable fluid (b)	H2	Standard differential pressure (kPa)	20	50	50	50
		Operating differential pressure (kPa)	10 to 50	30 to 80	30 to 80	30 to 80
		Max. working pressure (kPa)	50	80	80	80
	HE	Standard differential pressure (kPa)	50	100	100	100
		Operating differential pressure (kPa)	20 to 100	50 to 150	50 to 150	100 to 150
		Max. working pressure (kPa)	100	150	150	150

Note 6: The standard differential pressure is the differential pressure when the product is calibrated at the factory (with the secondary side opened to the atmosphere).

Note 7: The operating differential pressure is required to operate the product normally. It varies depending on the flow rate range and the applicable fluid.
The minimum operating differential pressure is required to flow the full-scale flow rate with the secondary side opened to the atmosphere.
The maximum working pressure (the maximum value of the operating differential pressure) is the maximum value of the primary side pressure. If larger pressure is applied, the control will become unstable or the maximum flow rate will become uncontrollable.

■ Flow rate display and integration

		Flow rate range (a)			
		0002	0005	0010	0020
Flow rate display	Display range	0.00 L/min to 2.00 L/min	0.00 L/min to 5.00 L/min	0.0 L/min to 10.0 L/min	0.0 L/min to 20.0 L/min
	Display resolution	0.01 L/min	0.01 L/min	0.1 L/min	0.1 L/min
Integration Note 8	Display range	9999.99 L	9999.99 L	99999.9 L	99999.9 L
	Display resolution	0.01 L	0.01 L	0.1 L	0.1 L
	Pulse output rate	0.02 L	0.05 L	0.1 L	0.2 L

Note 8: The integrated flow rate is a calculated (reference) value. The value is reset when the power is turned off.
If you want to start the flow integration after turning on the power, set the “Flow integration stop” and “Flow integration reset” bits in Process Data OUT to “0”.

1.3 Communication specifications

1.3.1 General

Item	Details
Communication protocol	IO-Link
Communication protocol revision	V1.1
Transmission rate	COM3(230.4kbps)
Port Type	Class A
Process Data (Input)	10byte
Process Data (Output)	4byte

Item	Details
Min Cycle Times	2ms
Data Storage	1kbyte
SIOMode support	None
Device ID	See the table below

■ Device ID

Device ID is different for each flow range.

Device ID	Product ID	Note
0x216001	FCM-9500-C	500mL/min Type
0x216002	FCM-0001-C	1L/min Type
0x216003	FCM-0002-C	2L/min Type
0x216004	FCM-0005-C	5L/min Type
0x216005	FCM-0010-C	10L/min Type
0x216006	FCM-0020-C	20L/min Type
0x216007	FCM-0050-C	50L/min Type
0x216008	FCM-0100-C	100L/min Type

※Please download the IODD file the CKD homepage.

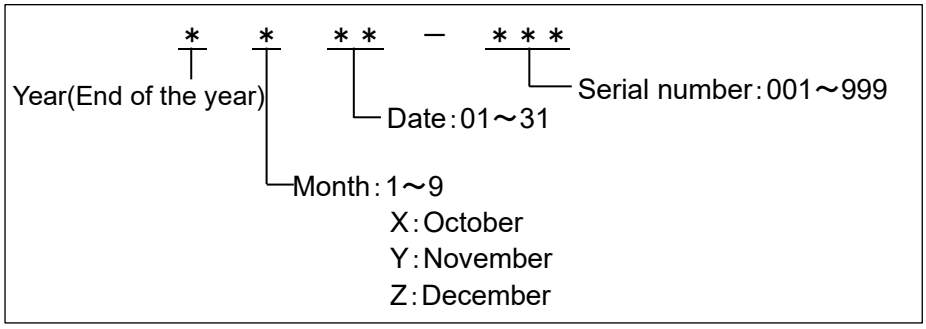
1.3.2 On demand data

■ Identification

Vendor ID：855(Decimal number)/ 357(Hexadecimal number)

Index	Sub index	Item	Value	Access	Data Length	Format
0x0010	0	Vendor Name	CKD Corporation	R	64byte	String
0x0011	0	Vendor Text	https://www.ckd.co.jp/	R	64byte	String
0x0012	0	Product Name	FCM-0050＊-＊C Note 1	R	40byte	String
0x0013	0	Product ID	FCM-0050-C Note 1	R	64byte	String
0x0014	0	Product Text	Small Size Flow Controller RapiFlow, 50L/min Note 1	R	64byte	String
0x0015	0	Serial- Number	＊＊＊＊-＊＊＊ Note 2	R	16byte	String
0x0016	0	Hardware Revision	v1.0 Note 1	R	64byte	String
0x0017	0	Firmware Revision	v2.0 Note 1	R	64byte	String
0x0018	0	Application Specific Tag	＊＊＊	R/W	32byte	String

R：Read out
R/W：Read out / Writing
Note 1: A reference example: 50L/min type.
Note 2: About serial No.



Flow rate range for each model

Model No.	Flow rate display range			Integrated flow	
	Display range	Display value	ProcessData output value	Integrated flow display range	Display value
FCM-(L)9500*-*C	0 to 500.0 mL/min	0 to 500	0 to 5000	0 to 999999 mL	0 to 999999
FCM-(L)0001*-*C	0.00 to 1.000 L/min	0 to 1.00	0 to 1000	0 to 9999.99 L	
FCM-(L)0002*-*C	0.00 to 2.000 L/min	0 to 2.00	0 to 2000		
FCM-(L)0005*-*C	0.00 to 5.000 L/min	0 to 5.00	0 to 5000		
FCM-(L)0010*-*C	0.0 to 10.00 L/min	0 to 10.0	0 to 1000	0 to 99999.9 L	
FCM-0020*-*C	0.0 to 20.00 L/min	0 to 20.0	0 to 2000		
FCM-0050*-*C	0.0 to 50.00 L/min	0 to 50.0	0 to 5000		
FCM-0100*-*C	0 to100.0 L/min	0 to 100	0 to 1000	0 to 999999 L	

1.3.3 Parameter and commands

■ Common specification

Index	Sub index	Item	Value	Access	Deta Length	Format
0x0002	0	System Command	See “Table 1 ” below	W	1byte	UInteger8
0x000C	0	Device Access Locks	0x0000：No lock 0x0001：Parameter lock 0x0002：Data storage lock	R/W	2byte	Record
0x0020	0	Error Count	0	R	2byte	UInteger16
0x0024	0	Device Status	0	R	1byte	UInteger8
0x0025	0	Detailed Devices Status	Refer to “Diagnosis”	R	33byte	Array of 3 Octetstring

R：Read out
W：Writing
R/W：Read out / Writing

Table 1 System Command

Value	Command	Contents
0x82	Restore Factory Settings	Set the setting value to the shipping state.
0xA0	Zero Adjust Start	Adjust current value as zero point
0xA1	Zero Adjust Reset	Return the zero point adjustment value to the initial value.

■ Individual specification

Index	Sub index	Item	Value	Data storage	Access	Data length	Format
0x0100	0	Applicable Fluid	0：AIR/ 1：AR/ 2：O2/ 3：LN/ 4：CH4/ 5：C3H8/ 6：H2/ 7：He/	-	R	2byte	UInteger16
0x0101	0	Switch output1(Tolerance mode) ON/OFF selection	1：ON 0：OFF	○	R/W	2byte	UInteger16
0x0102	0	Switch output1(Tolerance mode) NO/NC selection	0：NO(Normally Open) 1：NC(Normally Close)	○	R/W	2byte	UInteger16
0x0103	0	Switch output1(Tolerance mode) Lower limit value	0 %F.S. Setting range:-50 to 0%F.S.	○	R/W	2byte	Integer16
0x0104	0	Switch output1(Tolerance mode) Higher limit value	0 %F.S. Setting range:0 to 50%F.S.	○	R/W	2byte	Integer16
0x0105	0	Switch output2 (Designated Range Mode) ON/OFFselectiuon	1：ON 0：OFF	○	R/W	2byte	UInteger16
0x0106	0	Switch output2 (Designated Range Mode) NO/NC selection	0：NO(Normally Open) 1：NC(Normally Close)	○	R/W	2byte	UInteger16
0x0107	0	Switch output2 (Designated Range Mode) Lower limit value	0 %F.S. Note 1 Setting range:0～90%F.S.	○	R/W	2byte	UInteger16
0x0108	0	Switch output2 (Designated Range Mode) Higher limit value	100 %F.S. Note 1 Setting range:10～100%F.S.	○	R/W	2byte	UInteger16
0x0109	0	Switch output3(Integrated Pulse) ON/OFF selection	1：ON 0：OFF	○	R/W	2byte	UInteger16
0x010A	0	Switch output3(Integrated Pulse) NO/NC selection	0：NO(Normally Open) 1：NC(Normally Close)	○	R/W	2byte	UInteger16
0x010B	0	Switch output4 (Integrated Flow) ON/OFF selection	1：ON 0：OFF	○	R/W	2byte	UInteger16
0x010C	0	Switch output4 (Integrated Flow) NO/NC selection	0：NO(Normally Open) 1：NC(Normally Close)	○	R/W	2byte	UInteger16
0x010D	0	Switch output4 (Integrated Flow) Set value	0 L Setting range:Refer to Table 2	○	R/W	4byte	UInteger32
0x010E	0	Integration automatic shut-off function	0：OFF 1：ON	○	R/W	2byte	UInteger16
0x010F	0	Integration automatic shut-off setting value	0 L Setting range:Refer to Table 2	○	R/W	4byte	UInteger32
0x0110	0	Error automatic shut-off function	0：OFF 1：Vlave fully closes 2：Valve fully opens	○	R/W	2byte	UInteger16
0x0111	0	Control error threshold setting	Control value ±20 %F.S. Setting range:5～100%F.S.	○	R/W	2byte	UInteger16
0x0112	0	Position decimal point of data Note 5	0：Instantaneous flow XXX.X Integration flow None 1：Instantaneous flow XX.XX Integration flow XXXXX.X 2：Instantaneous flow X.XXX Integration flow XXXX.XX	-	R	2byte	Uinteger16

Index	Sub index	Item	Value	Data storage	Access	Data length	Format
0x0113	0	Auto power off setting	0：OFF 1：ON	○	R/W	2byte	UInteger16
0x0114	0	Key lock setting	0：Unlock 1：Lock	○	R/W	2byte	UInteger16
0x0115	0	Input setting	0：Normal Mode 1：Preset Mode 2：Direct Mode	○	R/W	2byte	UInteger16
0x0116	0	Preset memory 1	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x0117	0	Preset memory 2	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x0118	0	Preset memory 3	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x0119	0	Preset memory 4	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x011A	0	Preset memory 5	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x011B	0	Preset memory 6	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x011C	0	Preset memory 7	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x011D	0	Preset memory 8	0 L/min Note 2 Setting range:Refer to Table 2	○	R/W	2byte	UInteger16
0x011E	0	Operation setting while communication error occurred Note 3	0 : HOLD 1 : CLEAR 2 : OPEN	○	R/W	2byte	Uinteger16
0x011F	0	Switch output 1 (Tolerance mode) when valve fully opens Reference value setting ON/OFF	0 : OFF Note 4 1 : ON	○	R/W	2byte	UInteger16
0x0120	0	Switch output 1 (Tolerance mode) when valve fully opens Reference value	100%F.S. Setting range:0～100%F.S.	○	R/W	2byte	UInteger16

※ R：Read out、W：Writing、R/W：Read out / Writing

※ : Default value（The value of applicablefluid and position decimal point of data are fixed value. The value is fixed depending on selected type.）

Note 1: Set the difference 10%F.S. between the higher and lower limit. If the difference is under 10%F.S., the higher limit value is set to “lower limit value+10%F.S.”.

Note 2: If this is set to “9999”, “Valve fully opens”.

Note 3: The operation while communication error occurred is as indicated in Table 3.

Note 4: If this is “0：OFF”, the set flow rate just before valve fully opens is referred.

Note 5: The instantaneous flow rate value in communication is handled by 4 digits, which is 1 digit more than the 3 digits displayed on the screen of product. Please note the position decimal point.

Table 2

Model No.	Flow rate display range			Integrated flow	
	Display range	Display value	ProcessData output value	Integrated flow display range	Display value
FCM-(L)9500*-*C	0 to 500.0 mL/min	0 to 500	0 to 5000	0 to 999999 mL	0 to 999999
FCM-(L)0001*-*C	0.00 to 1.000 L/min	0 to 1.00	0 to 1000	0 to 9999.99 L	
FCM-(L)0002*-*C	0.00 to 2.000 L/min	0 to 2.00	0 to 2000		
FCM-(L)0005*-*C	0.00 to 5.000 L/min	0 to 5.00	0 to 5000		
FCM-(L)0010*-*C	0.0 to 10.00 L/min	0 to 10.0	0 to 1000	0 to 99999.9 L	
FCM-0020*-*C	0.0 to 20.00 L/min	0 to 20.0	0 to 2000		
FCM-0050*-*C	0.0 to 50.00 L/min	0 to 50.0	0 to 5000		
FCM-0100*-*C	0 to100.0 L/min	0 to 100	0 to 1000	0 to 999999 L	

Table 3

State / Cause	When an Communication error			When as Communication error recovery		
	Normal mode	Preset mode	Direct mode	Normal mode	Preset mode	Direct mode
C/Q line disconnection (Communication error)	**HOLD setting** Controlled flow rate is held in Process Data Out set value before an error occurrence.	**HOLD setting** Controlled flow rate is held in Preset set value before an error occurrence.	**HOLD setting** Controlled flow rate is controlled with Direct set value.	**HOLD setting** Controlled flow rate is controlled with Process Data Out set value.	**HOLD setting** Controlled flow rate is controlled with Preset set value.	**HOLD setting** Controlled flow rate is controlled with Direct set value.
	CLEAR setting Valve fully closes.	**CLEAR setting** Valve fully closes.	**CLEAR setting** Controlled flow rate is controlled with Direct set value.	**CLEAR setting** Controlled flow rate is controlled with Process Data Out set value.	**CLEAR setting** Controlled flow rate is controlled with Preset set value.	**CLEAR setting** Controlled flow rate is controlled with Direct set value.
	OPEN setting Valve fully opens.	**OPEN setting** Valve fully opens.	**OPEN setting** Controlled flow rate is controlled with Direct set value.	**OPEN setting** Controlled flow rate is controlled with Process Data Out set value.	**OPEN setting** Controlled flow rate is controlled with Preset set value.	**OPEN setting** Controlled flow rate is controlled with Direct set value.

※ Communication error is defined that "Process Data Status is invalid state" or "Process Data OUT is invalid state".
If the C/Q line is disconnected, the Process Data Status becomes invalid state.
When a disconnection occurs between the IO-Link master and its upper network, Process Data OUT is disabled.
(Depending on the IO-Link master specifications, Process Data OUT may not be invalidated even if the upper network is disconnected, so please check the master specifications.)

※ HOLD/CLEAR/OPEN is the switch for controlling the operation when an error occurrence in the communication function.
They can be set with “F8:Operation when a communication error occurrence” or “0x011E: Operation when a communication error occurrence” in IO-Link communication.

1.3.4 Process data IN

PD	PD0								PD1							
Bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
	MSB															LSB
Data Name	Integrated Flow Upper Byte															
Data Range	2byte															
Format	UInteger16															

PD	PD2								PD3							
Bit	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
	MSB															LSB
Data Name	Integrated Flow Lower Byte															
Data Range	2byte															
Format	UInteger16															

PD	PD4								PD5							
Bit	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
	MSB															LSB
Data Name	Set Value for Flow Rate(for confirmation) Note 1															
Data Range	2byte															
Format	UInteger16															

PD	PD6								PD7							
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	MSB															LSB
Data Name	Instantaneous Flow Rate Note 2															
Data Range	2byte															
Format	Integer16															

PD	PD8								PD9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Error	Warning	Normal Operation	-	Switch output Note 3				MSB			LSB	Input Select Note 4		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error Code							
Data name	True／False								0 to 15				0 to 2		True／False	
Format	Boolean								UInteger4				UInteger2		Boolean	

Note 1: The set flow rate value according to the present input select is displayed.
"9999" means "Valve fully opens".（Refer to "1.3.5 Process data OUT".）

Note 2: The minis side value in Instantaneous flow rate is displayed to confirm the gap of zero point and not displayed the flow rate of the reverse flow.

Note 3

Switch Output	Switch Function
1	Tolerance mode
2	Designated range mode
3	Integrated pulse
4	Not less than set value ON

Note 4

Input Select	Input Mode
0	Normal mode (Flow rate value)
1	Preset mode (3bit)
2	Direct memory mode（Key operation）

⚠ CAUTION

Start energization to this product after clearing Process Data OUT to "0".
There is a possibility the gas flows unintentionally.

The setting in this product can be changed with IO-Link communication from the master to the device (this product) and key operation.
The setting that be set at last is reflected as this product's setting because there is no hierarchical relationship and precedence on both sides. In case that the setting is set on the device side, it is synchronized with the master side. But sometimes it is not reflected to the display unless the display is update or the setting uploaded depending on master. Take care of that.

The value in Process Data OUT can be operated only on the master side.
The value cannot be reflected as Process Data OUT even if the setting is changed woth key operation on the device. Confirm Process Data IN and Parameter when confirming the product setting state on the master side.

Process Data OUT "Start / Stop" bit has the same role as switching "Flow rate controlled / Auto OFF".
But even if "Flow rate controlled" is switched to "Auto OFF" with key operation on the device side, Process Data OUT "Start / Stop" remains "1(Start)" state. (Process Data IN "Start / Stop" bit becomes "0(Stop)" and the product becomes "Auto OFF" state. To switch to "Flow rate controlled" on the master side in this state needs that "1(Start)" is set again after once "0(Stop)" is set. Then, the product becomes "Flow rate controlled" state.

If you reconnect after changing the settings by key operation while offline, please upload manually on the master side.
The setting change by key operation may not be reflected on the master side.

1.3.5 Process data OUT

PDx	PD0								PD1							
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	MSB															LSB
Data Name	Set Flow Rate Note 1															
Data Range	2byte（Refer to Process Data output value in "Table 2" ）															
Format	UInteger16															

PD	PD2								PD3							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Unused					Preset[Note2]			Unused		Integration		Unused		Reset[Note3]	Start/ Stop
						3	2	1			Reset	Stop °				
Deta Range						0 to 7					True/False				True/False	
Format						UInteger3					Boolean				Boolean	

Note 1: If "9999" is set, "Valve fully opens".
Note 2: Combination of preset memory number and bit.

Process Data OUT Preset			Preset memory number
Bit 3	Bit 2	Bit 1	
0	0	0	P1
0	0	1	P2
0	1	0	P3
0	1	1	P4
1	0	0	P5
1	0	1	P6
1	1	0	P7
1	1	1	P8

Set the preset memory contents using key operation of the device side or parameter of IO-Link communication. (Refer to "3.1.2")

Note 3: When the “Reset” bit is set to “1”, it becomes “Standby” status. The following operations are performed in the “Standby” status.

Item	Status
Flow rate controlled	Stop (Valve fully closed)
IO-Link communication	Communication can be continued and parameters can be changed.
Display	Off (Only the power lamp blinks)
Key operation	Unavailable
Integrated flow	Integrated flow value reset

Returning the “Reset” bit to “0” cancels the “Standby” status.

1.3.6 Observation

Index	Sub Index	Item	Value	Access	Data Length	Format
0x0400	0	Operating Time Note1	0～9,999,999h 【0～9,999,999】	R	4byte	Integer32
0x0401	0	Integration Flow Status	0：Not measurement of the integrated flow rate. 1：During the measurement of the integrated flow rate.	R	2byte	Integer16
0x0402	0	Zero Adjust Status	0：Untreated 1：Processing	R	2byte	Integer16
0x0403	0	Zero Adjust Point	Depending on flow range. (−10%F.S.～10%F.S.)	R	2byte	Integer16

※ R：Read out

Note 1: Be able to count more than 10 yeas of energization time.
Calculation：9,999,999h÷7,488h≒1335.5 Year
24h/Day × 26Day/Month × 12 months= 7,488h/Year

＜Reference＞

Example of Integrated flow calculation

Bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
hex	000F															
Data Name	Integrated Flow Upper Byte															

Bit	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
	0	1	0	0	0	0	1	0	0	0	1	1	1	1	1	1
hex	423F															
Data Name	Integrated Flow Lower Byte															

000F 423F(hex) ⇒ 999999(dec)
For FCM-0005 *-* C, the Integrated flow is 99999.9 L from Table 2 on P.14.

1.3.7 Diagnosis

Event Code	Type	Device Status	Error Code	Cause	Solution
0x8D02	Error	Failure	E 01	Supplied power voltage is outside the rated range. (Detected at：19.5V or less)	・Turn on the power again after adjusting the power voltage so that it is within the ratted range.
0x8D03	Error	Failure	E 02	Input signal exceeds the rated range. （Detected at input of：110%F.S. or more）	・Adjust the input signal so that it is within the rated range.
0x8D04	Error	Failure	E 03	Error occurred during EEPROM reading or writing.	・Turn on the power again. ・Replace the main body of this product.
0x8D05	Error	Failure	E 04	Error occurred during memory reading or writing.	・Turn on the power again. ・Replace the main body of this product.
0x8D06	Error	Failure	E 05	Flow rate does not maintain the set value for five or consecutive seconds. (Detected when difference between set value and control value is ±20%F.S. or more.) (Note1)	・Check the primary side pressure and supply pressure that is within the rated operating differential pressure range. After that, turn on the power again. ・Check that there is no leakage From the pipes, fittings, or other components and correct the connections. After that, turn on the power again.
0x8D07	Error	Failure	E 06	Output error occurs in sensor.	・Stop supplying fluid to the Product and set the flow rate to zero. After that, turn on the power again. ・Replace the main body of this product.
0x8D08	Error	Function Check	E 07	Valve is not auto off state when zero adjustment.	・Forcibly turn off the valve forcibly. After that, operate again.
0x8D09	Error	Function Check	E 08	Flow rate exceeds possible zero adjustment range （Flow rate≧±10%F.S.）	・Check the primary side pressure and supply pressure that is within the rated operating differential pressure range. After that, turn on the power again.
0x8D10	Warning	Out of specification	E 10	Solenoid valve is used with overload condition for 10 or consecutive seconds. (Note2)	・Check the primary side pressure and supply pressure that is within the rated operating differential pressure range. After that, turn on the power again. ・Check clogging of the pipes, fittings, or other components. After that, supply pressure that is within the rated operating differential pressure range and turn on the power again.
0x4210	Warning	Out of specification	E 11	Temperature of IO-Link driver is high.	・Check the operating environment.

Note 1: Threshold can be changed by IO-Link parameter.

Note 2: Abnormal condition is detected as the system and not as the product itself.（Preventive maintenance function）

Example of prospected condition.

・Primary side pressure drop by leakage.

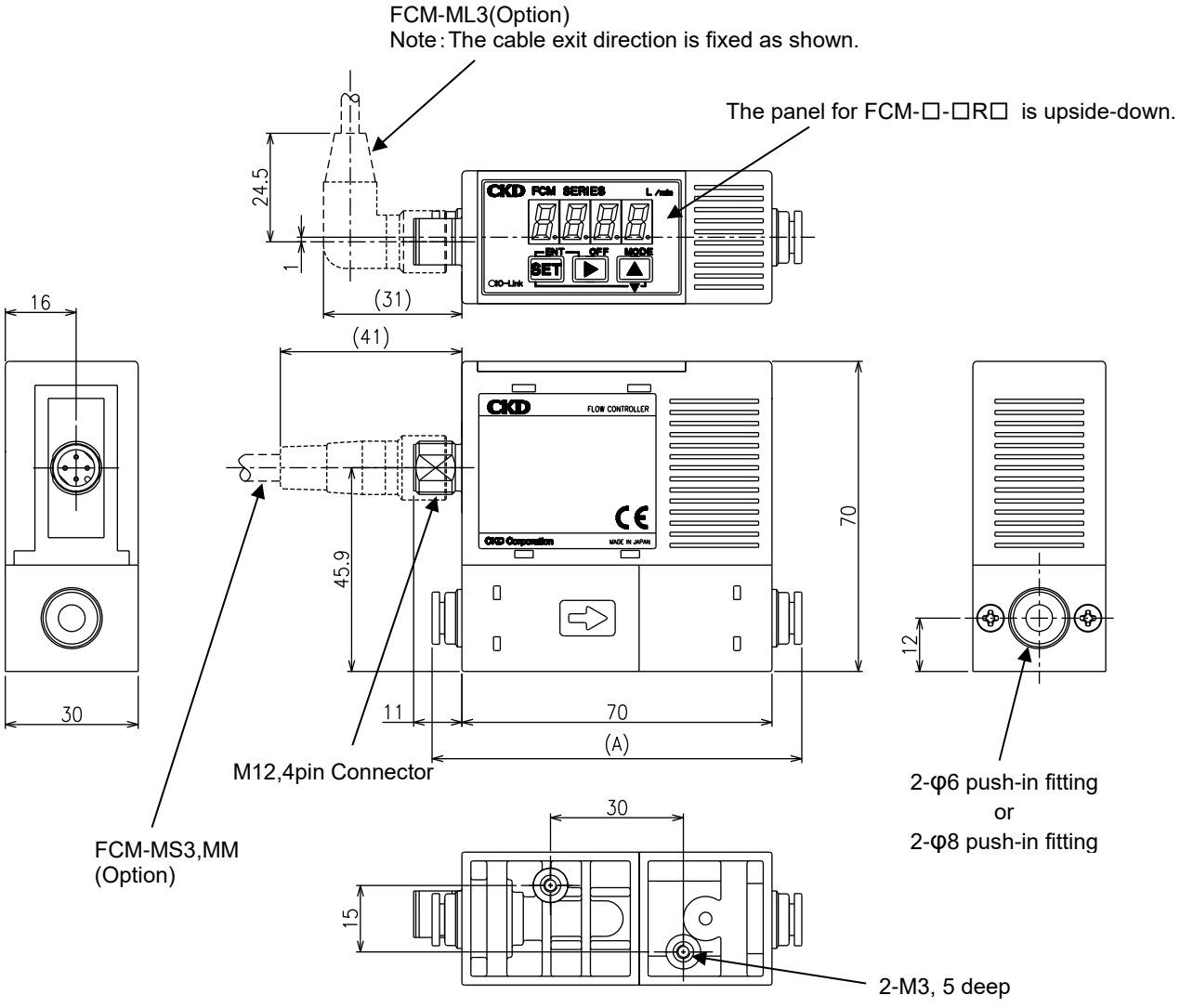
・Pressure loss increase by clogging filter.

・Excessive ambient temperature rising.

1.4 Dimensions

1.4.1 Resin body

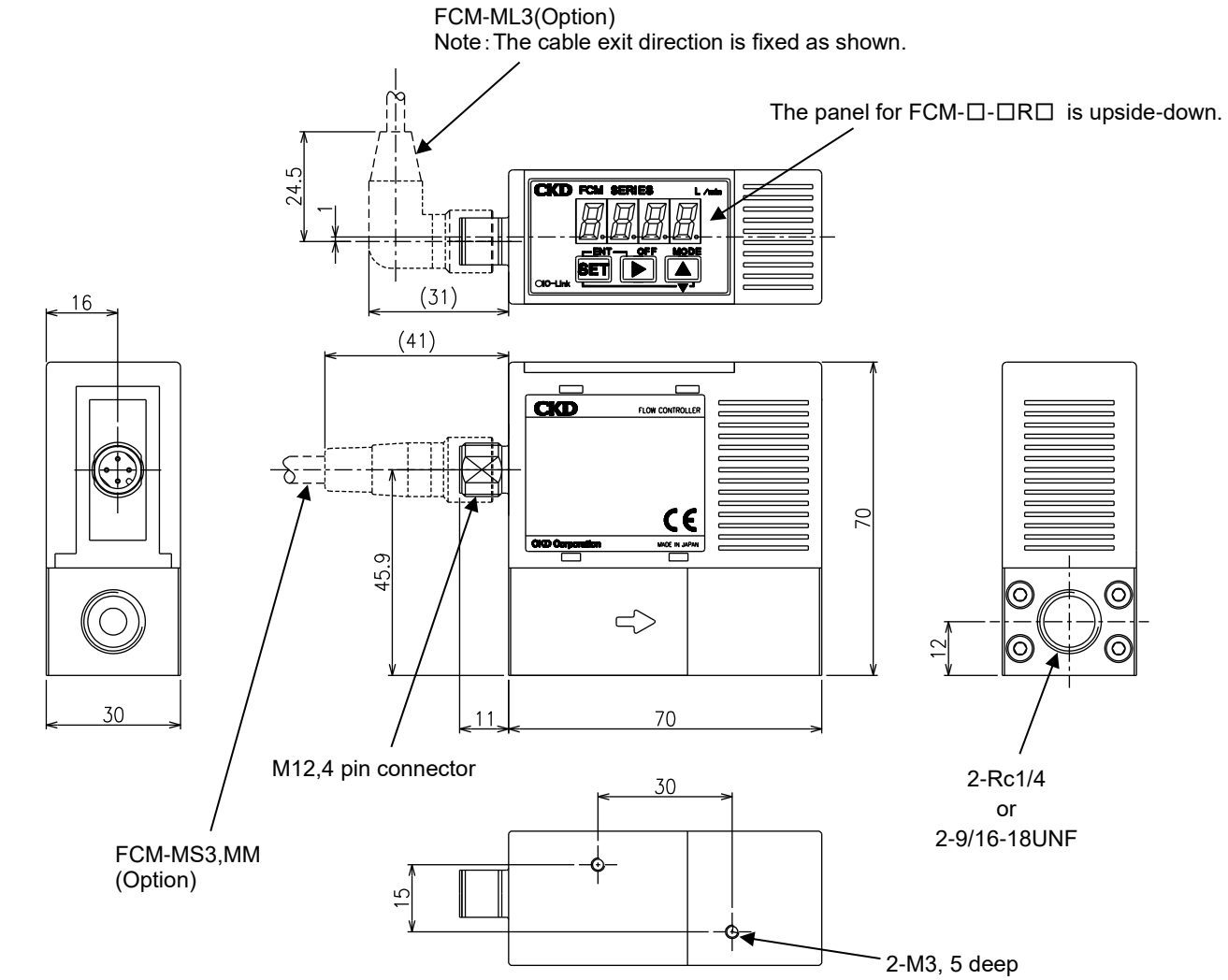
Model number : FCM-☐-H6C/H8C☐
Port size : Push-in(ϕ 6) or (ϕ 8)

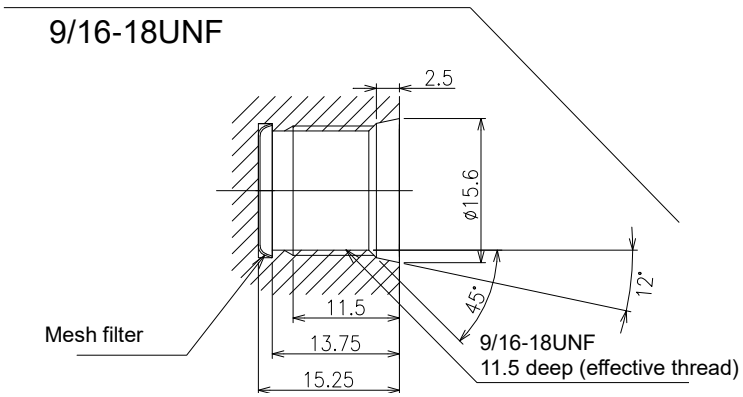


Model No.	Fitting	(A) size
FCM-□-H6C□	Push-in φ6	84
FCM-□-H8C□	Push-in φ8	85

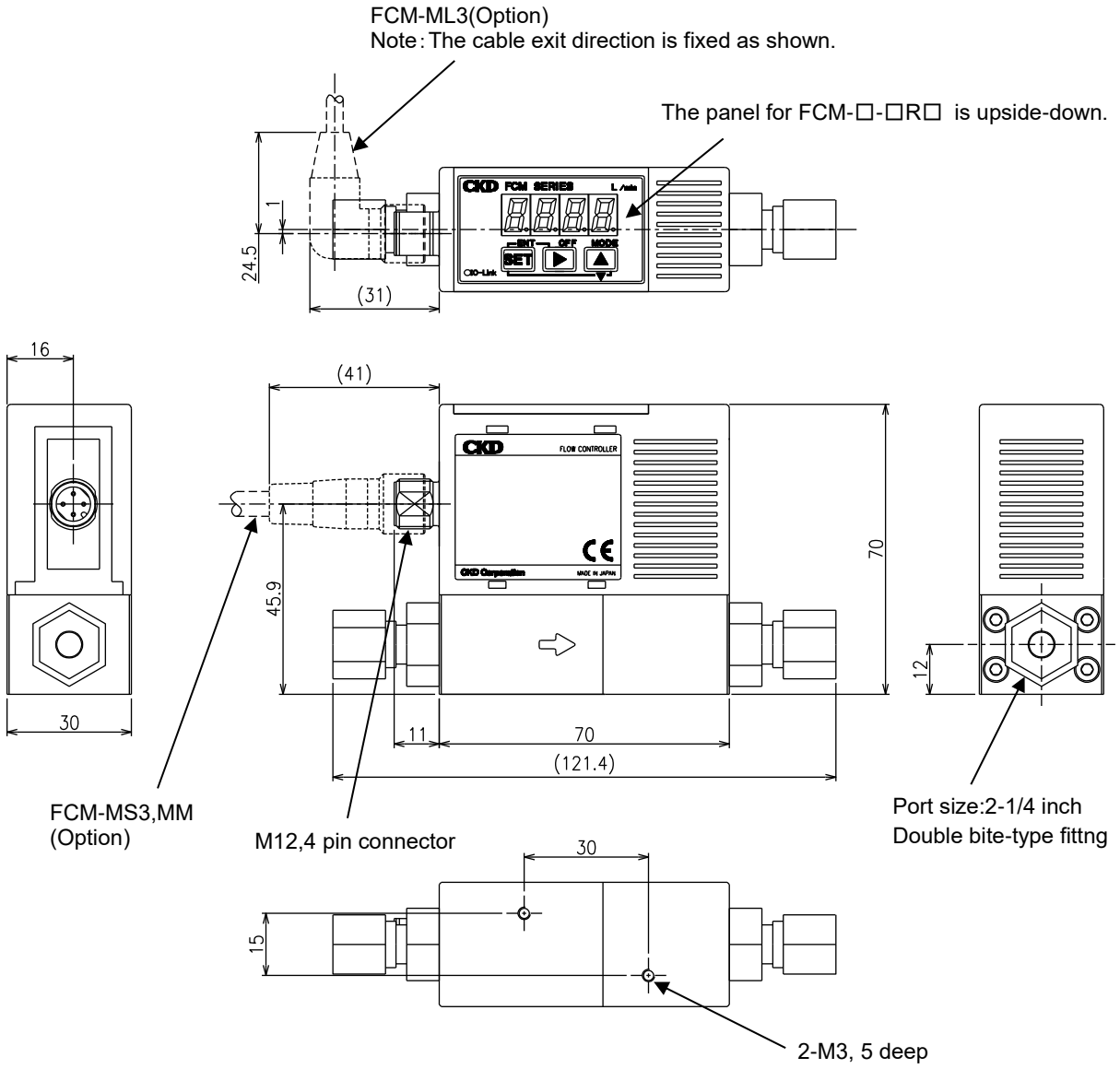
1.4.2 Stainless steel body

Model number : FCM-☐-8AC/UFC☐
Port size : Rc1/4 or 9/16-18UNF

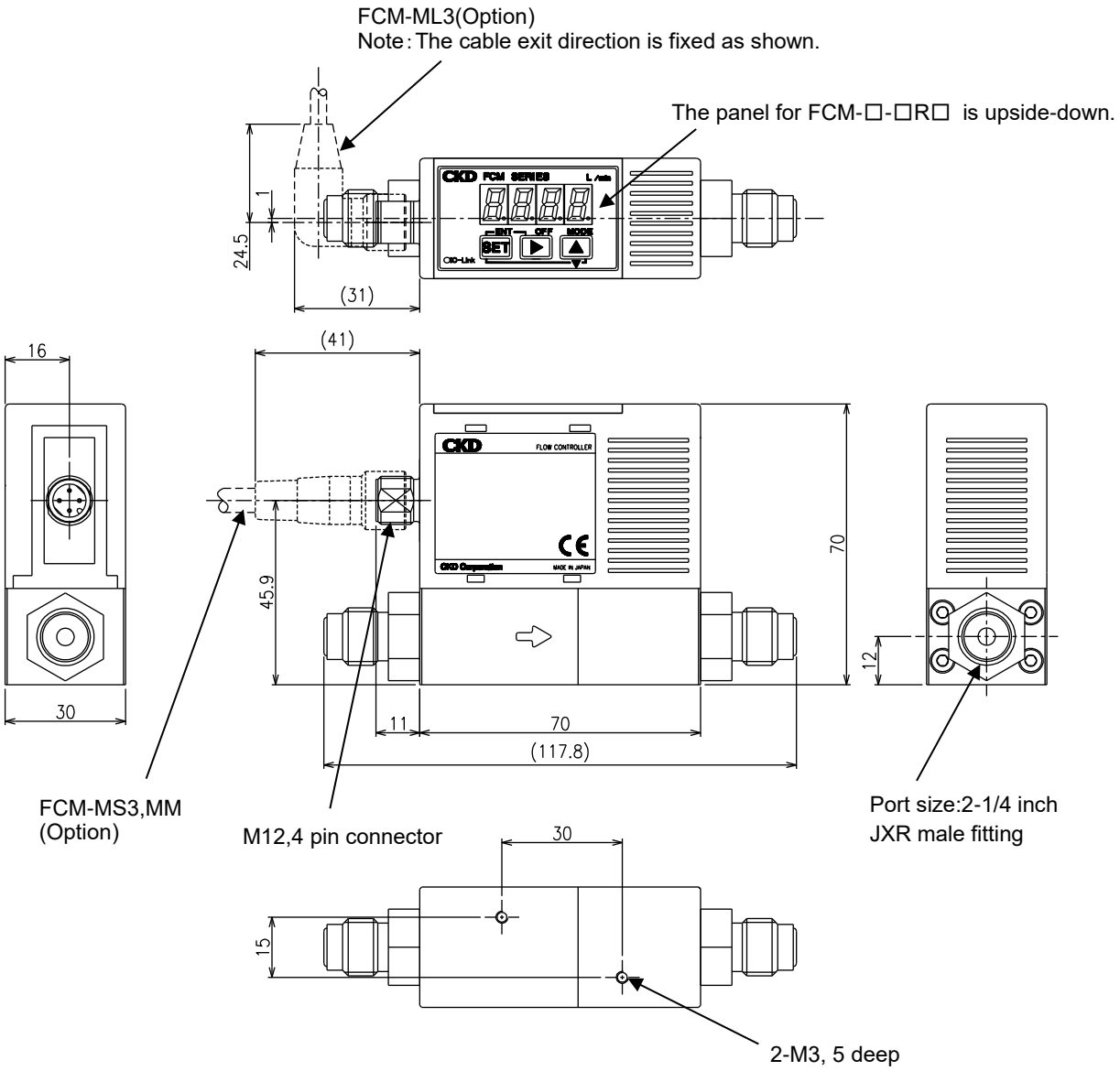




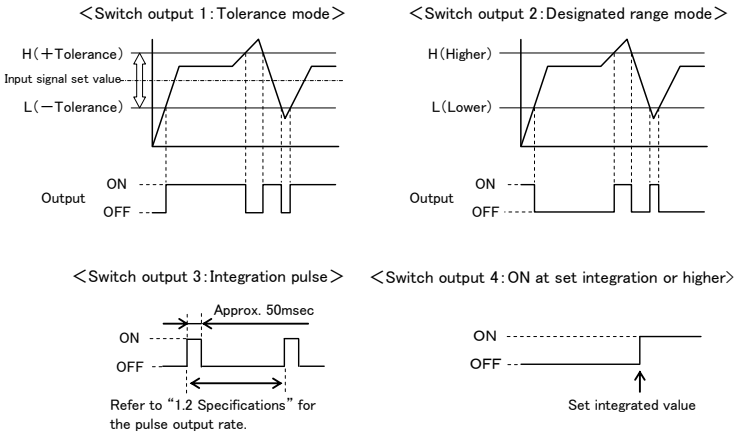
Model number : FCM-☐-4SC
Port size : 1/4-inch double bite-type fitting



Model number : FCM-☐-4RMC
Port size : 1/4-inch JXR male fitting

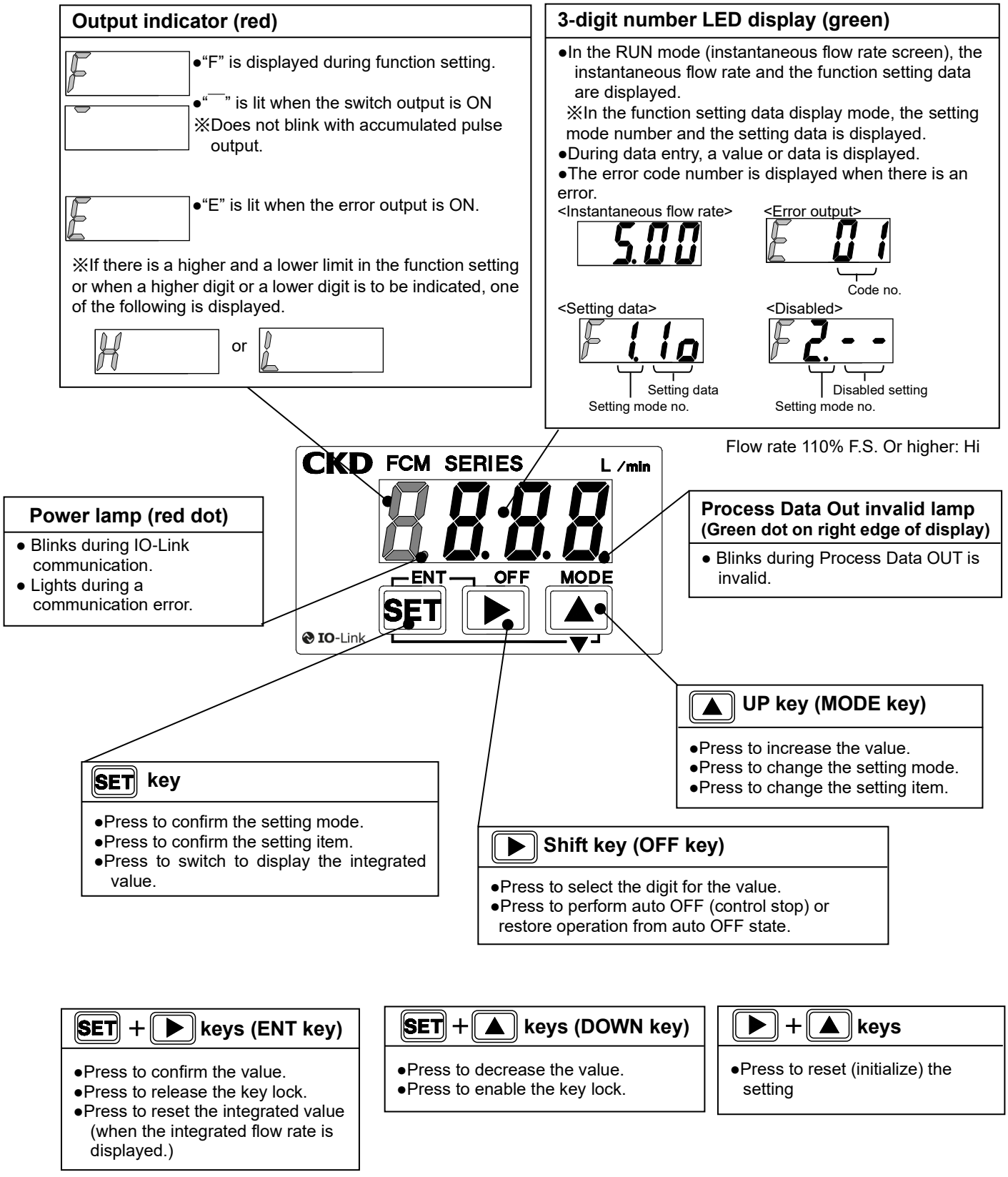


1.5 Functions

Function	Description	Usage
Instantaneous flow rate	Instantaneous flow rate is displayed. And instantaneous flow rate value is output to Process Data IN.	P.15 P.56
Set flow rate output	The present set flow rate is output to Process Data IN.	P.15
Integration function Integrated automatic shut off Function(F5)	The flow rate is integrated. Other functions as follows. ・Controlling Start/Stop, reset of integration function is possible with Process Data OUT ・Outputting ・Outputting integrated flow rate value to Process Data IN. ・Closing solenoid valve when the value reaches the set integrated flow. ・Outputting integrated pulse (Switch output 3) ・Turns the switch ON when the value reaches the set integrated flow（Switch output 4） How to reset the integrated value. ・Input Process Data OUT with key operation.	P.15 P.16 P.17 P.45 P.46 P.47 P.49 P.50 P.56
Direct memory function (F1)	Target value can be input with key operation.	P.37 P.57
Preset input function (F1)	Designated any flow rate 8 point with IO-Link parameter, key operation can be controlled with 3bit of Process Data OUT.	P.13 P.16 P.40 P.41 P.57
Normal mode input function(F1)	Any flow rate can be set to the target value with Process Data OUT.	P.16 P.43 P.57
Error display function	Error state can be displayed. Besides error display, there are functions as follows. ・Outputting the error signal to Process Data IN when the error occurs. ・Outputting the error code to Process Data IN. ・Auto off controlling when the error occurs.	P.15 P.18 P.61 P.65
Normal operation output	Outputting the signal that shows during normal operation（Not error state） to Process Data IN.	P.15
Switch output function (F4)	Each switch function can be set as followings. ・Switch output 1（Tolerance mode）: Turning the switch on when the value is within the tolerance value (arbitrary setting) against the controlled target value. ・Switch output 2（Designated range mode）: Turning the switch on when out of the designated range value. ・Switch output 3（Integration pulse）: Outputting the integration pulse when integration. ・Switch output 4（ON at set integrated or higher）: Turning the switch ON when the value reaches the set integrated flow. And Normal open(NO)／Normal close(NC) can be set against each switch output. 	P.12 P.15 P.49 P.50 P.51 P.52 P.53 P.54 P.55 P.59 P.60
Zero point adjustment (F7)	Adjusting the zero point of flow rate output.	P.11 P.61
Automatic power off (F3)	Flow rate display is turned off if there are no operations for approximately one minute. (Control is not stopped by automatic power off.) Power is saved since the display is turned off when not needed.	P.13 P.58

Error automatic shut-off(F6)	Control is automatically stopped, valve is fully opened or closed, and error output is turned ON when an error occurs.	P.12 P.61
Key lock	Setting change is disabled to prevent incorrect operations.	P.13 P.56
Setting reset	Factory setting is restored (initialization).	P.11 P.56
Control error threshold value setting	Threshold value for judgement control error can be set with IO-Link parameter.（Default：±20%F.S.）	P.12
Operation setting when the Communication error occurs (F8)	Operation setting when an error occurs can be set from HOLD (Holding set value)／CLEAR(Valve fully closes)／VALVE OPEN(Valve fully opens)	P.13 P.14 P.62
Operating time output	Displaying total operating time from start of use. The time is not reset even if the power is turned off and the setting is reset.	P.17
Data storage function	Uploading the set value to the master and downloading the set value from the master is possible. （Of the same model, the set value can be copied.）	P.12 P.13

1.5.1 Names and Functions of Display and Operation Panel



2. INSTALLATION

2.1 Environment

⚠WARNING

Do not use the product in an atmosphere that contains corrosive gas such as sulfur dioxide gas.
Use the product within the ambient temperature range of 0°C to 50°C.
Even if the temperature is within the specified range, do not use the product in places where sudden changes in the temperature may cause condensation.
Do not install the product in places where moisture, saline matters, dusts, or cutting chips are present and pressure is applied or reduced.
The degree of protection of the product is equivalent to IP40. The product cannot be used where the temperature changes sharply or humidity is high as condensation may develop in the product and cause damage.
Do not install the product to a movable section or in places subject to vibrations.
Vibrations and shocks may cause a malfunction.

⚠ CAUTION

Consider the pressure loss in the pipes and adjust the differential pressure between the upstream and the downstream of the product so that it falls within the operating differential pressure range.

The product may not operate properly if used outside the operating differential pressure range. The differential pressure increases especially when there is an orifice plate or objects regulating the flow on the secondary side (downstream side) of the product. Also, the flow rate control may become unstable due to frequent pressure fluctuation on the primary or secondary side or from not being able to follow the control of the product.

Blow air into the pipes to clean and remove cutting chips and foreign matters before piping.

The rectifying unit and the platinum sensor may become damaged if cutting chips or foreign matters enter into the pipes.

Connect a fitting when using a stainless steel body model with the OUT side opened to the atmosphere.

There is a risk of the port filter coming off.

Do not bend the tube near the push-in fitting when using a resin body model.

If there is a possibility for the tube near the push-in fitting to be subjected to stress, insert an insert ring into the tube and then insert the tube to the push-in fitting.

Insert the tube securely and then pull the tube to check that it does not come off when using a resin body model.

Use a tube cutter to cut the tube at a right angle.

Check that there is no gas leakage after piping.

Observe the following when using the product with oxygen gas.

- Piping must be performed by a qualified person who has extensive knowledge and techniques for handling oxygen gas.
- Use pipes that are free of oil.
- Remove foreign matters such as dirt and burrs from the pipes before mounting the product.
- Install a filter on the primary side of the product.

Do not install a pressure reducing valve (regulator) or a solenoid valve immediately before the product.

These valves may cause a drift and result in an error. Install a straight piping before the product as necessary.

Note that the change in the flow rate depends on the mounting orientation of the product.

Although the mounting orientation is specified as “no restriction”, the flow rate may change depending on the mounting orientation or the piping conditions.

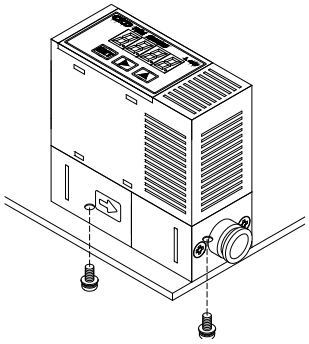
Do not install two or more products in close contact with each other.

The temperature of the products can rise due to the heat generated from the operation of each product. This may promote changes in characteristics or deterioration of resin materials. If using the products side by side, keep at least 10 mm between each product.

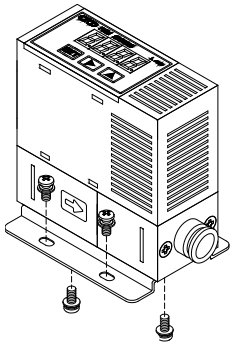
2.2 Mounting

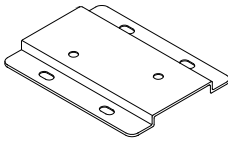
■ Mounting directly

Secure with the screws.



■ Mounting with dedicated bracket





Dedicated bracket
model number: FCM-LB1

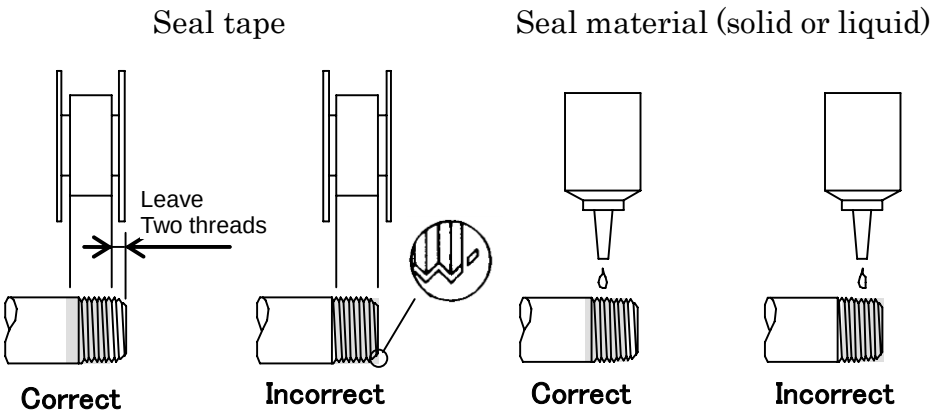
2.3 Piping

2.3.1 Pipe cleaning

Before piping, blow air into the pipes to clean and remove cutting chips and foreign matters. The rectifying unit and the platinum sensor may become damaged if cutting chips or foreign matters enter into the pipes.

2.3.2 Seal material

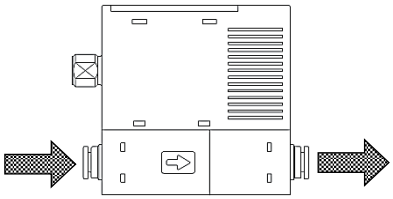
Apply a seal tape or seal material to the screw threads leaving two or more threads at the pipe end uncovered or uncoated. If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the pipes or device and cause a failure.
When using a seal tape, wind it around the screw threads in the direction opposite from the screw threads and press it down with your fingers to attach it firmly.
When using a liquid seal material, be careful not to apply it to resin parts. The resin parts can become damaged and this may lead to a failure or malfunction.
Also, do not apply seal material to the internal threads.



Remove any remaining seal material from the threads after removing the pipes if the pipes are to be reused.

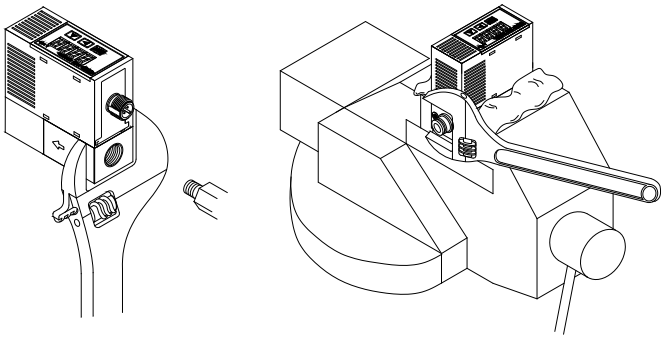
2.3.3 Piping direction

Pipe so that the fluid flows in the direction indicated on the body.



2.3.4 Tightening

- When piping, place the wrench on the stainless steel part of the body and do not apply force to the resin part.



- Following table shows the tightening torque for each fitting.

Port size	Tightening torque (N･m)
Rc1/4	6 to 8
9/16-18UNF	6 to 8

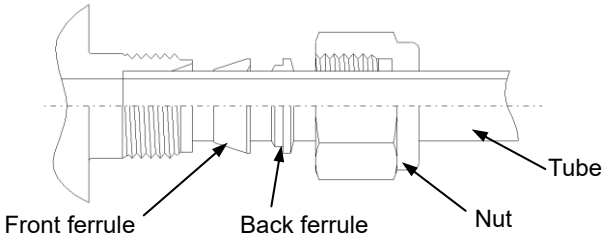
■ Tightening the fitting with port size of 4S/4RM (hydrogen/helium model)

<4S(double bite-type fitting)>

1 Check that the front ferrule, the back ferrule, and the nut are assembled correctly.

2 Insert the tube all the way into the body and tighten the nut with fingers as much as possible. (This position is called the finger-tight position.)

3 Tighten the nut 1 and 1/4 turns from the finger-tight position with a tool.

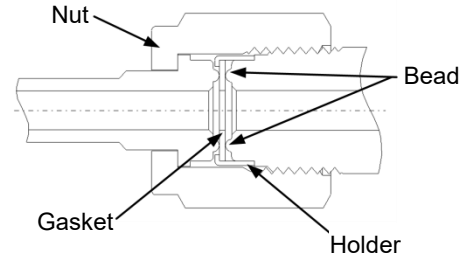


<4RM (1/4-inch JXR male fitting)>

1 Insert the gasket with a holder to the gland.
This will place and hold the gasket correctly on the bead.
(For a gasket without a holder, insert the gasket to the female nut.)

2 Assemble each part and tighten the nut with fingers as much as possible.
(This position is called the finger-tight position.)

3 Hold the body securely and tighten the female nut a 1/8 turn (when the gasket material is nickel or SUS316) from the finger-tight position.
For other gasket materials, contact your nearest CKD sales office or distributor.



2.4 Wiring

⚠ DANGER

Use the product within the specified power supply voltage range.
Applying voltage beyond the specified range may cause a malfunction, damage to the product, electric shock, or fire.
Do not connect a load exceeding the rated output.
The output circuit may become damaged or a fire may occur.

⚠ WARNING

Check the connector pins and the cable conductor colors before wiring.
Incorrect wiring may cause damage, failure, and malfunctions of the product. Check the wire color described in the Instruction Manual before wiring.
Check the wiring insulation.
Make sure that the wires do not contact other circuits and there is no ground fault and insulation failure between terminals. Otherwise, an overcurrent may flow into the product and cause damage.
For the product, use a DC stabilized power supply that is within the rating and isolated from the AC power.
If the power supply is not isolated, an electric shock may occur. If the power supply is not stabilized, the peak value may exceed the rating. This may damage the product or lead to poor accuracy.
Stop the control device and the machinery and turn off the power before wiring.
Operating the product suddenly may cause an unexpected behavior and a dangerous situation. Perform an electrical current test with the control device and the machinery stopped and set the required data. Discharge static electricity from your body, tools, and devices before and during work. For movable sections, use wiring material with the same level of bending resistance as a robot wire.
Install the product and its wiring away from sources of noise such as high-voltage lines as much as possible.
Take measures against surges on the power cable, separately.
Do not apply AC power.
Applying AC power (100 VAC) may cause damage to the product, electric shock, or fire.
For the power supply of the stainless steel body model, use a DC stabilized power supply completely isolated from the AC primary side and connect either the positive side or the negative side of the power supply to the F.G.
A varistor (limiting voltage of approximately 40 VDC) is connected between the stainless steel body and the internal power circuit to prevent a dielectric breakdown of the product. Do not conduct a withstand voltage test and an insulation resistance test between the stainless steel body and the internal power circuit. If these tests are required, disconnect the wiring before carrying them out. An excessive potential difference between the power supply and the stainless steel body will cause the internal parts to burn out. If the devices or the frames are electrically welded or a short-circuit accident occurs after installing, connecting, and wiring the stainless steel body model, a welding current, a transient high voltage during welding, or a surge voltage may run through the wires, the ground wires, and the fluid passage connected between the components described above. This may cause damage to the wires and the components. Disconnect all F.G. connections from the product and the electrical wiring before electric welding.
Do not incorrectly wire the polarity of the power.
The product may burst or burn.

⚠ Caution

Use a cable that is 20 m or shorter.

If extending the cable, be less than the cable length 20m from the master to the device (this product).

Insulate unused wires to avoid contact with other wires.

Connecting unused wires accidentally to the ground may cause the product to malfunction or become damaged.

Use the power supply unit that have the current supply ability sufficiently.

Use the power supply unit that have the current supply ability sufficiently to each port of IO-Link master. If the specifications are not satisfied, there is a possibility that the product performance will not be satisfied. In such cases, connect a DC stabilized power supply with sufficient current supply ability to L+ (24V) and L- (GND) instead of the IO-Link master.

2.4.1 M12 connector

⚠Caution

Do not rotate the M12 connector.
The L type cable connector does note rotate. Never turn it.

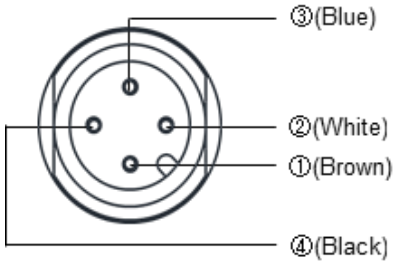
Turn off the power before inserting or removing the M12 connector.
Be sure to turn off the power before inserting or removing the M12 connector.

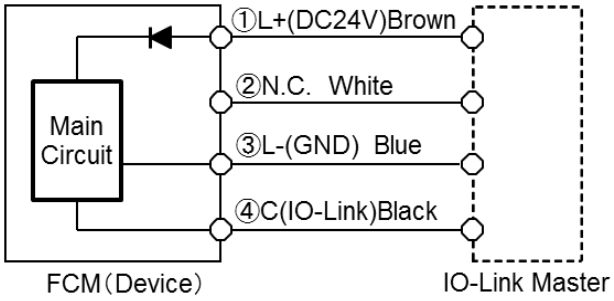
Always hold the connector when inserting or removing the M12 connector.
Do not pull on the cable.

When fitting the M12 connector, align the convex part of the main body side connector terminal with the concave part of the cable connector terminal.
After inserting it securely, hold the knurled part and tighten it clockwise so as not to damage the thread.

Be careful not to over-screw the connector.
If the connector is screwed excessively, the connector on the main unit may be damaged.
Recommended torque: 0.4 to 0.49 N · m

2.4.2 Cable connection





Pin No.	Option Cable Color	Name
①	Brown	L＋（DC24V）
②	White	N.C.
③	Blue	L－（GND）
④	Black	C（IO-Link）

3. USAGE

⚠WARNING

Warm up the product (at least 10 minutes) before use.
Output accuracy is affected not only by the temperature characteristics but also by the heat generated from energization.

Stop the device before changing the settings of the product.
The control system devices may operate unintentionally.

Do not disassemble or modify the product.
This may lead to a failure.

Install an external shut-off valve if the proportional solenoid valve must fully close.
The proportional solenoid valve in the product does not fully close. When the external shut-off valve is closed, keep the proportional valve fully closed (set flow rate is zero). If the product is controlling normally while the external shut-off valve is closed, excessive fluid will flow instantaneously when the external shut-off valve is opened.
Also, the heat generated from the proportional valve may affect the characteristics. Frequent on/off operation may shorten the service life of the proportional valve depending on the condition of use.

⚠CAUTION

Observe the conditions of use for conforming to the CE standard.
The product complies with the CE marking requirements of the EMC directive.
Following items are essential for the product to be in conformity to the harmonized standard EN 61000-6-2 related to immunity.

- Cable in which the power line and the signal line are paired and that is evaluated as a signal line.
- Measures against lightning surges on the device side.

⚠ CAUTION

Use the product in places where it is not subject to impacts from falling objects and vibrations since a micro sensor chip is incorporated.

Handle the product as a precision component during installation and transportation.

If an abnormality occurs during operation, immediately stop using the product, turn off the power and contact your dealer.

Create a program and a control circuit that ignores signals for approximately two seconds after energization.

This product will not control the flow rate for approximately two seconds after energization in order to perform a self-diagnosis.

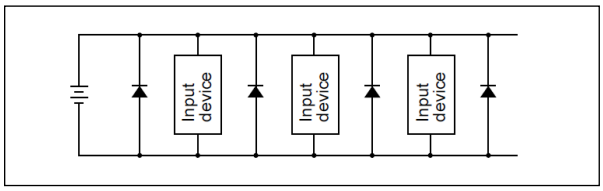
Use the product within the rated flow rate range.

Use the product within the operating differential pressure range.

Take measures against loop surge currents if the power supply is shared with an inductive load that generates surge currents.

Take the following measures to prevent damage from loop surge currents.

- Separate the power supply for the output systems that act as inductive loads (such as a solenoid valve and a relay) from that for the input systems (such as the flow rate controller).
- If the power supply cannot be separated, directly install a surge absorption element for each inductive load. The surge absorption element connected to a PLC or other devices only protectsthe individual device that the element is connected.
- Connect a surge absorption element to places on the power wiring shown in the figure below to protect the devices from disconnections at any place.



When the devices are connected to a connector, turn off the power before disconnecting or connecting the connector. If the connector is disconnected while the product is energized, the output circuit may become damaged due to loop surge currents.

3.1 Flow rate control

3.1.1 Controlling the flow rate using the direct memory function

Target value can be entered by key. Control flow rate can be controlled freely using the operation keys on the product even if there is no external input signal. Direct memory function has two operation modes.

Direct memory (1): Settings are applied by changing the value. (Even if the value is not confirmed, the flow rate can be varied by changing the value). This function is convenient for fine adjustment of the flow rate. Confirm the set value after determining the flow rate.

Direct memory (2): Applied after the value is confirmed. (When not confirming the value, the flow rate is not changed).

■ Direct memory (1) operation mode

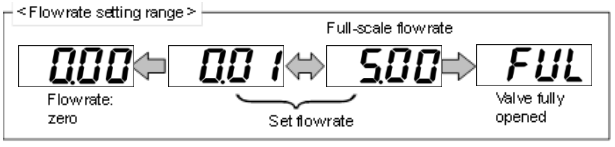
1 Turn the power supply ON.
The instantaneous flow rate is displayed.

2 Press the ▲ key.
The screen switches to the F1: Input signal confirmation screen, and the present input signal and input value are alternately displayed. (After approx. 3 secs. have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

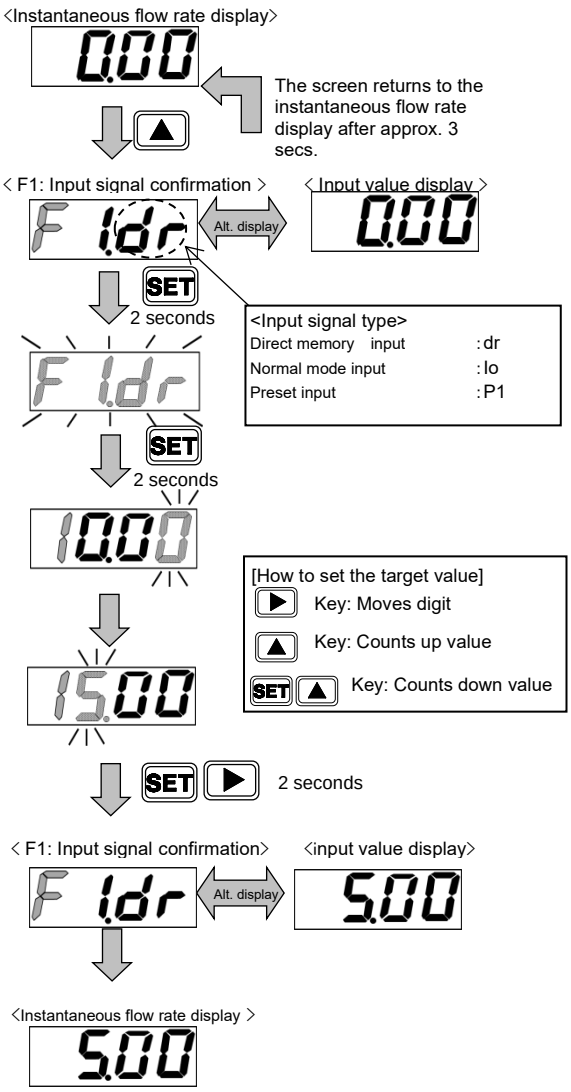
3 Hold down the SET key for approx. 2 secs.
"F1.dr" blinks.

4 Hold down the SET key for approx. 2 secs.
The screen enters the direct memory (1) setting screen.

5 Change the value.
The flow rate changes.
Even if the value is not confirmed, the flow rate can be changed by changing the value.



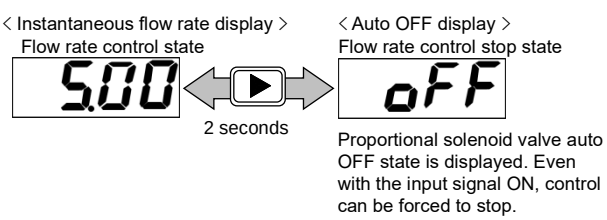
6 Hold down the SET and ▶ keys for approx. 2 secs.The value is confirmed, and the screen returns to F1: Input signal confirmation screen. Returns to the instantaneous flow rate display automatically after approx. 3 secs.



■ Auto OFF (flow rate zero) method

1 With the flow controlled (instantaneous flow rate displayed), hold down the ▶ key for approx. 2 secs.
Control can be forced to stop (flow rate zero).

2 With flow control stopped (auto OFF), hold down the ▶ key for approx. 2 secs.
It can be returned to the flow rate state.



■ Direct memory (2) operation mode

1 Turn the power supply ON.
The instantaneous flow rate is displayed.

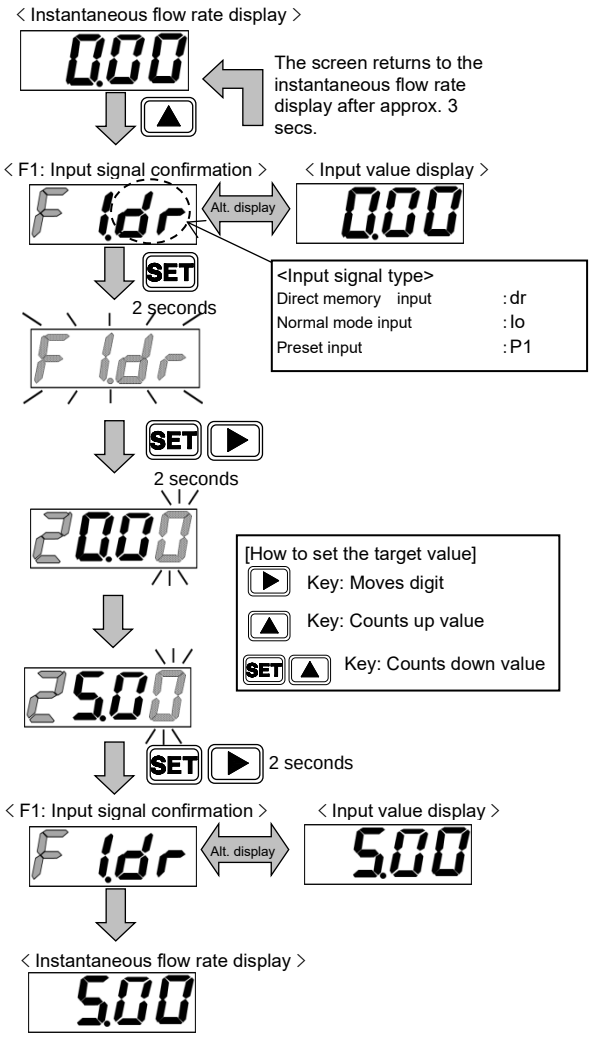
2 Press the ▲ key.
The screen switches to the F1: Input signal confirmation screen, and the present input signal and input value are alternately displayed.
(After approx. 3 secs. have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

3 Hold down the SET key for approx. 2 secs.
"F1.dr" blinks.

4 Hold down the SET and ▶ keys for approx. 2 secs. The screen enters the direct memory (2) setting screen.

5 Change the value.
When not confirming the value, the flow rate is not changed.

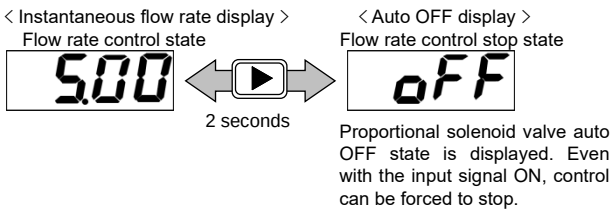
6 Hold down the SET and ▶ keys for approx. 2 secs.
The value is confirmed, and the screen returns to F1: Input signal confirmation screen. Returns to the instantaneous flow rate display automatically after approx. 3 secs.



■ Auto OFF (flow rate zero) method

1 With the flow controlled (instantaneous flow rate displayed), hold down the ▶ key for approx. 2 secs.
Control can be forced to stop (flow rate zero).

2 With flow control stopped (auto OFF), hold down the ▶ key for approx. 2 secs.
It can be returned to the flow rate state.



- Control is not stopped when setting direct memory. Taking safety into account, do this after stopping control (auto OFF) when required.
- The flow control /auto OFF state is controlled by the power is turned off and the power is turned on again.

■ Direct memory control method (IO-Link communication)

Although the input setting can be changed to direct memory over IO-Link communication, the direct memory value cannot be set. Operate the keys to set the value. The direct memory value will not be cleared even if the input setting is changed.
To change the flow rate set via IO-Link communication, use Normal Mode.

[Parameter setting]

・Input signal setting

Write "2: Direct Mode" to Index: 0x0115 (input setting).

Index	Sub Index	Item	Values
0x0115	0	Input Select	0 : Normal Mode 1 : Preset Mode 2 : Direct Mode

[Operation]

PD	PD2								PD3							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Unused					Preset			Unused		Integration		Unused		Reset	Start/ Stop
						3	2	1			Reset	Stop ゜				

・Set to start state (flow rate control state)

Set the Process Data OUT "start/stop" bit to "1" to set it to the start state. It will be controlled at the direct memory flow rate value that was set via key operation.

[Confirmation]

PD	PD4								PD5							
Bit	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
	MSB															LSB
Data Name	Set flow rate ← The value set in direct memory is displayed															

PD	PD8								PD9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	-	-	-	-	-	-	1	0	-	1
Data Name	Error	War ning	Normal operation	-	Switch output				MSB			LSB	Input select		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error code							

The start/stop state, input setting, and set flow rate can be confirmed with Process Data IN. Ensure that the current set flow rate can be confirmed with the Process Data IN set flow rate.

If the Process Data IN "Start/Stop" bit is "0" (Stop) or if the input setting is not "2" (Direct Mode), control cannot be performed using the direct memory set value.

3.1.2 Controlling the flow rate using the preset input function

For IO-Link type, 8 items can be specified arbitrarily for the flow rate, which can be switched with Process Data OUT (3bit).
Example: To control 0, 1, 2, 5, 6, 7, 8, or 10 L/min using preset input, select preset input for the input setting mode, and then set as follows:
P1 : 0L/min P2 : 1L/min P3 : 2L/min P4 : 5L/min
P5 : 6L/min P6 : 7L/min P7 : 8L/min P8 : 10L/min
When signals are input via Process Data OUT as indicated in the table at right, the values switch to each flow rate value stored in memory.

Process Data OUT preset			Preset Memory number
Bit 3	Bit 2	Bit 1	
0	0	0	P1
0	0	1	P2
0	1	0	P3
0	1	1	P4
1	0	0	P5
1	0	1	P6
1	1	0	P7
1	1	1	P8

■ Control method using preset input signal

1 Turn the power supply ON.
The instantaneous flow rate is displayed.

2 Press the ▲ key.
The screen switches to the F1: Input signal confirmation screen, and the present input signal and input value are alternately displayed.
(After approx. 3 secs. have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

3 Hold down the SET key for approx. 2 secs.
"F1.dr" blinks

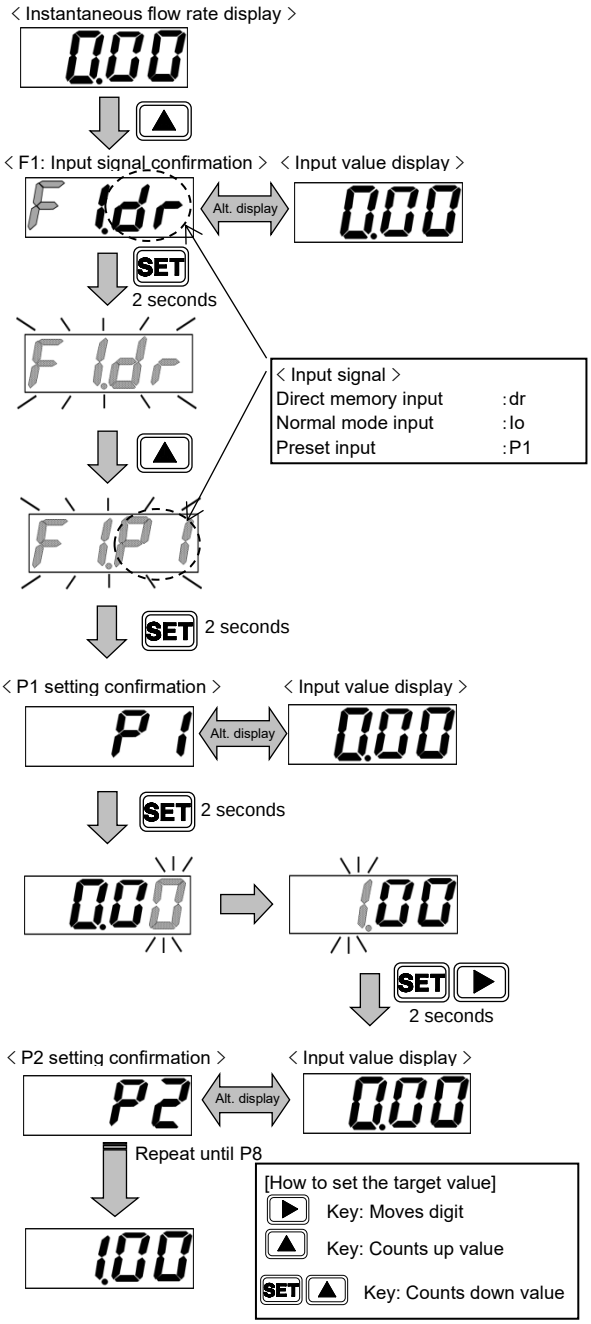
4 Press the ▲ key 2 times.
"F1.P1" blinks.

5 Hold down the SET key for approx. 2 secs.
The screen enters the P1 setting confirmation screen.

6 Hold down the SET key for approx. 2 secs.
Enter the target value when the screen enters the target value input screen.

7 Hold down the SET and ▶ keys for approx. 2 secs.
The target value is stored in memory, and the screen enters the P2 setting confirmation screen.

8 Repeat the same procedure, and determine the target values for P2 through P8. Returns to the instantaneous Flow rate can be controlled using the preset input.



If switching bit 1, bit 2, and bit 3 at the same time, switch within 15 msec.
As an example, note that preset memory may be wrongly set if there is a large time difference, such as when switching the preset memory no. from P2 → P3.

■ Control method using preset input signal (IO-Link communication)

[Parameter setting]

▪Input signal setting

Write "1: Preset Mode" to Index: 0x0115 (input setting).

▪Preset memory 1 to 8 setting

Write the set flow rate to Index: 0x0116 to 0x011D (preset memory 1 to 8).

Parameter and Command

Index	Sub Index	Item	Values
0x0115	0	Input Select	0 : Normal Mode 1 : Preset Mode 2 : Direct Mode
0x0116	0	Preset Memory 1	0.00 L/min
to	to	to	to
0x011D	0	Preset Memory 8	10.00 L/min

- The flow rate is a 4-digit value. No decimal point is required if not using IODD. However, a decimal point must also be entered if using IODD.
- Entering "9999" will set this to fully open (FuL).

[Operation]

Process Data OUT

PD	PD2								PD3							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Unused					Preset			Unused		Integration		Unused		Reset	Start/ Stop
						3	2	1			Reset	Stop				

▪Set to start state (flow rate control state)

Set the Process Data OUT "start/stop" bit to "1" to set it to the start state. It will be controlled by each flow rate stored in memory, based on the preset memory no.

▪Preset memory switching

The preset memory no. can be switched via preset input(Process Data OUT preset bit). When preset 3bit is input as indicated in the table, it switches to each flow rate value stored in memory.

Process Data OUT preset			Preset Memory number
Bit 3	Bit 2	Bit 1	
0	0	0	P1
0	0	1	P2
0	1	0	P3
0	1	1	P4
1	0	0	P5
1	0	1	P6
1	1	0	P7
1	1	1	P8

[Confirmation]

Process Data IN

PD	PD4								PD5							
Bit	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
	MSB															LSB
Data Name	Set flow rate ← The flow rate set in the specified preset memory no. is displayed															

PD	PD8								PD9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	-	-	-	-	-	-	0	1	-	1
Data Name	Error	War ning	Normal operation	-	Switch output				MSB			LSB	Input select		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error code							

The start/stop state, input setting, and set flow rate can be confirmed with Process Data IN. Ensure that the current set flow rate can be confirmed with the Process Data IN set flow rate.

If the Process Data IN "start/stop" bit is "0" (stop) or the input setting is not "1" (Preset Mode), the Process Data IN "set flow rate" will not be changed even if it is switched to the Process Data OUT preset bit.

3.1.3 Setting change using shortcut keys (only when using direct memory and preset input functions)

When using the direct memory function and the preset input function to control the flow rate, the screen can enter the set value change screen with a single key operation using the shortcut keys.

- The screen enters the screen for changing the set value of the input signal when the shortcut key is pressed.(Example: When controlling the flow rate with the preset input P2, the screen enters the P2 set value change screen).
- This does not apply when controlling the flow rate using normal mode input.

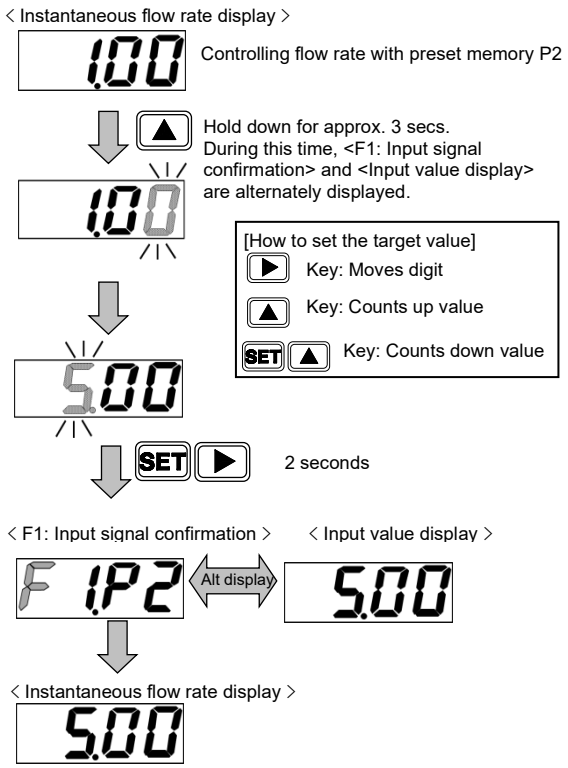
■ Set value change method using shortcut keys

1 Turn the power supply ON.
The instantaneous flow rate is displayed.
(Applicable only when controlling with direct memory function or preset input function).

2 Hold down the ▲ key for approx. 3 secs.
It will enter the screen for changing the set value of the input signal when the ▲ key is pressed.

3 Change the value.
The flow rate changes.
Even if the value is not confirmed, the flow rate can be changed by changing the value.

4 Hold down the SET and ▶ keys for approx. 2 secs.
The value is confirmed, and the screen returns to F1: Input signal confirmation screen. Returns to the instantaneous flow rate display automatically after approx. 3 secs.



- When changing settings using shortcut keys, do not switch the preset memory no. The setting value may be stored at an incorrect preset number.
- Because the data is not stored in memory after turning OFF the power supply without confirming the value, make sure to confirm the value before turning OFF the power supply.

3.1.4 Controlling the flow rate using the normal mode input function (IO-Link communication only)

The flow rate can be controlled using the Process Data OUT "set flow rate". Set values cannot be changed using key operation.

■ Setting method using IO-Link communication

[Parameter setting]

・Input signal setting

Write "0: Normal Mode" to Index: 0x0115 (input select).

Parameter and Command

Index	Sub Index	Item	Values
0x0115	0	Input Select	0 : Normal Mode 1 : Preset Mode 2 : Direct Mode

【操作】

Process Data OUT

PD	PD0								PD1							
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	MSB															LSB
Data Name	Set flow rate															

PD	PD2								PD3							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Unused					Preset			Unused		Integration		Unused		Reset	Start/ Stop
						3	2	1			Reset	Stop				

⇓

”1”

・Set to start state (flow rate control state)

Set the Process Data OUT "start/stop" bit to "1" to set it to the start state. The flow rate can be controlled using the Process Data OUT "set flow rate"

Flow rate setting range for each model

Model No.	Process Data OUT	Set flow rate
FCM-9500*-*C	0 to 5000	0.0 to 500.0 mL/min
FCM-0001*-*C	0 to 1000	0.000 to 1.000 L/min
FCM-0002*-*C	0 to 2000	0.000 to 2.000 L/min
FCM-0005*-*C	0 to 5000	0.000 to 5.000 L/min
FCM-0010*-*C	0 to 1000	0.00 to 10.00 L/min
FCM-0020*-*C	0 to 2000	0.00 to 20.00 L/min
FCM-0050*-*C	0 to 5000	0.00 to 50.00 L/min
FCM-0100*-*C	0 to 1000	0.0 to 100.0 L/min

- The flow rate is a 4-digit value. No decimal point is required if not using IODD. However, a decimal point must also be entered if using IODD.
- Do not enter a value outside of the setting range. Restrict the setting in the user program so that the Process Data OUT setting cannot be set outside of the range.
- As the only exception to this rule, entering "9999" will set this to fully open (FuL).

[Confirmation]
Process Data IN

PD	PD4								PD5							
Bit	**47**	**46**	**45**	**44**	**43**	**42**	**41**	**40**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**
	MSB															LSB
Data Name	Set flow rate ← The value set in Process Data OUT "set flow rate" is displayed															

PD	PD8								PD9							
Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0**	**0**	**-**	**1**
Data Name	Error	War ning	Normal operation	-	Switch output				MSB			LSB	Input select		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error code							

The start/stop state, input setting, and set flow rate can be confirmed with Process Data IN. Ensure that the current set flow rate can be confirmed with the Process Data IN "set flow rate".

If the Process Data IN "start/stop" bit is "0" (stop) or the input setting is not "0" (Normal Mode), the Process Data IN "set flow rate" will not be changed even if it is switched to the Process Data OUT "set flow rate".

3.2 Flow rate integration

3.2.1 How to display integrated flow

Displays flow rate integration. The display range is as in the table below.

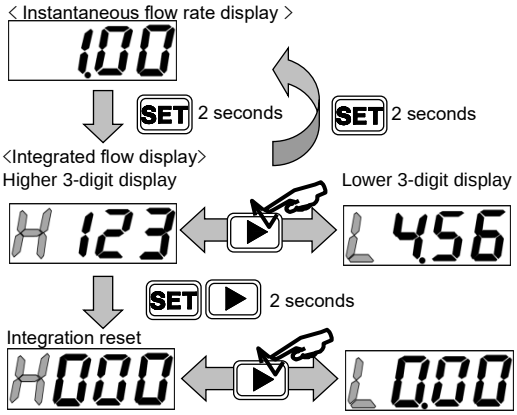
Model No. FCM-		9500 L9500	0001 L0001	0002 L0002	0005 L0005	0010 L0010	0020	0050	0100
Flow rate display	Display range	0 to 500 mL/min	0.00 to 1.00 L/min	0.00 to 2.00 L/min	0.00 to 5.00 L/min	0.0 to 10.0 L/min	0.0 to 20.0 L/min	0.0 to 50.0 L/min	0 to 100 L/min
Integrating functions	Display range	999999 mL	9999.99 L	9999.99 L	9999.99 L	99999.9 L	99999.9 L	99999.9 L	999999 L
	Display resolution	1mL	0.01L	0.01L	0.01L	0.1L	0.1L	0.1L	1L
	Pulse output rate	5mL	0.01L	0.02L	0.05L	0.1L	0.2L	0.5L	1L

■ How to display integration

1 Turn the power supply ON.
Instantaneous flow rate display integration begins. (The integrated value is reset when the power supply is turned OFF).

2 Hold down the SET key for approx. 2 secs.
The screen enters the integration display screen.To return to the instantaneous flow rate display, hold down the SET key for approx. 2 secs.
Pressing the ▶ key switches the display digit.

3 Hold down the SET and ▶ keys for approx. 2 secs. Integration reset is performed.
Integration reset can also be performed using the Process Data OUT "integration reset" bit. The integrated value is also reset when the power supply is turned OFF.



Process Data OUT

PD	PD2								PD3							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Unused					Preset			Unused		Integration		Unused		Reset	Start/ Stop
						3	2	1			Reset	Stop				

■ How to display integration（IO-Link communication）

Display the integrating flow using the Process Data IN integrating flow upper bytes and lower bytes.

Accumulated flow calculation example

Process Data IN

PD	PD0								PD1							
Bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
hex	0001															
Data Name	Integrated Flow Upper Byte															

PD	PD2								PD3							
Bit	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0
hex	E240															
Data Name	Integrated Flow Lower Byte															

0001 E240(hex) ⇒ 123456(dec)
For FCM-0005*-*C, the integrating flow will be 1234.56 L.

・Integration reset

Integration reset can be performed by setting the Process Data OUT "integration reset" bit to "1".
When the "integration reset" bit is "1", the integrated value will continue to be cleared to 0 L.
To restart flow rate integration, set the "integration reset" bit to "0".

・Integration stop

Integration stop can be performed by setting the Process Data OUT "integration stop" bit to "1".
When the "integration stop" bit is "1", flow rate integration will be continuously stopped.
To restart flow rate integration, set the "integration stop" bit to "0".

Process Data OUT

PD	PD2								PD3							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Unused					Preset			Unused		Integraion		Unused		Reset	Start/ Stop
						3	2	1			Reset	Stop				

The integrated value is reset when the power supply is turned OFF.
To start flow rate integration when the power is turned ON, set the Process Data OUT"integration stop" and "integration reset" bits to "0".

3.2.2 Closing the proportional solenoid valve at the set integrated flow rate

When the value reaches the set integrating flow, the proportional solenoid valve is closed. Ideal for filling processes with a constant flow rate, etc.

■ Operation mode (key operation)

1 Turn the power supply ON.
The instantaneous flow rate is displayed.

2 Press the ▲ key 8 times.
The screen enters the F5: Integration auto shutoff setting screen. If the integration auto shutoff setting is enabled, "F5.on" and the current set value are alternately displayed. (After approx. 3 secs. have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

3 Hold down the SET key for approx. 2 secs.
"F5.--" blinks.

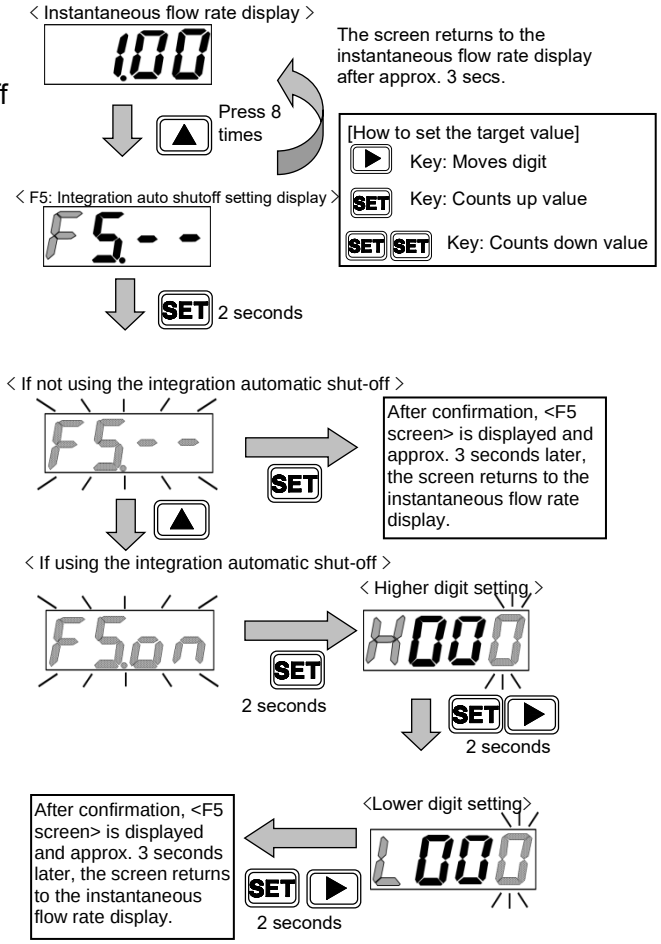
4 To disable integration auto shutoff, hold down the SET key for approx. 2 secs.
The display returns to F5 screen, and after approx. 3 secs., it returns to the instantaneous flow rate display.

5 To use integration auto shutoff, press the ▲ key. "F5.on" blinks.

6 Hold down the SET key for approx. 2 secs, and then set the upper digits.

7 Hold down the SET and ▶ keys for approx. 2 secs, and then set the lower digits.

8 Hold down the SET and ▶ keys for approx. 2 secs. The display returns to F5 screen, and after approx. 3 secs., it returns to the instantaneous flow rate display.



- After auto shutoff only, the integrated value is reset once the input signal drops to zero.
- The proportional solenoid valve is shutoff automatically when the value matches the integrating flow value.
- When the display turns "OFF" by auto shutoff, the switch output display is not turned ON. The integrated value can also be reset (key entry or Process Data OUT) to return to the flow rate display.
- Even if the auto shutoff function is disabled at the time of auto shutoff, operation cannot be performed unless the integrated value is reset.
- The integrated value is reset at the point when the auto shutoff is turned "ON" and the value is set.
- After changing the setting for each function, reset the integrating flow value.

■ Operation mode（IO-Link communication）

[Parameter setting]

・Integration auto shutoff function enable/disable setting

Write "1: ON" to Index: 0x010E (integration auto shutoff function) to enable.

・Integration auto shutoff value setting

Write the integrating flow value to set to Index: 0x010F (integration auto shut-off setting value).

Parameter and Command

Index	Sub Index	Item	Values
0x010E	0	Integration auto shutoff function	0：OFF 1：ON
0x010F	0	Integration auto shutoff set value	1234.56 L

- After auto shutoff only, the integrated value is reset once the input signal drops to zero.
- The proportional solenoid valve is shutoff automatically when the value matches the integrating flow value.
- When the display turns "OFF" by auto shutoff, the switch output display is not turned ON. The integrated value can also be reset (key entry or Process Data OUT) to return to the flow rate display.
- Even if the auto shutoff function is disabled at the time of auto shutoff, operation cannot be performed unless the integrated value is reset.
- The integrated value is reset at the point when the auto shutoff is turned "ON" and the value is set.
- After changing the setting for each function, reset the integrating flow value.
- The integrating flow value is a 6-digit value. No decimal point is required if not using an IODD file. However, a decimal point must also be entered if using an IODD file.

3.2.3 Outputting integrated pulse

The integrated pulse is output. * Refer to "1.2 Specifications" for the pulse rate.

■ Operation mode (key operation)

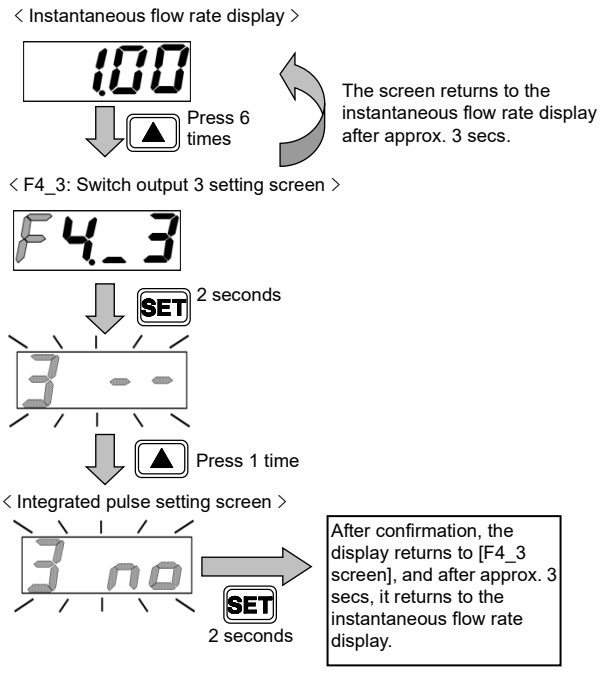
1 Turn the power supply ON.
The instantaneous flow rate is displayed.

2 Press the ▲ key 6 times.
The screen enters the F4_3: Switch output 3 setting screen."F4._3" and the current set value are alternately displayed.
(After approx. 3 secs. have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

3 Hold down the SET key for approx. 2 secs.
The unit enters switch output 3 output specifications setting mode.

4 Hold down the ▲ key to select output specifications.
"3 - -": Do not use switch output 3
"3 no": Normally open
"3 nc": Normally closed

5 Hold down the SET key for approx. 2 secs.
The integrated pulse output is confirmed, and the screen returns to the F4_3 screen. The screen returns to the instantaneous flow rate screen after approx. 3 secs.



■ Operation mode (IO-Link communication)

[Parameter setting]

・Switch output 3 (integrated pulse) enable/disable setting
Write "1: ON" to Index: 0x0109 (switch output 3 ON/OFF selection).

Parameter and Command

Index	Sub Index	Item	Values
0x0109	0	Switch output 3 (integrated pulse) ON/OFF selection	1:ON 0:OFF
0x010A	0	Switch output 3 (integrated pulse) NO/NC selection	0:NO 1:NC

・Switch output 3 (integrated pulse) NO(Normally Open) / NC(Normally Close) selection
Write "0: NO(Normally Open)" to Index: 0x010A (switch output 3 NO/NC selection).

[Confirmation]

Process Data IN

PD	PD8								PD9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Error	Warning	Normal operation	-	Switch output				MSB			LSB	Input select		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error code							

Confirm output using the Process Data IN "switch output 3" bit.

3.2.4 Turning the switch ON with the set integrated flow rate

The switch output is turned ON when the value reaches the set integrating flow value.

■ **Operation mode (key operation)**

6 Turn the power supply ON.
The instantaneous flow rate is displayed.

7 Press the ▲ key 7 times.
The screen enters the F4_4: Switch output 4 setting screen. "F4._4" and the current set value are alternately displayed.
(After approx. 3 secs. Have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

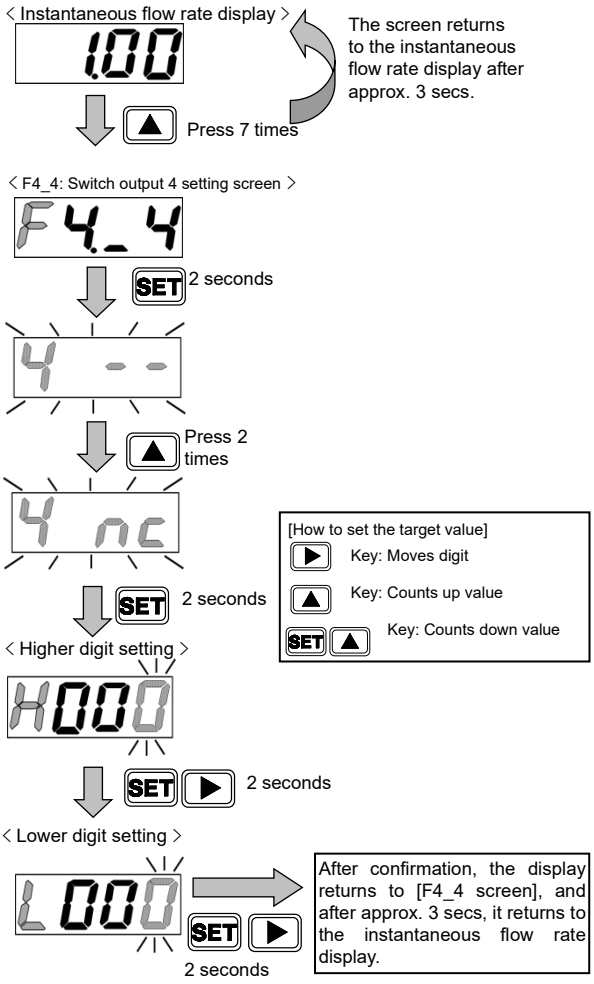
8 Hold down the SET key for approx. 2 secs.
The unit enters switch output 4 output specifications setting mode.

9 Hold down the ▲ key to select output specifications.
"4 - -": Do not use switch output 4
"4 no": Normally open
"4 nc": Normally closed

10 Hold down the SET key for approx. 2 secs. The screen enters the target value setting screen.
If not using switch output 4, the display returns to F4_4 screen, and after approx. 3 secs., it returns to the instantaneous flow rate display.

11 After setting the higher 3 digits of the target value, hold down the SET and ▶ keys for approx. 2 secs.

12 After setting the lower 3 digits of the target value, hold down the SET and ▶ keys for approx. 2 secs.
The integrated value is reset immediately after confirmation. The display returns to F4_4 screen, and after approx. 3 secs., it returns to the instantaneous flow rate display.



After changing the setting, reset the integrating flow value.

■ Operation mode（IO-Link communication）

[Parameter setting]

・Switch output 4 (ON above set integrated value) enable/disable setting
Write "1: ON" to Index: 0x010B (switch output 4 ON/OFF selection).

・Switch output 4 (ON above set integrated value) NO(Normally Open) / NC(Normally Close) selection
Write "0: NO(Normally Open)" to Index: 0x010C (switch output 4 NO/NC selection).

Parameter and Command

Index	Sub Index	Item	Values
0x010B	0	Switch output 4 (set integrated value) ON/OFF selection	1：ON 0：OFF
0x010C	0	Switch output 4 (set integrated value) NO/NC selection	0：NO 1：NC
0x010D	0	Switch output 4 (set integrated value) Set value	1234.56 L

・Switch output 4 (ON above set integrated value) set value input
Write the integrating flow value to set to Index: 0x010D (switch output 4 set value).

After changing the setting, reset the integrating flow value.
The integrating flow value is a 6-digit value. No decimal point is required if not using an IODD file. However, a decimal point must also be entered if using an IODD file.

[Confirmation]

Process Data IN

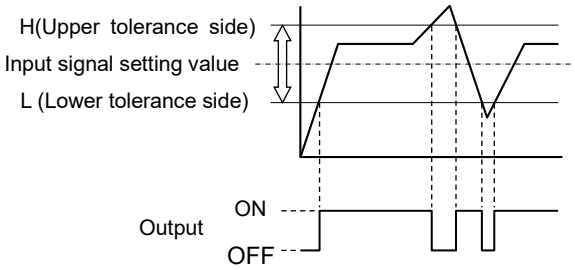
PD	PD8								PD9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Error	Warning	Normal operation	-	Switch output				MSB			LSB	Input select		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error code							

Confirm output using the Process Data IN "switch output 4" bit.

3.3 Switch output function

3.3.1 Using tolerance mode

Turns the switch output ON when the value is within tolerance against the input signal set value. The tolerance value can be set on both positive and negative sides, with % F.S. (full scale).



■ Operation mode (key operation)

1 Turn the power supply ON.
The instantaneous flow rate is displayed.

2 Press the ▲ key 4 times.
The screen enters the F4_1: Switch output 1 setting screen. "F4._1" and the current set value are alternately displayed.
(After approx. 3 secs. have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

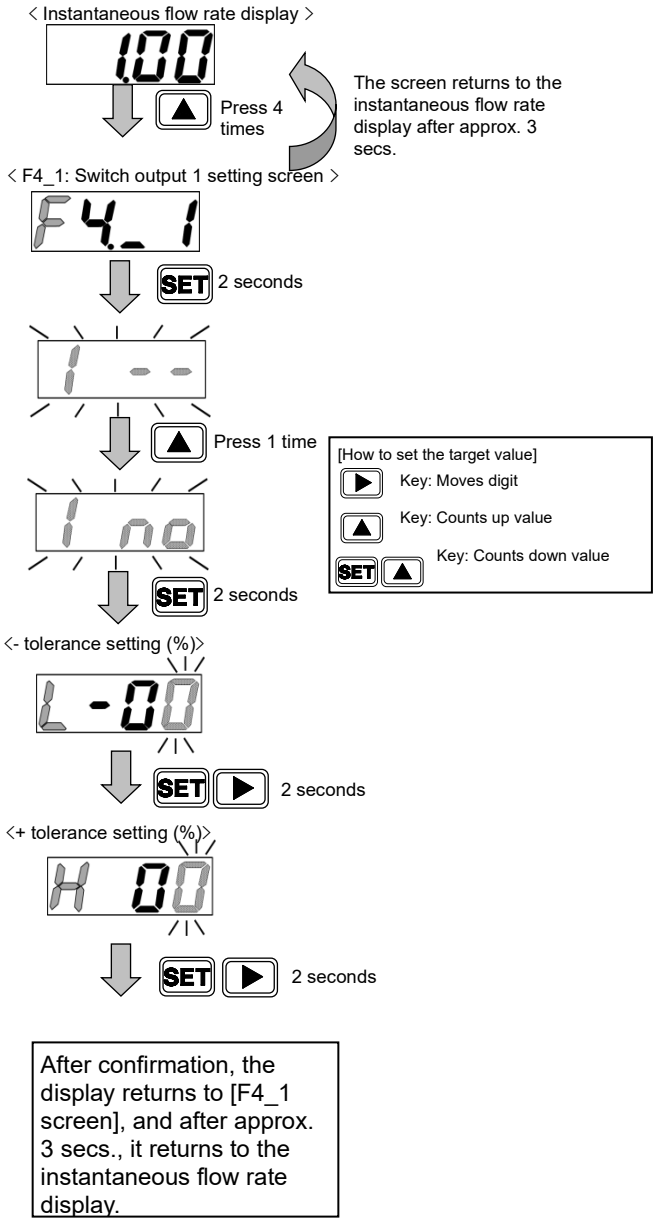
3 Hold down the SET key for approx. 2 secs.
The unit enters switch output 1 output specifications setting mode.

4 Hold down the ▲ key to select output specifications.
"1 - -": Do not use switch output 1
"1 no": Normally open
"1 nc": Normally closed

5 Hold down the SET key for approx. 2 secs. The screen enters the target value setting screen.
If not using switch output 1, the display returns to F4_1 screen, and after approx. 3 secs., it returns to the instantaneous flow rate display.

6 After setting the tolerance value (negative side), hold down the SET and ▶ keys for approx. 2 secs.
Negative side setting range: -50 to 0% F.S.

7 After setting the tolerance value (positive side), hold down the SET and ▶ keys for approx. 2 secs.
Positive side setting range: 0 to 50% F.S.
The display returns to F4_1 screen, and after approx. 3 secs., it returns to the instantaneous flow rate display.



The tolerance is not set in "FuL" (valve fully open). When using switch output in tolerance mode, note that the switch output setting will use the same tolerance for the input value prior to changing it if the input signal is changed to "FuL" (valve fully open).

■ Operation mode（IO-Link communication）

[Parameter setting]

Parameter and Command

Index	Sub Index	Item	Values
0x0101	0	Switch output 1 (tolerance) ON/OFF selection	1：ON 0：OFF
0x0102	0	Switch output 1 (tolerance) NO/NC selection	0：NO 1：NC
0x0103	0	Switch output 1 (tolerance) Lower limit value	-10 %F.S.
0x0104	0	Switch output 1 (tolerance) Upper limit value	10 %F.S.

・Switch output 1 (tolerance mode) enable/disable setting
Write "1: ON" to Index: 0x0101 (switch output 1 ON/OFF selection).

・Switch output 1 (tolerance mode) NO(Normally Open) / NC(Normally Close) selection
Write "0: NO(Normally Open)" to Index: 0x0102 (switch output 1 NO/NC selection).

・Switch output 1 (tolerance mode) lower limit value input
Write the tolerance value (negative side) to Index: 0x0103 (switch output 1 lower limit value).

・Switch output 1 (tolerance mode) upper limit value input
Write the tolerance value (positive side) to Index: 0x0104 (switch output 1 upper limit value).

[Confirmation]

Process Data IN

PD	PD8								PD9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Error	Warning	Normal operation	-	Switch output				MSB			LSB	Input select		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error code							

Confirm output using the Process Data IN "switch output 1" bit.

■ Reference value setting when valve fully open

The tolerance is not set in "FuL" (valve fully open).
Set the behavior to use when the input signal is changed to "FuL" (valve fully open).

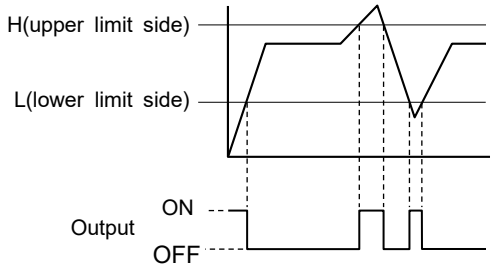
Parameter and Command

Index	Sub Index	Item	Values
0x011F	0	Reference value setting when valve fully open ON/OFF selection	1：ON 0：OFF
0x0120	0	Reference value when valve fully open	50 %F.S.

・Reference value setting ON/OFF selection when valve fully open
If Index: 0x011F is set to "1: ON", switch output will be determined using the tolerance for the value set in Index: 0x0120.
If Index: 0x011F is set to "0: OFF", switch output will be determined using the same tolerance for the input value prior to changing it to "FuL" (valve fully open).

3.3.2 Using the designated range mode

The switch output turns ON when the value is outside the designated flow rate range. The upper/lower limits are set regardless of input signal set value (control target value).
Both upper and lower limits can be set, with % F.S. (full scale).



■ Operation mode (key operation)

1 Turn the power supply ON.
The instantaneous flow rate is displayed.

2 Press the ▲ key 5 times.
The screen enters the F4_2: Switch output 2 setting screen. "F4._2" and the current set value are alternately displayed.
(After approx. 3 secs. have elapsed without pressing a key, the display returns to the instantaneous flow rate display).

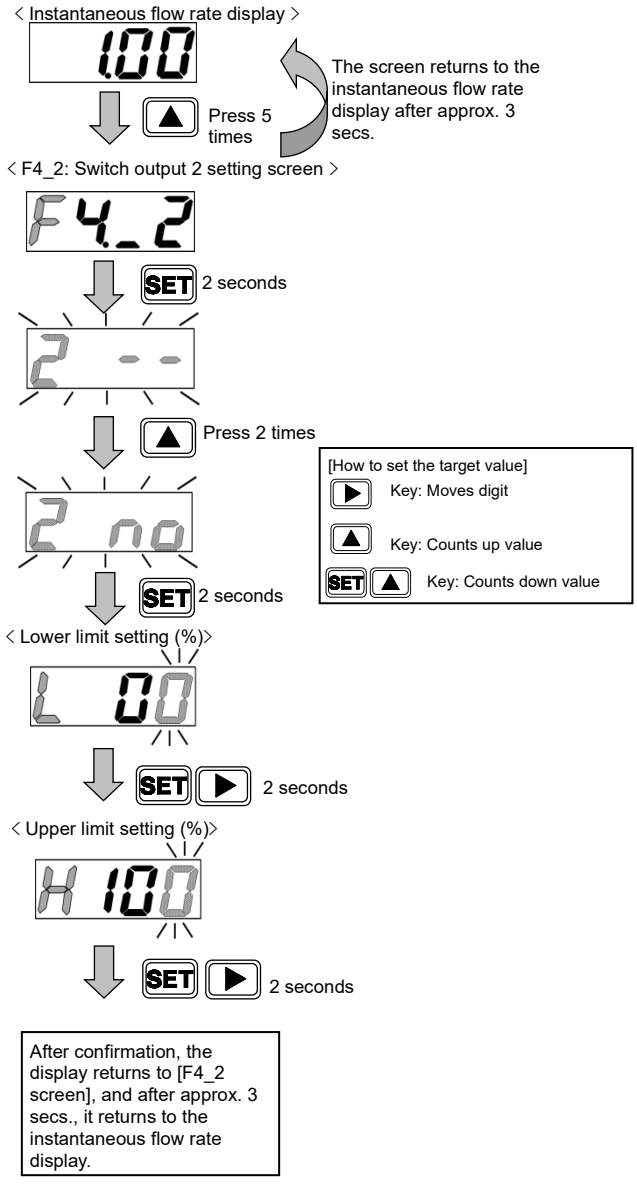
3 Hold down the SET key for approx. 2 secs.
The unit enters switch output 2 output specifications setting mode.

4 Hold down the ▲ key to select output specifications.
"2 - -": Do not use switch output 2
"2 no": Normally open
"2 nc": Normally closed

5 Hold down the SET key for approx. 2 secs. The screen enters the target value setting screen.

6 After setting the lower limit, hold down the SET and ▶ keys for approx. 2 secs.
Lower limit setting range: 0 to 90% F.S.

7 After setting the upper limit, hold down the SET and ▶ keys for approx. 2 secs.
Upper limit setting range: 10 to 100% F.S. With interval of 10% F.S. or more between the upper limit and lower limit.
The display returns to F4_2 screen, and after approx. 3 secs., it returns to the instantaneous flow rate display.



■ Operation mode（IO- Link communication）

[Parameter setting]

Parameter and Command

Index	Sub Index	Item	Values
0x0105	0	Switch output 2 (designated range) ON/OFF selection	1：ON 0：OFF
0x0106	0	Switch output 2 (designated range) NO/NC selection	0：NO 1：NC
0x0107	0	Switch output 2 (designated range) Lower limit value	30 %F.S.
0x0108	0	Switch output 2 (designated range) Upper limit value	70 %F.S.

・Switch output 2 (designated range mode) enable/disable setting
Write "1: ON" to Index: 0x0105 (switch output 2 ON/OFF selection).

・Switch output 2 (designated range mode) NO(Normally Open) / NC(Normally Close) selection
Write "0: NC(Normally Close)" to Index: 0x0106 (switch output 2 NO/NC selection).

・Switch output 2 (designated range mode) lower limit value input
Write the lower limit value (0 to 90% F.S). to Index: 0x0107 (switch output 2 designated range).

・Switch output 2 (designated range mode) upper limit value input
Write the upper limit value (10 to 100% F.S). to Index: 0x0108 (switch output 2 designated range).

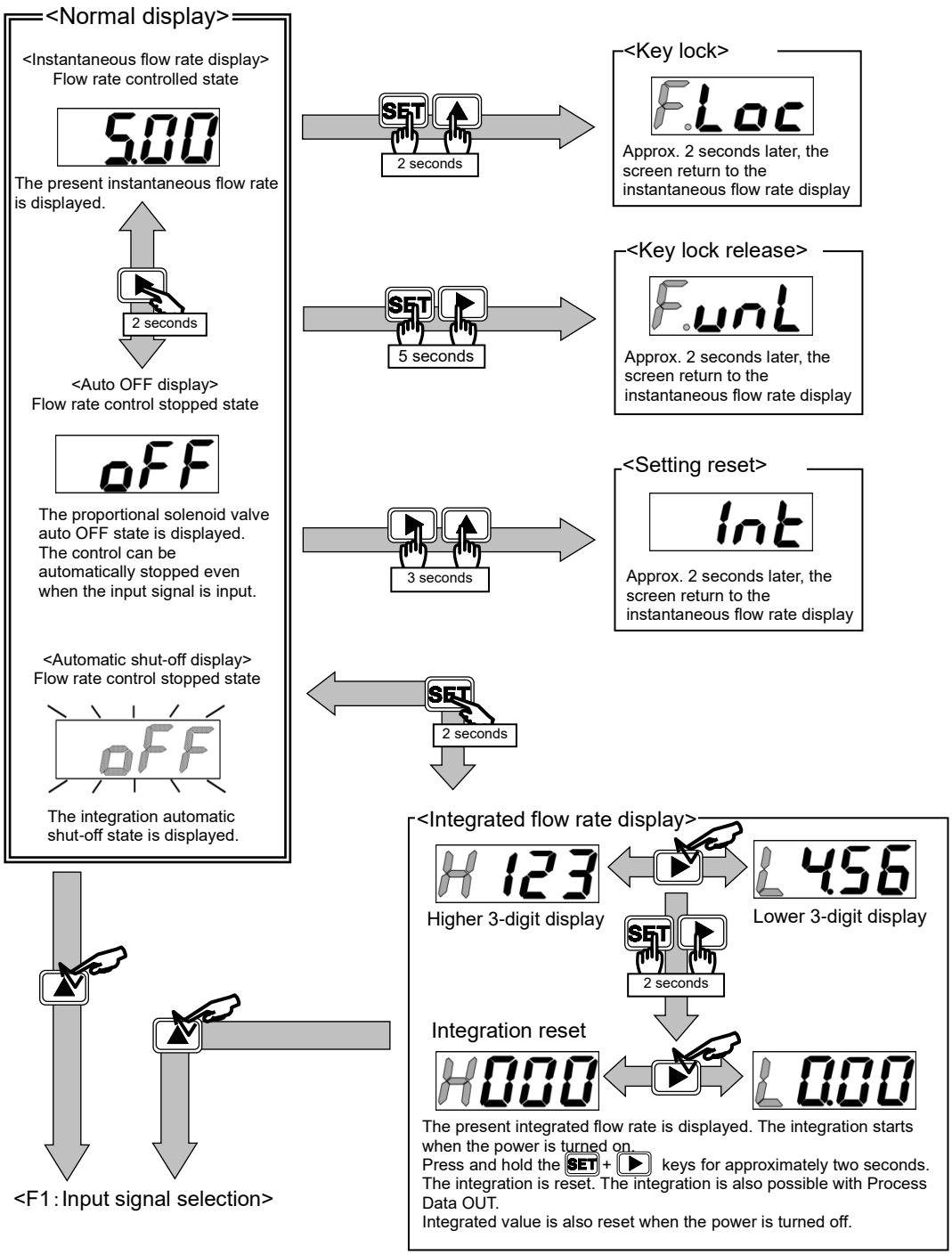
Set an interval of 10% F.S. or more between the upper limit and lower limit.
If this is less than 10% F.S., the upper limit value will be set to "lower limit value +10% F.S.".

[Confirmation]
Process Data IN

PD	PD8								PD9							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data Name	Error	Warning	Normal operation	-	Switch output				MSB			LSB	Input select		Integration automatic shut-off status	Start /Stop
					4	3	2	1	Error code							

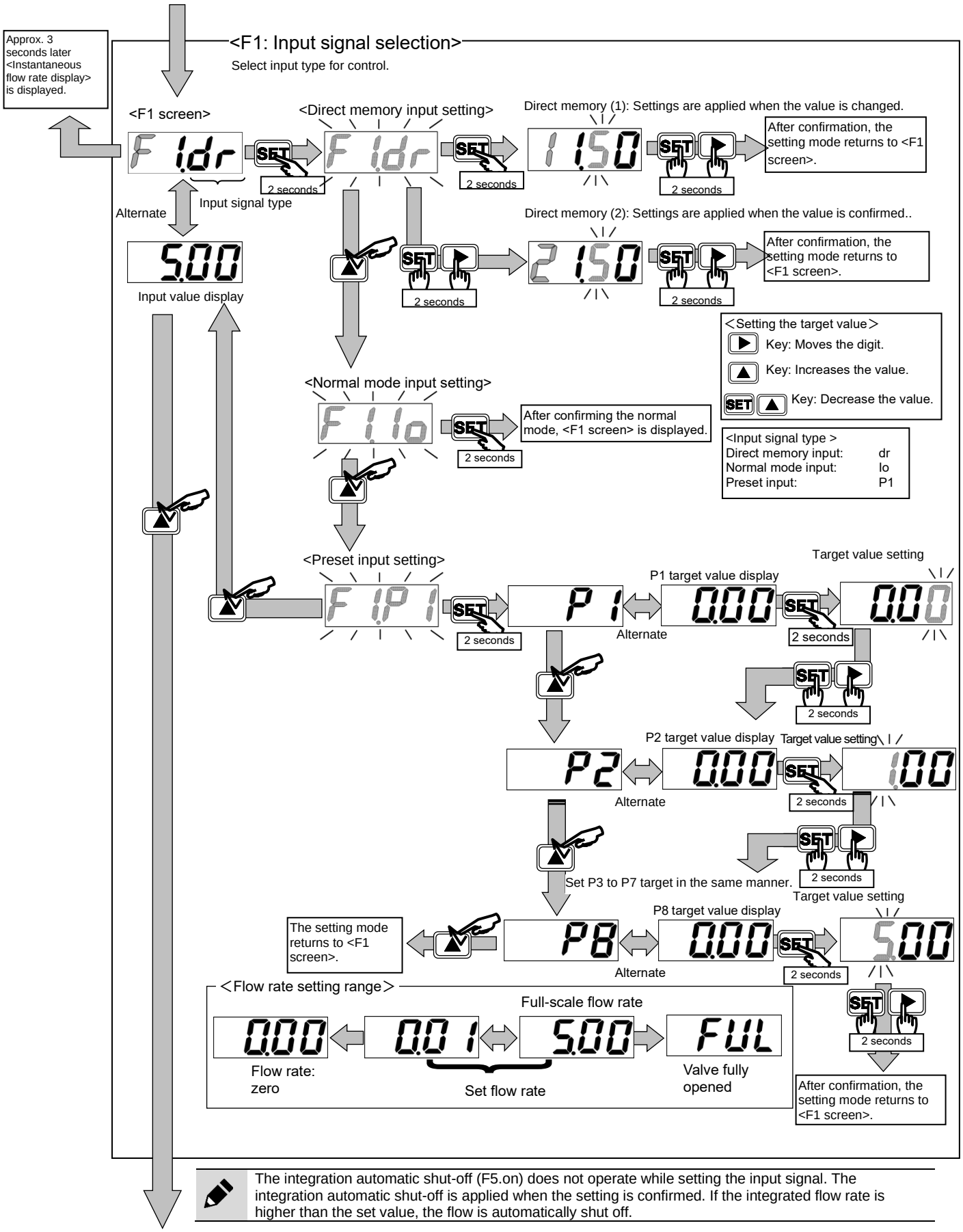
Confirm output using the Process Data IN "switch output 2" bit.

3.4 Operation Flow



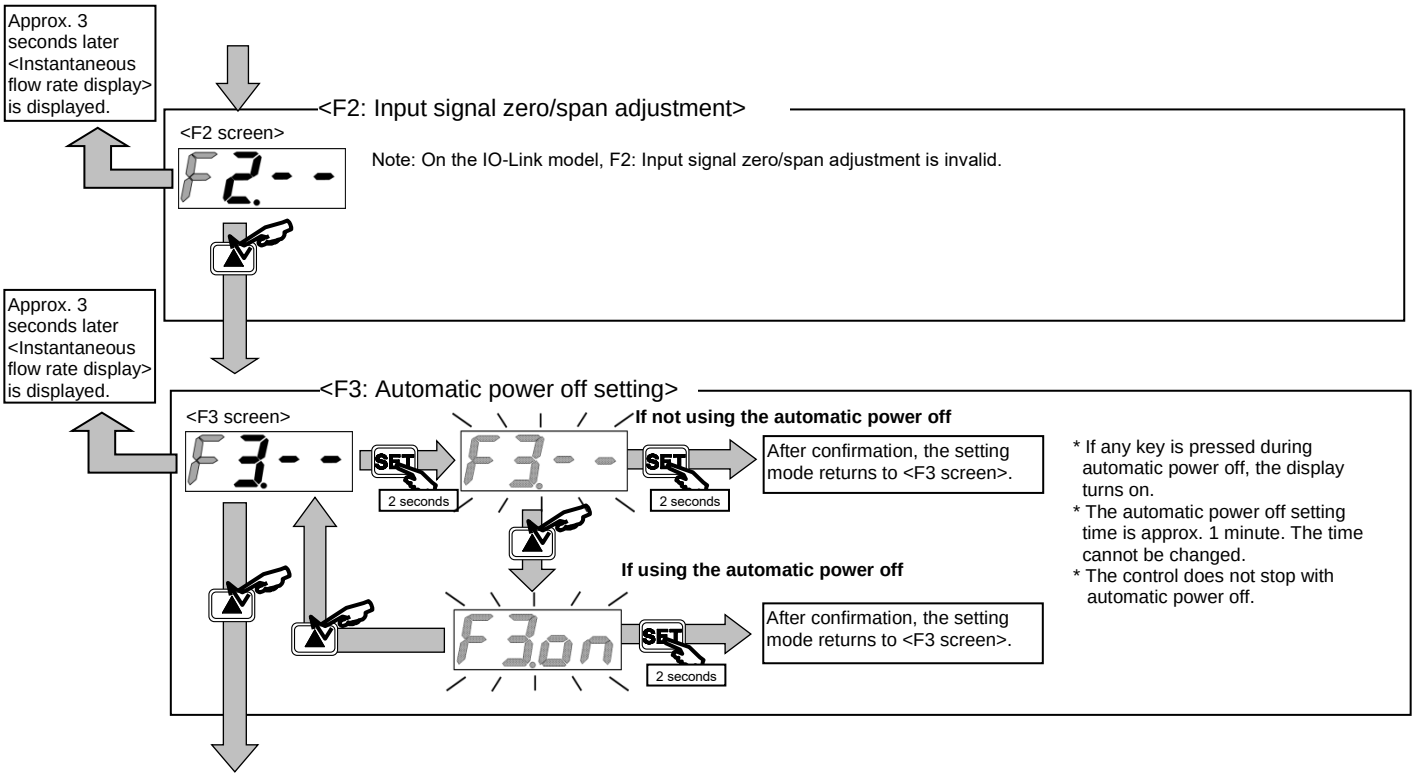
The key lock is disabled before shipping from the factory. Lock the key as necessary.
The key lock state (enabled/disabled) is maintained even if the power is turned off.

- When the key lock is enabled, only auto OFF operation is allowed.
- To disable the key lock, press SET + ▶ keys for approximately five seconds.
- The control does not stop while setting the F1:Input signal selection. In situations where safety must be considered, stop the control (auto OFF) before making these setting.
- The flow control /auto OFF state is controlled by the power is turned off and the power is turned on again.

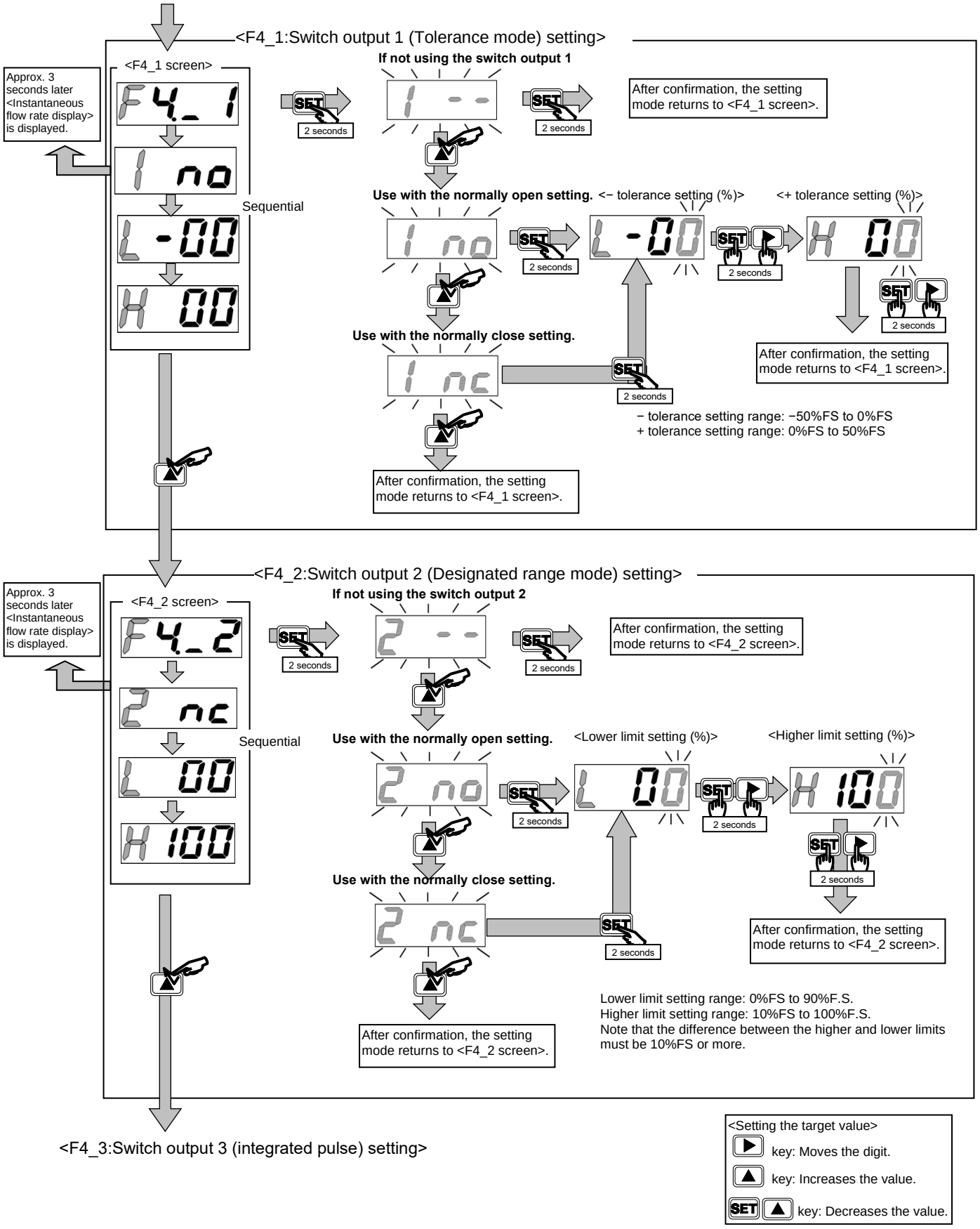


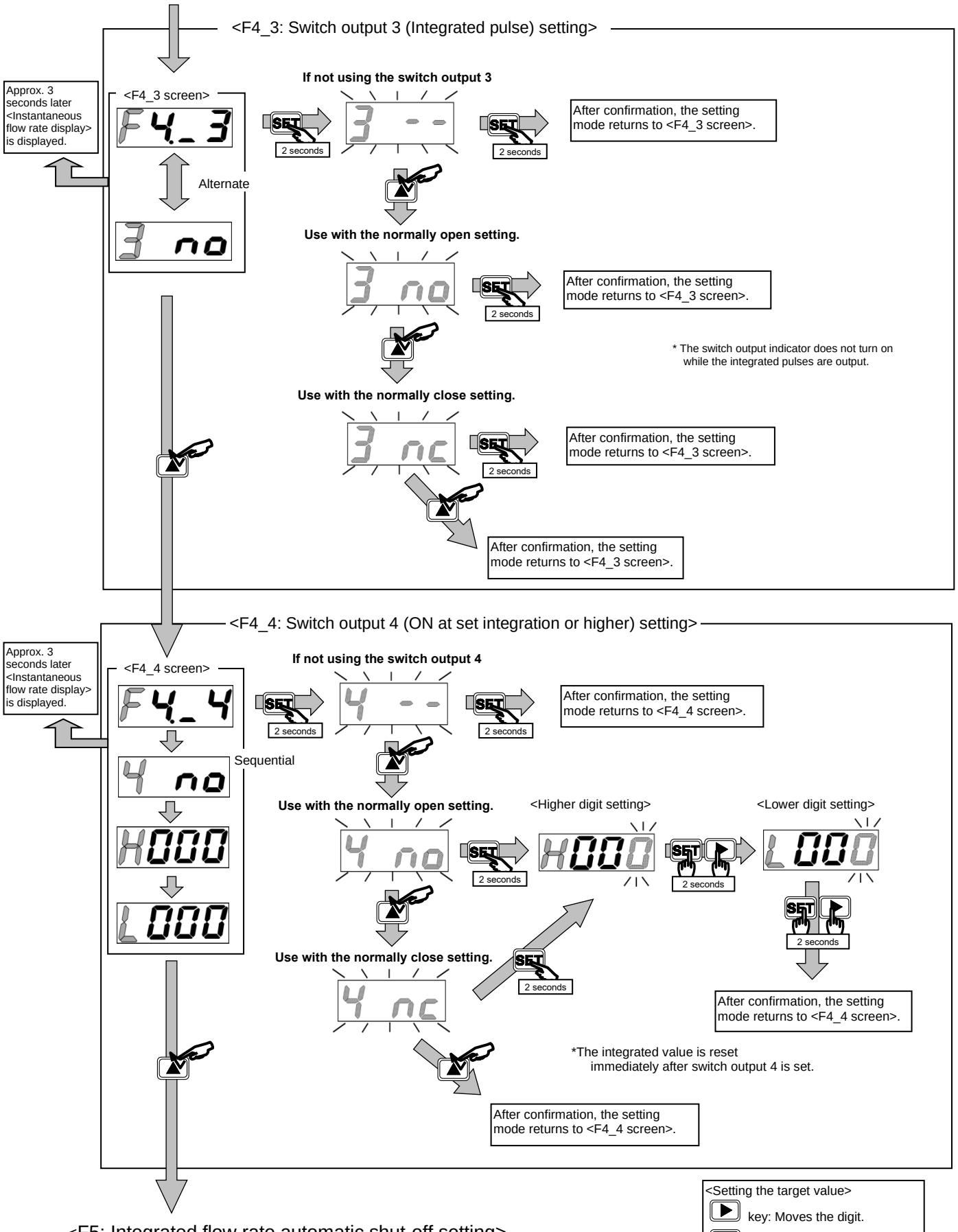
The integration automatic shut-off (F5.on) does not operate while setting the input signal. The integration automatic shut-off is applied when the setting is confirmed. If the integrated flow rate is higher than the set value, the flow is automatically shut off.

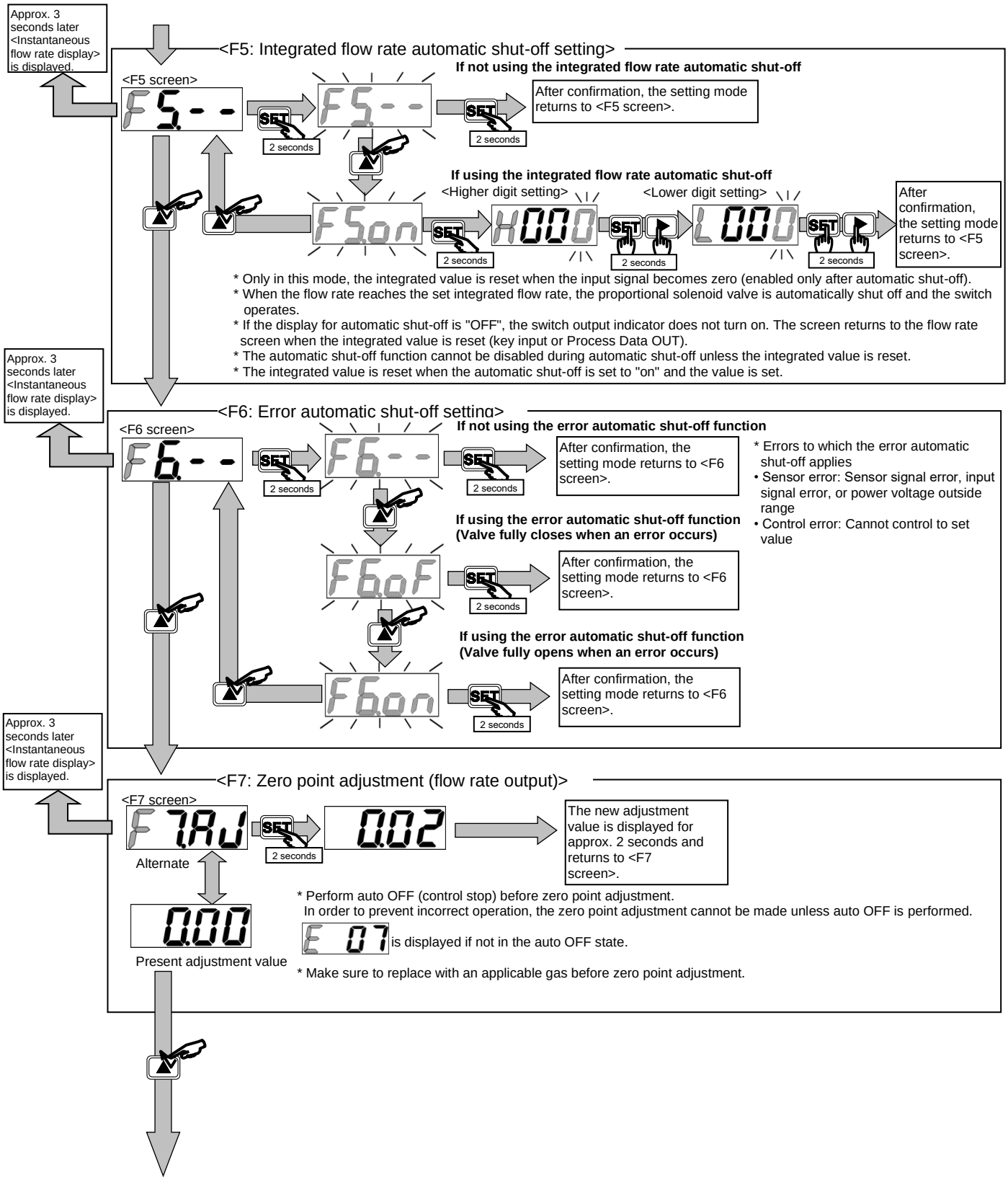
<F2: Input signal zero/span adjustment>



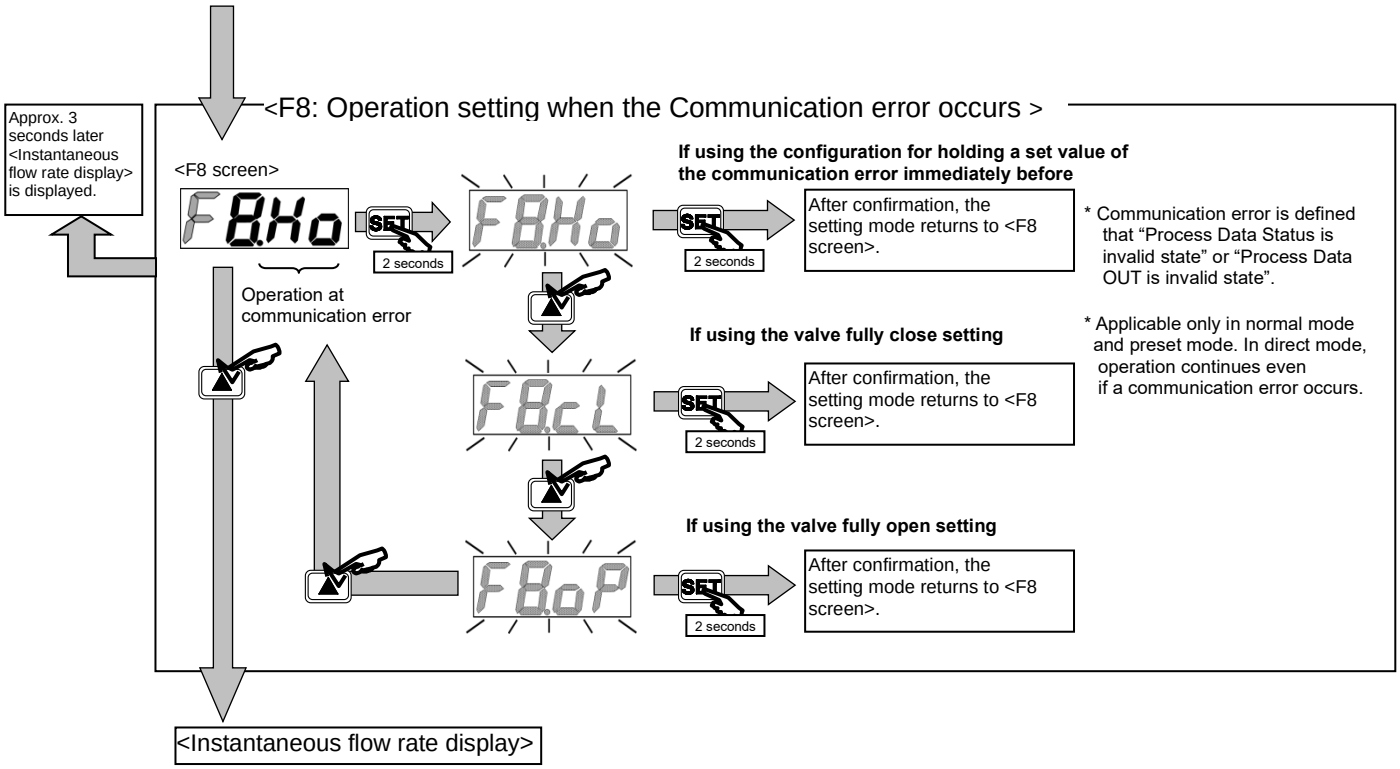
<F4_1: Switch output 1 (Tolerance mode) setting>


<F4_1:Switch output 1 (Tolerance mode) setting>
<F4_1 screen>
Approx. 3 seconds later <Instantaneous flow rate display> is displayed.
Sequential
If not using the switch output 1
2 seconds
After confirmation, the setting mode returns to <F4_1 screen>.
Use with the normally open setting.
<− tolerance setting (%)>
<+ tolerance setting (%)>
Use with the normally close setting.
After confirmation, the setting mode returns to <F4_1 screen>.
− tolerance setting range: −50%FS to 0%FS
+ tolerance setting range: 0%FS to 50%FS
After confirmation, the setting mode returns to <F4_1 screen>.
<F4_2:Switch output 2 (Designated range mode) setting>
<F4_2 screen>
Approx. 3 seconds later <Instantaneous flow rate display> is displayed.
Sequential
If not using the switch output 2
After confirmation, the setting mode returns to <F4_2 screen>.
Use with the normally open setting.
<Lower limit setting (%)>
<Higher limit setting (%)>
Use with the normally close setting.
After confirmation, the setting mode returns to <F4_2 screen>.
Lower limit setting range: 0%FS to 90%F.S.
Higher limit setting range: 10%FS to 100%F.S.
Note that the difference between the higher and lower limits must be 10%FS or more.
After confirmation, the setting mode returns to <F4_2 screen>.
<F4_3:Switch output 3 (integrated pulse) setting>
<Setting the target value>
key: Moves the digit.
key: Increases the value.
key: Decreases the value.


<F4_3: Switch output 3 (Integrated pulse) setting>
Approx. 3 seconds later <Instantaneous flow rate display> is displayed.
<F4_3 screen>
F4_3
Alternate
3 no
If not using the switch output 3
SET
2 seconds
3 - -
After confirmation, the setting mode returns to <F4_3 screen>.
Use with the normally open setting.
3 no
After confirmation, the setting mode returns to <F4_3 screen>.
* The switch output indicator does not turn on while the integrated pulses are output.
Use with the normally close setting.
3 nc
After confirmation, the setting mode returns to <F4_3 screen>.
After confirmation, the setting mode returns to <F4_3 screen>.
<F4_4: Switch output 4 (ON at set integration or higher) setting>
Approx. 3 seconds later <Instantaneous flow rate display> is displayed.
<F4_4 screen>
F4_4
Sequential
4 no
H000
L000
If not using the switch output 4
4 - -
After confirmation, the setting mode returns to <F4_4 screen>.
Use with the normally open setting.
4 no
<Higher digit setting>
H000
<Lower digit setting>
L000
After confirmation, the setting mode returns to <F4_4 screen>.
Use with the normally close setting.
4 nc
*The integrated value is reset immediately after switch output 4 is set.
After confirmation, the setting mode returns to <F4_4 screen>.
<F5: Integrated flow rate automatic shut-off setting>
<Setting the target value>
key: Moves the digit.
key: Increases the value.
key: Decreases the value.



<F8: Operation setting when the Communication error occurs >


<F8: Operation setting when the Communication error occurs >
Approx. 3 seconds later <Instantaneous flow rate display> is displayed.
<F8 screen>
F8.Ho
SET
2 seconds
Operation at communication error
If using the configuration for holding a set value of the communication error immediately before
After confirmation, the setting mode returns to <F8 screen>.
* Communication error is defined that “Process Data Status is invalid state” or “Process Data OUT is invalid state”.
If using the valve fully close setting
F8.cL
After confirmation, the setting mode returns to <F8 screen>.
* Applicable only in normal mode and preset mode. In direct mode, operation continues even if a communication error occurs.
If using the valve fully open setting
F8.oP
After confirmation, the setting mode returns to <F8 screen>.
<Instantaneous flow rate display>

4. TROUBLESHOOTING

4.1 Problems, Causes, and Solutions

If the product does not operate as intended, check the table below for a possible solution.

Problem	Cause	Solution
The settings cannot be changed by key operation.	Key is locked.	Release the key lock according to "3.4 Operation Flow" and then change the settings. Or change “Index: 0x0114 Key lock setting” to “0:Unlock” to release the key lock.
	Operation keys do not work.	Replace the product.
The settings cannot be changed with IO-Link.	"Index: 0x000C Device Access Lock" is "0x0001: Parameter lock".	To change various settings, change “Index: 0x000C Device Access Lock” to “0x0000 No lock” to release parameter lock.
	Communication errors are occurring.	・Check the status of Power Lamp (red dot). *If Power Lamp is lighting, the communication between FCM and IO-Link master has not been established. Since there is a possibility of disconnection, etc., check the wiring, etc., to establish IO-Link communication. ・Check the status of Process Data OUT invalid lamp. *If the green dot on the right edge of the display is blinking, Process Data OUT is invalid. Communication may not have been established between the IO-Link master and its upper network, so check the communication status of the upper network
Flow rate does not display.	Automatic power off function is enabled.	Press any operation key. * If the display turns on and then off after one minute, the automatic power off function is enabled. * Refer to "3.4 Operation Flow" to disable the automatic power off. Or change “Index: 0x0113 Auto power off setting” to “0: OFF”.
	Power supply is not connected correctly.	Connect the rated power correctly.
	There is disconnection inside FCM.	Replace the product.
	Connector is not connected correctly due to deformed connector pin.	Replace the product.
	Cable is disconnected.	Replace the cable.
Switch output does not turn ON.	Switch output is disabled.	Refer to "3.3 Switch output function".
	There is a failure in FCM.	Replace the product.
	Switch output action mode is incorrect. Note 1	Refer to “1.5 Functions”.
Switch output does not turn OFF.	Switch output is disabled.	Refer to "3.3 Switch output function".
	There is a failure in FCM.	Replace the product.
	Switch output action mode is incorrect. Note 1	Refer to “1.5 Functions”.
Flow rate is unstable.	Differential pressure is above operating differential pressure range.	Decrease the primary side pressure.
	Fluctuation of primary side pressure is large.	Install a regulator on the primary side.
	There is an interference with regulator.	Change the set pressure of the regulator.
	There is a large pressure loss between regulator and FCM. (Fluctuation of primary side pressure is large due to changing flow rate.)	Shorten and widen the pipe.
	There is a failure in FCM.	Replace the product.
	Flow rate on secondary side is restricted.	Do not restrict the flow rate with flow rate adjustment valve, or widen the pipe.
	Flow rate from primary side is insufficient.	Check the primary pressure or piping condition.

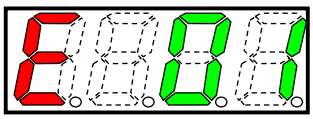
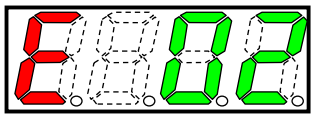
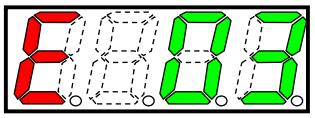
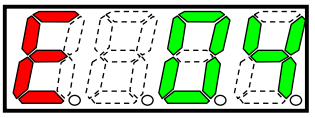
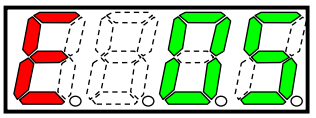
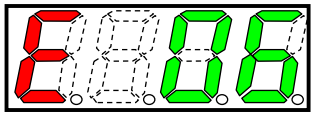
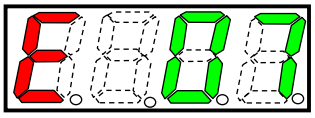
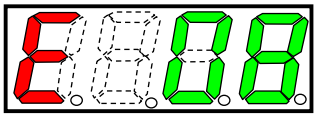
Problem	Cause	Solution
Flow rate display does not become zero.	Zero point of sensor is not aligned correctly.	Perform zero point adjustment of the sensor. Refer to "3.4 Operation Flow". Or, write “0xA0” to “Index: 0x0002 System Command” and adjust the zero point.
	There is a failure in FCM.	Replace the product.
	Warm-up time is insufficient.	Since the product is affected by heat generated from energization, warm up the product (energize at least 10 minutes before use).
	Fluid in product has not been replaced with applicable fluid.	Replace with an applicable fluid before use.
	Sensor display is incorrect due to foreign matters inside.	Replace the product and install a filter on the primary side of the product to prevent foreign matters from entering inside.
Fluid does not flow.	Differential pressure is below operating differential pressure range.	Increase the primary side pressure.
	Differential pressure is above operating differential pressure range.	Decrease the primary side pressure.
	Ambient temperature is high.	Lower the ambient temperature.
	Integration automatic shut-off function is enabled.	Reset the integration automatic shut-off. Refer to "3.2 Flow rate integration".
	Error automatic shut-off function is enabled.	Check "4.2 Error Code" and eliminate the cause of the error.
	Input signal and action mode do not match.	Check the input signal.
	There is a failure in FCM.	Replace the product.
	Proportional solenoid valve is fully closed due to auto OFF.	Release the Auto OFF by key operation or setting “Start / Stop” bit of Process Data OUT to “1: Start”
Excessive fluid flows.	Input signal is input with no primary side pressure supplied.	Supply the primary side pressure and then input the input signal.
	Input signal is input with secondary side valve of FCM closed.	Open the secondary side valve of FCM and then input the input signal.
	Differential pressure is above operating differential pressure range.	Decrease the primary side pressure.
	There is a failure in FCM.	Replace the product.
	"FuL" (fully open) is set in preset or direct memory mode.	Refer to "3.1 Flow rate control".
Accuracy is poor	Regulator is vibrating to some degree.	Change the set pressure of the regulator.
	Foreign matter is adhering to sensor.	Replace the product.
	Non-applicable gas is used.	Use an applicable gas.
Integrated flow rate is zero and does not change.	The “Integration reset” bit of Process Data OUT is “1: ON”.	Set the Process Data OUT “Integration Reset” bit to “0: OFF” Refer to “3.2 Flow rate integration”
	The “Integration Stop” bit of Process Data OUT is “1: ON”.	Set the Process Data OUT “Integration Stop” bit to “0: OFF” Refer to “3.2 Flow rate integration”

Note 1: The operation pattern differs in the tolerance mode and the designated range mode.

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

4.2 Error Code

Basically, errors are reset automatically. If an error is not reset automatically, perform auto OFF or turn off the power, confirm the cause and correct the errors according to the table below. Then, turn off the auto OFF function or turn on the power again.

Type	Explanation	7Seg. Display	Action	Treatment
Error	Supplied power voltage is outside the rated range. Detected at 19.5 VDC or less.		Depends on F6 Setrting. (Note 2)	・Turn on the power again after adjusting the power voltage so that it is within the ratted range.
Error	Input signal exceeds the rated range. Detected at input of 110%F.S. or more.		Depends on F6 Setrting. (Note 2)	・Adjust the input signal so that it is within the rated range.
Error	Error occurred during EEPROM reading or writng.		Flow control stopped.	・Turn on the power again. ・Replace the main body of this product.
Error	Error occurred during memory reading or writing.		Flow control stopped.	・Turn on the power again. ・Replace the main body of this product.
Error	Flow rate does not maintainthe set value for five or more consecutive seconds. Detected when difference between set value and control value is ±20%F.S. or more. (Note 1)		Depends on F6 Setrting. (Note 2)	・Check the primary side pressure and supply pressure that is within the rated operating differential pressure range. After that, turn on the power again. ・Check that there is no leakage From the pipes, fittings, or other components and correct the connections. After that, turn on the power again.
Error	Output error occurs in sensor.		Flow control stopped. Valve closed.	・Stop supplying fluid to the Product and set the flow rate to zero. After that, turn on the power again. ・Replace the main body of this product.
Error (Note 3)	The value is not in the Auto OFF state during zero adjustment.		Flow control does not stop.	・Forcibly turn off the valve forcibly. After that, operate again.
Error (Note 3)	The flow rate exceeds the range where zero adjustment is possible. （Flow Rate≧±10%F.S.）		Flow control does not stop.	・Check the primary side pressure and supply pressure that is within the rated operating differential pressure range. After that, turn on the power again.
Warning (Note 3)	The Proportional solenoid valve has been used at the limit value continuously for more than 10 seconds	(No Display) Process Data IN error code is "E10"	Flow control does not stop.	・Check the primary side pressure and supply pressure that is within the rated operating differential pressure range. After that, turn on the power again. ・Check clogging of the pipes, fittings, or other components. After that, supply pressure that is within the rated operating differential pressure range and turn on the power again.
Warning (Note 3)	The temperature of the IO-Link driver is high.	(No Display) Process Data IN error code is "E11"	Flow control does not stop.	・Check the operating environment.

Note 1: Threshold can be changed by IO-Link parameter.
Note 2: The operation changes depending on the setting of “F6 Error automatic shutoff setting”.
Note 3: This is a function only for the IO-Link type.

5. WARRANTY PROVISIONS

5.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

5.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.