Instruction manual

Capacitance Electromagnetic Flow Sensor

WFC series

- Thoroughly read this instruction manual before using the sensor.
- Please read safety instructions carefully.
- Keep this manual near the sensor where all concerned personnel have easy access to it.

CKD Corporation
Jul.21.2020

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Capacitance Electromagnetic Flow Sensor　WFC Series

Instruction Manual　No. SM-A09186-A /2

1. Safety precautions

When designing and manufacturing a device using CKD products, the manufacturer is obligated to check that device safety mechanical mechanism or water control circuit and the system operated by electrical control that controls the devices is secured.

It is important to select, use, handle, and maintain the product appropriately to ensure that the CKD product is used safely. Observe warnings and precautions to ensure device safety.

Check that device safety is ensured, and manufacture a safe device.

⚠ WARNING :

1. This product is designed and manufactured as a general industrial machine part. It must be handled by an operator having sufficient knowledge and experience in handling.

2. Use this product in accordance of specifications.

Contact CKD when using the product outside the unique specifications range, when using it outdoors, and when using it under the conditions and environment below.

Do not attempt to modify or additionally machine the product.

(1) Use for special applications requiring safety including nuclear energy, railroad, aviation, ship, vehicle, medical equipment, or applications coming into contact with beverage or food, amusement equipment, emergency shutoff circuits, press machine, brake circuits, or for safeguard.

(2) Use for applications where life or assets could be adversely affected, and special safety measures are required.

3. Observe corporate standards and regulations, etc., related to the safety of device design and control, etc.

ISO 4414, JIS B 8370 (pneumatic system rules)

JEPS2008 (policy for pneumatic cylinder use and selection)

High Pressure Gas Maintenance Laws, Occupational Safety and Sanitation Laws and other safety rules, association standards and regulations etc.

4. Do not handle, pipe, or remove devices before confirming safety.

(1) Inspect and service the machine and devices after confirming safety of the entire system related to this product.

(2) Note that there may be hot or charged sections even after operation is stopped.

(3) When inspecting or servicing the device, turn off the energy source (air supply or water supply), and turn off power to the facility. Discharge any compressed air from the system, and pay enough attention to possible water leakage and leakage of electricity.

(4) When starting or restarting a machine or device that incorporates pneumatic components, make sure that the system safety, such as pop-out prevention measures, is secured.

5. Observe warnings and cautions on the pages below to prevent accidents.

■The Safety cautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.

⚠ DANGER : When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, or when there is a high degree of emergency to a warning.

⚠ WARNING : When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

⚠ CAUTION : When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation.
In any case, important information that must be observed is explained.

Precautions with regard to guarantee

●Guarantee period

The guarantee period of our product shall be one (1) year after it is delivered to the place specified by the customer.

●Guarantee coverage

If any failure for which CKD CORPORATION is recognized to be responsible occurs within the above warranty period, a substitute or necessary replacement parts shall be provided free of charge, or the product shall be repaired free of charge at the plant of CKD CORPORATION.

However, the guarantee excludes following cases:

①Defects resulting from operation under conditions beyond those stated in the catalogue or specifications.
②Failure resulting from malfunction of the equipment and/or machine manufactured by other companies.
③Failure resulting from wrong use of the product.
④Failure resulting from modification or repairing that CKD CORPORATION is not involved in.
⑤Failure resulting from causes that could not be foreseen by the technology available at the time of delivery.
⑥Failure resulting from disaster that CKD is not responsible of.

Guarantee stated here covers only the delivered products. Any other damage resulting from failure of the delivered products is not covered by this guarantee.

●Confirmation of product compatibility

Our customer shall be responsible of confirming compatibility of our product used in our customer's system, machinery or device.

2. Cautions when using

2-1 Cautions for design and selection

◆Working fluid◆

DANGER:

■Do not use this product for drinking water.
This product does not comply with the Food Sanitation Act and must not be used to measure water intended for human consumption. Use this product solely as an industrial sensor.

■Do not use this product for flammable fluids.

WARNING:

■Do not use this product as a meter for commercial transactions.
This product does not comply with the Measurement Act and must not be used for commercial transactions. Requests for calibration are not accepted. Use this product as an industrial sensor and not as a measuring instrument.

■This product is for fluids that do not corrode water/wetted part materials with conductivity 5 μS/cm or more. Fluids with low conductivity cannot be detected normally.

◆Working environment◆

DANGER:

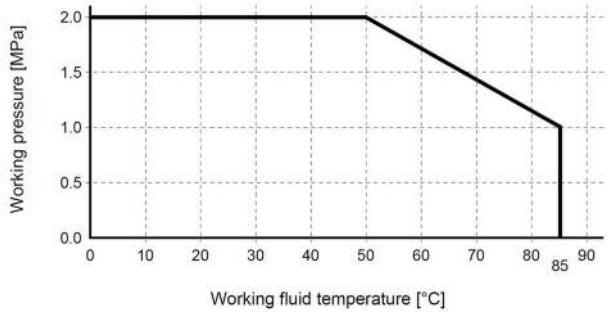
■ Explosive environment
Do not use this product in an explosive gas atmosphere. This product is not designed to avoid ignition of surrounding flammables. Using this product in an explosive atmosphere can result in an explosion and fire.

WARNING:

■Corrosive environment
Do not use this product in an atmosphere where there is danger of corrosion (for example, in the presence of corrosive gas such as sulfur dioxide).

■Fluid temperature
The fluid temperature is 0 to 85 ° C when the working pressure is 0 to 1.0 MPa. When the working pressure is 0 to 2.0 MPa, use with a fluid temperature of 0 to 50°C (*See the figure below). If using at low temperatures, take freeze prevention measures such as adding antifreeze.
If the temperature of the fluid passing through the product or of the surrounding environment is high, the product itself may become hot. Avoid direct contact to prevent burns. Additionally, do not use this product in places where sudden changes in temperature can occur even if the ambient temperature is within specifications.

Operating ambient temperature range



■Maximum working pressure

Do not use this product at a pressure exceeding the maximum operating pressure; otherwise, it can cause product failure. To prevent the pressure from exceeding the maximum operating pressure, particularly due to water hammer, take the following measures:

1) Use a water hammer reduction valve, or a similar mechanism, and regulate the valve closing speed.
2) Use elastic piping material, such as rubber hose, or an accumulator to absorb impact pressure.
3) Keep the pipe length as short as possible.

■Drip-proof environment (Equivalent to IP65)

Degree of protection is when the cable option is mounted. This product employs a dustproof, drip-proof structure that provides reliability during maintenance and cleaning, during which it may be exposed to water splashes. However, avoid using this product in places where it may be constantly exposed to water or intense splattering of water and/or oil.

Also, use at an ambient humidity of 85% RH or lower. If the ambient humidity is high, there is a possibility of malfunction due to dew condensation or invasion of steam.

■Conditions of use for CE conformity

This product is in compliance with the EMC directive and carries a CE marking. The harmonized standard concerning immunity applied to this product is EN 61000- 6-2, and the following requirements must be satisfied in order to conform to this standard:

- ●Assessment of this product is conducted by assessing a cable that pairs a power supply line and a signal line as a signal line.
- ●This product does not have immunity against surges so surge protection measures must be provided on the system side.

⚠ CAUTION:

■Do not exceed the product's specified range.

■Do not use with a positive ground.

■Do not use for applications in direct contact with beverages/foodstuffs/chemical liquids, etc.

2-2 Cautions for mounting, piping, and wiring

◆Piping◆

⚠ CAUTION:

■Pipes can be installed in any orientation, including vertical and horizontal, provided that they are installed so that the fluid constantly fills the piping as it flows through the pipes.
When installing a pipe vertically, making the fluid flow upward can reduce the influence of air bubbles inside.

■Do not install the product in locations where it is exposed to strong light such as direct sunlight or to radiant heat.

■Set the flow direction for piping and flow rate sensor correctly.

■Do not drop, bump or apply excessive impact. In addition, when handling, hold the body of the product. (Do not hold by the cables.)

■Do not install this product in places where it is exposed to strong compression/tensile strength/load/vibration after installation.

■Do not use the product as footing or place any heavy objects on top of the product.

■The product may be damaged if excessive load is applied. Also, make sure that load from piping is not applied.

■Keep the piping just before the sensor as straight as possible and ensure that there are no parts that disturb the flow such as protrusion of packing.

■Before installing piping, clean the pipes to remove all foreign matter, cutting chips, and residual testing water from the pipes.

■Keep this product away from power equipment such as high voltage devices and motors.

■**Do not place strong magnets or magnetic fields close to this product.**

■Make sure that the lead wire is free of repeated bends and tension. Otherwise, it could result in a wire break.

■Condensation can occur if there is significant difference between the ambient temperature and the fluid temperature, and its dew can enter electrical parts and cause operation failure. If there is possibility of condensation, mount the flow sensor horizontally and make sure the display is facing upward.

■If a pipe is narrowed just before the flow sensor, or if there is a valve or other restricting component on the primary side, cavitation occurs inside the pipe, making accurate measurement impossible. For this reason, install such piping on the secondary side of the sensor.

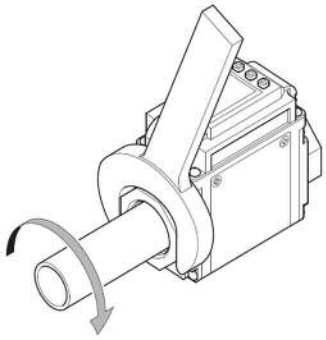
Cavitation: Vapor bubbles that form when static pressure at the back is smaller than the water vapor pressure, such as with a boat screw. This can cause a decrease in efficiency and damage to the screw.

However, operating the pump with the secondary-side valve closed may cause the flow sensor to detect pressure waves from the pump, resulting in incorrect indication. If this occurs, install the valve on the primary side. When doing so, ensure that a straight pipe with a diameter of at least 10 times the bore size is installed between the valve and the flow sensor.

■Use proper torque to tighten the pipes when connecting them.
The purpose is to prevent water leakage and screw damage.
To ensure that the screw threads are not damaged, tighten the bolts by hand before using a tool.

⚠ CAUTION:

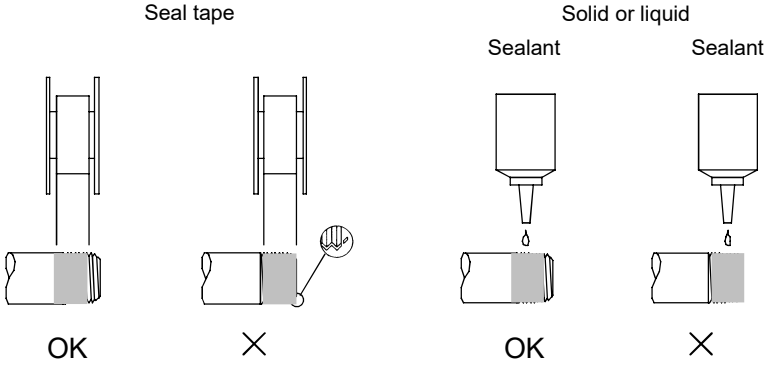
■When installing a piping or fitting to the product, hold the socket that is on the attaching side with a tool. Holding the socket that is on the opposite side or the body may cause damage.



Socket	Tightening torque N・m
10A	22 to 24
15A	28 to 30
20A	34 to 36

■Make sure that no sealing tape or adhesive enters the pipes when connecting the piping.
Before piping, clean blowing air and clean in order to remove foreign matter, chips, etc. in piping.

When connecting pipes, wrap sealing tape in the direction opposite from the threading, starting 2 mm inside from the tip of the threaded portion of the pipe. If sealing tape protrudes from the pipe threads, it could get cut when the pipe is screwed in. This can cause the tape to enter inside and cause product failure. When using a liquid sealant, make sure it does not adhere to plastic parts. Otherwise, plastic parts can be damaged, which is dangerous.



◆Wiring◆

⚠ DANGER:

■Make sure the power supply voltage and outputs are within the specified range. Applying a voltage that is outside of the specified range may cause malfunction, damage to the sensor, electric shock, and/or fire. Also, do not use any load that exceeds the rated output. Using such a load may result in damage to the output part or cause a fire.

⚠ WARNING:

■Check the line color and terminal number when wiring. While an overcurrent protection circuit for the output transistor and a protection circuit for erroneous wiring, using diodes for preventing reverse connection, are implemented, these do not protect against all incorrect wiring. Incorrect wiring can result in malfunction, failure, or damage to the sensor. Check the instruction manual for line colors and terminal numbers in order to ensure correct wiring.

■Make sure that wires are properly insulated. Check that wires do not come into contact with other circuits, and that there is no ground fault or insulation failure between terminals. Otherwise, overcurrent may flow into the sensor, causing damage.

⚠ CAUTION:

- ■There is a risk of electric shock on touching the electrical wiring connections.
- ■Always turn the power OFF before carrying out wiring. Never touch the live parts with wet hands.
- ■It is recommended to electrically isolate the power supply and receiver from other points.
- ■Do not wire together with the power wire/power cables.
- ■Keep the cable away from all sources of noise, including power distribution wires. Noise can cause malfunctions.
- ■Keep unused wires from coming into contact with other wires.
- ■Please screw the M12 connector all the way in. If it is not screwed all the way in, the waterproofness of the connector will not be demonstrated and water may enter the electrical equipment section and cause malfunction or display failure.

2-3 Cautions in operation

⚠ CAUTION:

- ■Perform zero adjustment operation after confirming that the flow path of the product is full of water and the flow is stationary.
- ■Change the settings after stopping the equipment.
- ■After the power supply is turned ON, there is a 10-second warm-up period. Do not use display/output during this time.
- ■Do not press the setting switch with sharp objects.
- ■When a liquid ring circuit is formed, the pressure could rise due to changes in the temperature and the product may be damaged.
  Prevent a liquid ring circuit by providing a relief valve in the system.
- ■When fluid is not flowing, be sure to turn OFF the power of the product. If it remains energized in a state where fluid is not flowing, there is a risk of malfunction.
- ■Observe the rated flow range and use.
- ■Do not use a load that can produce surge voltage.
- ■Do not apply excessive tensile strength to the cable.
- ■Do not turn the L type cable. There is a risk of damage.
- ■If a problem occurs during operation, turn off the power immediately, stop use, and contact the dealer.

2-4 Cautions for inspection and maintenance

⚠ CAUTION:

- ■Ensure proper operation through periodic inspections.
- ■Before removing the equipment, shut off the power supply, make sure that no pressure is applied, and take other safety precautions.
- ■Do not disassemble or modify this product as it may cause a malfunction.
- ■For cleaning, use mild detergent or any other non-polluting cleaning agent.
- ■When blowing air, make sure to blow from downstream. Pressure should not exceed 0.3 MPa.

3. Product

3-1 With IO-Link, fluid temperature measurement function Specifications/ How to order

Specifications

Descriptions			WFC-150	WFC-600	
Port size			Rc3/8, G3/8, 3/8NPT	Rc1/2, G1/2, 1/2NPT	Rc3/4, G3/4, 3/4NPT
Applicable fluid			Fluids (conductive fluids) that do not corrode water/wetted part materials		
Available fluid conductivity			5 µS/cm or more		
Detection			Capacitance		
Rated flow range			0.5 to 15 L/min	2.0 to 60 L/min	
Low flow cut flow rate		*1	Measured range max. flow rate of 3%		
Working fluid temperature		*8	0 to 85°C (no freezing)		
Display units			Instantaneous flow rate L/min Accumulated flow L, kL, ML Fluid temperature °C		
Flow rate	Repeatability	*2	±2.0% F.S.		
	Ambient temperature characteristics	*2	±5.0% F.S. (base temperature 25°C)		
	Fluid temperature characteristics	*2	±5.0% F.S. (base temperature 25°C)		
Fluid temperature	Measurement range		0 to 85°C (operational range is -10 to 110°C)		
	Measurement accuracy		±2°C (less than 50°C) *The difference between the fluid temperature and the ambient temperature is within ±5°C ±5°C (50°C and over) *The difference between the fluid temperature and the ambient temperature is within −35°C		
Working pressure (according to the fluid temperature conditions)		*8	0 to 1.0 MPa (0 to 85°C), 0 to 2.0 MPa (0 to 50°C)		
Proof pressure			3.0 MPa		
Response time		*3	0.1 s/0.25 s/0.5 s/1 s/2 s/5 s (Initial value 1 s)		
Integrating flow range			0.0 to 99999999.9 L		
			0.1 L increments		
Pressure loss		*9	0.02 MPa or less (at max. rated flow)		
Switch output			NPN or PNP MOS-FET output		
	Max. load current		50 mA		
	Max. applied voltage		30 VDC		
	Internal voltage drop		NPN: 2.0 V or less PNP: 2.4 V or less		
	Output protection		Overcurrent abnormal alarm, overcurrent protection		
	Output mode		Select from hysteresis mode, window comparator mode, integrated output mode, integrated pulse output mode, alarm output mode, and frequency pulse output mode		
Analog output	Voltage output		Voltage output: 1 to 5 V Load impedance: 50 kΩ or more		
	Current output		Current output: 4 to 20 mA Load impedance: 500 Ω or less		
Switch input	Input time		20 ms or more		
	Short-circuit current		Approx. 2 mA		
Display			2-screen display (main screen: green/red 2-color display, sub-screen: white) Display refresh cycle 5 times/s		
Power supply voltage			When setting switch output: 24 VDC ±10% (ripple P-P ±10% or less)		
			When setting IO-Link: 20 to 30 VDC (ripple P-P ±10% or less)		
Current consumption			65 mA or less (with 24 VDC, 25°C)		
Environmental resistance	Degree of protection		IP65 equiv. *5		
	Operating ambient temperature range		0 to 50°C (no condensation)		
	Ambient humidity range		35 to 85% RH (no condensation)		
Mounting orientation			Unrestricted in vertical/horizontal direction		
Compliant standards			EC Directives (EMC Directive, RoHS Directive)		
Material of wetted parts			PPS, FKM, CAC804 or C6931		
Weight	Body	*4	Approx. 460 g	Approx. 490 g	Approx. 520 g
	Cable	Cable	Approx. 170 g		
		L type cable			
		Two-sided connector cable	Approx. 180 g		
		L type two-sided connector cable	Approx. 100 g		
	Bracket		Approx. 30 g		

*1: Flow rate less than the low flow cut flow rate displays 0 L/min.
*2: Characteristics when the response time is 1 s.
*3: The response time to reach 63% of the value in relation to the step input.
*4: When using options, add the weight of optional parts.
*5: Degree of protection is when the cable option is mounted.
*6: Contact CKD when installing in parallel at intervals of less than 50 mm.
*7: Piping port and body metal part are grounded to DC (−)/blue wire. This product cannot be used in (+) ground power supply. Contact CKD if using in (+) ground power supply.
*8: The fluid temperature when the working pressure is 0 to 1.0 MPa. When working pressure is 0 to 2.0 MPa, use with a fluid temperature of 0 to 50°C. (Refer to the graph on the following page for the usable range.)
*9: Depends on JIS B 8570-1.

How to order

WFC - 150 - 10A - CT - C3

Ⓐ Flow rate range
Ⓑ Port size
Ⓒ IO-Link fluid temperature measurement
Ⓓ Option (attachment)

Code	Content
Ⓐ Flow rate range	
150	0.5 to 15 L/min
600	2.0 to 60 L/min

Ⓑ Port size

	Flow rate range	150	600
10*	3/8	●	
15*	1/2		●
20*	3/4		●

* Thread	
A	Rc Thread
G	G Thread
N	NPT Thread

Ⓒ IO-Link fluid temperature measurement	
C	IO-Link compatible
CT	With IO-Link compatible, fluid temperature measurement function
T	With fluid temperature measurement function

Ⓓ Option (attachment)	
Blank	None
C3	Cable (M12/4-conductor/3 m) attached
L3	L type cable (M12/4-conductor/3 m) attached
B3	Two-sided connector cable (M12/4-conductor/3 m) attached
G3	L type two-sided connector cable (M12/4-conductor/3 m) attached
B	Bracket attached

[Example of model No.]

WFC-150-10A-CT-C3B

Ⓐ Flow rate range : 0.5 to 15 L/min
Ⓑ Port size : Rc3/8
Ⓒ IO-Link/fluid temperature measurement : With IO-Link compatible, fluid temperature measurement function
Ⓓ Option : Cable, bracket attached

(Note) Codes of attachments are not indicated in the product body model No. display section.
For example, in the case of WFC-150-10A-CT-C3B
Product body (display) : "WFC-150-10A-CT"
Cable (packaging display) : "WFC-C3"
Bracket (packaging display) : "WFC-B"
Of these three sets, "WFC-150-10A-CT-C3B" is displayed on the bag or box containing the entire package.

● Discrete option (cable, bracket) model No.

WFC - C3

Ⓓ Option

3-2 Standard Specifications/ How to order

Specifications

Descriptions			WFC-150	WFC-600	
Port size			Rc3/8, G3/8, 3/8NPT	Rc1/2, G1/2, 1/2NPT	Rc3/4, G3/4, 3/4NPT
Applicable fluid			Fluids (conductive fluids) that do not corrode water/wetted part materials		
Available fluid conductivity			5 µS/cm or more		
Detection			Capacitance		
Rated flow range			0.5 to 15 L/min	2.0 to 60 L/min	
Low flow cut flow rate *1			Measured range max. flow rate of 3%		
Working fluid temperature *8			0 to 85°C (no freezing)		
Display units			Instantaneous flow rate L/min Accumulated flow L, kL, ML		
Repeatability *2			±2.0% F.S.		
Temperature characteristics	Ambient temperature characteristics *2		±5.0% F.S. (base temperature 25°C)		
	Fluid temperature characteristics *2		±5.0% F.S. (base temperature 25°C)		
Working pressure (according to the fluid temperature conditions) *8			0 to 1.0 MPa (0 to 85°C), 0 to 2.0 MPa (0 to 50°C)		
Proof pressure			3.0 MPa		
Response time *3			0.25 s/0.5 s/1 s/2 s/5 s (Initial value 1 s)		
Integrating flow range			0.0 to 99999999.9 L		
			0.1 L increments		
Pressure loss *9			0.02 MPa or less (at max. rated flow)		
Switch output			NPN or PNP transistor output		
	Max. load current		50 mA		
	Max. applied voltage		30 VDC		
	Internal voltage drop		NPN: 2.0 V or less PNP: 2.4 V or less		
	Output protection		Overcurrent abnormal alarm, overcurrent protection		
	Output mode		Select from hysteresis mode, window comparator mode, integrated output mode, integrated pulse output mode, alarm output mode		
Analog output		Voltage output	Voltage output: 1 to 5 V Load impedance: 50 kΩ or more		
		Current output	Current output: 4 to 20 mA Load impedance: 500 Ω or less		
Switch input		Input time	20 ms or more		
		Short-circuit current	Approx. 2 mA		
Display			2-screen display (main screen: green/red 2-color display, sub-screen: white) Display refresh cycle 5 times/s		
Power supply voltage			24 VDC ±10% (ripple P-P ±10% or less)		
Current consumption			65 mA or less		
Environmental resistance	Degree of protection		IP65 equiv. *5		
	Operating ambient temperature range		0 to 50°C (no condensation)		
	Ambient humidity range		35 to 85% RH (no condensation)		
Mounting orientation			Unrestricted in vertical/horizontal direction		
Compliant standards			EC Directives (EMC Directive, RoHS Directive)		
Material of wetted parts			PPS, FKM, CAC804 or C6931		
Weight	Body *4		Approx. 460 g	Approx. 490 g	Approx. 520 g
	Cable	Cable	Approx. 170 g		
		L type cable			
	Bracket		Approx. 30 g		

*1: Flow rate less than the low flow cut flow rate displays 0 L/min.
*2: Characteristics when the response time is 1 s.
*3: The response time to reach 63% of the value in relation to the step input.
*4: When using options, add the weight of optional parts.
*5: Degree of protection is when the cable option is mounted.
*6: Contact CKD when installing in parallel at intervals of less than 50 mm.
*7: Piping port and body metal part are grounded to DC (−)/blue wire. This product cannot be used in (+) ground power supply. Contact CKD if using in (+) ground power supply.
*8: The fluid temperature when the working pressure is 0 to 1.0 MPa. When working pressure is 0 to 2.0 MPa, use with a fluid temperature of 0 to 50°C. (Refer to the graph on the following page for the usable range.)
*9: Depends on JIS B 8570-1.

How to order

WFC - 150 - 10A - N V - C3

Ⓐ Flow rate range
Ⓑ Port size
Ⓒ Switch output
Ⓓ Analog output
Ⓔ Option (attachment)

Code	Content
Ⓐ Flow rate range	
150	0.5 to 15 L/min
600	2.0 to 60 L/min

Ⓑ Port size

	Flow rate range	150	600
10*	3/8	●	
15*	1/2		●
20*	3/4		●

*** Thread**	
A	Rc thread
G	G thread
N	NPT thread

Ⓒ Switch output	
N	NPN transistor output
P	PNP transistor output

Ⓓ Analog output	
V	Voltage output (1 to 5 V)
A	Current output (4 to 20 mA)

Ⓔ Option (attachment)	
Blank	None
C3	Cable (M12/4-conductor/3 m attached)
L3	L type cable (M12/4-conductor/3 m) attached
B	Bracket attached

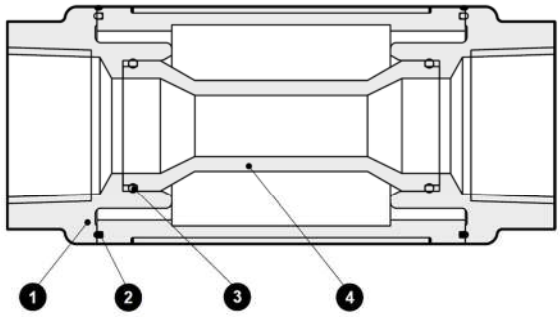
[Example of model No.]
WFC-150-10A-NV-C3B
Ⓐ Flow rate range : 0.5 to 15 L/min
Ⓑ Port size : Rc3/8
Ⓒ Switch output : NPN transistor output
Ⓓ Analog output : Voltage output (1 to 5 V)
Ⓔ Option : Cable, bracket attached

(Note) Codes of attachments are not indicated in the product body model No. display section.
For example, in the case of WFC-150-10A-NV-C3B
Product body (display) : "WFC-150-10A-NV"
Cable (packaging display) : "WFC-C3"
Bracket (packaging display) : "WFC-B"
Of these three sets, "WFC-150-10A-NV-C3B" is displayed on the bag or box containing the entire package.

• Discrete option (cable, bracket) model No.

WFC - C3
ⒺOption

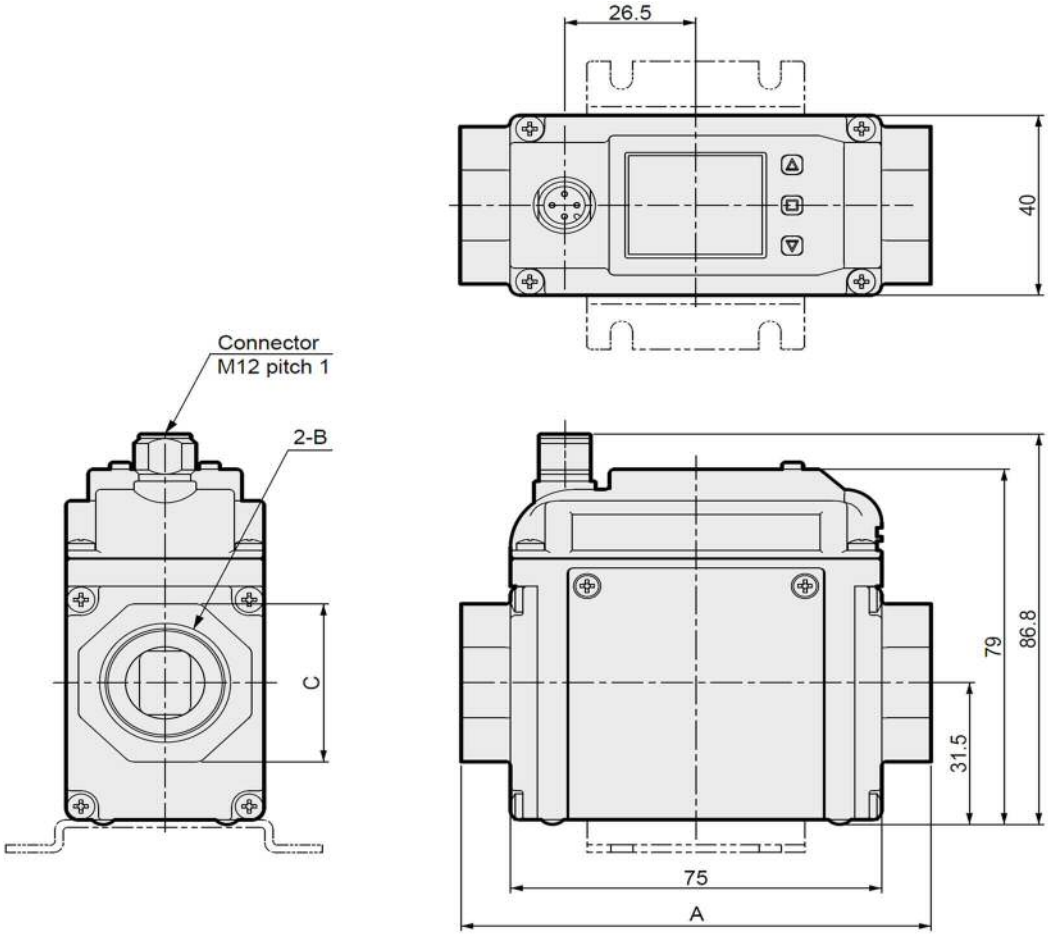
3-3 Internal structure and parts list



* Shows the internal structure when the display screen is in front.

No.	Part name	Material		Quantity
1	Socket	CAC804 or C6931	Copper alloy	2
2	Packing	FKM	Fluoro rubber	2
3	O-ring	FKM	Fluoro rubber	2
4	Measuring tube	PPS Resin		1

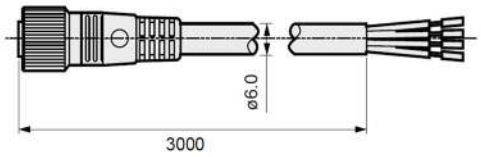
3-4 Dimensions



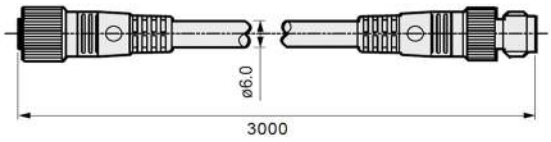
Model No.	A	B	C
WFC-150-10A	90	Rc3/8	24
WFC-150-10G		G3/8	
WFC-150-10N		3/8NPT	
WFC-600-15A	95	Rc1/2	28
WFC-600-15G		G1/2	
WFC-600-15N		1/2NPT	
WFC-600-20A		Rc3/4	35
WFC-600-20G		G3/4	
WFC-600-20N		3/4NPT	

●Cable option

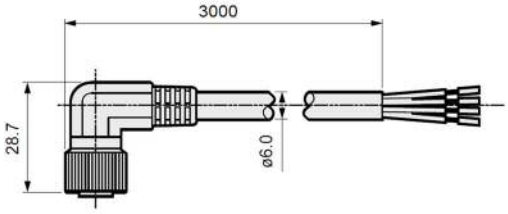
Discrete option model No.: **WFC-C3**



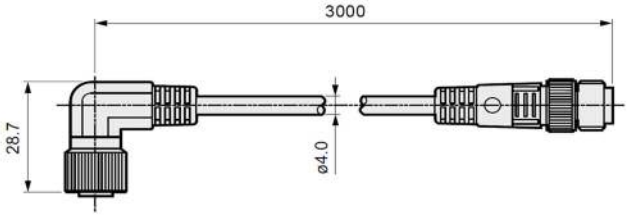
Discrete option model No.: **WFC-B3**



Discrete option model No.: **WFC-L3**

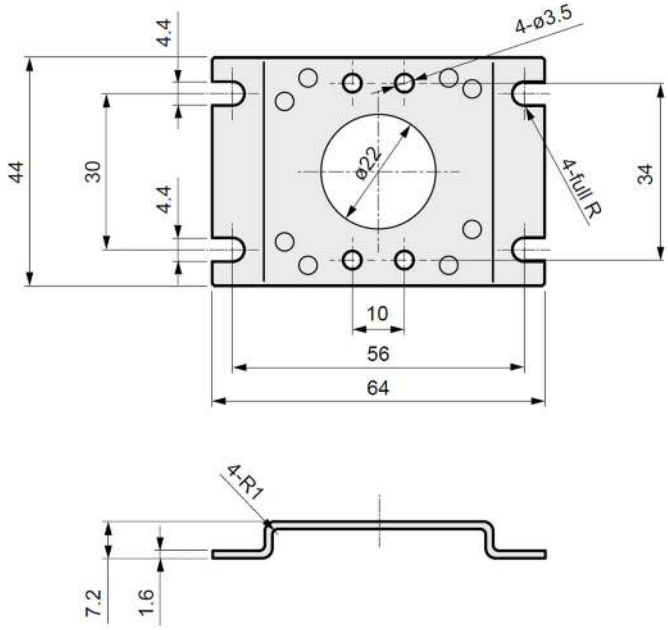


Discrete option model No.: **WFC-G3**



●Bracket option

Discrete option model No.: **WFC-B**



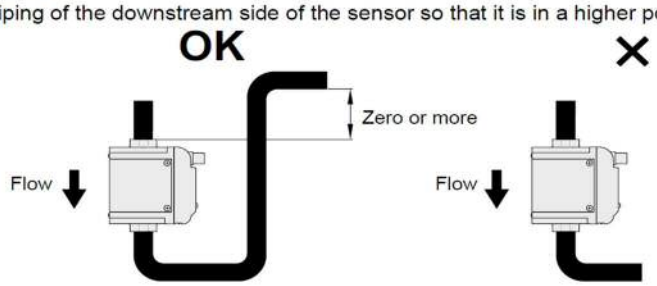
4. Installation

・When installing the flow rate sensor, refer to the notes on use in "2-2 Cautions for mounting, piping, and wiring ". For the water quality and installation location, please refer to "2-1 Cautions for design and selection" section.
・Perform piping so that the flow path of the product is always full of water. If it is not full of water, the flow rate may be displayed even in the stationary state. If the inside of the piping becomes two layers of water and air, flow measurement cannot be performed accurately. Also, when air bubbles or the like are mixed in, it cannot measure accurately as well.

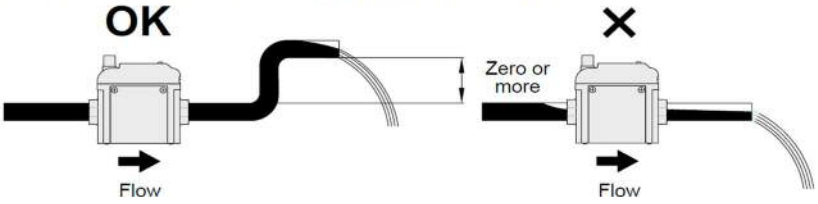
4-1 Recommended piping

Install so that the flow direction is bottom to top.

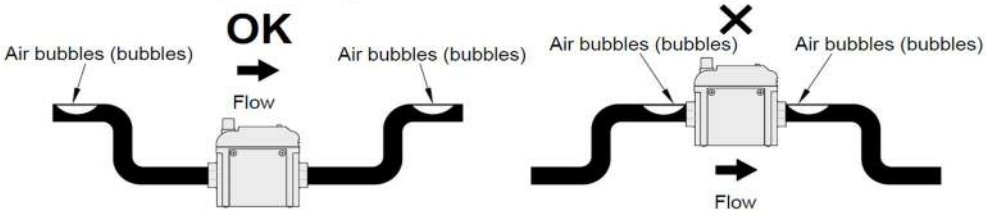
For top to bottom flow
Rotate the piping of the downstream side of the sensor so that it is in a higher position than the sensor.



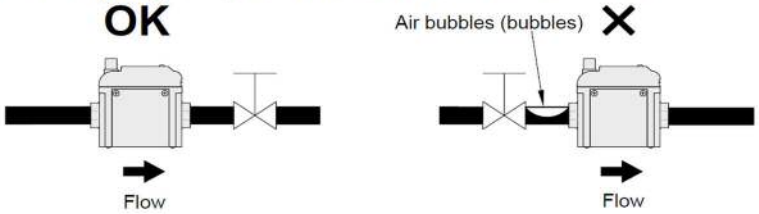
For sensors with atmosphere release on the downstream side
Install the sensor so that it is in a lower position than the exhaust port.



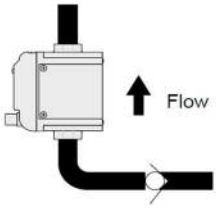
Install the sensor in a position that prevents air bubbles from accumulating.



Install the flow rate adjusting valve, etc. on the downstream side of the sensor.



If the flow path may become empty due to reverse flow caused by water head pressure when water is stopped, installation of the check valve is recommended.



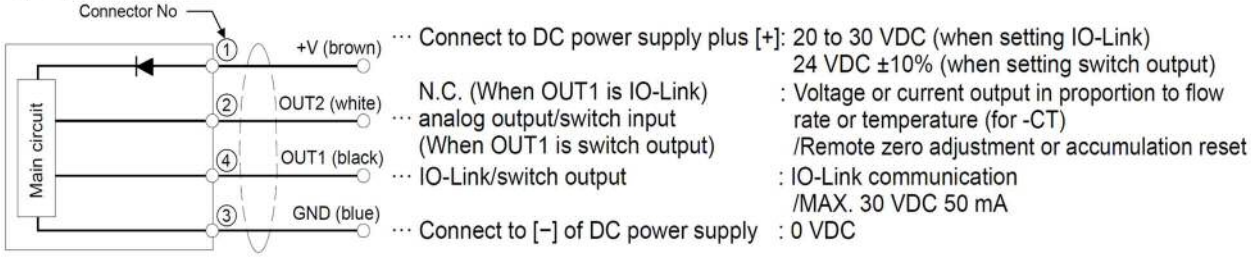
Use CKD's CCH Series check valve.

4-2 Wiring method

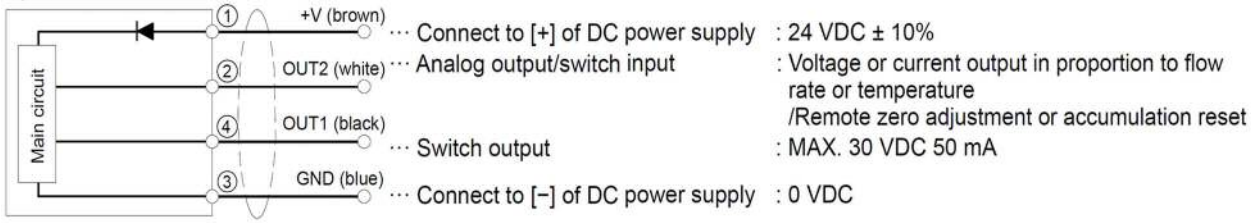
・When wiring, be sure to refer to precautions on use.

1) and 2) are used with the "With IO-Link, fluid temperature measurement" wiring diagram, and 3) and 4) are used with the "Standard" wiring diagram.

1) -C, -CT

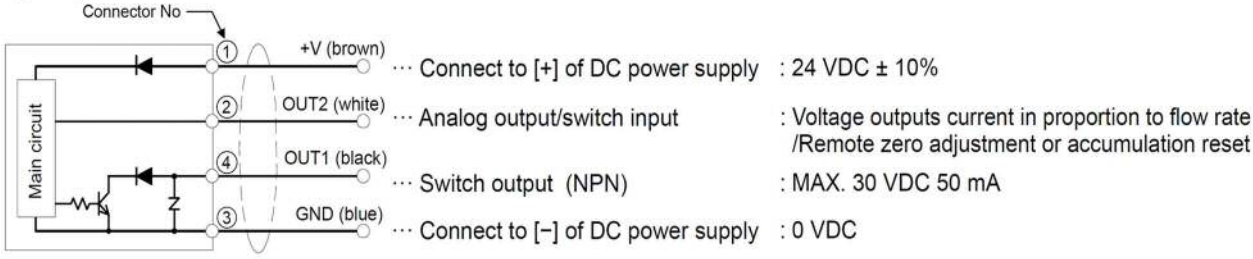


2) -T

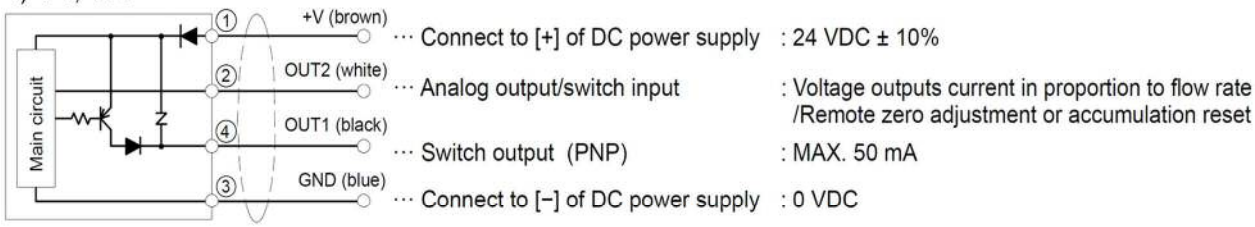


* With -C, -CT, and -T, the NPN/PNP of switch output can be switched from settings.
The voltage/current of analog output can also be switched from settings.

3) -NV, -NA

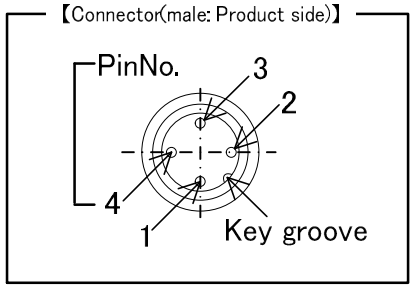


4) -PV, -PA



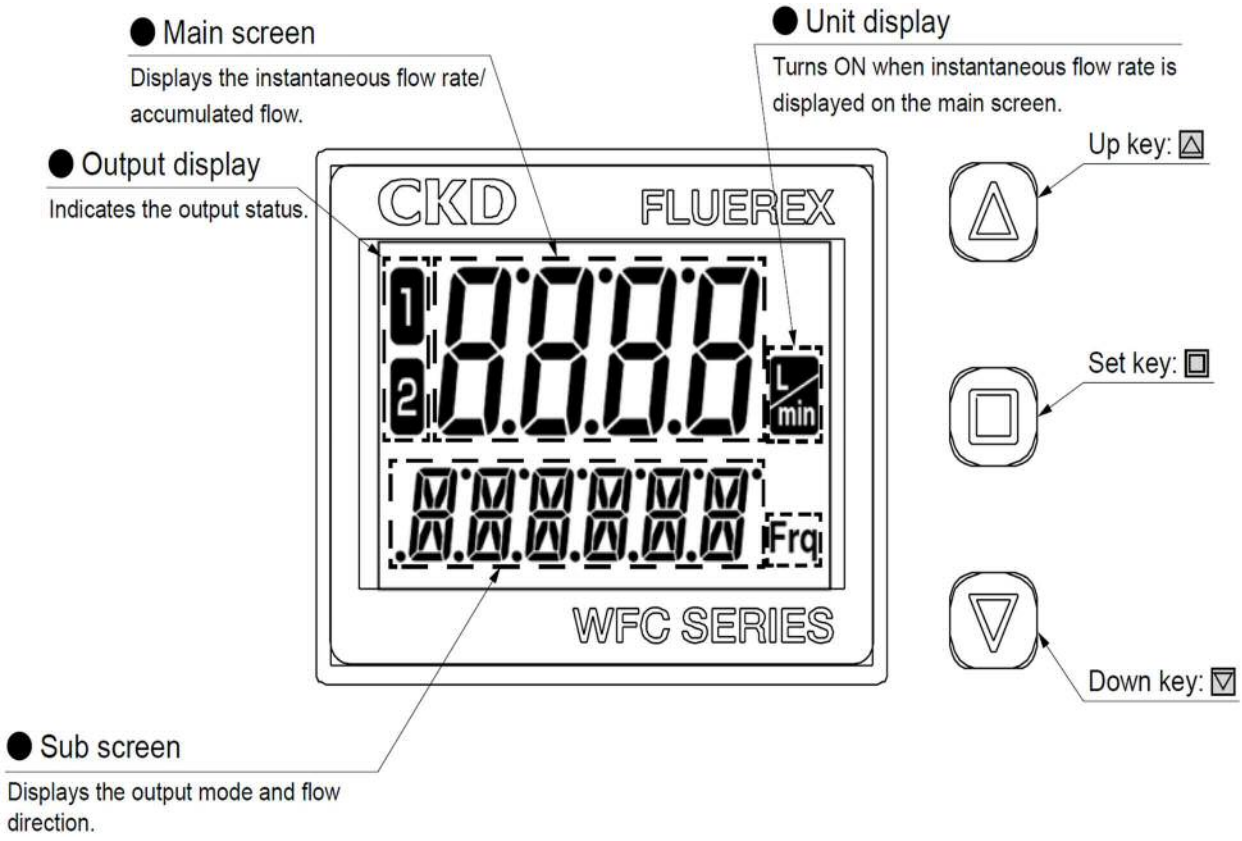
* Wiring for when the cable option is installed.

	Switch output	Analog output
-NV	NPN transistor output	1 to 5 [V]
-NA		4 to 20 [mA]
-PV	PNP transistor output	1 to 5 [V]
-PA		4 to 20 [mA]



5. Operation

5-1 Functions and measurement mode



[Normal screen]

Instantaneous flow rate display	Hysteresis mode P1 5.0	Window comparator mode WINdoW	Integrated output mode 1234L	Integrated pulse output mode 0.0 IL/P
	Analog output (flow rate) FS 10.0	Analog output (fluid temperature) FS 10	Switch input: remote zero adjustment ZERo	Digital input: Accumulation reset RESEt
	Alarm output mode ALARM	Fluid temperature c 100	Frequency pulse output mode FREQ-P	IO-Link communication mode ioL INK
	Flow direction ---→	←---	Select any character ******	No sub-screen display
Total integrating flow display	8888 L	Integrated unit can be switched to "L", "kL", "ML" with up key: ▲ and down key: ▼.		

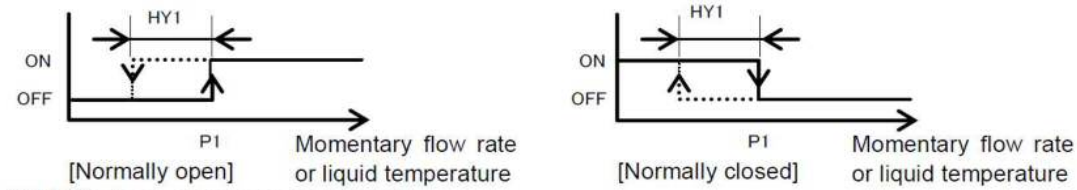
5-2 Output modes and output operations

・Please note that the operation method differs depending on the model No.

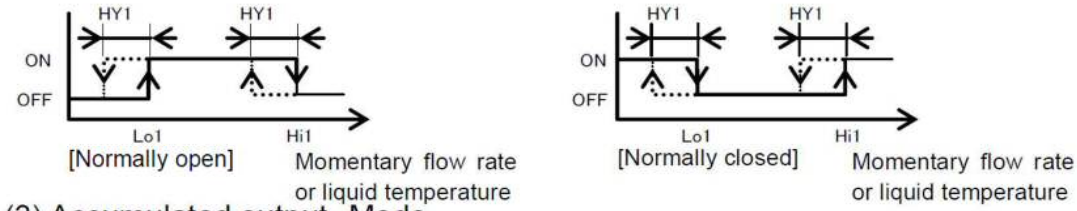
5-2-1 Switch Output (SIO) Mode

[OUT1 output]

(1) Hysteresis mode

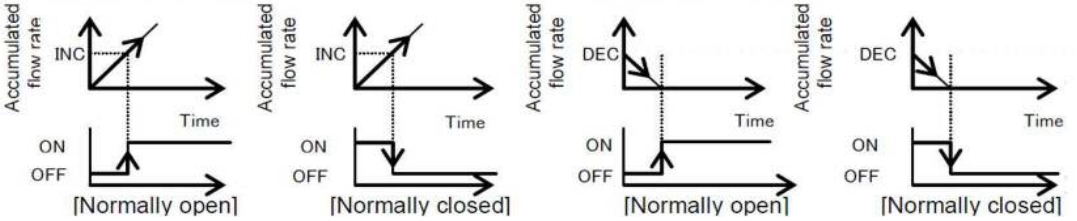


(2) Window comparator mode

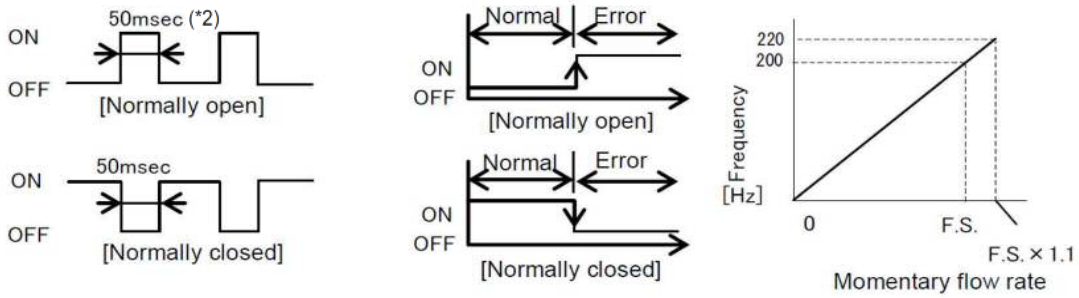


(3) Accumulated output Mode

Increment mode　　Decrement mode



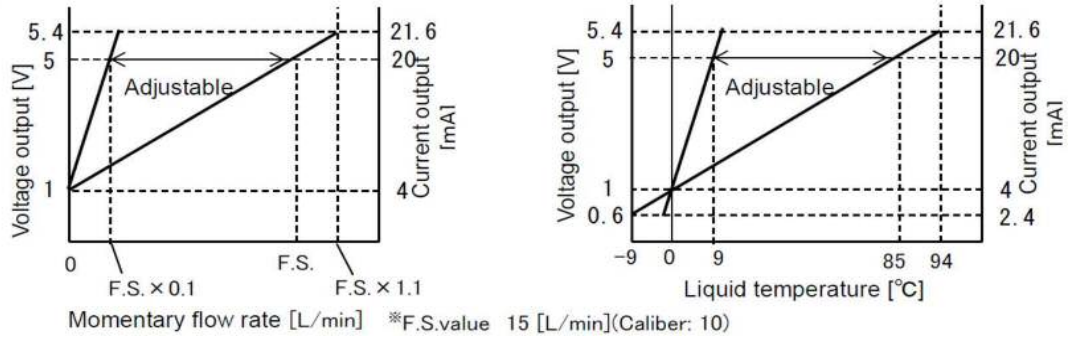
(4) Accumulated pulse output　5) Alarm output mode　(6) Frequency output (*1)



*1 Only model No. WFC-□□□-□□□- C/CT/T is supported.

*2 10msec when the pulse rate is 0.01L/Pulse･

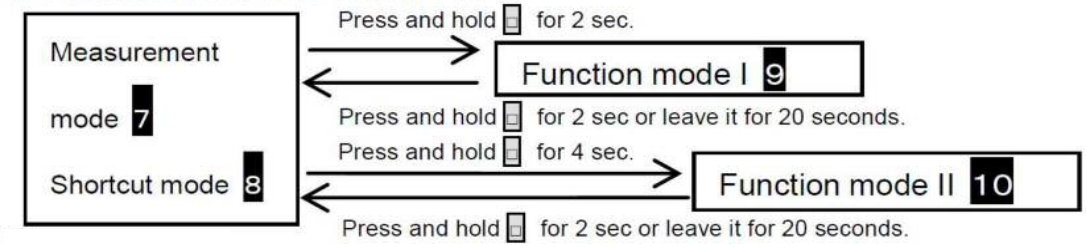
[OUT2 output]　　(*3)



*3 Only model No. WFC-□□□-□□□-CT/T is supported.

5-2-2 Mode Selection

You can select the modes by shortcut mode operation in the measurement mode. You can move from the measurement mode to the Function mode I or Function mode II as shown below.

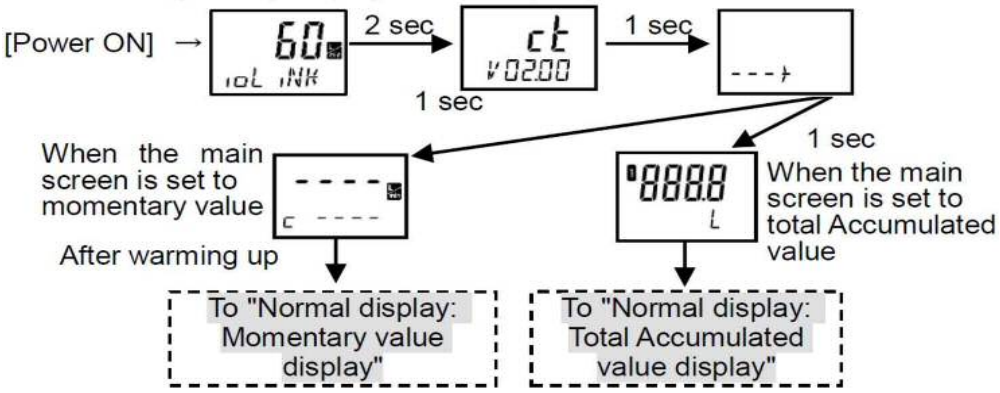


5-2-3 Normal Operation (Measurement Mode)

[Overview]
The measurement mode is the normal operation mode enabled after the startup display upon power-ON to output and display measured values.
By switching from the measurement mode to the shortcut mode or Function mode to change settings as necessary.

[Regarding Model No. WFC-□□□-□□□-C/CT/T]

[Startup display]
The following startup display is shown upon power ON.



[Normal display: Momentary value display]
The main screen shows the momentary value and the sub-screen shows the liquid temperature (*1).

Flow rate	Liquid temperature	Momentary value display
0.0L/min to 110% of maximum flow rate or less	0 to 85℃	ON
Over 110% of maximum flow rate to 120% or less	-10 to -1℃ and 86 to 110℃	Blinking (*2)
Over 120% of maximum flow rate		E007 (Excessive flow rate error)
	Less than -10℃ or over 110℃	E008 (Fluid temperature error)

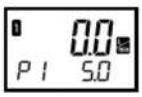
*1 When the main screen shows the momentary value, the sub-screen will show codes such as "OUT1" or "OUT2" in accordance with the setting of the Function mode (F4: Sub-screen).
*2 When the flow rate is within the specified value, the main screen will blink. When the liquid temperature is within the specified value, only the sub-screen will blink.

(1) When flow direction is selected by F4

(2) When liquid temperature is selected by F4

(3) When OUT1 is selected by F4

One of the following is displayed according to the setting of the Function mode F1: OUT1.

Hysteresis mode	Window Comparator mode	Accumulated output mode	Accumulated pulse output mode	Alarm output mode	Frequency output mode	IO-Link communication mode
						

(4) When OUT2 is selected by F4

One of the following is displayed according to the setting of the Function mode F2: OUT2.

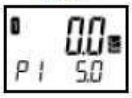
Analog output (Flow rate)	Analog output (Liquid temp.)	Switch input: Remote zero adjustment	Switch input: Accumulated output reset	IO-Link setting
				

(5)When arbitrary text is selected by F4

(6)When no sub-screen display is selected by F4

(7)When IO-Link output1 is selected by F4

One of the following is displayed according to the setting of the IO-Link Output1.

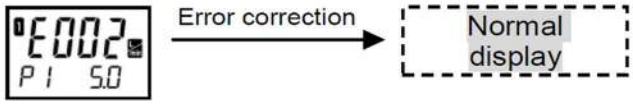
Hysteresis mode	Window Comparator mode	Accumulated output mode	Accumulated pulse output mode
			

※ It is a function that has been added to Ver.2.04 or later.
The version is displayed at power-up.

[Normal display: Total Accumulated value display]

The main screen shows the Accumulated value and sub-screen shows the unit for the Accumulated value.
You can use the △ and ▽ buttons to change the unit in the sequence of "L" → "kL" → "ML."

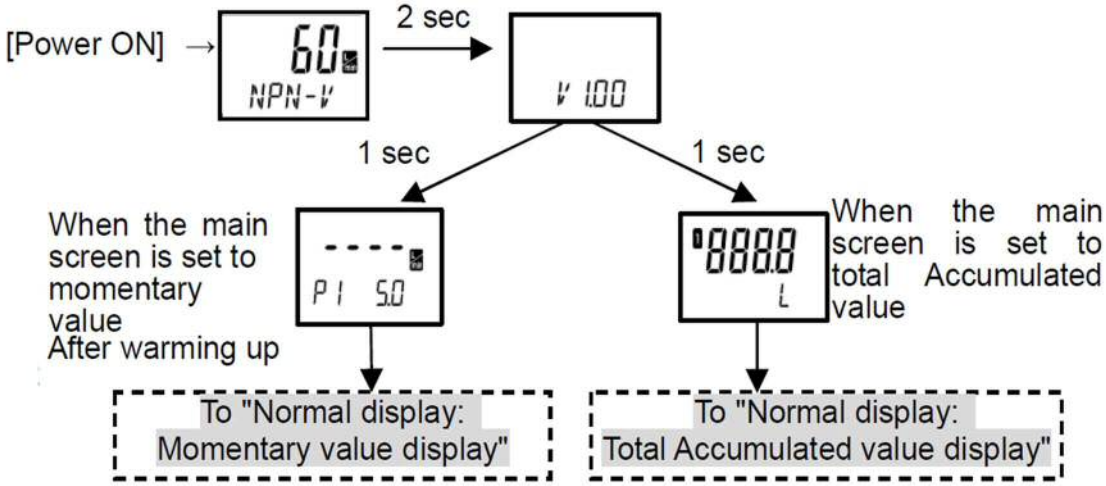
[Alarm display]
When an error is detected, the main screen shows an error code to indicate the error. The error code remains until the error has been resolved.



Error code	Error	Description	Countermeasure
E001	Power supply voltage error	When the power supply voltage is less than 17 V to 18 V (Turns OFF at less than 17 V)	Use the power supply voltage within the specification range.
E002	Internal error (1)	An error occurred with the internal data.	Power OFF the product and then power it ON again.
E003	Internal error (2)	An error occurred with the internal circuit.	
E004	Excessive current	An excessive current has flowed in the switch output.	Power OFF the product and check the load.
E005	Measurement target fluid error	The flow rate cannot be measured correctly due to an abnormal current flowing in the target fluid or air is mixed with it.	Power OFF the product and check the target fluid for abnormality.
E006	Reverse flow	The fluid flows in the direction opposite to the set direction.	Check the flow direction setting.
E007	Excessive flow rate	The flow rate exceeds 120% of the maximum flow rate.	Check the flow rate and decrease it as necessary.
E008	Fluid temperature error	The detected liquid temperature is less than -10℃ or over 110℃.	Check the liquid temperature. For the trouble described on the left, adjust the temperature.

[Regarding Model No. WFC-□□□-□□□-NV/NA/PV/PA]

[Startup display]
The following startup display is shown upon power ON.



[Normal display: Momentary value display]
The main screen shows the momentary value.

Flow rate	Momentary value display
0.0L/min to 110% of maximum flow rate or less	ON
Over 110% of maximum flow rate to 120% or less	Blinking
Over 120% of maximum flow rate	E007 (Excessive flow rate error)

When the main screen shows the momentary value, the sub-screen will show codes such as "OUT1" or "OUT2" in accordance with the setting of the Function mode (F4: Sub-screen).

(1) When OUT1 is selected by F4

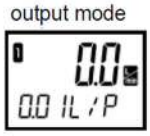
One of the following is displayed according to the setting of the Function mode F1: OUT1.

Hysteresis mode

Window comparator mode

Accumulated output mode

Accumulated pulse output mode



Alarm output mode

(2) When OUT2 is selected by F4

One of the following is displayed according to the setting of the Function mode F2: OUT2.

Analog output

Digital input: Remote zero adjustment

Digital input: Accumulated output reset

(3) When flow direction is selected by F4

(4) When arbitrary text is selected by F4

(5) When no sub screen-display is selected by F4

[Normal display: Total Accumulated value display]

The main screen shows the Accumulated value and sub-screen shows the unit for the Accumulated value.

You can use the △ and ▽ buttons to change the unit in the sequence of "L" → "kL" → "ML."

[Alarm display]

When an error is detected, the main screen shows an error code to indicate the error. The error code remains until the error has been resolved.

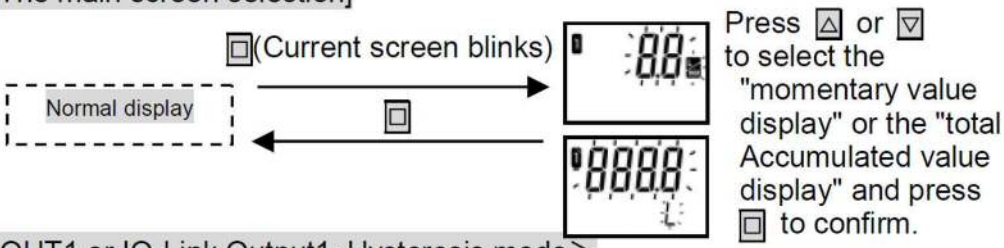
Error correction → Normal display

Error code	Error	Description	Countermeasure
E002	Internal error (1)	An error occurred with the internal data.	Power OFF the product and then power it ON again.
E003	Internal error (2)	An error occurred with the internal circuit.	
E004	Excessive current	An excessive current has flowed in the switch output .	Power OFF the product and check the load.
E005	Measurement target fluid error	The flow rate cannot be measured correctly due to an abnormal current flowing in the target fluid or air is mixed with it.	Power OFF the product and check the target fluid for abnormality.
E006	Reverse flow	The fluid flows in the direction opposite to the set direction.	Check the flow direction setting.
E007	Excessive flow rate	The flow rate exceeds 120% of the maximum flow rate.	Check the flow rate and decrease it as necessary.

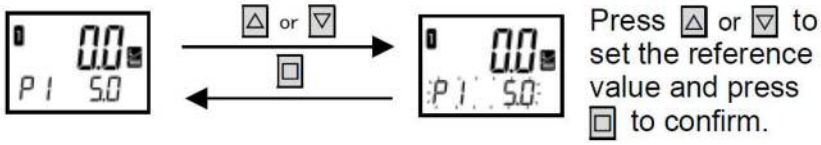
5-2-4 Easy Setup (Shortcut Mode)

You can select frequently used settings by a shortcut operation from the normal display.

[The main screen selection]

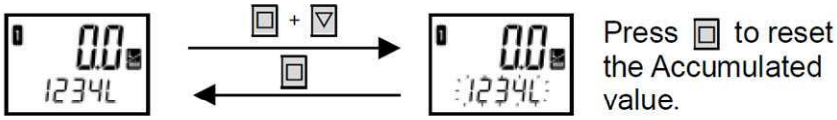


＜OUT1 or IO-Link Output1：Hysteresis mode＞



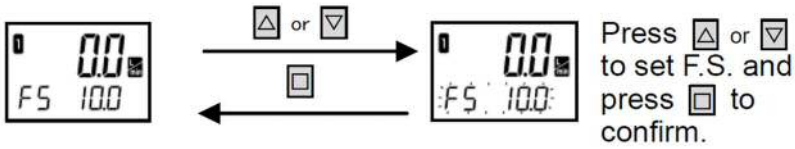
※ "IO-Link Output1" setting is a feature added since Ver.2.04.
The version is displayed at power-up.

＜OUT1 or IO-Link Output1：Accumulated output mode＞

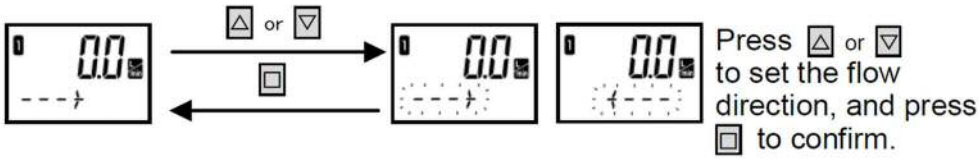


※ "IO-Link Output1" setting is a feature added since Ver.2.04.
The version is displayed at power-up.

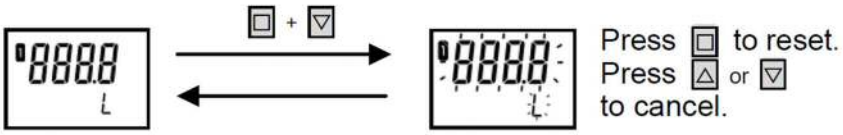
[OUT2: Analog output FS mode]



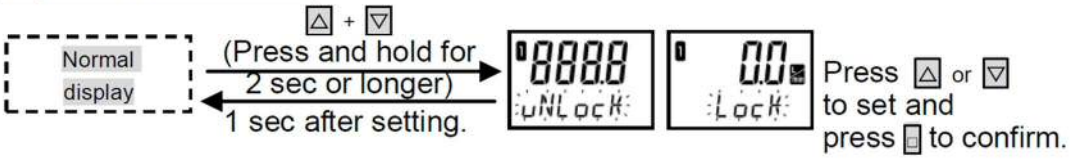
[Flow direction]



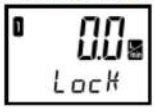
[Total Accumulated value reset]



[Key lock enable/disable]



* While the key lock is enabled, all other operations are disabled. Disable the key lock in a similar method as when you enabled it. When you press any key while key lock is enabled, "LOCK" will be shown on the sub-screen for 2 seconds.



5-2-5 Basic Settings (Function Mode I)

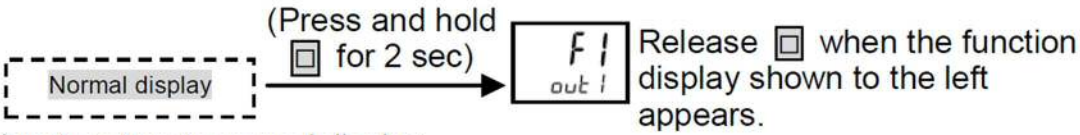
[Overview]

(1) List of items for Function mode I

The Function mode I provides the following setting items.

Display	Item	Description
F1	OUT1	Specifies the output method for OUT1.
F2	OUT2	Selects from analog output and switch input. (Not displayed when set to IO-Link)
F3	Response time	Sets the response time
F4	Sub-screen	Sets the contents of the sub-screen.
F5	Flow direction	Sets the flow direction of the target fluid.
F6	Total Accumulated display unit	Selects the unit for total Accumulated value display.

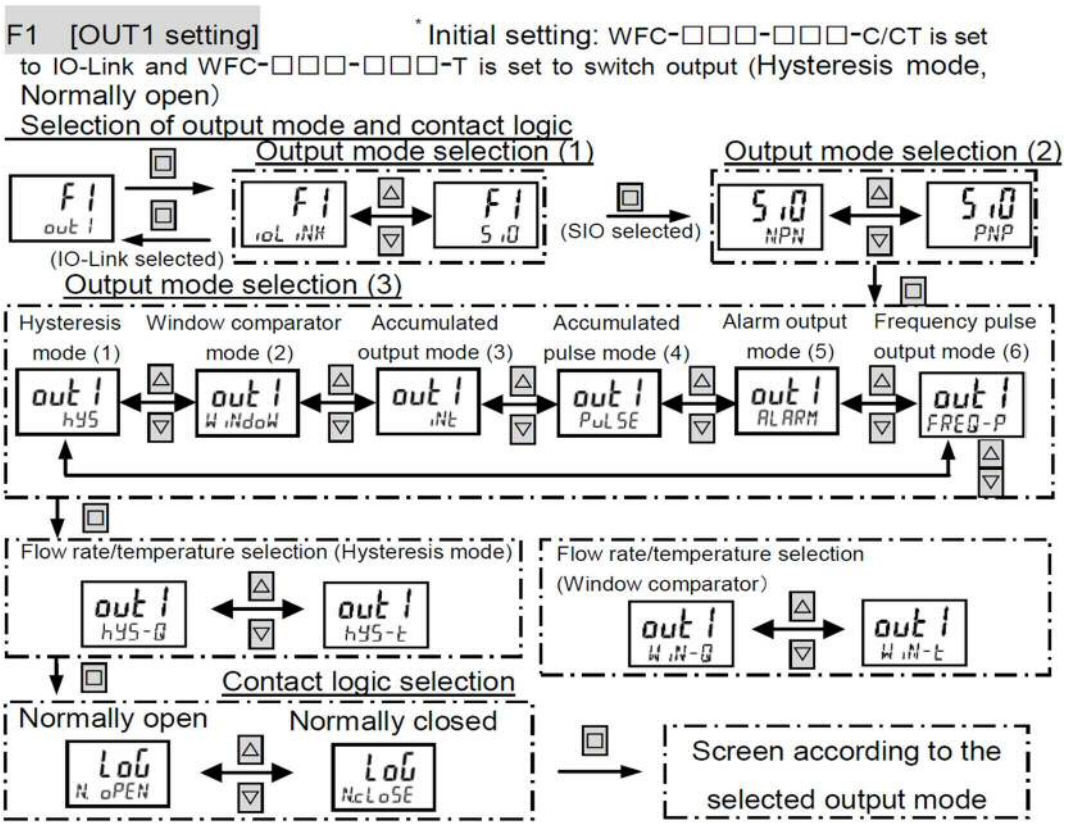
(2) How to switch to Function mode I



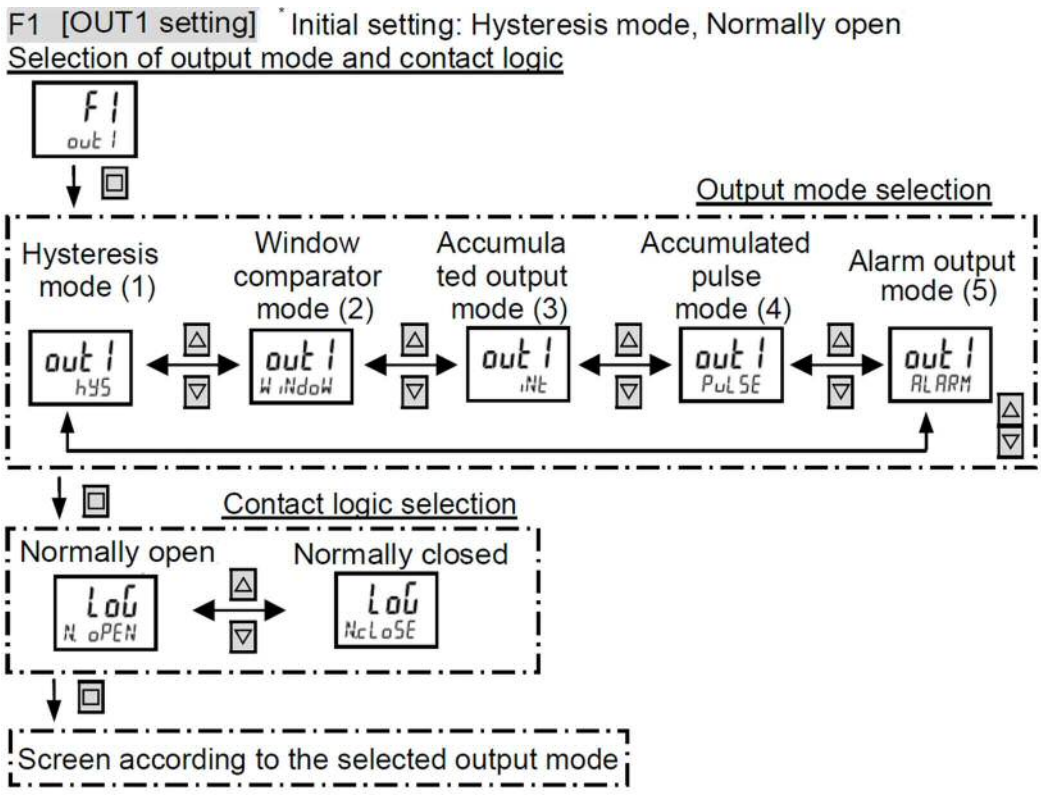
(3) How to return to normal display

- Press and hold for 2 sec while "F*" is shown to return to the normal display.
- The screen also returns automatically to the normal display if you do nothing for 20 seconds. Note that if you do not confirm the selected value, after 20 seconds the screen will automatically return to the normal display, and the selected value will be cancelled.

[Regarding Model No. WFC-□□□-□□□-C/CT/T]

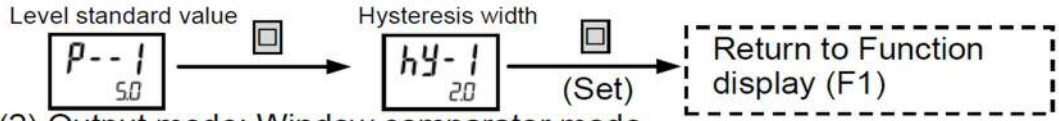


[Regarding Model No. WFC-□□□-□□□-NV/NA/PV/PA]



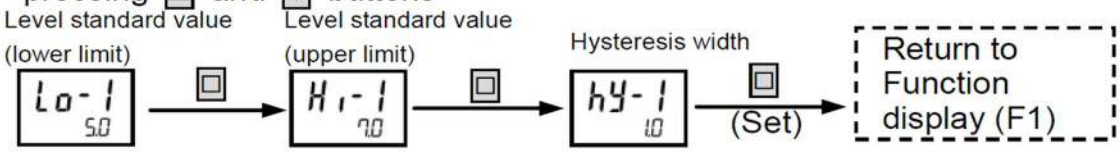
(1) Output mode: Hysteresis mode

The current value is shown on the sub-screen and you can change it by pressing △ and ▽ buttons.

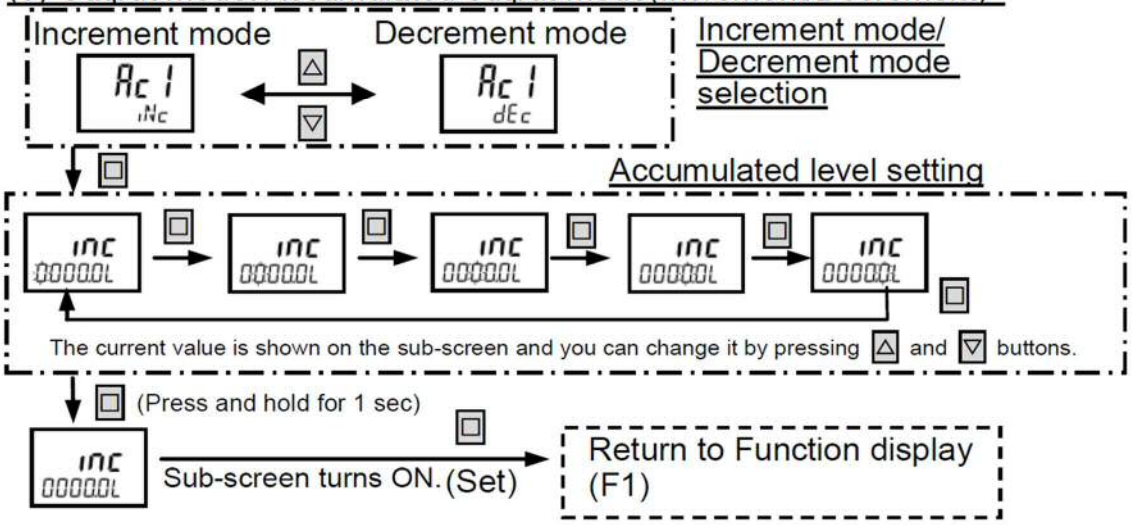


(2) Output mode: Window comparator mode

The current value is shown on the sub-screen and you can change it by pressing △ and ▽ buttons

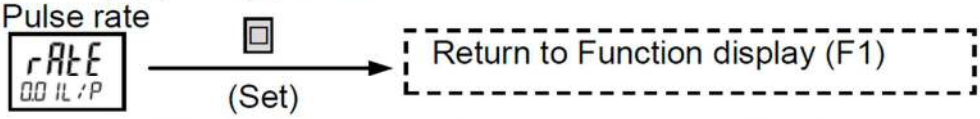


(3) Output mode: Accumulated output mode(Increment/Decrement)



(4) Output mode: Accumulated pulse output

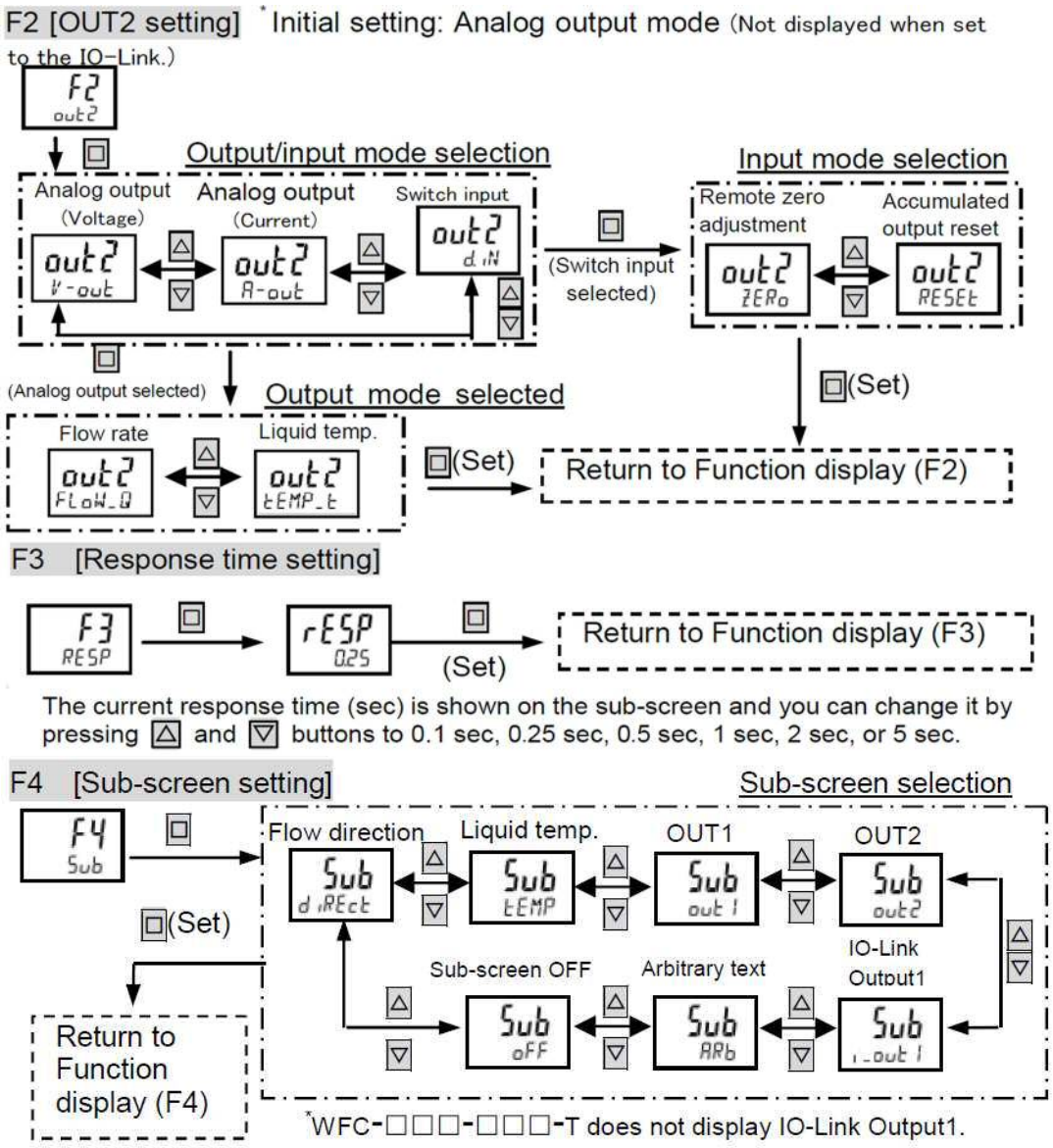
The pulse rate is shown on the sub-screen and you can change it by pressing △ and ▽ buttons.



You can set the pulse rate as follows depending on the flow rate range.

Pulse rate [L/Pulse]	Flow rate range	
	0.5 to 15L/min	2.0 to 60L/min
0.01	○	×
0.1	○	○
0.2	×	○
1	○	○
10	×	○

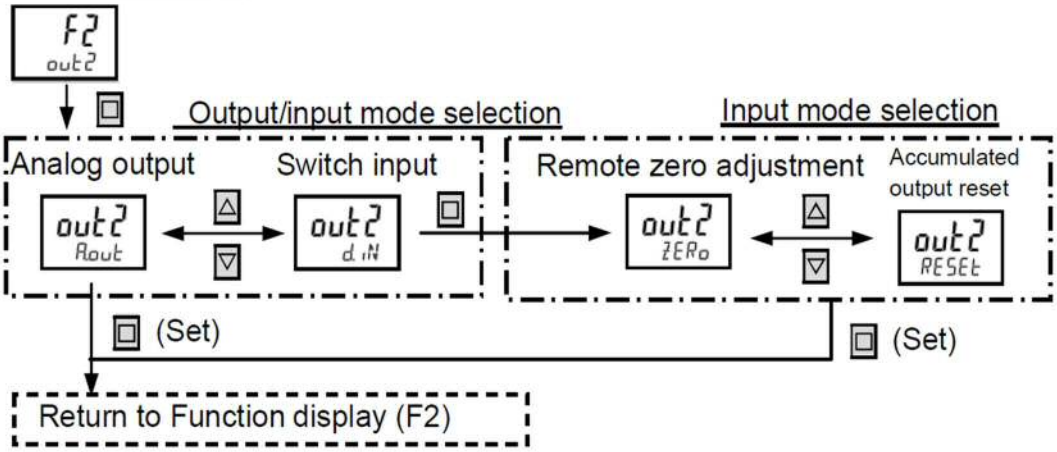
[Regarding Model No. WFC-□□□-□□□-C/CT/T]



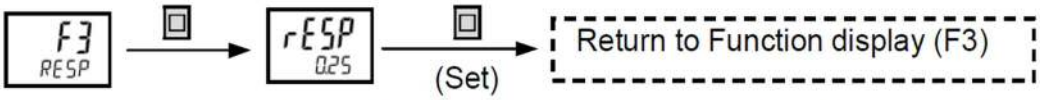
※ "IO-Link Output1" setting is a feature added since Ver.2.04.
The version is displayed at power-up.

[Regarding Model No. WFC-□□□-□□□-NV/NA/PV/PA]

F2 [OUT2 setting] * Initial setting: Analog output mode

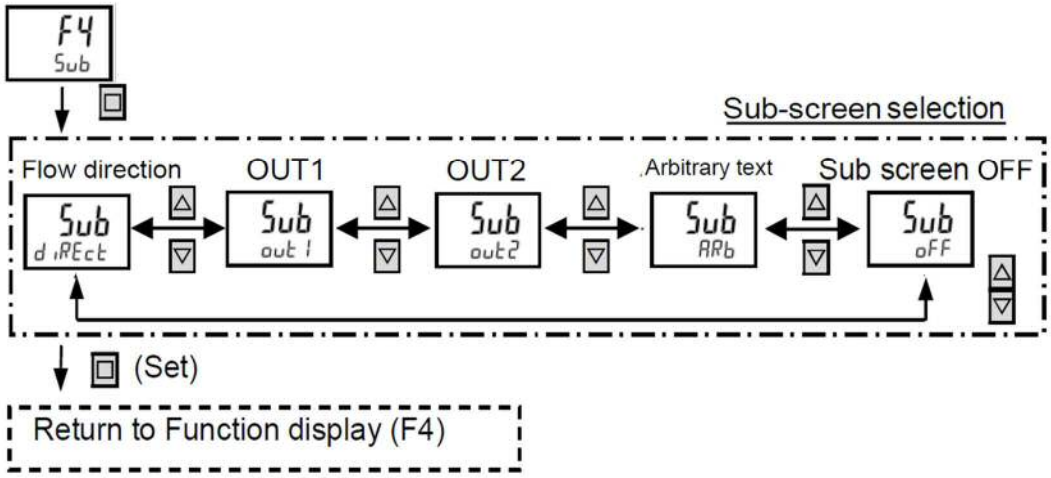


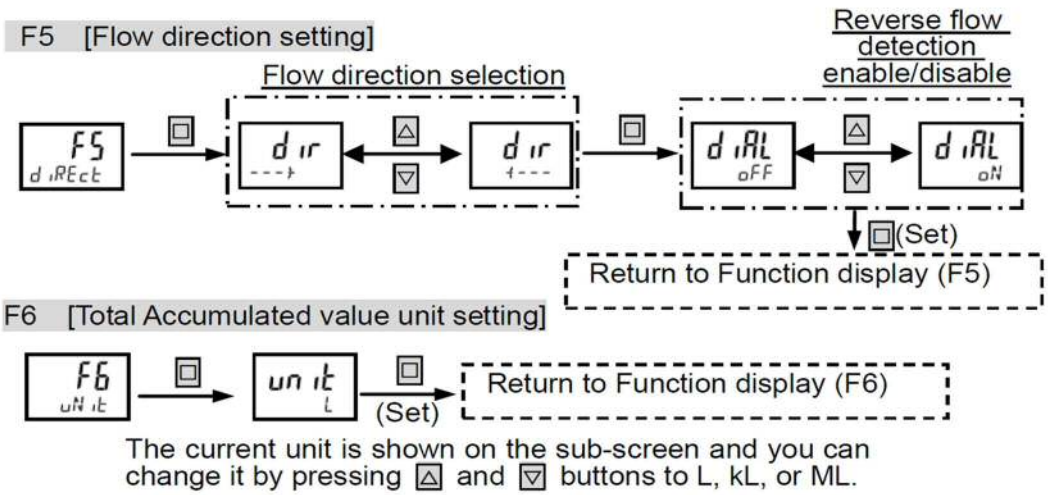
F3 [Response time setting]



The current response time (sec) is shown on the sub-screen and you can change it by pressing △ and ▽ buttons to 0.25 sec, 0.5 sec, 1 sec, 2 sec, or 5 sec.

F4 [Sub-screen setting]





5-2-6 Advanced Settings (Function Mode II)

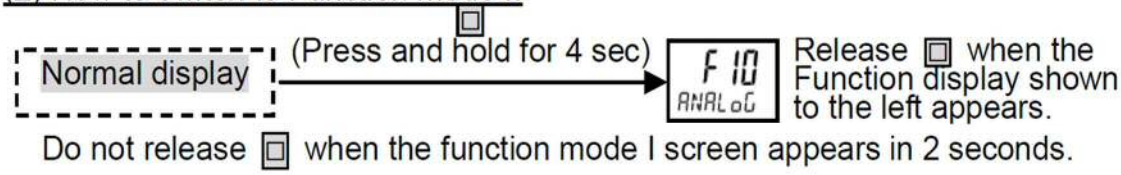
[Overview]

(1) List of items for Function mode II

The Function mode II provides the following setting items.

Display	Item	Description
F10	Analog output FS	Sets the free scale Function for the analog output. (Not displayed when set to the IO-Link.)
F20	Display color	Sets the display color for the main screen.
F30	ECO mode	Enables/disables the ECO mode.
F40	Zero adjustment	Runs zero adjustment.
F50	Forced output	Selects output functions to forcibly run. (Not displayed when set to the IO-Link.)
F60	Parallel mode	Selects the parallel mode.
F70	Arbitrary text	Selects arbitrary text shown on the sub-screen.
F80	Reverse display	Reverse the display direction upside down.
F90	Factory defaults	Returns the setting to the factory defaults.

(2) How to switch to Function mode II



Do not release □ when the function mode I screen appears in 2 seconds.

You can switch the Function display by pressing △ or ▽.

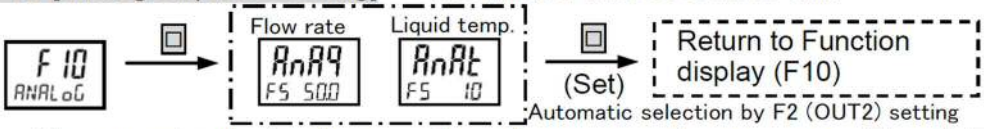
(3) How to return to normal display

・Press and hold □ for 2 sec while "F*" is shown to return to the normal display.

・The screen also returns automatically to the normal display if you do nothing for 20 seconds. Note that if you do not confirm the selected value, the screen will automatically return to the normal display, and the selected value will be cancelled.

[Regarding Model No. WFC-□□□-□□□-C/CT/T]

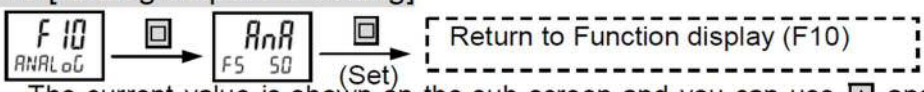
F10 [Analog output FS setting] ※ Not displayed when set to the IO-Link.



The current value is shown on the sub-screen and you can use △ and ▽ buttons to set the full scale value of the analog output from 10 to 100% of the maximum flow rate.

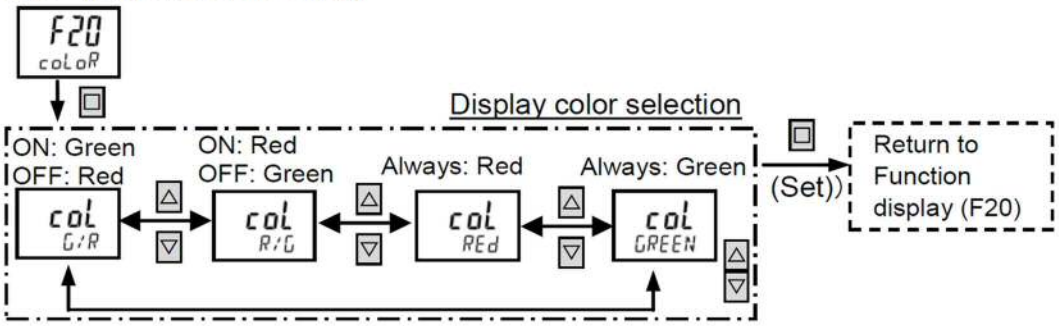
[Regarding Model No. WFC-□□□-□□□-NV/NA/PV/PA]

F10 [Analog output FS setting]



The current value is shown on the sub screen and you can use △ and ▽ buttons to set the full scale value of the analog output from 10 to 100% of the maximum flow rate.

F20 [Display color setting]

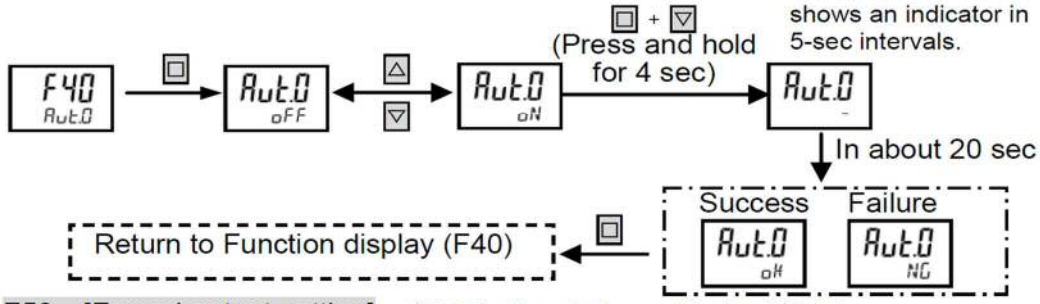


F30 [ECO mode setting]

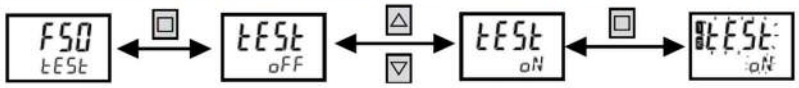
ON/OFF is shown on the sub-screen and you can change it by pressing △ and ▽ buttons. If you set it to ON, the ECO mode is enabled and the screen turns OFF when you do nothing for 1 minute.

F40 [Zero adjustment]

When zero adjustment starts, the sub-screen shows an indicator in 5-sec intervals.



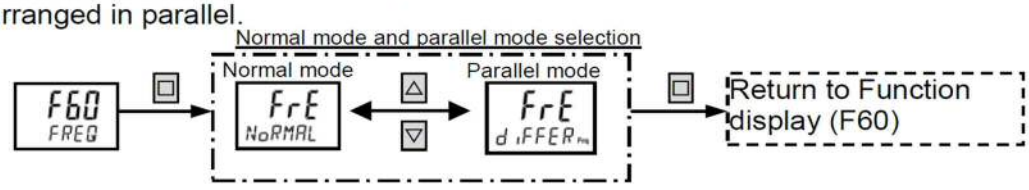
F50 [Forced output setting] *Not displayed when set to the IO-Link.



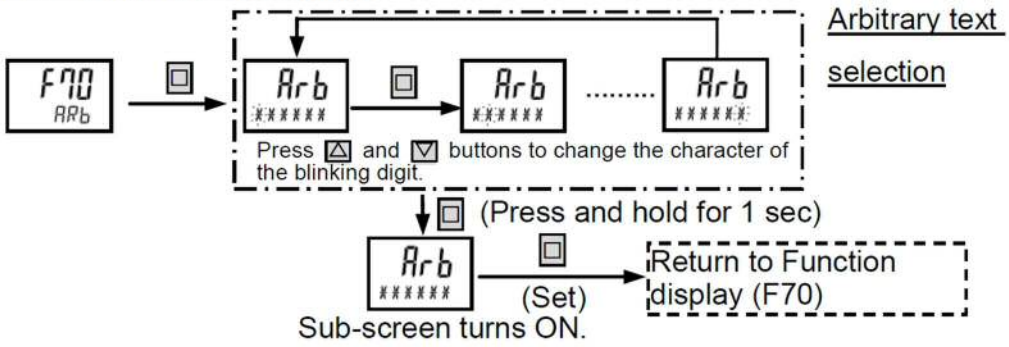
OUT1
Outputs switch output ON. Output display 1 turns ON.
OUT2
Outputs 5V or 20mA for analog output. Output display 2 turns ON.
For switch input, output display 2 turns ON synchronously with input ON.
During forced output, the screen does not return to the normal display automatically even when you do nothing for 20 sec.

F60 [Parallel mode setting]

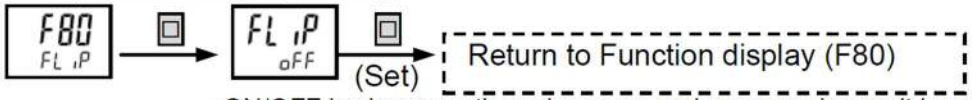
You can use parallel mode to perform stable measurements with sensors arranged in parallel.



F70 [Arbitrary text setting]

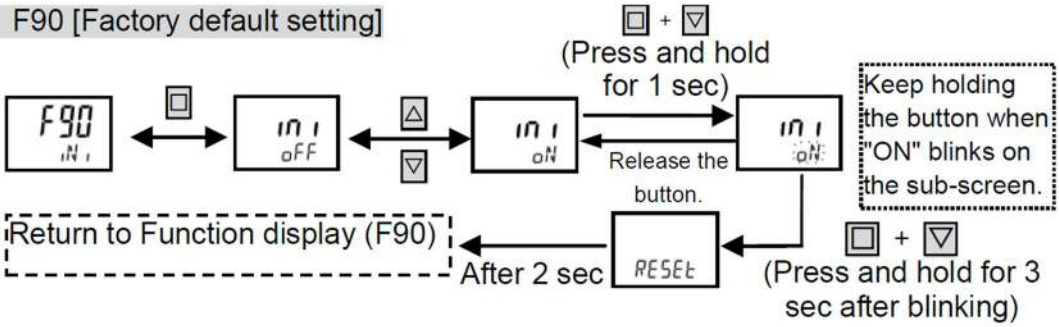


F80 [Reverse display setting]



ON/OFF is shown on the sub-screen and you can change it by pressing △ and ▽ buttons. OFF means the normal display and ON means the reverse display.

F90 [Factory default setting]



5-3 IO-Link

[model No.]

WFC

[Item]

5-3-1. General

5-3-2. On demand data

① Identification

② Parameter and commands

5-3-3. Process data IN

5-3-4. Observation

5-3-5. Diagnosis

5-3-1. General

Item	Detail
Communication Protocol	IO-Link
Communication Protocol Version	V1.1
Bitrate	COM2 (38.4kbps)
Connection	M12 Class A
Process Data Input Length	4bytes
Process Data Output Length	0byte
Minimum Cycle Time	5ms
Data Storage Size	1kbyte
SIO Mode	Not supported
Device ID	*See paragraph 5-3-2①

5-3-2. On demand data

① Identification

Vendor ID : 855（Dec）/ 0x357（Hex）

Device ID : See the table below

Device ID (Dec)	Device ID (Hex)	Model Number	Product Type
2174977	0x213001	WFC-150-□□□-C	15L
2174978	0x213002	WFC-600-□□□-C	60L
2174979	0x213003	WFC-150-□□□-CT	15L (**With fluid temperature measurement function**)
2174980	0x213004	WFC-600-□□□-CT	60L (**With fluid temperature measurement function**)

Index (Hex)	Sub Index	Item	Value (Dec)	Access *1	Length	Format
0x0010	0	Vendor Name	CKD Corporation	R	64bytes	String
0x0011	0	Vendor Text	http://www.ckd.co.jp/	R	64bytes	String
0x0012	0	Product Name	WFC-150-10A-C *2	R	64bytes	String
0x0013	0	Product ID	WFC-150-xxx-C *2	R	64bytes	String
0x0014	0	Product Text	Flow rate sensor, 15.0L/min *2	R	64bytes	String
0x0015	0	Serial- Number	8101-000 *2	R	16bytes	String
0x0016	0	Hardware Revision	1.00 *2	R	64bytes	String
0x0017	0	Firmware Revision	2.00 *2	R	64bytes	String
0x0018	0	Application Specific Tag	***	R/W	32bytes	String

*1. R : Read only, R/W : Read/Write

*2. Reference example（15L Type）

② Parameter and commands

Common specification

Index (Hex)	Sub Index	Item	Value (Dec)	Access *1	Length	Format	DS *2
0x0002	0	System Command	*See the table below	W	1byte	UInteger8	–
0x000C	0	Device Access Locks	0x0000 : Unlocked 0x0001 : Parameter Lock 0x0002 : Data Storage Lock	R/W	2bytes	Record	●
0x0020	0	Error Count	0	R	2bytes	UInteger16	–
0x0024	0	Device Status	0	R	1byte	UInteger8	–
0x0025	0	Detailed Devices Status	*See paragraph 5	R	24bytes	Array[9] of 3OctetString	–

*1. R : Read only、W : Write only、R/W : Read/Write

*2. [●]means that the value of the Index is saved in Data Storage.

System Command

Value (Hex)	Command	Description
0x82	Restore Factory Settings	Set every parameters to Factory Settings
0xA0	Peak Hold Q Reset	Reset the peak value of flow rate (Max/Min)
0xA1	Peak Hold T Reset	Reset the peak value of temperature (Max/Min)
0xA2	Total Accumulated value Reset	Reset the integrated flow rate
0xA3	Zero adjustment	Set zero point of flow rate

Individual specification

Index (Hex)	Sub Index	Item	Value (Dec)	Access *1	Length	Format	DS *2
0x0040	0	Change Main Display	0:Instantaneous flow rate 1:Accumulated flow	R/W	1byte	UInteger8	●
0x0041	0	Key lock	0:Unlock 1:Lock	R/W	1byte	UInteger8	●
0x0042	0	OUT1	0:IO-Link	R	1byte	UInteger8	–
0x0043	0	OUT2	0:NC	R	1byte	UInteger8	–
0x0044	0	Change Sub Display	0:Flow direction 1:OUT1 2:OUT2 3:Optional characters 4:OFF 5:Fluid temperature *4	R/W	1byte	UInteger8	●
0x0045	0	Flow direction	0:Forward direction (→) 1:Reverse direction (←)	R/W	1byte	UInteger8	●
0x0046	0	Integrating flow Unit	0:L 1:kL 2:ML	R/W	1byte	UInteger8	●
0x0047	0	Color	0:ON Green, OFF Red 1:ON Red、OFF Green 2:Always red 3:Always green	R/W	1byte	UInteger8	●
0x0048	0	Eco mode	0:OFF 1:ON	R/W	1byte	UInteger8	●
0x0049	0	Parallel mode	0:Normal mode 1:Parallel mode	R/W	1byte	UInteger8	●
0x004A	0	Display vertical inversion	0:OFF (normal display) 1:ON (Reverse display)	R/W	1byte	UInteger8	●
0x004B	0	IO-Link Output1 Mode	0:Hysteresis_Flow rate 1:Window comparator_Flow rate 2:Integrated output_Increment 3:Integrated output_Decrement 4:Integrated pulse 5:Hysteresis_Temperature *4 6:Window comparator_Temperature *4	R/W	1byte	UInteger8	●
0x004C	0	IO-Link Output2 Mode	0:Hysteresis_Flow rate 1:Window comparator_Flow rate 2:Integrated output_Increment *5 3:Integrated output_Decrement 4:Integrated pulse 5:Hysteresis_Temperature *4 6:Window comparator_Temperature *4	R/W	1byte	UInteger8	●

Index (Hex)	Sub Index	Item	Value (Dec)	Access *1	Length	Format	DS *2
0x004D	0	IO-Link Output1 contact	0:Normally Open 1:Normally Closed	R/W	1byte	UInteger8	●
0x004E	0	IO-Link Output1 Integrated flow pulse rate	*See Table 1	R/W	1byte	UInteger8	●
0x004F	0	IO-Link Output2 contact	0:Normally Open 1:Normally Closed	R/W	1byte	UInteger8	●
0x0050	0	IO-Link Output2 Integrated flow pulse rate	*See Table 1	R/W	1byte	UInteger8	●
0x0100	0	Response Time	2:0.10s 4:0.25s 6:0.5s 11:1.0s 21:2.0s 51:5.0s	R/W	2bytes	UInteger16	●
0x0101	0	Optional characters	Any 6 characters ******	R/W	6bytes	String	●
0x0102	0	Output1 Hysteresis mode Flow rate threshold	*See Table 2	R/W	2bytes	UInteger16	●
0x0103	0	Output1 Hysteresis mode Flow hysteresis	*See Table 2	R/W	2bytes	UInteger16	●
0x0104	0	Output1 Window mode Flow rate upper limit	*See Table 3	R/W	2bytes	UInteger16	●
0x0105	0	Output1 Window mode Flow rate lower limit	*See Table 3	R/W	2bytes	UInteger16	●
0x0106	0	Output1 Window mode Flow hysteresis	*See Table 3	R/W	2bytes	UInteger16	●
0x0107	0	Output1 Integrated output mode Threshold	0 to 99999 【0 to 9999.9L】	R/W	4bytes	UInteger32	●
0x0108 *3	0	Output1 Hysteresis mode Temperature threshold	0 to 85 【0 to 85℃】	R/W	2bytes	UInteger16	●
0x0109 *3	0	Output1 Hysteresis mode Temperature hysteresis	0 to 84 【0 to 84℃】	R/W	2bytes	UInteger16	●

Index (Hex)	Sub Index	Item	Value *3 (Dec)	Access *1	Length	Format	DS *2
0x010A *3	0	Output1 Window mode Temperature upper limit	0 to 85 【0 to 85℃】	R/W	2bytes	UInteger16	●
0x010B *3	0	Output1 Window mode Temperature lower limit	0 to 84 【0 to 84℃】	R/W	2bytes	UInteger16	●
0x010C *3	0	Output1 Window mode Temperature hysteresis	0 to 83 【0 to 83℃】	R/W	2bytes	UInteger16	●
0x010D	0	Output2 Hysteresis mode Flow rate threshold	*See Table 2	R/W	2bytes	UInteger16	●
0x010E	0	Output2 Hysteresis mode Flow hysteresis	*See Table 2	R/W	2bytes	UInteger16	●
0x010F	0	Output2 Window mode Flow rate upper limit	*See Table 3	R/W	2bytes	UInteger16	●
0x0110	0	Output2 Window mode Flow rate lower limit	*See Table 3	R/W	2bytes	UInteger16	●
0x0111	0	Output2 Window mode Flow hysteresis	*See Table 3	R/W	2bytes	UInteger16	●
0x0112	0	Output2 Integrated output mode Threshold	0 to 99999 【 0 to 9999.9L】	R/W	4bytes	UInteger32	●
0x0113 *3	0	Output2 Hysteresis mode Temperature threshold	0 to 85 【0 to 85℃】	R/W	2bytes	UInteger16	●
0x0114 *3	0	Output2 Hysteresis mode Temperature hysteresis	0 to 84 【0 to 84℃】	R/W	2bytes	UInteger16	●
0x0115 *3	0	Output2 Window mode Temperature upper limit	0 to 85 【0 to 85℃】	R/W	2bytes	UInteger16	●
0x0116 *3	0	Output2 Window mode Temperature lower limit	0 to 84 【0 to 84℃】	R/W	2bytes	UInteger16	●
0x0117 *3	0	Output2 Window mode Temperature hysteresis	0 to 83 【0 to 83℃】	R/W	2bytes	UInteger16	●
0x0118	0	Low flow cut	0 to 300 to 10000 【 0.00 to 100.00%】	R/W	2bytes	UInteger16	●
0x0119	0	Zero adjustment	-10000 to 0 to 10000 【 -100.00 to 100.00%】	R/W	2bytes	Integer16	●

*1. R : Read only、R/W : Read/Write

*2. [●]means that the value of the Index is saved in Data Storage.

*3. area : Factory Settings

*4. Only for WFC-□□□-□□□CT

*5. WFC-□□□-□□□-C factory setting

Table 1

WFC-150	WFC-600
0:0.01L/Pulse 1:0.1L/Pulse 2:1L/Pulse	0:0.1L/Pulse 1:1L/Pulse 2:10L/Pulse 3:0.2L/Pulse

*1. area : Factory Settings

Table 2

Model No.	Hysteresis mode	
	Threshold	Hysteresis
WFC-150	0, 5 to 150 【0, 0.5 to 15.0L/min】	0 to 149 【0 to 14.9L/min】
WFC-600	0, 20 to 600 【0, 2.0 to 60.0L/min】	0 to 599 【0 to 59.9L/min】

*1. area : Factory Settings

Table 3

Model No.	Window comparator mode		
	Upper Limit	Lower Limit	Hysteresis
WFC-150	0, 5 to 150 【0, 0.5 to 15.0L/min】	0, 5 to 149 【0, 0.5 to 14.9L/min】	0 to 148 【0 to 14.8L/min】
WFC-600	0, 20 to 600 【0, 2.0 to 60.0L/min】	0, 20 to 599 【0, 2.0 to 59.9L/min】	0 to 598 【0 to 59.8L/min】

5-3-3 Process data IN

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Data	MSB															LSB
	Instantaneous flow rate															
Range	*See Table 4															
Format	UInteger16															

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data	Error	Warn	-	-	-	-	Switch output		MSB							LSB
							2	1	Fluid temperature *1							
Range	True/False								-10 to 110【-10 to 110℃】							
Format	Boolean								Integer8							

*1. Only for WFC-□□□-□□□-CT

Table 4

Model No.	Instantaneous flow rate
WFC-150	0 to 180【0.0 to 18.0L/min】
WFC-600	0 to 720【0.0 to 72.0L/min】

5-3-4 Observation

Index (Hex)	Sub Index	Item	Value (Dec)	Access *1	Length	Format
0x0400	0	Peak Hold Q Max (Instantaneous Flow Rate)	*See Table 5	R	2bytes	UInteger16
0x0401	0	Peak Hold Q Min (Instantaneous Flow Rate)				
0x0402 *2	0	Peak Hold T Max (Temperature)	-10 to 110 【-10 to 100℃】	R	1byte	Integer8
0x0403 *2	0	Peak Hold T Min (Temperature)				
0x0404	0	Integrated Flow Rate	*See Table 5	R	4bytes	UInteger32
0x0405	0	Operating Time	0 to 99999 【0 to 99999h】	R	4bytes	UInteger32

*1. R : Read only

*2. Only for WFC-□□□-□□□-CT

Table 5

Model No.	Instantaneous flow rate
WFC-150	0 to 180 【0.0 to 18.0L/min】
WFC-600	0 to 720 【0.0 to 72.0L/min】

Table 6

Unit	Integrating flow
L	0 to 999999999 【0 to 99999999.9L】
kL	0 to 999999999 【0 to 99999.9999kL】
ML	0 to 999999999 【0 to 99.9999999ML】

5-3-5 Diagnosis

Event Code (Hex)	Type	Device Status	Cause	Treatment method
0x4210	Warning	Out of specification	Device temperature over-run	Check the ambient temperature
0x5100	Error	Failure	Power supply fault	Check supply power
0x6320	Error	Failure	Memory abnormality	Turn ON the power again
0x8C20	Error	Failure	Flow rate is over 1.2 times of F.S.	Use the flow rate within the range of FS
0x8D06	Error	Failure	Temperature Sensor is over 110°C	The fluid temperature should be 85 °C or less
0x8D07	Error	Failure	Temperature Sensor is less than -10°C	The fluid temperature should not be less than 1°C
0x8D09	Error	Failure	Internal abnormality	Turn ON the power again
0x8D0A	Error	Failure	Fluid abnormality	Turn OFF the power and check that there is no abnormality in the measured fluid
0x8D0B	Error	Failure	Reverse flow detection	Check the flow direction setting

6. Maintenance

6-1 Prohibition of disassembly and modification

⚠ CAUTION:

●Since this product is a very precise sensor, you cannot exchange parts and repair it by the customer.

●Do not disassemble this product. Products reassembled after disassembly cannot meet the specifications.

●If you need repair please return it to the manufacturer. If foreign matter such as seal tape adheres to the piping, please remove with tweezers etc.

7. Troubleshooting

Classification	Symptom	Cause	Remedies and measures
Display	Nothing is displayed.	Miswiring	Refer to "4-2 Wiring method" and wire correctly.
		Low voltage	Measure the power supply voltage with a tester. Apply voltage as specified.
	The instantaneous flow rate display greatly fluctuates.	The display fluctuates due to the pulsating flow of the pump.	Install an accumulator (tank) on the upstream side of the sensor to attenuate pulsating flow. If there is absolutely no way to suppress pulsation, there is a method of stabilizing the display by slowing the responsiveness of the sensor. Please consult with the manufacturer separately.
		Due to cavitation (bubbles), measurement cannot be performed accurately, and the display fluctuates.	Suppress the occurrence of cavitation. (When cavitation is occurring, a sound is generated.) Refer to "4-1 Recommended piping ". Continues use may cause damage.
		The flow path of the product is not full of water.	Perform piping so that the flow path of the product isalways full of water.
		The flow direction of the fluid is different from the detection direction of the sensor.	Refer to the [Flow direction] section in "5-2-4 Basic Settings (Shortcut Mode)" and correct the detection direction.
	The display at power-on is repeated many times.	Repeated noise is applied. (Inverter noise)	Ground the equipment (inverter) that seems to be generating noise, and press down the noise.
	Despite the fact that the fluid is not flowing, the flow rate is displayed.	Even when the fluid is not flowing, the flow rate may be displayed.	Since it is not a malfunction, use as it is.
Switch output	Switch output is not output.	Miswiring	Refer to "4-2 Wiring method" and wire correctly.
	Switch output causes chattering.	The pulsating flow rate goes around the set value of the switch.	Set the hysteresis larger than the pulsation value.
	When power is turned on, an abnormality occurs, the valve closes and the flow rate does not flow.	After the power supply is turned ON, there is a 10-second warm-up period, so the switch does not operate normally.	Mask the switch operation for 10 seconds immediately after turning on the power.
Analog output	Analog output is not. Analog output is low.	Miswiring。	Refer to "4-2 Wiring method" and wire correctly.
		The impedance of the load does not match.	Adjust the impedance of the load. Refer to "3-2 Specifications " Analog output
	Analog output does not stabilize.	Noise is applied.	Suppress generation of noise. Analog output is measured in the AC range voltage, and if it is 0.1 V or more, the analog output is oscillating. Ground the minus DC power supply. Or, separate the cable / sensor from the power equipment (compressor / pump) and power line.
Other	External leakage.	Wear and scratches on O-ring.	Contact the dealer.
		Looseness of screws and bolts.	Tighten the screws and bolts sufficiently.
	Body is abnormally hot.	Damaged internal circuit.	Stop use immediately and contact the dealer.

∗For other troubles, consult with CKD.