CKD

SM－662556－A

Instruction manual

Karman vortex flow rate sensor FLUEREX

WFK2 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.

Aug.30.2023 5th

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Flow rare sensor for water FLUEREX WFK2 series

Instruction Manual No. SM-662556-A

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 for operation

2-1 Cautions for design 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.

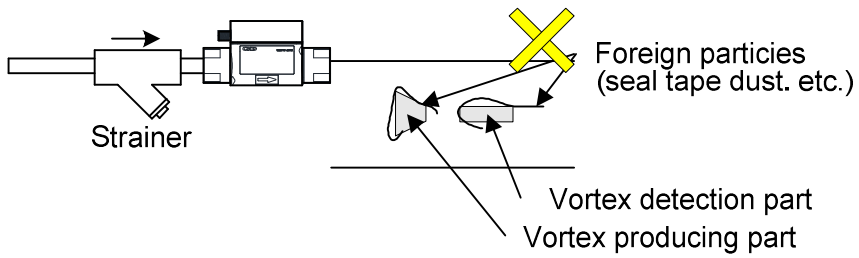
■Do not use this product for fluids other than water (industrial water, clean water). When supporting fluorine-based fluids, the product can be used only with the fluids described in the applicable fluid.

■The quality of applicable fluid must comply with the water quality standard (cooling water – circulating water system - circulating water) specified in the "Guideline of Water Quality for Refrigeration and Air Conditioning Equipment" published by Japan Refrigeration and Air Conditioning Industry Association. Using water that does not meet the water quality standard may cause performance degradation. (excluding fluorine-based liquids)

■Electrical conductivity of fluids must be at least 0.2 mS/m. Contact CKD for use of fluids that have electrical conductivity in the range of 0.05 mS/m to 0.2 mS/m. Fluids that have electrical conductivity below 0.05 mS/m are considered as ultra-pure water and must not be used. (excluding fluorine-based liquids)

CAUTION:

■ If there is a risk of foreign matter entering the fluid, install a filter (strainer) on the primary side. If foreign matter adheres to the vortex generator/vortex detector, measurement accuracy can be compromised.



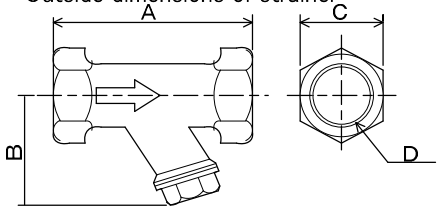
Strainer specifications

Item	Specifications
Fluid used	Water
Withstanding pressure(MPa)	2
Operating pressure range(MPa)	0 to 1
Working temperature range(°C)	1 to 90

Major component materials

Body	Bronze casting
Strainer	Stainless

Outside dimensions of strainer



Model No.	A	B	C	D
WF-FL-280730	70	44	23	Rc 3/8
WF-FL-280731	80	49	28	Rc 1/2
WF-FL-280732	100	57	35	Rc 3/4
WF-FL-280733	115	72	43	Rc 1
WF-FL-280734	135	82	52	Rc1 1/4
WF-FL-280735	160	98	59	Rc1 1/2

Strainer mesh size: φ1.4 × pitch 2.4 mm

◆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.

However, if the option (ATEX supported) is selected, the product can be used in an environment with II 3 G Ex ec II C T4 Gc　0℃≦Ta≦50℃. Also, refer to “3-4. Option (ATEX supported)” for operating conditions

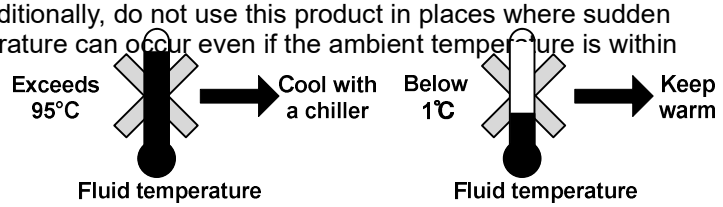
WARNING:

■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 and ambient temperature

Keep the fluid temperature within 1°C to 95°C (-10 to 95°C when compatible with fluorine liquid), and the ambient temperature within 0°C to 50°C. If the fluid temperature exceeds 95°C, cool it down with a cooling device such as a chiller. If there is a risk of freezing, drain the fluid or keep it warm to prevent freezing. 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.



■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)

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 temperature 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.

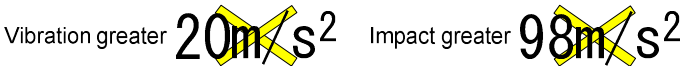
■Option (ATEX supported)

If the option (ATEX supported) is selected, never unplug and plug back in this product in an explosive atmosphere while it is being energized.

CAUTION:

■Vibration and impact

Do not expose this product to vibration greater than or equal to 20 m/s^2 and impact greater than or equal to 98 m/s^2. Excessive vibration and impact may cause malfunction and/or damage as this product uses Karman's vortex principle for detection.



■Manual valve

When a manual valve is used to adjust the flow to a small flow rate, the degree of opening (gap) of the manual valve becomes very small. If the fluid contains foreign matter larger than this gap, the foreign matter may clog the gap, causing a decrease in the flow rate.

■Option (ATEX supported)

If the option (ATEX supported) is selected, Use ATEX Directive compatible M12 cable.

2-2 Cautions for mounting, piping, and wiring

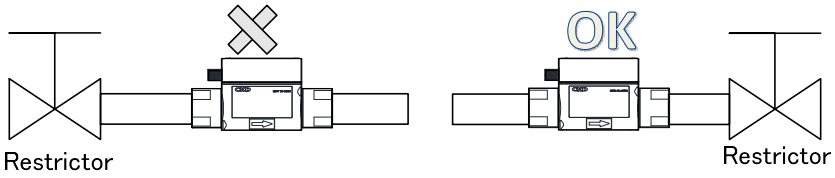
◆Piping◆

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.

■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. If there is no choice but to position the valve on the primary side, ensure that a straight pipe with a diameter of 10 times or more bore size is installed between the valve and the flow rate 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.



■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.

■When using an elbow or bush in the piping
When using an elbow or bush in the piping with WFK2-100 and WFK2-250 series model, provide straight piping sections with at least 10D on the primary side and 5D on the secondary side. However, port size change by bush should be within one size. Note that, without a straight pipe, measurement accuracy can be compromised due to disturbances in the flow rate and/or pressure distribution. (Straight pipes are not necessary for the WFK2-005, WFK2-020, WFK2-050 series. However, in order to ensure stable measurement, it is recommended to install a straight pipe.)

Note: "D" here represents the inner diameter of the pipe.

Port size	Rc3/8 (10A)	Rc1/2 (15A)	Rc3/4 (20A)	Rc1 (25A)	Rc11/4 (32A)	Rc11/2 (40A)
5D	50mm	75mm	100mm	125mm	160mm	200mm
10D	100mm	150mm	200mm	250mm	320mm	400mm

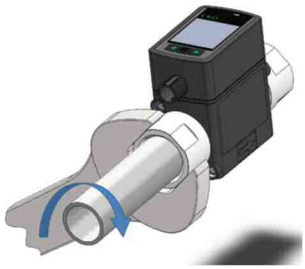
■Make sure the weight of piping is not applied to the flow sensor. Otherwise, it may cause damage and external leakage. It is recommended to secure the piping.

■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.

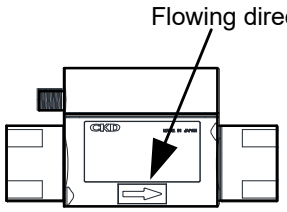
Connecting screw	Tightening torque N·m
Rc3/8	31 to 33
Rc1/2	41 to 43
Rc3/4	62 to 65
Rc1	83 to 86
Rc1 1/4	94 to 100
Rc1 1/2	104 to 108

⚠ CAUTION:

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



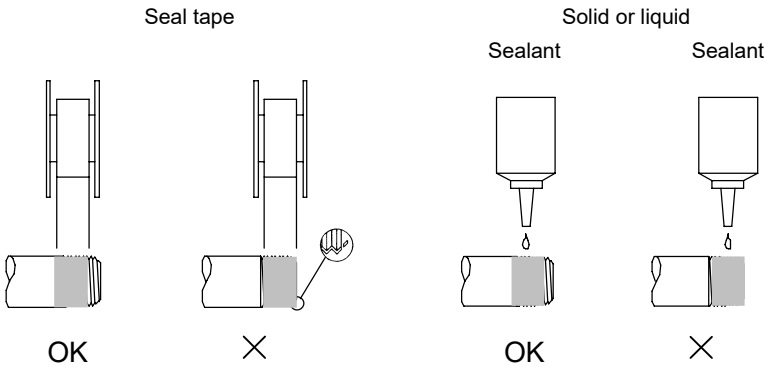
■When installing piping, make sure that the direction of the flow matches the direction of the arrow marked on the body. Connecting the pipe in the wrong direction will not measure the flow rate correctly.



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

■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.



■If there is a risk of freezing, take measures on the equipment side, such as draining fluid from the pipes, to prevent freezing.

■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.

◆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:

■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.

■Do not short-circuit the output transistor.
When a load is short-circuited, overcurrent protection circuit is triggered to prevent damage to the output transistor; however, if this state persists, the output transistor could be damaged.
Overcurrent protection · · · about 50 mA

■Do not use a load that can produce surge voltage.
While an element that protects against surge is inserted, repeated exposure to surges can lead to damage. Use relays and solenoid valves that are equipped with surge absorption elements. If there is a surge source on the same power supply line, similarly implement surge protection.

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

■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 for operation

⚠ WARNING:

■If the fluid temperature is high, the temperature of the manual valve handle and knob will be high. There is a risk of burns if it is touched directly.

⚠ CAUTION:

■If a problem occurs during operation, turn off the power immediately, stop use, and contact the dealer. Slight heating (about 40°C) of the display section is not abnormal.

■Hardware check and other internal settings are performed during the first two seconds or so after turning on the power. Display and output will not function normally during this time. Particularly, if a transistor output is used in the control of an interlock circuit, an abnormal stop may occur. Mask the output during this period.

■When changing the output setting value, stop devices before changing settings in order to prevent the control system devices from operating unintentionally.

■After adjusting the flow rate with the manual valve, be sure to fix with the push lock for the cock type and the lock nut for the needle type. If not fixed, the flow rate will fluctuate.

■Do not turn the handle and knob forcibly when fully closing, fully opening, or fixing the manual valve (0.5N·m or less). The manual valve could become damaged to the point where it cannot be adjusted or fixed.

■Operate the manual valve when it is filled with liquid.

■Use the manual valve (needle) only for flow rate adjustment. Internal leakage occurs even when the valve is fully closed.

■Do not use the manual valve continuously.

■The position of the dial mark on the manual valve varies depending on the individual model. It does not indicate the absolute opening.

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 Model number indication method

Item	Basic model number	1st hyphen	2nd hyphen (option)	Specifications	Remarks
Shape / Material	WFK2-				
Flow rate		-005		Flow rate 0.4 to 5.0L/min	
		-020		Flow rate 1.6 to 20L/min	
		-050		Flow rate 4.0 to 50L/min	
		-100		Flow rate 8 to 100L/min	
		-250		Flow rate 20 to 250L/min	

Connection port diameter					WFK2-005	WFK2-020	WFK2-050	WFK2-100	WFK2-250
		AA		Rc 3/8	○	○	○		
		BA		Rc 1/2	○	○	○		
		CA		Rc 3/4	○	○	○		
		DA		Rc 1				○	○
		EA		Rc 1 1/4				○	○
		FA		Rc 1 1/2				○	○
		AB		G 3/8	○	○	○		
		BB		G 1/2	○	○	○		
		CB		G 3/4	○	○	○		
		DB		G 1				○	○
		EB		G 1 1/4				○	○
		FB		G 1 1/2				○	○
		AC		NPT 3/8	○	○	○		
		BC		NPT 1/2	○	○	○		
		CC		NPT 3/4	○	○	○		
		DC		NPT 1				○	○
		EC		NPT 1 1/4				○	○
		FC		NPT 1 1/2				○	○

IO-Link·Analog output				Specifications	Remarks
		A		Switch · Analog output type	DC0 to 5V/DC1 to 5V
		B		Switch · Analog output type	DC4 to 20mA
		C		Switch · Analog output type	DC0 to 10V/DC1 to 10V
		D		IO-Link compatible type	DC0 to 5V/DC1 to 5V
		E		IO-Link compatible type	DC4 to 20mA
		F		IO-Link compatible type	DC0 to 10V/DC1 to 10V
Unit			A	L/min L, m^3 °C	
			B	L/min, us gal/min L, m^3, us gal °C, °F	
Manual valve			N	Sensor only	
			A	With manual valve (cock type)	
			B	With manual valve (needle type)	
Option			No symbol	None	
			-A	Standard cable (M12, 3m, O.D. 6mm, 4-conductor (0.5 mm^2), O.D. of insulated body 1.9mm) attached	
			-B	Both end connector cables (M12, 3m, O.D. 6mm, 4-conductor) attached	
Option				No symbol	None
				C	Bracket attached, with mounting screw (2 sets are attached when manual valve attaching is selected)
Option				No symbol	None
				-EX	ATEX supported
				-SF	Compatible with fluorine liquids

3-2 Accessories

●Operation manual

3-3 Specifications/Outline drawing
◆WFK2 series

Small body

Model No. / Descriptions			WFK2-005	WFK2-020	WFK2-050
Connection	Connection diameter (Rc,G,NPT)		3/8 , 1/2 , 3/4		
	Connection part material		Stainless steel		
Working conditions	Applicable fluid		Clean water and industrial water		
			Fluorine liquid proof option: Fluorinert™(FC-3283, FC-40), Galden®(HT135, HT200), Novec™7300, Opteon™SF10 (*8)		
	Maximum working Pressure	MPa	1.0		
	Proof pressure	MPa	1.5		
	Manual valve (cock) internal leakage	mL/min	0		
	Manual valve (cock) allowable back pressure	MPa	0.3		
	Ambient temperature	°C	0 to 50 (85% RH or less, no condensation)		
	Fluid temperature (*1)	°C	Standard: 1 to 95 Fluorine-based liquid compatible option: -10 to 95		
Flow rate	Flow rate range	L/min	0.4 to 5.0	1.6 to 20	4 to 50
	Display minimum unit	L/min	0.01	0.1	0.1
	Repetition accuracy	(*2)	Analog accuracy：±2.5%F.S. Display accuracy：±2.5%F.S. ±1digit		
	Temperature accuracy	(*2)(*3)	±5%F.S.(25 °C standard, 10 to 50 °C)		
	Low flow rate cut		5%F.S.		
	Integrated flow range	(*4)	99999L or 99999m^3 (unit selectable) Reset by power off		
	Integrated flow pulse rate (*4)	L/pulse	0.1,0.5,1	0.1,0.5,1,10	0.5,1,10,50
	Pressure loss (when the fluid is water)	MPa	0.07 (at F.S.)	0.05 (at F.S.)	0.05 (at F.S.)
	Response time (*5)	sec	0.25, 0.5, 1, 5, 10 (initial value: 1)		
Temperature	Measurement temperature range	°C	0 to 100		
	Accuracy	°C	0 to less than 50: Analog accuracy ± 2, Display accuracy ± 2 ± 1 digit (Display minimum unit 1)		
			50 to 100: Analog precision ± 3, Display accuracy ± 3 ± 1 digit (display minimum unit 1)		
Output	Display		2 screen LCD display Instantaneous flow rate: 3 digits Water temperature: 2 digits Integrated flow rate: 5 digits Screen rotation included		
	Analog output	(*6)	Standard: 0 to 5 VDC/1 to 5 VDC Option: 4 to 20 mA DC, 0 to 10 VDC/1 to 10 VDC		
	Switch output		NPN or PNP transistor open collector output (switchable by setting)		
	Max load current		50mA		
	Max applied voltage		DC30V		
	Internal voltage drop		2.0V or less		
Power-supply voltage			Analog output standard: 12 to 24 VDC ±10% Analog output option: 24 VDC ±10%		
Current consumption		(*7)	50mA or less		
Installation	Mounting orientation		No restriction		
	Straight piping section		Not required		
	Protective structure		Equivalent to IP65		
	Mass	g	3/8(Rc,G,NPT): approx. 320, with manual valve (cock) approx. 510, with manual valve (needle) approx. 820 1/2(Rc,G,NPT): approx. 320, with manual valve (cock) approx. 510, with manual valve (needle) approx. 820 3/4(Rc,G,NPT): approx. 400, with manual valve (cock) approx. 590, with manual valve (needle) approx. 880		

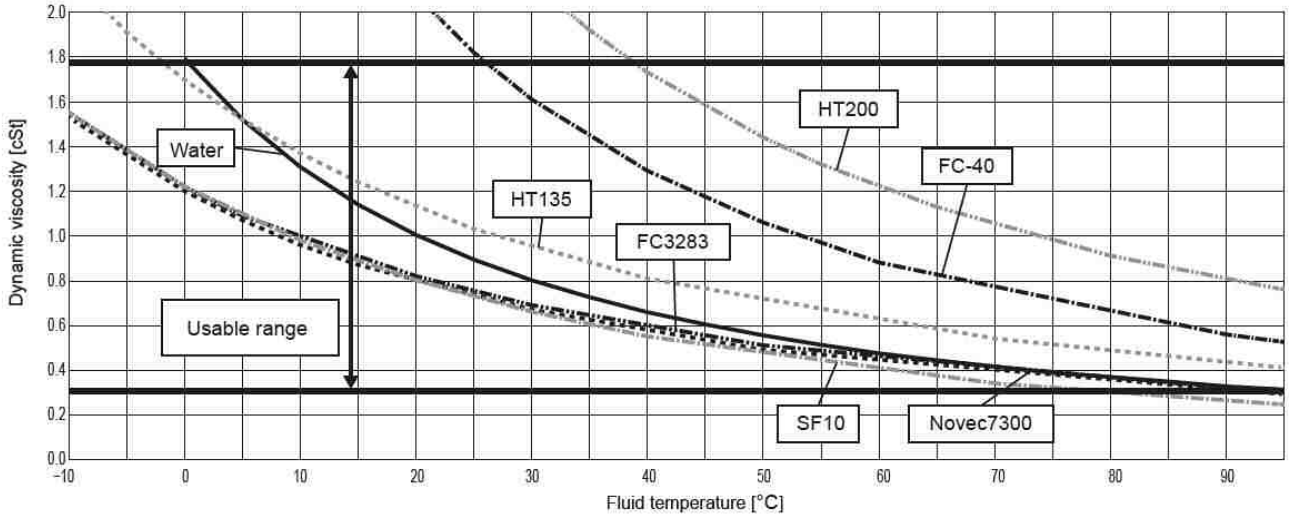
*1: For flourine liquids, the fluid temperature range which can be measured differs depending on the fluid type. Refer to the measurable fluid temperature range graph.

*2: Accuracy is the average value in 10 seconds (without bubbles).F.S. refers to the full scale flow rate.

*3: This temperature characteristics are when the fluid is water. For fluorine liquids, check the range of the corresponding kinematic viscosity.

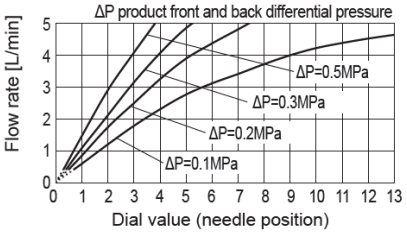
*4: The integrated flow rate is a calculated (reference) value. When the power is turned OFF, it will be reset. Also, there is a chance that there will be a discrepancy between the displayed integrated flow rate and the integrated pulse output.
*5: The time to attain 70% of the original output after the normal flow rate (used) drops instantly to 0.
*6: Check the allowable load on the wiring method page.
*7: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.
*8: Fluorinert™ and Novec™ are trademarks of 3M Corporation. Galden® is a registered trademark of Solvay Specialty Polymers. Opteon™ is a trademark of Chemours Company.

●Measurable fluid temperature range

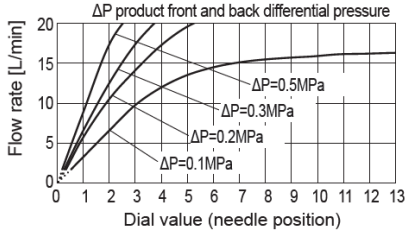


●Manual valve (needle) flow characteristics

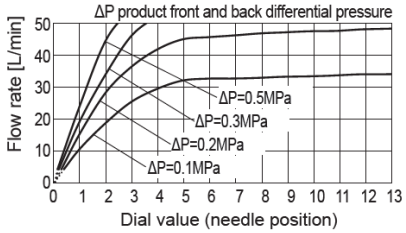
● WFK2-005



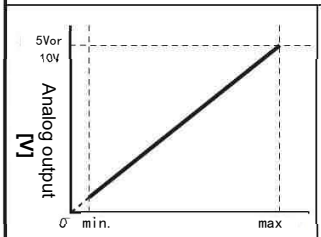
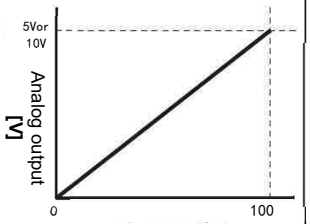
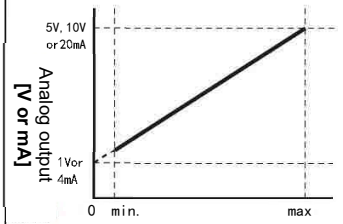
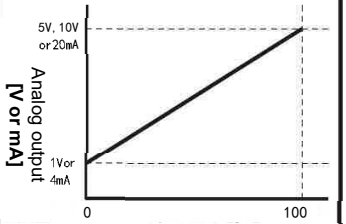
● WFK2-020



● WFK2-050



* Internal leakage occurs even when the number of rotations of the needle valve is 0 (fully closed).

Switch ・ Analog output type DC0～5V **Switch ・ Analog output type DC0～10V**		**Switch ・ Analog output type DC1～5V** **Switch ・ Analog output type DC1～10V** **Switch ・ Analog output type DC4～20mA**	
			

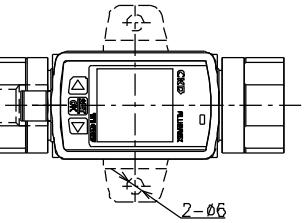
Note: When the original range analog output and span adjustment are not performed, this will be the output value.

Large body

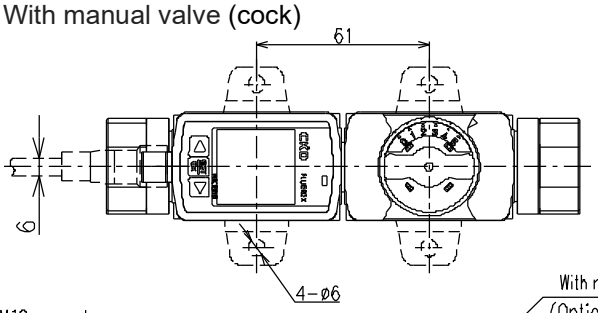
Model No. / Descriptions			WFK2-100	WFK2-250
Connection	Connection diameter (Rc,G,NPT)		1 , 1 1/4 , 1 1/2	
	Connection part material		Stainless steel	
Working conditions	Applicable fluid		Clean water and industrial water	
	Maximum working Pressure	MPa	1.0	
	Proof pressure	MPa	1.5	
	Ambient temperature	°C	0 to 50 (85% RH or less, no condensation)	
	Fluid temperature	°C	1 to 95	
Flow rate	Flow rate range	L/min	8 to 100	20 to 250
	Display minimum unit	L/min	1	1
	Repetition accuracy	(*1)	Analog accuracy:±2.5%F.S. Display accuracy:±2.5%F.S. ±1digit	
	Temperature accuracy	(*1)	±5%F.S.(25 °C standard, 10 to 50 °C)	
	Low flow rate cut		5%F.S.	
	Integrated flow range	(*2)	99999L or 99999m^3 (unit selectable) Reset by power off	
	Integrated flow pulse rate (*2)	L/pulse	1,10,50,100	10,50,100
	Pressure loss	MPa	0.05 (at F.S.)	0.03 (at F.S.)
	Response time (*3)	sec	0.25, 0.5, 1, 5, 10 (initial value: 1)	
Temperature	Measurement temperature range	°C	0 to 100	
	Accuracy	°C	0 to less than 50: Analog accuracy ± 2, Display accuracy ± 2 ± 1 digit (Display minimum unit 1)	
			50 to 100: Analog precision ± 3, Display accuracy ± 3 ± 1 digit (display minimum unit 1)	
Output	Display		2 screen LCD display Instantaneous flow rate: 3 digits Water temperature: 2 digits Integrated flow rate: 5 digits Screen rotation included	
	Analog output	(*4)	Standard: 0 to 5 VDC/1 to 5 VDC Option: 4 to 20 mA DC, 0 to 10 VDC/1 to 10 VDC	
	Switch output		NPN or PNP transistor open collector output (switchable by setting)	
	Max load current		50mA	
	Max applied voltage		DC30V	
	Internal voltage drop		2.0V or less	
Power-supply voltage			Analog output standard: 12 to 24 VDC ±10% Analog output option: 24 VDC ±10%	
Current consumption		(*5)	50mA or less	
Installation	Mounting orientation		No restriction	
	Straight piping section		IN-side: 10D or more OUT-side: 5D or more	
	Protective structure		Equivalent to IP65	
	Mass	g	1(Rc,G,NPT) : About 870 1 1/4(Rc,G,NPT) : About 1010 1 1/2(Rc,G,NPT) : About 1100	

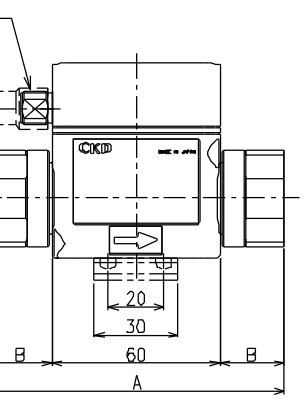
*1: Accuracy is the average value in 10 seconds (without bubbles).F.S. refers to the full scale flow rate.
*2: The integrated flow rate is a calculated (reference) value. When the power is turned OFF, it will be reset. Also, there is a chance that there will be a discrepancy between the displayed integrated flow rate and the integrated pulse output.
*3: The time to attain 70% of the original output after the normal flow rate (used) drops instantly to 0.
*4: Check the allowable load on the wiring method page.
*5: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.

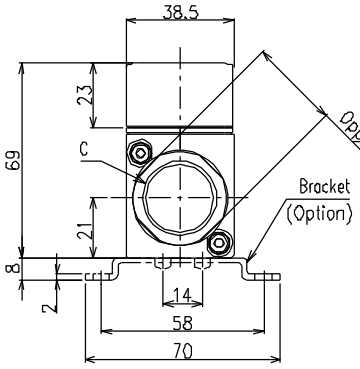
【WFK2-005,020,050】

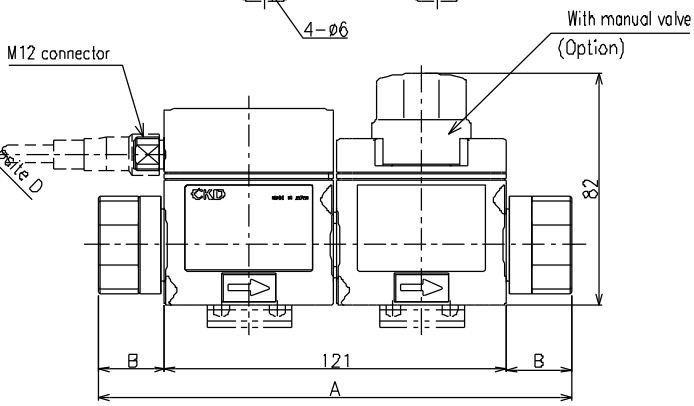


With manual valve (cock)

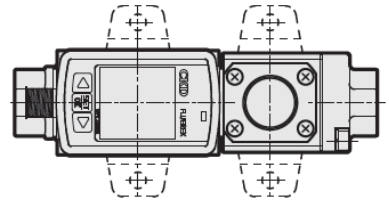


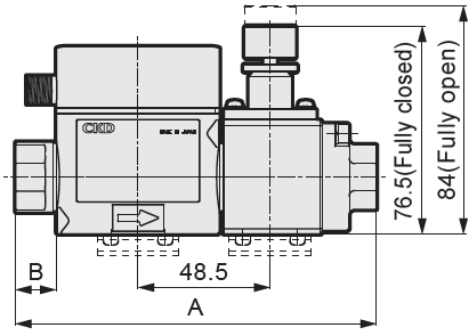




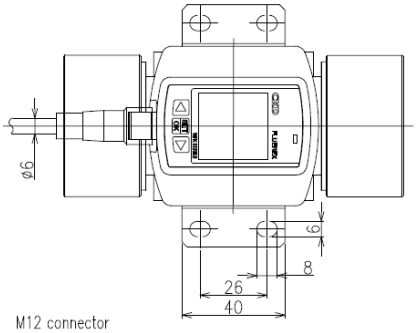


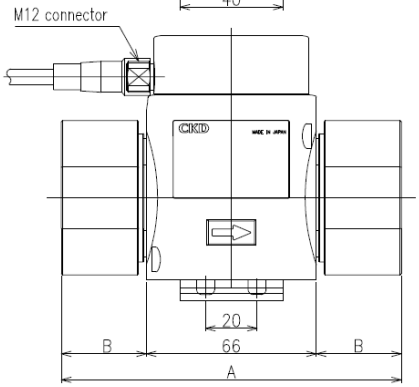
With manual valve (needle)

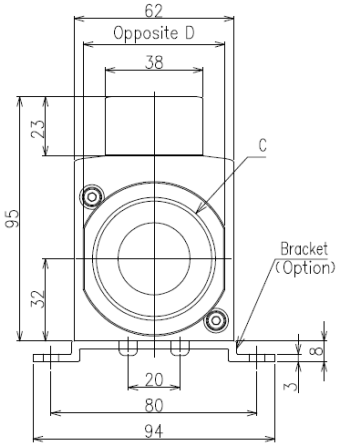




【WFK2-100,250】







Model No.	A	B	C	Opposite side D	Model No.	A	B	C	Opposite side D
WFK2-[*1]A[*3]**N	90	15	Rc3/8	24	WFK2-[*1]A[*3]**A	151	15	Rc3/8	24
WFK2-[*1]B[*3]**N	90	15	Rc1/2	27	WFK2-[*1]B[*3]**A	151	15	Rc1/2	27
WFK2-[*1]C[*3]**N	106	23	Rc3/4	32	WFK2-[*1]C[*3]**A	167	23	Rc3/4	32
WFK2-[*2]D[*3]**N	106	20	Rc1	46	WFK2-[*1]A[*3]**B	132.5	15	Rc3/8	24
WFK2-[*2]E[*3]**N	125	29.5	Rc1 1/4	50	WFK2-[*1]B[*3]**B	132.5	15	Rc1/2	27
WFK2-[*2]F[*3]**N	132	33	Rc1 1/2	55	WFK2-[*1]C[*3]**B	148.5	23	Rc3/4	32

[*1]: Select from 005, 020, 050
[*2]: Select form 100, 250
[*3]: Select from A, B, and C (the dimensions of the G screw and NPT screw are the same)

3-4 Option (ATEX supported)

・The following should be observed.
Ⅱ3 G Ex ec Ⅱ C T4 Gc　0℃≦Ta≦50℃

※Working conditions

1) Keep the product stored in the protective box while it is in use to protect the flow rate sensor from all directions.
The strength of the protective box: Greater than that of DC01, DC03, DC04, DC05, DC06 and DC07.
Plate thickness: 1 mm or more
Clearance between the flow rate sensor and plate: 70 mm or more.
2) There is a possibility that the electrostatic charge could be drained. Attach the product to grounded metal.
Wipe it with a damp cloth.
3) Use the product in a clean environment with Pollution Degree 2 or higher.

・Temperature rating of fluid being measured
From a point of view of explosion protection, the temperature of fluid being measured should be 95°C.

・ATEX Directive 2014/34/EU
EN standards for explosive atmospheres.
EN IEC 60079-0: 2018
EN 60079-7:2015

・Self declaration No.EX-272

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 selection " section.

・When installing piping, make sure that the direction of the flow matches the direction of the arrow marked on the body.

・Please always use the flow sensor with the inside of that filled with water. If the inside of the piping becomes two layers of water and air, flow measurement can not be performed accurately. Also, when air bubbles or the like are mixed in, it can not measure accurately as well.

4-1 Recommended piping

・ The recommended piping is shown in Fig. 4-1.

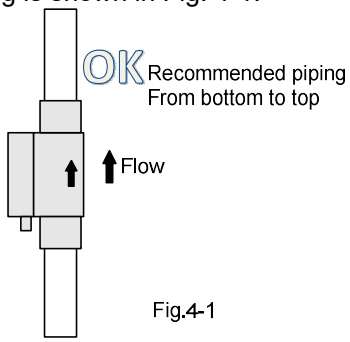


Fig.4-1

4-2 Piping method avoiding entry of air bubbles

・Refer to Fig. 4-2, Fig. 4-3, Fig. 4-4 when bubbles (mixed flow of gas and liquid) occur due to piping conditions.

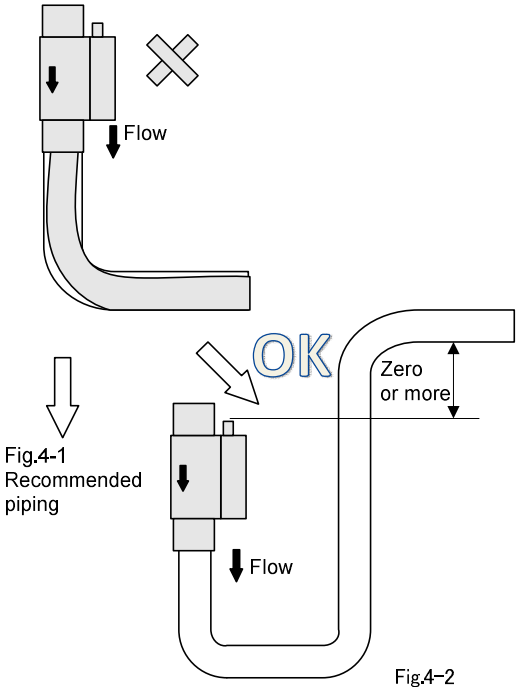
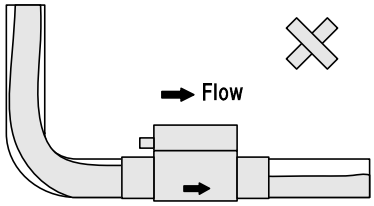


Fig.4-1
Recommended
piping

Fig.4-2



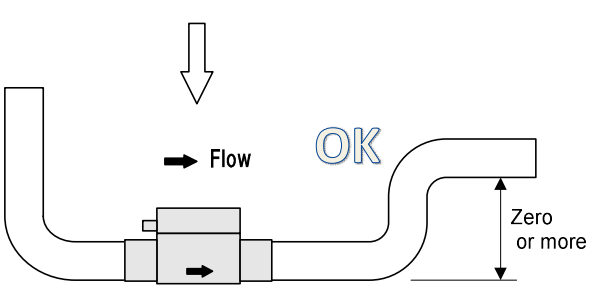


Fig.4-3

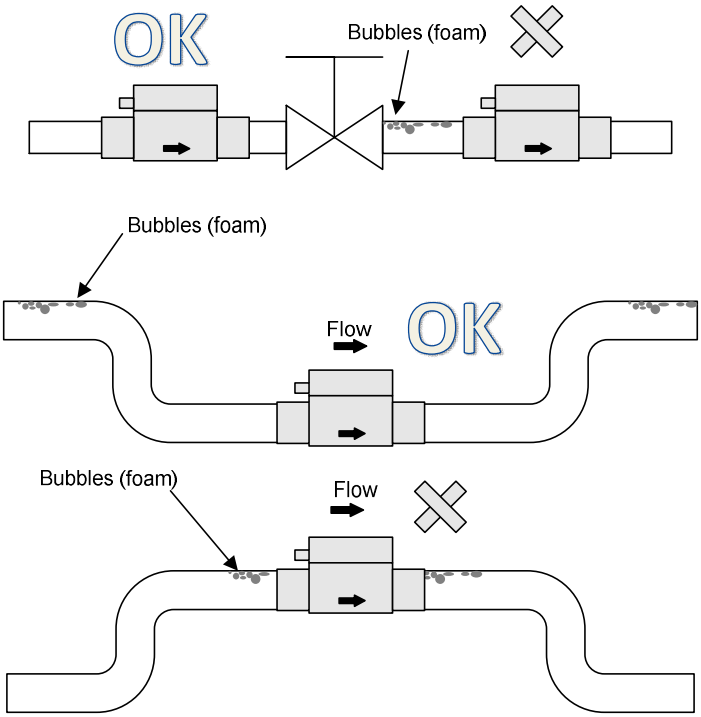


Fig.4-4

4-3 Wiring method

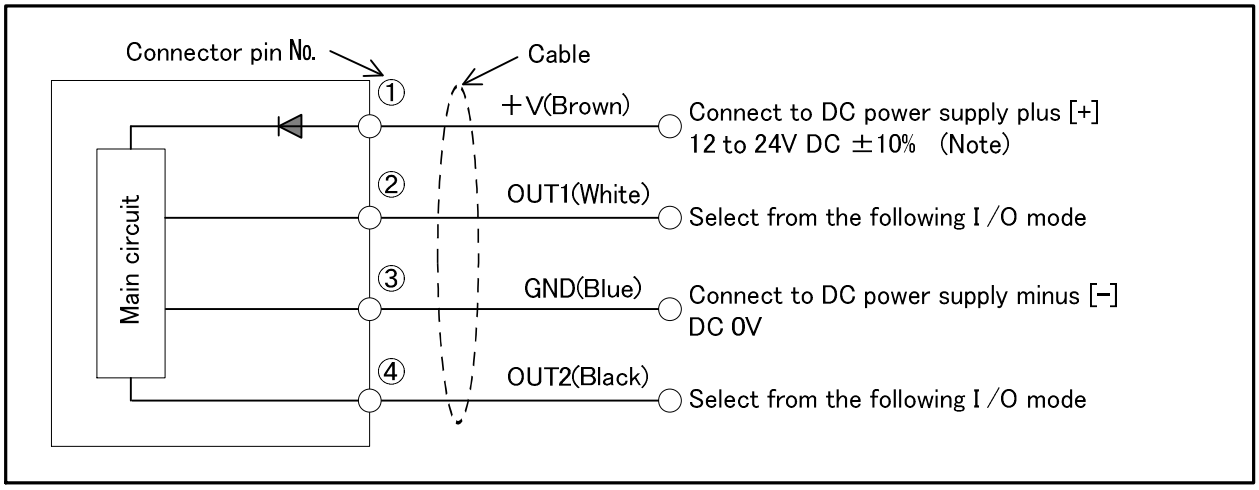
・When wiring, be sure to refer to precautions on use.

・Option (analog output)

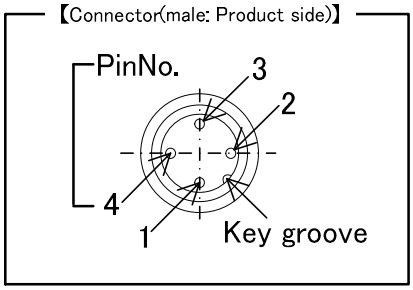
<Switch · Analog output type>
WFK2-*****A** : (0 to 5V/1 to 5V)
WFK2-*****B** : (4 to 20mA)
WFK2-*****C** : (0 to 10V/1 to 10V)

<IO-Link compatible>
WFK2-*****D** : (0 to 5V/1 to 5V)
WFK2-*****E** : (4 to 20mA)
WFK2-*****F** : (0 to 10V/1 to 10V)

Note:Analog output can not be used when IO-Link compatible type set to IO-Link to OUT2.



Note:In the case of analog output for standard (0 to 5 V/1 to 5 V).
For the option (4 to 20 mA, 0 to 10 V/ 1 to 10 V), it is 24 VDC ± 10%.



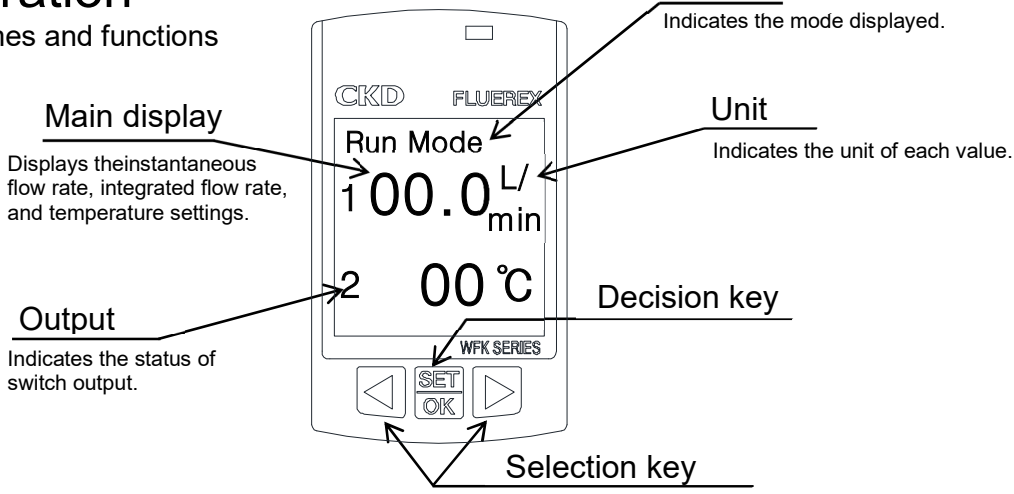
• Make sure to observe the rating of the output transistor.
• For current output, use an inter-channel isolated type AD converter.

[Load impedance]

Item	【A, D】 0 to 5V / 1to 5V	【B, E】 4 to 20mA	【C, F】 0 to 10V / 1 to 10V
Allowable load	50kΩ and over	500Ω or less	50kΩ and over

5. Operation

5-1 Part names and functions

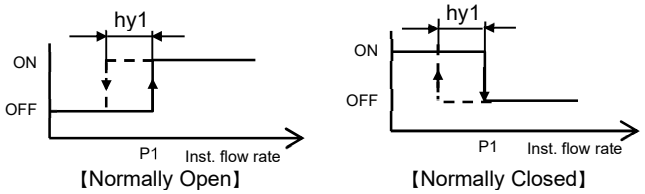


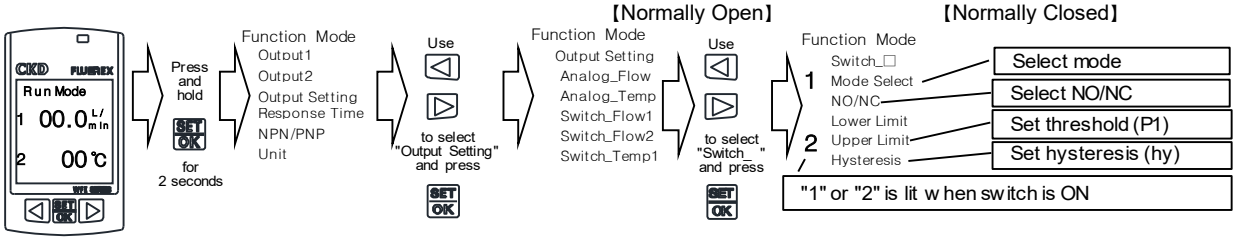
5-2 Output modes and output operations

5-2-1 Switch output (Since the calculated value is rounded off, the display and switch output operation may be out of order.)

1) Hysteresis mode

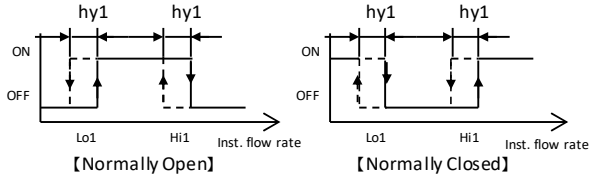
Set outputs 1 and 2 individually.
Store 2 settings each for instantaneous flow rate and temperature.

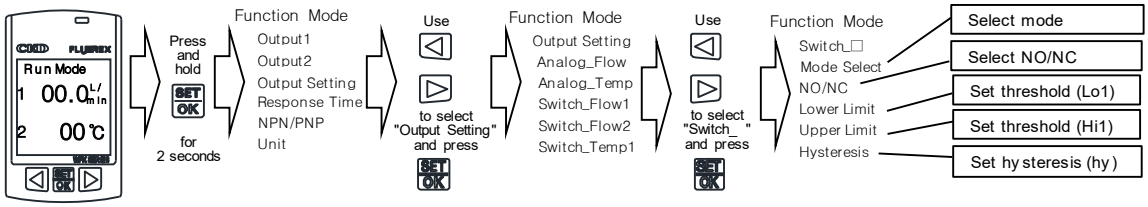




2) Window mode

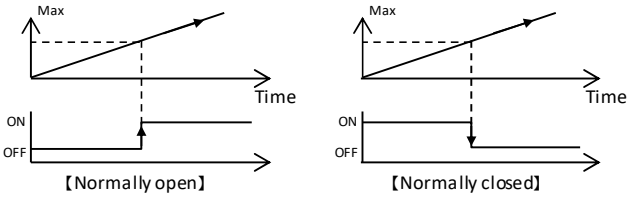
Set outputs 1 and 2 individually.
Store 2 settings each for instantaneous flow rate and temperature.

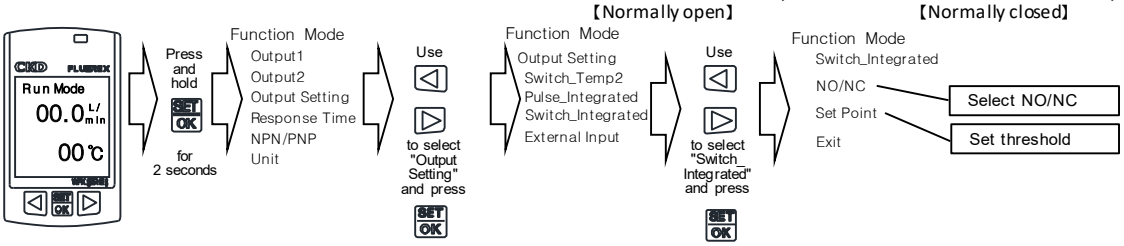




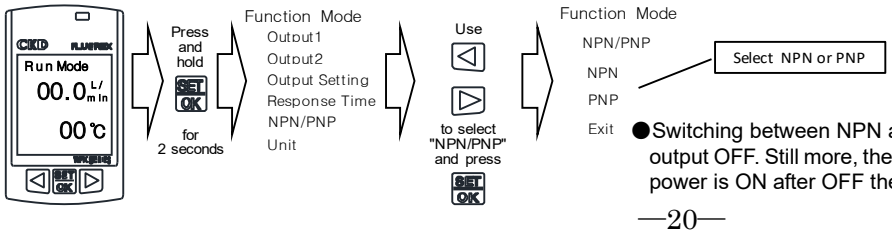
3) Integrated output mode

Set outputs 1 and 2 individually.
Reset the Integrated flow rate with power OFF, button operation, external input.





4) NPN/PNP switching



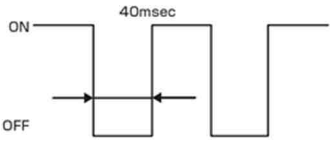
● Switching between NPN and PNP should be done with switch output OFF. Still more, the switching setting is applied when the power is ON after OFF the power.

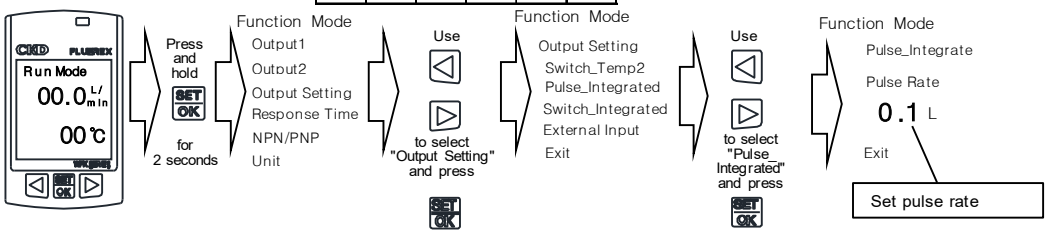
5-2-2 Integrated pulse output

Set the pulse rate for outputting pulse in accordance with the integrated flow rate count.

Pulse rate that can be selected for each model is shown.

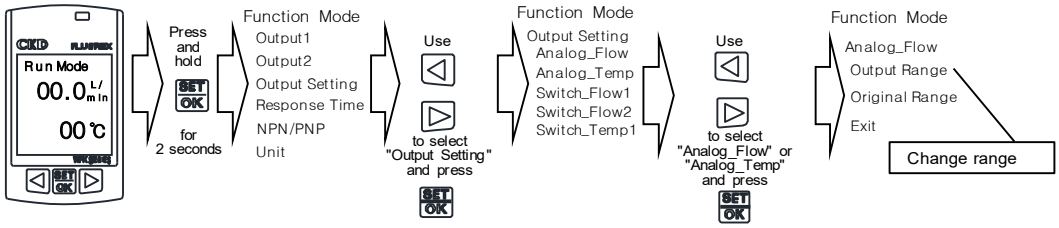
Model	5L	20L	50L	100L	250L
0.1L	○	○			
0.5L	○	○	○		
1L	○	○	○	○	
10L		○	○	○	○
50L			○	○	○
100L				○	○



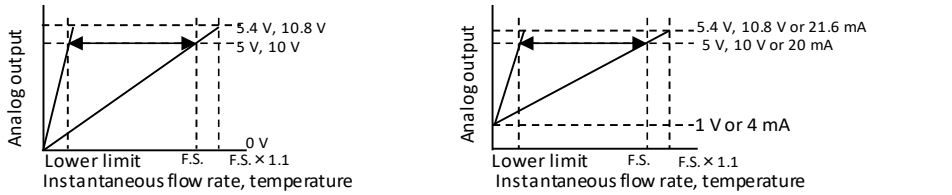


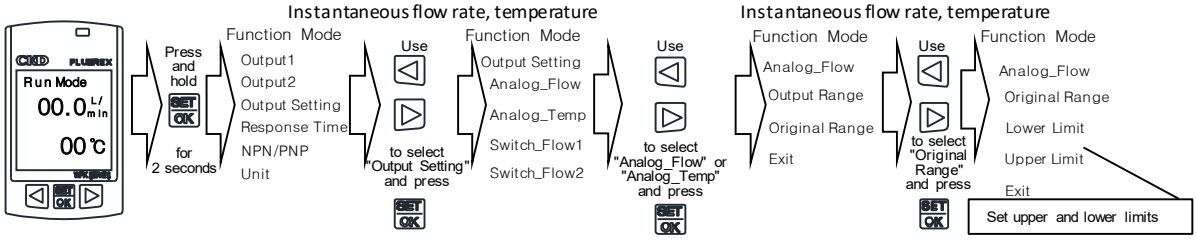
5-2-3 Analog output

1) Output change: Applies to outputs of instantaneous flow rate and temperature.
   0 to 5 V/1 to 5 V type --- Select either 0 to 5 V output or 1 to 5 V output
   4 to 20 mA type --- No output switching
   0 to 10 V/1 to 10 V type --- Select either 0 to 10 V output or 1 to 10 V output



2) Original range analog output
   Set upper and lower limits for analog output.
   Note: The set range must not exceed the maximum flow rate of each flow rate range.

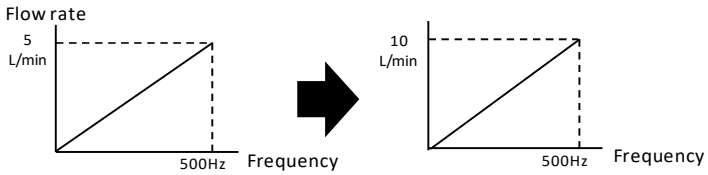


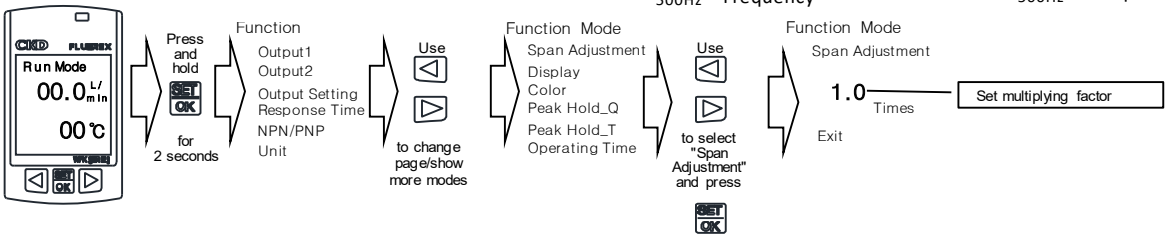


5-2-4 Span adjustment

Adjust span to 0.1 to 2.5 times the initial flow rate.

【Example】When set to "2.0 Times"

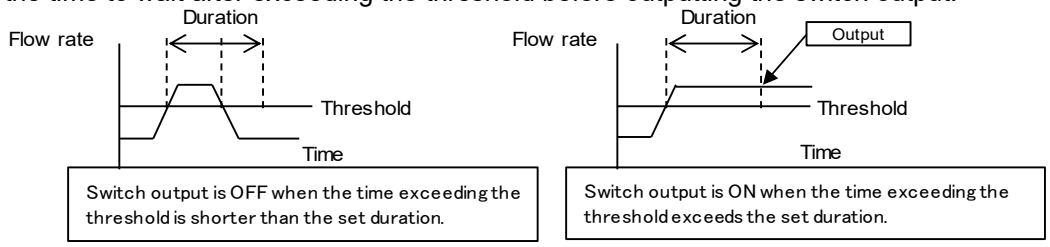


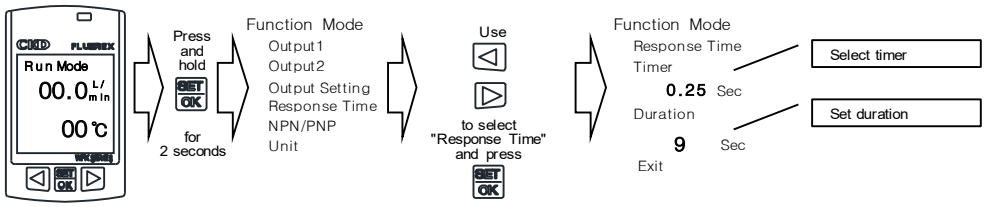


5-2-5 Response time setting

1) Timer --- Change response time (average moving time) of instantaneous flow rate.
Select from 0.25 second, 0.5 second, 1 second, 5 seconds, 10 seconds.
(Factory default is 1 second)

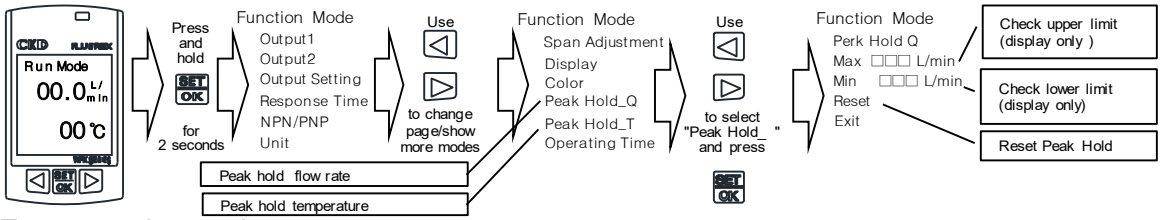
2) Duration --- Set duration to a time between 0 to 9 seconds.
Duration is the time to wait after exceeding the threshold before outputting the switch output.





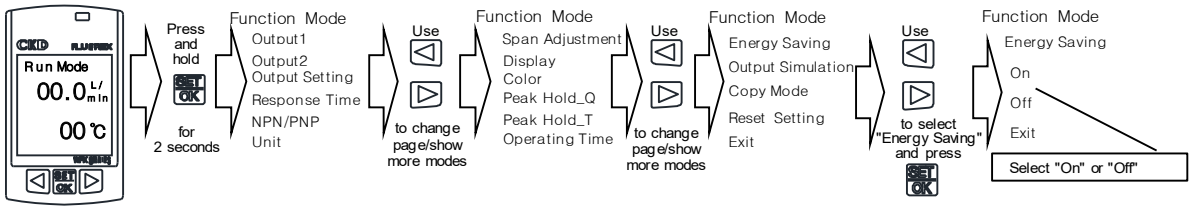
5-2-6 Peak hold

Check the maximum and minimum values of instantaneous flow rate and temperature.
Reset the maximum and minimum values with power OFF, button operation, external input.



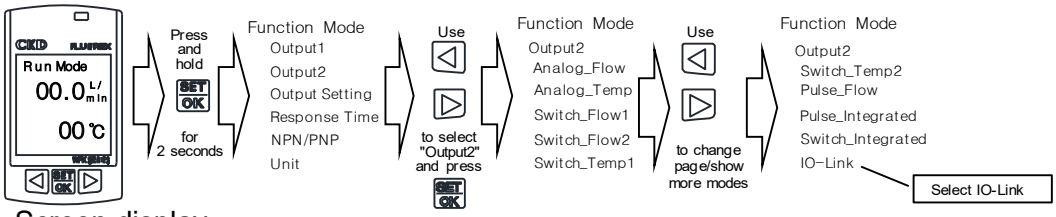
5-2-7 Energy saving setting

Select "On" or "Off" to set the energy saving mode.
When "On", LCD backlight turns off after 1 minute of inactivity.



5-2-8 IO-Link

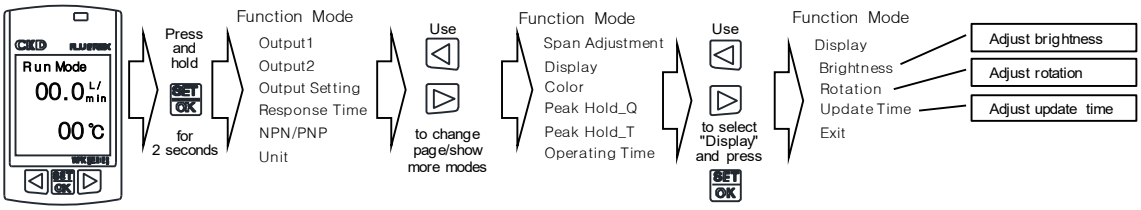
Connect to IO-Link (output 2 only) for bidirectional communication such as acquiring measurement data and changing threshold.
Note:Only for models with IO-Link option



5-2-9 Screen display

1) Display

Brightness ---Select from 25%, 50%, 75%, 100%
Rotation --- Select from 0 °, 90 °, 180 °, 270 °
Update Time --- Select from 0.25 second, 0.5 second, 1 second, 5 seconds, 10 seconds



2) Color

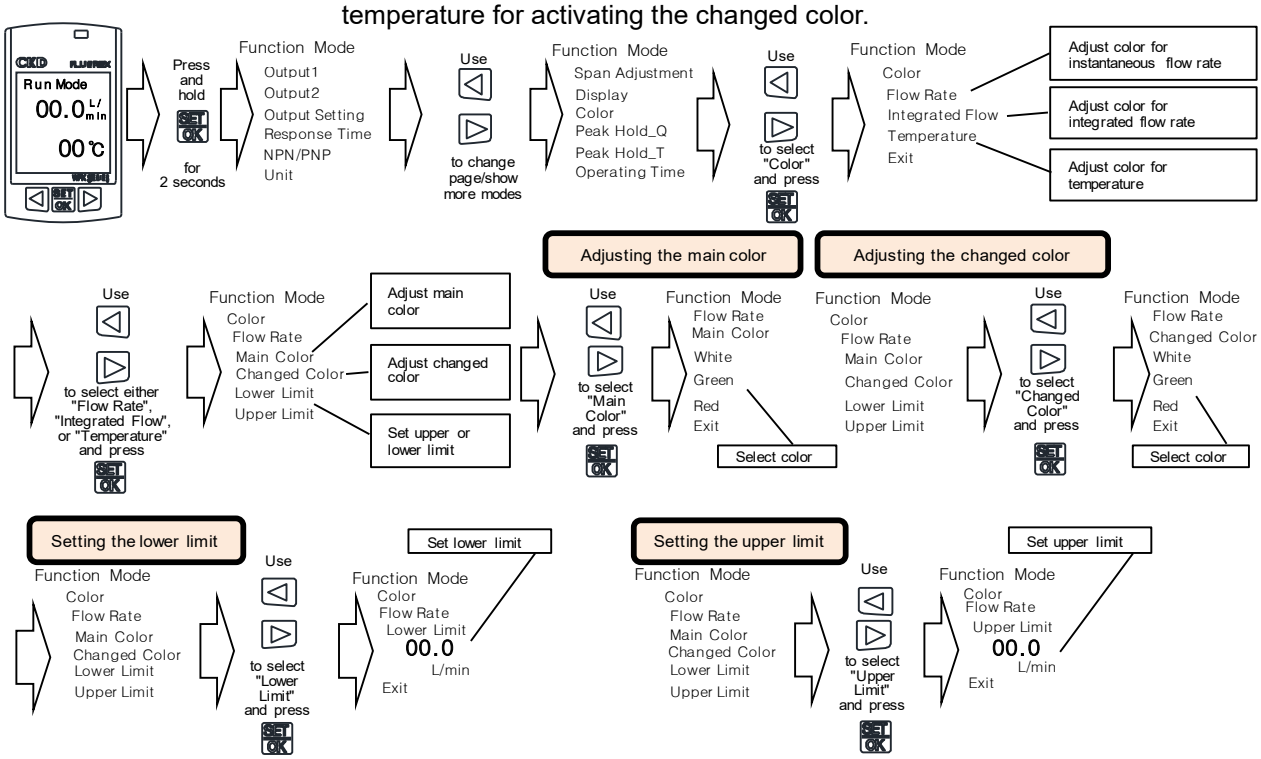
Main Color ---Set/Change the font color used for the main display (select from white, green, red).

Changed Color ---Set the font color to use when instantaneous flow rate, integrated flow rate, or temperature exceeds the set upper limit or falls below the set lower limit.

Available font colors --- Select from white, green, red.

· Upper limit setting: Set the upper limit of instantaneous flow rate, integrated flow rate, temperature for activating the changed color.

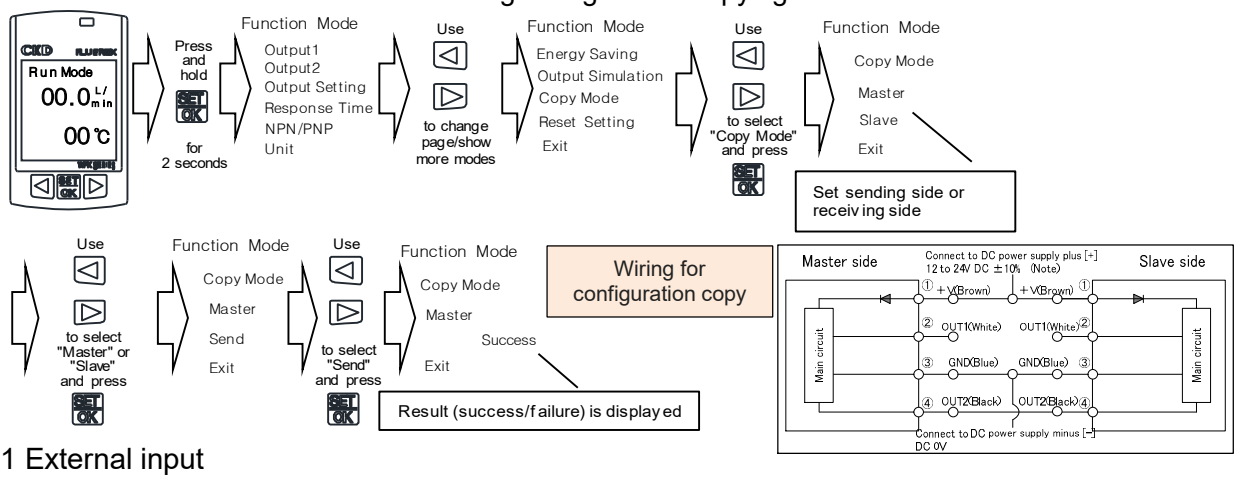
· Lower limit setting: Set the lower limit of instantaneous flow rate, integrated flow rate, temperature for activating the changed color.



5-2-10 Configuration copy

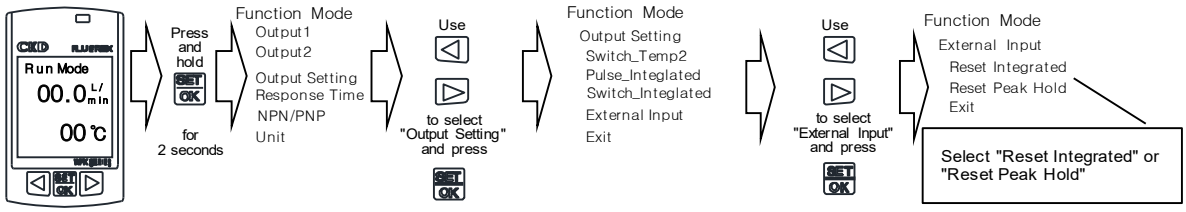
Connect two WFK2 units and copy the settings.

Remove WFK 2 from the device during configuration copying.



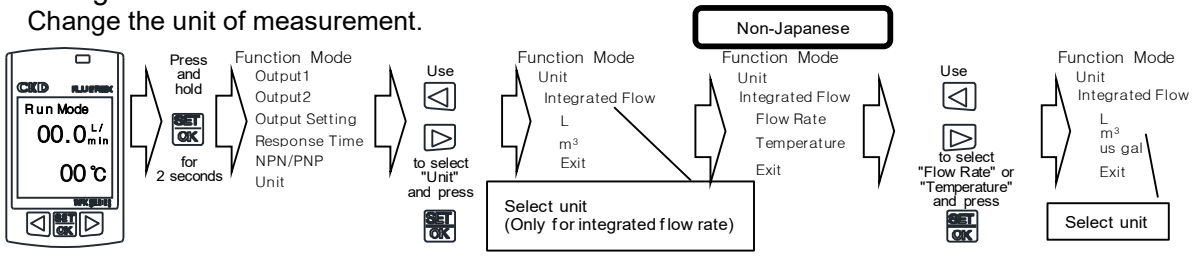
5-2-11 External input

Reset integrated value and peak hold value by inputting external signal.



5-2-12 Change unit

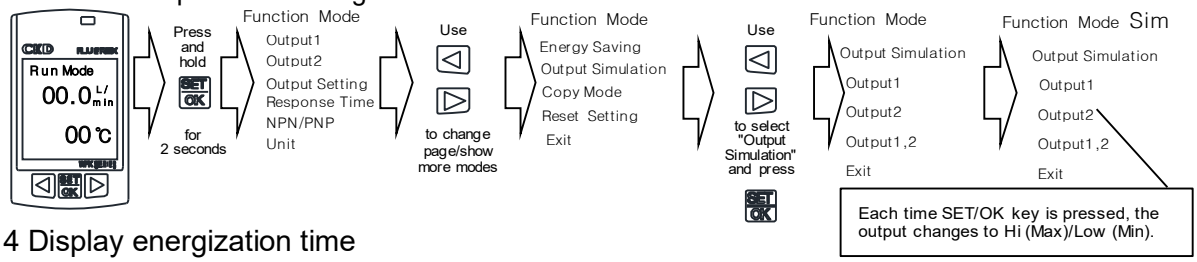
Change the unit of measurement.



(In the case of °F, there are the values that is not able to be set, because temperature is processed in °C.)

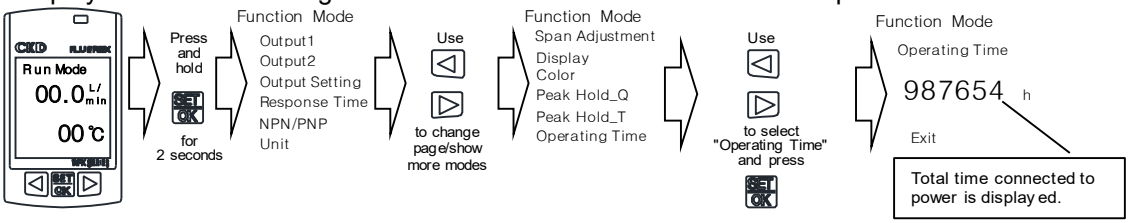
5-2-13 Simulation output

Force the output of switch signal.



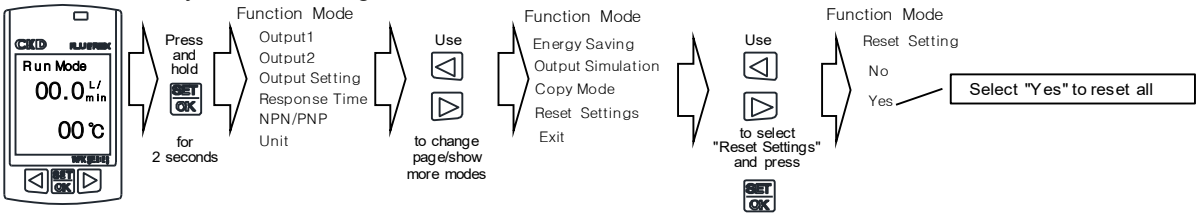
5-2-14 Display energization time

Display the sum of the lengths of time the unit has been connected to power.



5-2-15 All reset

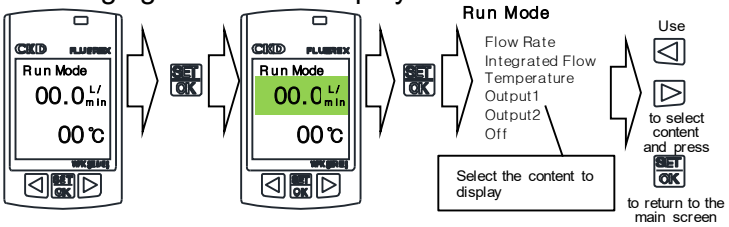
Reset to factory default settings.



5-3 Easy setting function

For frequently used settings, use the shortcut operation to move from the normal screen to the setting screen.

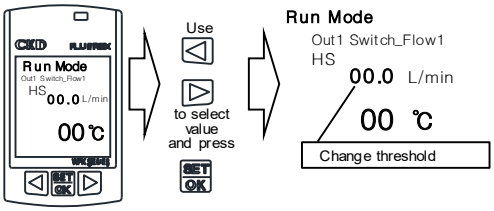
5-3-1 Changing the content displayed on main screen



5-3-2 Setting the switch

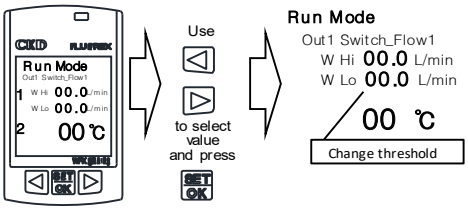
1) Hysteresis mode

When the display screen is in hysteresis mode, threshold can be changed by selecting a number from Run mode.



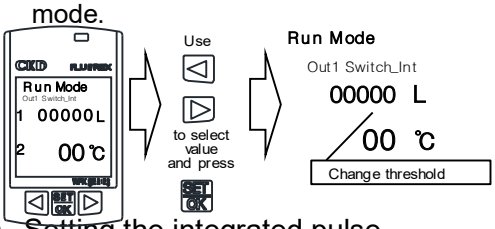
2) Window mode

When the display screen is in window mode, threshold can be changed by selecting a number from Run mode.



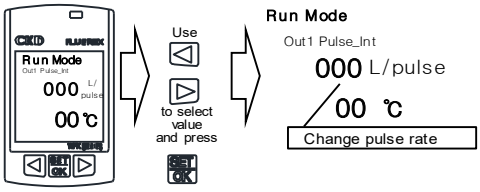
3) Setting the integrated switch

When the display screen is in integrated switch, threshold can be changed by selecting a number from Run mode.



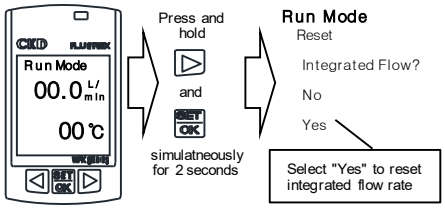
4) Setting the integrated pulse

When the display screen is in integrated pulse, threshold can be changed by selecting a number from Run mode.



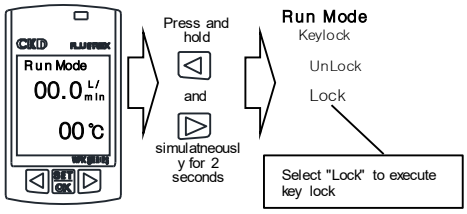
5-3-3 Resetting the integrated flow rate

It's possible to reset the integrated flow rate in Run mode.



5-3-4 Executing the key lock

It’s possible to execute Key lock in Run mode.



5-4 IO-Link

•LED brinks during IO-Link communication.
•When using IO-Link, supply voltage should be DC18V or higher.
• IODD files are available for download from our website. (https://www.ckd.co.jp/english/)
•Please refer to the following for communication specifications and parameter specifications.

5-4-1 General

Item	Detail
Communication Protocol	IO-Link
Communication Protocol Version	V1.1
Bitrate	COM2（38.4kbps）
Connection	M12 Class A
Process Data Input Length	4 byte
Process Data Output Length	0 byte
Minimum Cycle Time	5 ms
Data Storage Size	1 kbyte
SIO Mode	Not supported
Device ID	*See paragraph 5-4-2

5-4-2 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	Type of the product
2162690	0x210002	WFK2-005xxxAx	5L
2162691	0x210003	WFK2-020xxxAx	20L
2162692	0x210004	WFK2-050xxxAx	50L
2162693	0x210005	WFK2-100xxxAx	100L
2162694	0x210006	WFK2-250xxxAx	250L
2162695	0x210007	WFK2-005xxxBx	5L（International Model）
2162696	0x210008	WFK2-020xxxBx	20L（International Model）
2162697	0x210009	WFK2-050xxxBx	50L（International Model）
2162698	0x21000A	WFK2-100xxxBx	100L（International Model）
2162699	0x21000B	WFK2-250xxxBx	250L（International Model）

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format
0x0010	0	Vendor Name	CKD Corporation	R	64byte	String
0x0011	0	Vendor Text	http://www.ckd.co.jp/	R	64byte	String
0x0012	0	Product Name	WFK2-005AAAAN ※2	R	64byte	String
0x0013	0	Product ID	WFK2-005xxxAx ※2	R	64byte	String
0x0014	0	Product Text	Flow rate sensor for water, 0.4L/min to 5.0L/min ※2	R	64byte	String
0x0015	0	Serial- Number	8101-000 ※2	R	16byte	String
0x0016	0	Hardware Revision	v1.0 ※2	R	64byte	String
0x0017	0	Firmware Revision	v1.0 ※2	R	64byte	String
0x0018	0	Application Specific Tag	***	R/W	32byte	String

※1. R : Read only、R/W : Read/Write

※2. Reference example（5L 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	2byte	Record	●
0x0020	0	Error Count	0	R	2byte	UInteger16	–
0x0024	0	Device Status	0	R	1byte	UInteger8	–
0x0025	0	Detailed Devices Status	*See paragraph 5	R	24byte	Array[8] of 3 Octet String	–

※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	Reset Peak Hold Q	Reset the peak value of flow rate (Max/Min)
0xA1	Reset Peak Hold T	Reset the peak value of temperature (Max/Min)
0xA2	Reset Integration Flow	Reset the integrated flow rate
0xBE	Teach-in	Set the instantaneous value to the parameter (Flow rate/Temperature)

Individual specification

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format	DS ※2
0x0100	0	Change Main Display	0:Flow Rate 1:Integrated Flow 2:Temperature 3:Output1 4:Output2 5:Off	R/W	2byte	UInteger16	●
0x0101	0	Change Sub Display	0:Flow Rate 1:Integrated Flow 2:Temperature 3:Output1 4:Output2 5:Off	R/W	2byte	UInteger16	●
0x0102	0	Output1	2:Switch_Flow1 3:Switch_Flow2 4:Switch_Temp1 5:Switch_Temp2 7:Pulse_Integrated Flow 8:Switch_Integrated Flow 10:OFF	R/W	2byte	UInteger16	●
0x0103	0	Output2	9:IO-Link	R	2byte	UInteger16	–
0x0104	0	Output IO-Link Ch1	3:Switch_Flow1 4:Switch_Flow2 5:Switch_Temp1 6:Switch_Temp2 9:Switch_Integrated Flow 0:OFF	R/W	2byte	UInteger16	●
0x0105	0	Output IO-Link Ch2	3:Switch_Flow1 4:Switch_Flow2 5:Switch_Temp1 6:Switch_Temp2 9:Switch_Integrated Flow 0:OFF	R/W	2byte	UInteger16	●
0x0106	0	Output IO-Link Ch3	3:Switch_Flow1 4:Switch_Flow2 5:Switch_Temp1 6:Switch_Temp2 9:Switch_Integrated Flow 0:OFF	R/W	2byte	UInteger16	●
0x0107	0	Output IO-Link Ch4	3:Switch_Flow1 4:Switch_Flow2 5:Switch_Temp1 6:Switch_Temp2 9:Switch_Integrated Flow 0:OFF	R/W	2byte	UInteger16	●

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format	DS ※2
0x010E	0	Switch_Flow1 Mode	0:Hysteresis 1:Window Comparator	R/W	2byte	UInteger16	●
0x010F	0	Switch_Flow1 NO/NC	0:NO(Normally Open) 1:NC(Normally Close)	R/W	2byte	UInteger16	●
0x0110	0	Switch_Flow1 Lower Limit	*See Table 1	R/W	2byte	UInteger16	●
0x0111	0	Switch_Flow1 Upper Limit	*See Table 1	R/W	2byte	UInteger16	●
0x0112	0	Switch_Flow1 Hysteresis	*See Table 1	R/W	2byte	UInteger16	●
0x0113	0	Switch_Flow2 Mode	0:Hysteresis 1:Window Comparator	R/W	2byte	UInteger16	●
0x0114	0	Switch_Flow2 NO/NC	0:NO(Normally Open) 1:NC(Normally Close)	R/W	2byte	UInteger16	●
0x0115	0	Switch_Flow2 Lower Limit	*See Table 1	R/W	2byte	UInteger16	●
0x0116	0	Switch_Flow2 Upper Limit	*See Table 1	R/W	2byte	UInteger16	●
0x0117	0	Switch_Flow2 Hysteresis	*See Table 1	R/W	2byte	UInteger16	●
0x0118	0	Switch_Temp1 Mode	0:Hysteresis 1:Window Comparator	R/W	2byte	UInteger16	●
0x0119	0	Switch_Temp1 NO/NC	0:NO(Normally Open) 1:NC(Normally Close)	R/W	2byte	UInteger16	●
0x011A	0	Switch_Temp1 Lower Limit	*See Table 2	R/W	2byte	UInteger16	●
0x011B	0	Switch_Temp1 Upper Limit	*See Table 2	R/W	2byte	UInteger16	●
0x011C	0	Switch_Temp1 Hysteresis	*See Table 2	R/W	2byte	UInteger16	●
0x011D	0	Switch_Temp2 Mode	0:Hysteresis 1:Window Comparator	R/W	2byte	UInteger16	●
0x011E	0	Switch_Temp2 NO/NC	0:NO(Normally Open) 1:NC(Normally Close)	R/W	2byte	UInteger16	●
0x011F	0	Switch_Temp2 Lower Limit	*See Table 2	R/W	2byte	UInteger16	●
0x0120	0	Switch_Temp2 Upper Limit	*See Table 2	R/W	2byte	UInteger16	●
0x0121	0	Switch_Temp2 Hysteresis	*See Table 2	R/W	2byte	UInteger16	●

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format	DS ※2
0x0123	0	Pulse_Integrated Flow Pulse Rate	*See Table 3	R/W	2byte	UInteger16	●
0x0124	0	Switch_Integrated Flow NO/NC	0:NO(Normally Open) 1:NC(Normally Close)	R/W	2byte	UInteger16	●
0x0125	0	Switch_Integrated Flow Set Point	*See Table 4	R/W	4byte	UInteger32	●
0x0127	0	Response Time Time	0:0.25s/ 1:0.5s/ 2:1s/ 3:5s/ 4:10s	R/W	2byte	UInteger16	●
0x0128	0	Response Time Duration	0:0s/ 1:1s/ 1:2s/ 3:3s/ 4:4s/ 5:5s/ 6:6s/ 7:7s/ 8:8s/ 9:9s	R/W	2byte	UInteger16	●
0x012A	0	Unit Integrated Flow	0:L 1:m^3 2:usgal ※4	R/W	2byte	UInteger16	●
0x012B	0	Unit Flow Rate	0:L/min 1:usgal/min ※4	R/W	2byte	UInteger16	●
0x012C	0	Unit Temperature	0:°C 1:°F ※4	R/W	2byte	UInteger16	●
0x012D	0	Span Adjustment	1 to 25 10 【0.1 to 2.5 Times】	R/W	2byte	UInteger16	●
0x012F	0	Display Brightness	0:25%/ 1:50%/ 2:75%/ 3:100%	R/W	2byte	UInteger16	●
0x0130	0	Display Rotation	0:0°/ 1:90°/ 2:180°/ 3:270°	R/W	2byte	UInteger16	●
0x0131	0	Display Update Time	0:0.25s/ 1:0.5s/ 2:1.0s/ 3:5.0s/ 4:10.0s	R/W	2byte	UInteger16	●
0x0132	0	Flow Rate Main Color	0:White/ 1:Green/ 2:Red	R/W	2byte	UInteger16	●
0x0133	0	Flow Rate Changed Color	0:White/ 1:Green/ 2:Red	R/W	2byte	UInteger16	●
0x0134	0	Flow Rate Changed Color Lower Limit	*See Table 1	R/W	2byte	UInteger16	●
0x0135	0	Flow Rate Changed Color Upper Limit	*See Table 1	R/W	2byte	UInteger16	●

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format	DS ※2
0x0136	0	Integrated Flow Main Color	0:White/ 1:Green/ 2:Red	R/W	2byte	UInteger16	●
0x0137	0	Integrated Flow Changed Color	0:White/ 1:Green/ 2:Red	R/W	2byte	UInteger16	●
0x0138	0	Integrated Flow Changed Color Lower Limit	*See Table 4	R/W	4byte	UInteger32	●
0x0139	0	Integrated Flow Changed Color Upper Limit	*See Table 4	R/W	4byte	UInteger32	●
0x013A	0	Temperature Main Color	0:White/ 1:Green/ 2:Red	R/W	2byte	UInteger16	●
0x013B	0	Temperature Changed Color	0:White/ 1:Green/ 2:Red	R/W	2byte	UInteger16	●
0x013C	0	Temperature Changed Color Lower Limit	*See Table 2	R/W	2byte	UInteger16	●
0x013D	0	Temperature Changed Color Upper Limit	*See Table 2	R/W	2byte	UInteger16	●
0x013E	0	Energy Saving	0:Off 1:On（Backlight Off）	R/W	2byte	UInteger16	●
0x013F	0	Key Lock	0:Unlock 1:Lock	R/W	2byte	UInteger16	●
0x0190	0	Teach-in Teach Ch	0:Flow1/ 1:Flow2 2:Temp1/ 3:Temp2	R/W	2byte	UInteger16	–
0x0191	0	Teach-in Lower/Upper	0:Lower Limit 1:Upper Limit	R/W	2byte	UInteger16	–
0x0406	0	Simulation Output	0:Output1/ 3:Off	R/W	2byte	UInteger16	–

※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. This value is able to be set only in International Model.

Table 1

Unit	WFK2-005	WFK2-020	WFK2-050	WFK2-100	WFK2-250
L/min	0 to 500 【0.00 to 5.00】	0 to 200 【0.0 to 20.0】	0 to 500 【0.0 to 50.0】	0 to 100 【0 to 100】	0 to 250 【0 to 250】
usgal/min ※1	0 to 132 【0.00 to 1.32】	0 to 53 【0.0 to 5.3】	0 to 132 【0.0 to 13.2】	0 to 26 【0 to 26】	0 to 66 【0 to 66】

※1. This value is able to be set only in International Model.

※2. area : Factory Settings

※3. In the case when Span Adjustment is changed, the maximum range of the value is changed.

(ex1) Set Span Adjustment to 2.5Times in 5L Type

0 to 1250【0.00 to 12.50L/min】

(ex2) Set Span Adjustment to 0.1Times in 5L Type

0 to 50 【0.00 to 0.50L/min】

Table 2

Unit	Upper/Lower Limit	Hysteresis
°C	0 to 99 【0 to 99°C】	0 to 99 【0 to 99°C】
°F ※1	32 to 210 【32 to 210°F】	0 to 99 【0 to 99°F】

※1. This value is able to be set only in International Model.

※2. area : Factory Settings

※3. In the case of °F, there are the values that is not able to be set,
because temperature is processed in °C. (ex) If you set 200°F, set value become 199°F.

Table 3

Unit	WFK2-005	WFK2-020	WFK2-050	WFK2-100	WFK2-250
L/pulse	0:0.1 1:0.5 2:1	0:0.1 1:0.5 2:1 3:10	1:0.5 2:1 3:10 4:50	2:1 3:10 4:50 5:100	3:10 4:50 5:100
m^3/pulse	0:0.0001 1:0.0005 2:0.001	0:0.0001 1:0.0005 2:0.001 3:0.01	1:0.0005 2:0.001 3:0.01 4:0.05	2:0.001 3:0.01 4:0.05 5:0.1	3:0.01 4:0.05 5:0.1
usgal/pulse ※1	0:0.05 1:0.25 2:0.5	0:0.05 1:0.25 2:0.5 3:5	1:0.25 2:0.5 3:5 4:25	2:0.5 3:5 4:25 5:50	3:5 4:25 5:50

※1. This value is able to be set only in International Model.

※2. area : Factory Settings

Table 4

Unit	Integrated Flow rate
L	0 to 99999 【0 to 99999L】
m^3	0 to 99999 【0 to 99999m^3】
usgal ※1	0 to 99999 【0 to 99999usgal】

※1. This value is able to be set only in International Model.

※2. area : Factory Settings

5-4-3 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 5															
Format	UInteger16															

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data	Error	Warn	-	-	Output IO-Link				MSB							LSB
					4	3	2	1	Temperature							
Range	True/False								-10 to 110【-10 to 110°C】							
Format	Boolean								Integer8							

※1. Instantaneous Flow Rate and Temperature of Process data are always output in SI unit.

Table 5

Model Number	Instantaneous Flow Rate
WFK2-005	0 to 5500【0.000 to 5.500L/min】
WFK2-020	0 to 2200【0.00 to 22.00L/min】
WFK2-050	0 to 5500【0.00 to 55.00L/min】
WFK2-100	0 to 1100【0.0 to 110.0L/min】
WFK2-250	0 to 2750【0.0 to 275.0L/min】

※1. In the case when Span Adjustment is changed, Instantaneous Flow Rate is changed.

(ex1) Set Span Adjustment to 2.5Times in 5L Type

0 to 13750【0.000 to 13.750L/min】

(ex2) Set Span Adjustment to 0.1Times in 5L Type

0 to 550 【0.000 to 0.550L/min】

5-4-4 Observation

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format
0x0400	0	Peak Hold Q Max (Instantaneous Flow Rate)	*See Table 6	R	2byte	UInteger16
0x0401	0	Peak Hold Q Min (Instantaneous Flow Rate)				
0x0402	0	Peak Hold T Max (Temperature)	*See Table 7	R	2byte	Integer16
0x0403	0	Peak Hold T Min (Temperature)				
0x0404	0	Integrated Flow Rate	*See Table 8	R	4byte	UInteger32
0x0405	0	Operating Time	0 to 99999 【0 to 99999h】	R	4byte	UInteger32

※1. R : Read only

Table 6

Unit	WFK2-005	WFK2-020	WFK2-050	WFK2-100	WFK2-250
L/min	0 to 550 【0.00 to 5.50】	0 to 220 【0.0 to 22.0】	0 to 550 【0.0 to 55.0】	0 to 110 【0 to 110】	0 to 275 【0 to 275】
usgal/min ※1	0 to 145 【0.00 to 1.45】	0 to 58 【0.0 to 5.8】	0 to 145 【0.0 to 14.5】	0 to 29 【0 to 29】	0 to 73 【0 to 73】

※1. This value is able to be set only in International Model.

※2. In the case when Span Adjustment is changed, Instantaneous Flow Rate is changed.

(ex1) Set Span Adjustment to 2.5Times in 5L Type

0 to 1375 【0.00 to 13.75L/min】

(ex2) Set Span Adjustment to 0.1Times in 5L Type

0 to 55 【0.000 to 0.55L/min】

Table 7

Unit	Temperature
°C	-10 to 110 【-10 to 110°C】
°F ※1	14 to 230 【14 to 230°F】

※1. This value is able to be set only in International Model.

Table 8

Unit	Integrated Flow Rate
L	0 to 99999999 【0 to 99999999L】
m^3	0 to 99999 【0 to 99999m^3】
usgal ※1	0 to 26417200 【0 to 26417200usgal】

※1. This value is able to be set only in International Model.

5-4-4 Diagnosis

Event Code (Hex)	Type	Device Status	Cause	Treatment method
0x4210	Warning	Out of specification	Device temperature over-run	Check the ambient temperature
0x5000	Error	Failure	Memory abnormality inside the product	Turn on the power again
0x5111	Warning	Out of specification	Main power supply voltage is abnormally low (less than about 18V)	Make sure that the main power supply voltage does not drop
0x6000	Error	Failure	Memory abnormality inside the product	Turn on the power again
0x6320	Error	Failure	Memory abnormality inside the product	Turn on the power again
0x8C10	Warning	Out of specification	Flow rate is 1 times to 1.1 times of F.S.	Use the flow rate within the range of FS
0x8C20	Error	Failure	Flow rate is over 1.1 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 95 °C or less
0x8D07	Error	Failure	Temperature Sensor is less than -10°C	The fluid temperature should not be less than 1°C
0x8D08	Error	Failure	Output1 is overcurrent condition	Use with proper load attached

6. Maintenance

6-1 Prohibition of disassembly and modification

⚠ CAUTION:

- Since this product is a very precise sensor, you can not exchange parts and repair it by the customer.

- 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. Be careful not to apply strong force to the vortex generator / vortex detection section.

7. Troubleshooting

Classification	Symptom	Cause	Remedies and measures
Display	Nothing is displayed.	Miswiring	Refer to "4-3 Wiring method" and wire correctly
		Low voltage	Measure the power supply voltage with a tester. When DC is 10.8 V or less, error indication appears. 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 can not be performed accurately, and the display fluctuates.	Suppress the occurrence of cavitation. (When cavitation is occurring, a sound is generated.) Refer to "4-2 Piping method avoiding entry of air bubbles ". Continues use may cause damage.
	Although the valve is closed and the flow rate is zero, instantaneous flow rate display is not zero.	The vortex detection body erroneously detects vibration.	Suppress the vibration transmitted to the sensor to 2 G or less. If the piping vibrates, fix it to a rigid place by using a bracket.
		Noise is applied.	Earth the metal part of the sensor or ground the negative of the DC power supply. Please try one of the more effective methods.
	Display instantaneous flow rate less than it actually is.	The flow direction of the fluid is different from the detection direction of the sensor.	Correct the direction of the sensor.
		Due to cavitation (bubbles), measurement can not be performed accurately, and the display decreases.	Suppress the occurrence of cavitation. (When cavitation is occurring, a sound is generated.) Refer to "4-2 Piping method avoiding entry of air bubbles ". Continues use may cause damage.
		The flow rate is much larger than the full scale flow rate.	Use the one with the proper flow range. In this case, you can confirm by gradually closing the throttle valve and increasing the flow rate at a certain point.
	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.
Switch output	Switch output is not output.	Miswiring	Refer to "4-3 Wiring method" and wire correctly. Although a short-circuit protection circuit is included, it may be damaged if it is short-circuited for a long time. Short circuit protection current ... 50 mA
	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.	Since the hardware check is performed for 2 seconds after turning on the power, the switch does not operate normally.	Mask the switch operation for 2 seconds immediately after turning on the power.
Analog output	Analog output is not. Analog output is low.	Miswiring	Refer to "4-3 Wiring method" and wire correctly. Although a short-circuit protection circuit is included, it may be damaged if it is short-circuited for a long time. Short circuit protection current ... 50 mA
		When the display also decreases in the same way, please refer to "Display instantaneous flow rate less than it actually is".	
		The impedance of the load does not match.	Adjust the impedance of the load. Refer to "4-3 Wiring method" load impedance
	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. Earth the metal part of the sensor or ground the minus DC power supply. Or, separate the cable / sensor from the power equipment (compressor / pump) and power line.
Other	Body is abnormally hot.	Damaged internal circuit.	Stop use immediately and contact the dealer. Slight heating (about 40°C) of the display section is not abnormal.

Error code	Name	Contents	Treatment method
Err 00	Memory error	Memory abnormality inside the product.	If it does not recover after turning the power on again, we will need to investigate.
Err 04			
Err 08			
Err 01	OUT1 is overcurrent condition	OUT is in a state of 50 mA or more. However, it will automatically return (release) after 2 seconds, and will re-judge.	Use with proper load attached.
Err 02	OUT2 is overcurrent condition		
Err 03	OUT1 and OUT2 are overcurrent condition		
Err 05	Overflow	Flow rate is over 1.1 times of FS.	Use the flow rate within the range of FS.
Err 06	High temperature	Sensor temperature is over 110 °C.	The fluid temperature should be 95 °C or less.
Err 07	Low temperature	Sensor temperature is less than -10 °C.	The fluid temperature should not be less than 1°C.
Err 10	Main power supply voltage shortage	Main power supply voltage is abnormally low.	Make sure that the main power supply voltage does not drop.

8. Warranty Provisions

8-1 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.

8-2 Warranty period

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