CKD

Instruction manual

Flow rate sensor for water FLUEREX

WFK3000 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

NOV.5.2024 Ver.4

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Flow rare sensor for water FLUEREX WFK3000 series

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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:

① Defects 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.

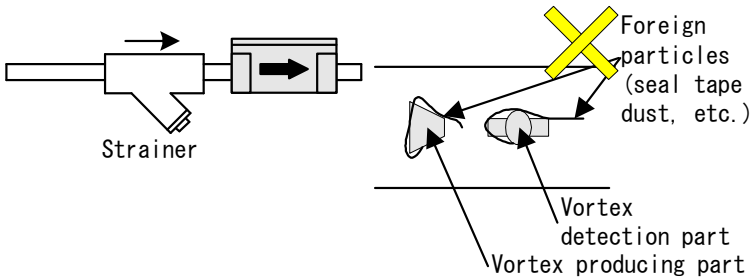
■Do not use this product for fluids other than water (industrial water, clean water).

■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.

■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.

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.



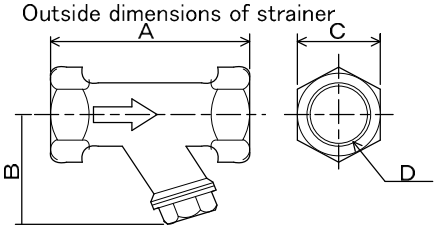
Strainer specifications

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

Strainer mesh size: φ1.4 × pitch 2.4 mm

[SM-328088-A]

◆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.

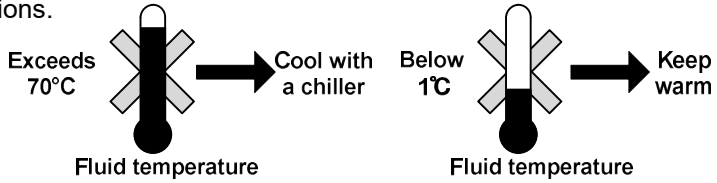
WARNING:

■Corrosive environment

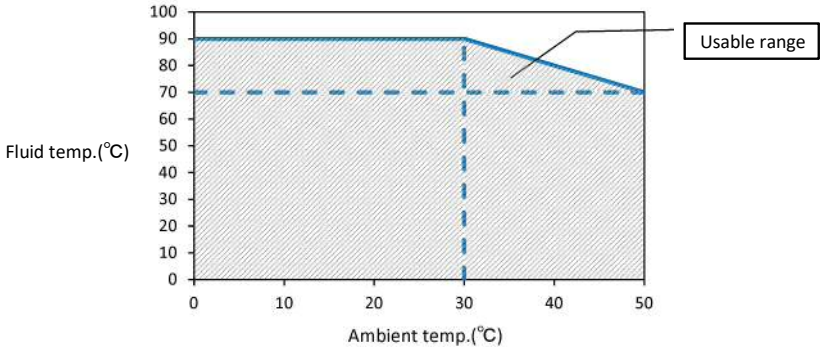
Do not use this product in an atmosphere where there is danger of corrosion (for example, in the presence of corrosive gas such as sulfur dioxide).

■Fluid temperature and ambient temperature

Keep the fluid temperature within 1°C to 70°C and the ambient temperature within 0°C to 50°C. If the fluid temperature exceeds 70°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.



However, WFK3060 series can be used within the scope of the following.



■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

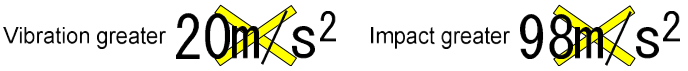
This product is in compliance with the EMC directive and carries a CE marking. The harmonized standard concerning immunity applied to this product is EN 61000- 6-2, and the following requirements must be satisfied in order to conform to this standard:

- ●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.

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.



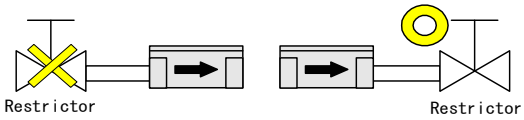
2-2 Cautions for mounting, piping, and wiring

◆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.
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.



■When using an elbow or bush in the piping
When using an elbow or bush in the piping with WFK3060 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 WFK3004,WFK3012,WFK3032 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.

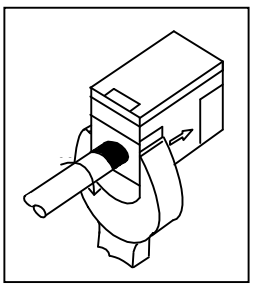
Port size	Rc3/8 (10A)	Rc1/2 (15A)	Rc3/4 (20A)	Rc1 (25A)
5D	50mm	75mm	100mm	125mm
10D	100mm	150mm	200mm	250mm

■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.

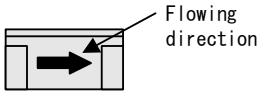
Connection thread	Tightening torque
Rc3/8(10A)	31～33[N･m]
Rc1/2(15A)	41～43[N･m]
Rc3/4(20A)	62～65[N･m]
Rc1(25A)	83～86[N･m]

■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.



CAUTION:

■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.

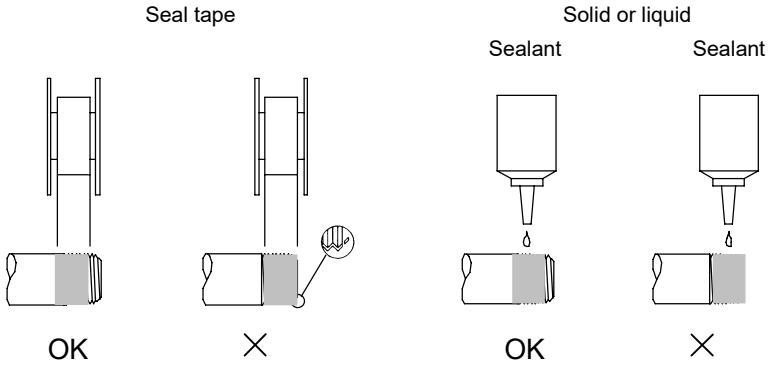


■Before installing piping, clean the pipes to remove all foreign matter, cutting chips, and residual testing water from the pipes.

■Make sure that no force is applied to the plastic parts when piping.

■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.

2-3 Cautions for operation

⚠ 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.

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	Type	1st hyphen	2nd hyphen (Option)	Specifications	Note					
Port type/material	WFK3			Internal-thread (Stainless)	Compact and equipment built-in types					
Flow rate	004			flow rate 0.5-4L/min						
	012			flow rate 1.5-12L/min						
	032			flow rate 4-32L/min						
	060			flow rate 8-60L/min						
Oytput type	S			sensor type	WFK3***S		WFK3***M		WFK3***C	
	M			switch type						
	C			sensor switch type	004,012,032	060	004,012,032	060	004,012,032	060
Port saze		-10		Rc 3/8	○		○		○	
		-15		Rc 1/2	○		○		○	
		-20		Rc 3/4		○		○		○
		-25		Rc 1		○		○		○
Sensor output tipe			-A0	DC0-5V	○	○				
			-A1	DC4-20mA	○	○				
			-A2	DC1-5V	○	○				
			-A3	DC0-10V	○	○				
Switch output type			-N0	NPN Transistor open collector 2point(a contact point)			○	○		
			-N1	NPN Transistor open collector 2point(b contact point)			○	○		
			-P0	PNP Transistor open collector 2point(a contact point)			○	○		
			-P1	PNP Transistor open collector 2point(b contact point)			○	○		
Sensor Switch output type			-A0N0	DC0-5V, NPN Transistor open collector 1point(a contact point)					○	○
			-A0N1	DC0-5V, NPN Transistor open collector 1point(b contact point)					○	○
			-A0P0	DC0-5V, PNP Transistor open collector 1point(a contact point)					○	○
			-A0P1	DC0-5V, PNP Transistor open collector 1point(b contact point)					○	○
			-A1N0	DC4-20mA, NPN Transistor open collector 1point(a contact point)					○	○
			-A1N1	DC4-20mA, NPN Transistor open collector 1point(b contact point)					○	○
			-A1P0	DC4-20mA, PNP Transistor open collector 1point(a contact point))					○	○
			-A1P1	DC4-20mA, PNP Transistor open collector 1point(b contact point))					○	○
			-A2N0	DC1-5V, NPN Transistor open collector 1point(a contact point)					○	○
			-A2N1	DC1-5V, NPN Transistor open collector 1point(b contact point)					○	○
			-A2P0	DC1-5V, PNP Transistor open collector 1point(a contact point)					○	○
			-A2P1	DC1-5V, PNP Transistor open collector 1point(b contact point)					○	○
			-A3N0	DC0-10V, NPN Transistor open collector 1point(a contact point)					○	○
			-A3N1	DC0-10V, NPN Transistor open collector 1point(b contact point)					○	○
			-A3P0	DC0-10V, PNP Transistor open collector 1point(a contact point)					○	○
			-A3P1	DC0-10V, PNP Transistor open collector 1point(b contact point)					○	○
Bracket			No symbol	Without Bracket						
			-B	With Bracket						

note1) Second hyphens are used to show the alarm output type, analog output and bracket in that order.
If no markings are used, subsequent makings are moved left.

note2) When selecting "-A3" for analog output, the unit must always be used at DC15-24V.

3-2 Accessories

●Operation manual

3-3 Specifications/Outline drawing

◆WFK3000 series

Model No. / Descriptions			WFK3004	WFK3012	WFK3032	WFK3060
Port	Port size		Rc3/8, Rc1/2			Rc3/4, Rc1
	Port material		Stainless steel : SCS13			
Working conditions	Applicable fluid		Clear water, industrial water			
	Max. working pressure	MPa	1			
	Proof pressure	MPa	1.5			
	Ambient temperature	℃	0 to 50 (85%RH or less)			
	Fluid temperature	℃	1 to 70			
Flow rate	Flow rate measurement range	L/min	0.5 to 4.0	1.5 to 12	4.0 to 32	8.0 to 60
	Precision		Analog precision: ±2.5%F.S. Display precision: ±2.5%F.S.±1digit (1digit=0.1L/min(less than 10L/min), 1L/min(10L/min and over))			
	Temperature characteristics		±5%F.S. (10 to 50℃, 20℃ reference)			
	Pressure loss	MPa	0.06 (at F.S.)	0.05 (at F.S.)	0.06 (at F.S.)	0.05 (at F.S.)
	Response time		1sec (Note 1)			
Output	Display		S series: None M series, C series: Instant flow rate 2 digit LED display (1digit=0.1L/min(less than 10L/min), 1L/min(10L/min and over))			
	Analog output		M series: None S series, C series: Standard (0 to 5VDC), Option (4 to 20mA, 1 to 5V, 0 to 10VDC)			
	Switch output	Number of points	S series: None M series: 2 point transistor output (select NPN/PNP) C series: 1 point transistor output (select NPN/PNP)			
		Rating	S series: None M series, C series: MAX. DC50mA			
		Internal voltage drop	S series: None M series, C series: (NPN) 2.0V or less (PNP) 2.5V or less			
Power supply voltage			12 to 24VDC±10%(MAX80mA) (S series, C series: 15 to 24VDC for option A3)			
Current consumption			80mA or less			
Installation	Mounting orientation		Unrestricted in vertical/horizontal orientation			
	Straight piping section		None (Note 2)			IN side 10D, OUT side 5D
	Degree of protection		Equivalent to IP65 (excluding the unit with optional water temperature measuring function)			
Cable			3m, 4-core, final diameter 4.8㎜, core wire 0.2mm^2, insulator outer diameter 1.3㎜			
Weight		g	Rc3/8: 380 Rc1/2: 410			Rc3/4: 470 Rc1: 510
Bracket Weight		g	28 (including screws)			

Note1 : This is the time required to return to 70% of the original output after the normal flow rate (in use) is instantly dropped to 0.
Note2 : A straight pipe (IN side 10D, OUT side 5D) should be installed to eliminate the effect of piping conditions.
(D indicates the connection port diameter.)

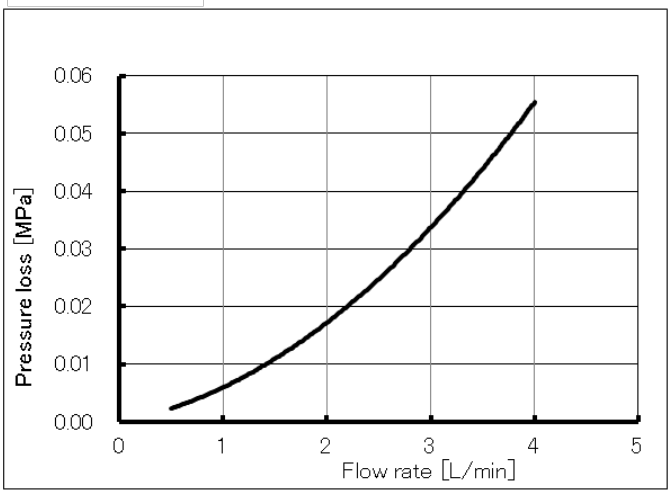
Water temperature measuring function (option) [S series]

Specifications	Measurement temperature	℃	10 to 70
	Port size		Rc3/8 (Note 3)
Output	Temperature output (analog)		1 to 7VDC (linear Output)
	Precision	℃	±2 (under 50) ±3 (50 to 70) (Note 4)

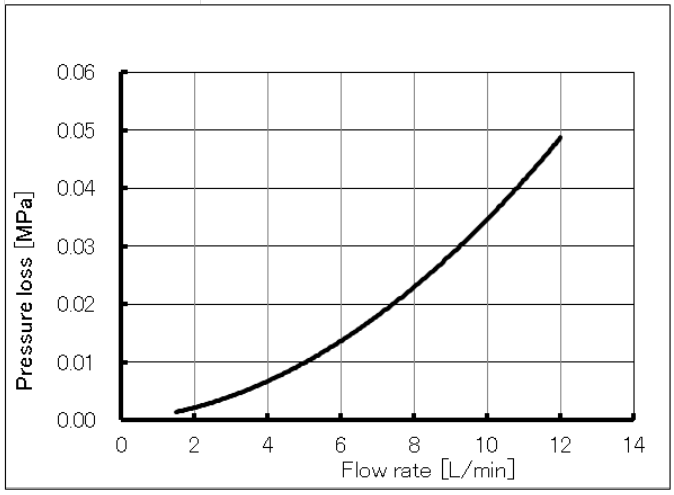
Note3 : Port size is Rc3/8 only.
Note4 : When the difference between the fluid temperature and ambient temperature is within ±10℃.

Pressure loss

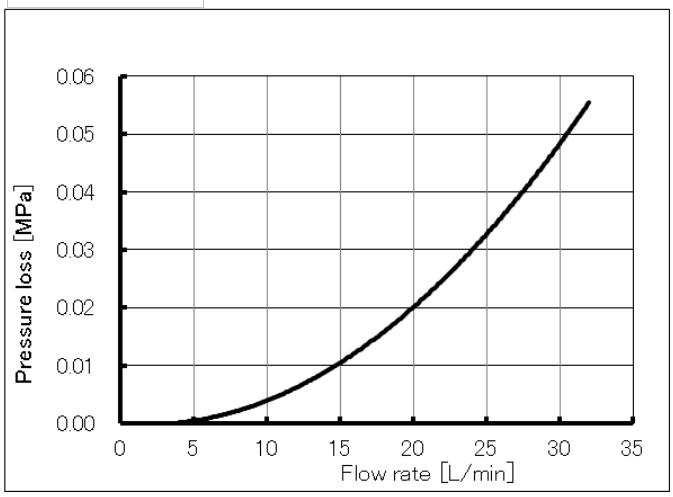
●WFK3004



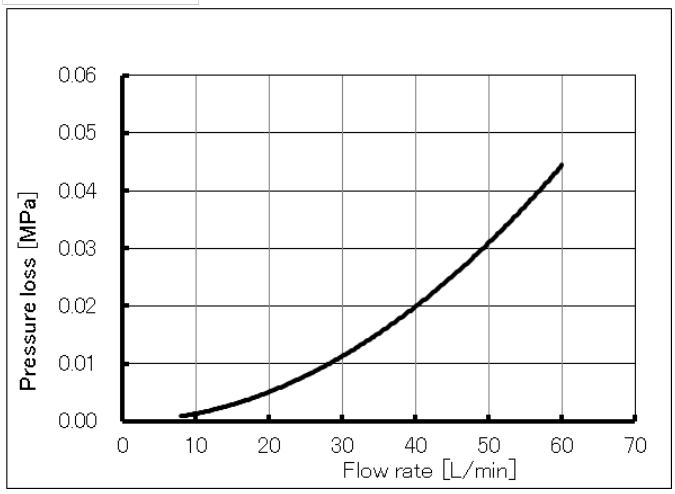
●WFK3012



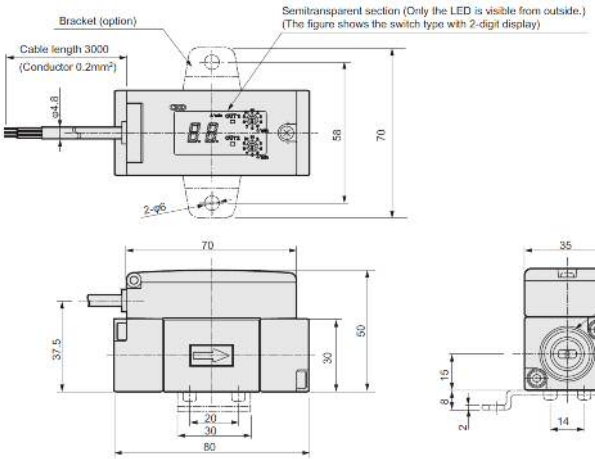
●WFK3032

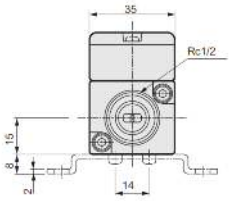


●WFK3060

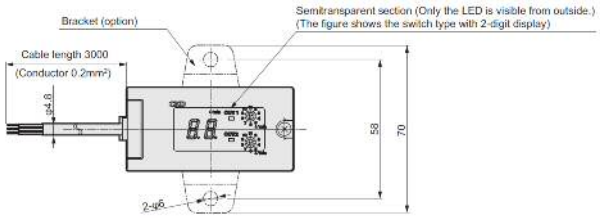


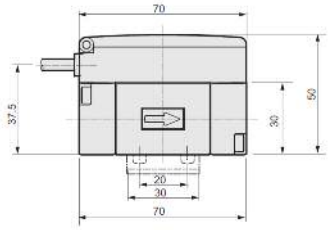
WFK3004,3012,3032 15A

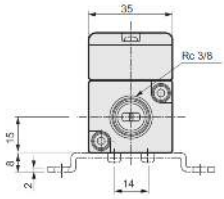




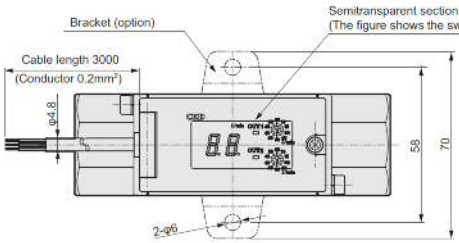
WFK3004,3012,3032 10A

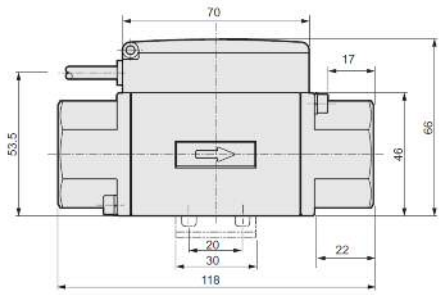


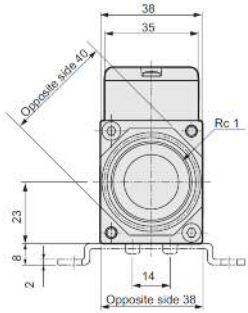




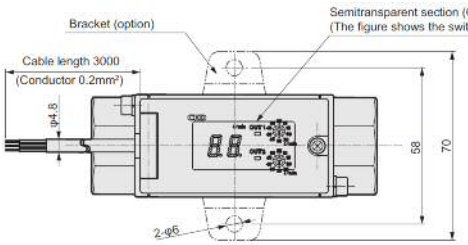
WFK3060 25A

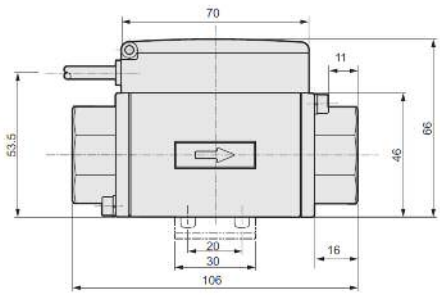


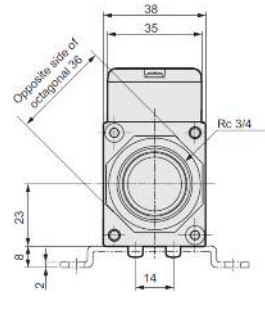




WFK3060 20A







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.

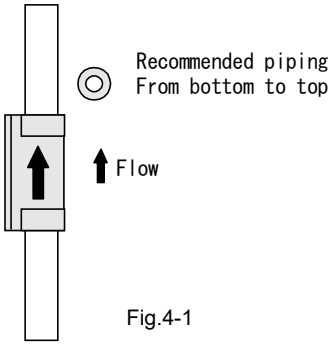


Fig.4-1

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.

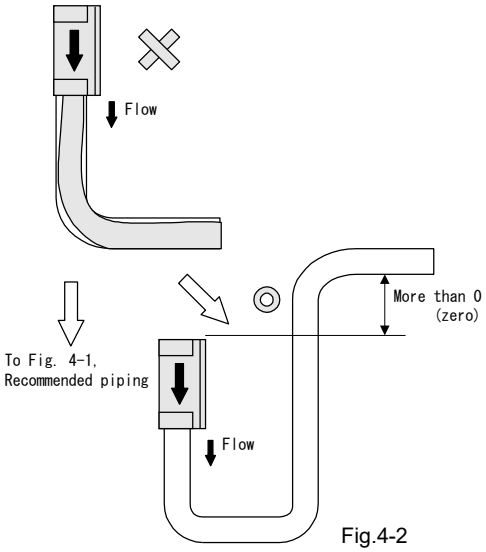


Fig.4-2

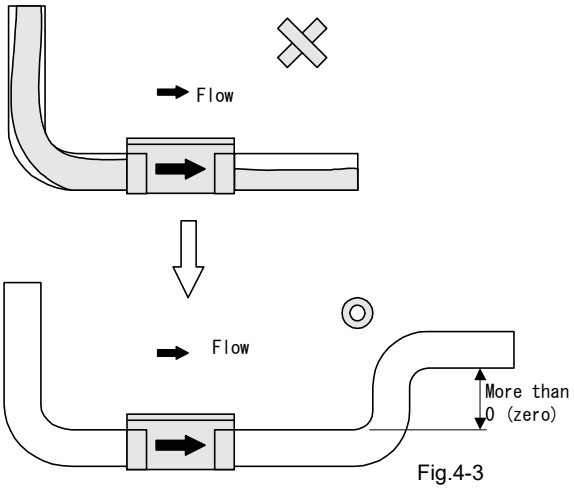


Fig.4-3

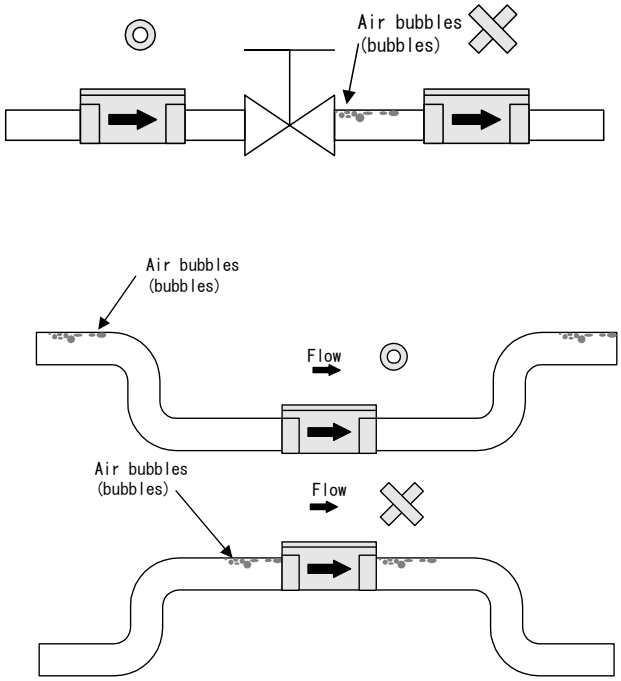


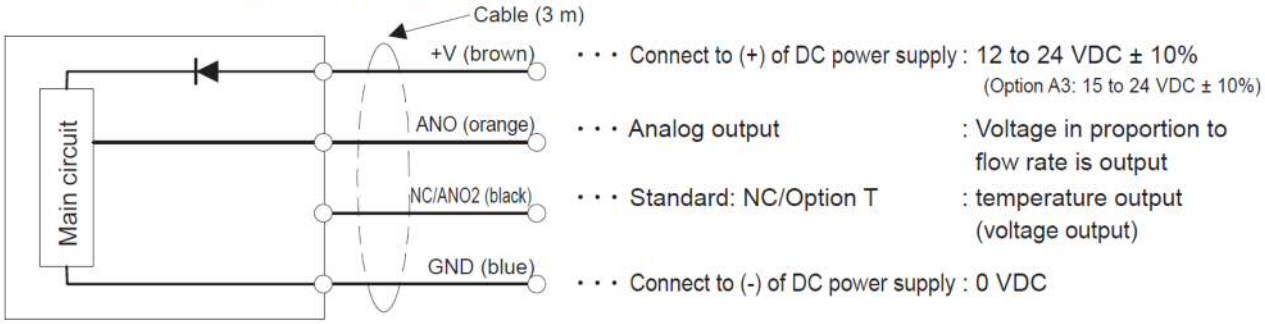
Fig.4-4

4-3 Wiring method

- Please read this instruction manual carefully before wiring.
- This product has Cable, that is vinyle cabtyre cord(4-conductor size 0.2mm^2).
- Option(Alarm output of the sensor switch type will be one point).

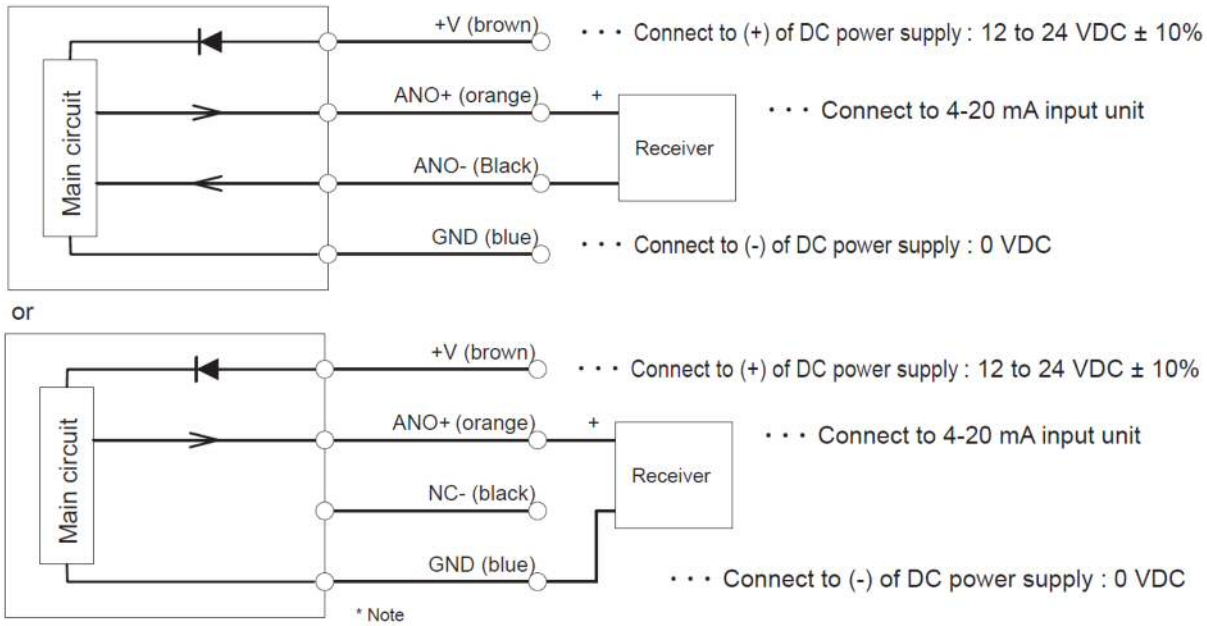
sensor type (output analog)	switch type (output alarm)	sensor switch type (alarm is 1point)			
-A0: (0-5[V])	-N0: (NPN a contact 2point)	-A0N0	-A1N0	-A2N0	-A3N0
-A1: (4-20[mA])	-N1: (NPN b contact 2point)	-A0N1	-A1N1	-A2N1	-A3N1
-A2: (1-5[V])	-P0: (PNP a contact 2point)	-A0P0	-A1P0	-A2P0	-A3P0
-A3: (0-10[V])	-P1: (PNP b contact 2point)	-A0P1	-A1P1	-A2P1	-A3P1

● WFK3***S (sensor type voltage output: -A0, -A2, -A3)



● WFK3***S (sensor type current output: -A1)

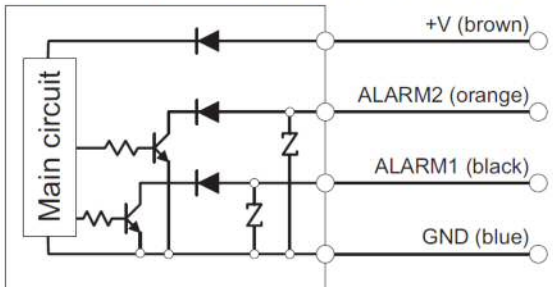
The current output (A1) has 2 types of wiring methods. Please use a wiring method that is tailored to the contents printed on the product side.



or

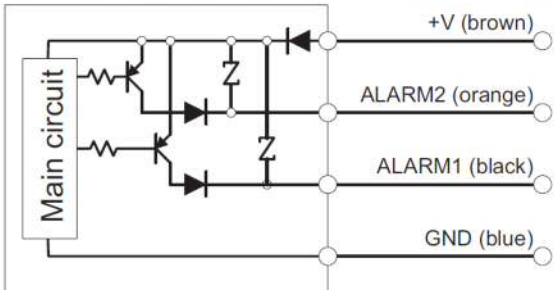
* Note
When connecting two or more flow rate sensors to the upper-level input circuit (receiver), carefully prevent signal interference.

● WFK30***M (switch type NPN output: -N0, -N1)



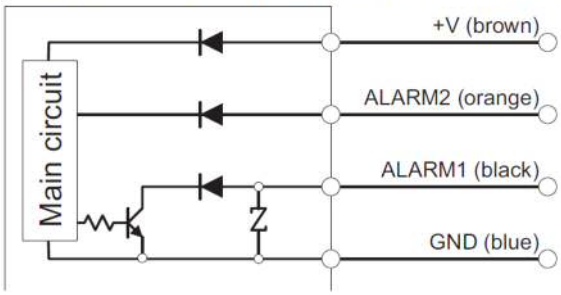
・・・Connect to (+) of DC power supply : 12 to 24 VDC±10%
・・・Switch 2 (OUT2) output : MAX 30 VDC•50mA
・・・Switch 1(OUT1) output : MAX 30 VDC•50mA
・・・Connect to (-) of DC power supply : 0 VDC

● WFK3***M (switch type PNP output: -P0, -P1)



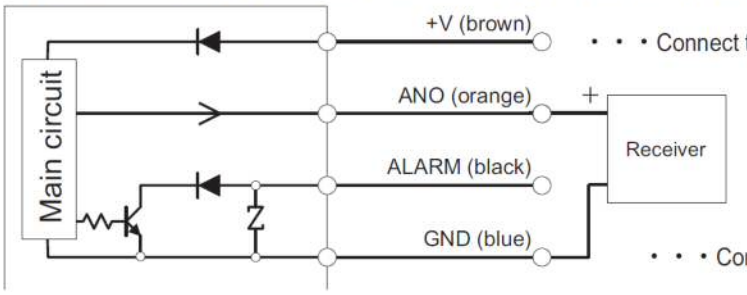
・・・Connect to (+) of DC power supply : 12 to 24 VDC±10%
・・・Switch 2 (OUT2) output : MAX 50mA
・・・Switch 1 (OUT1) output : MAX 50mA
・・・Connect to (-) of DC power supply : 0 VDC

● WFK3***C (sensor type voltage output specifications: -A0, -A2, -A3, switch type NPN output specifications: N0, N1)



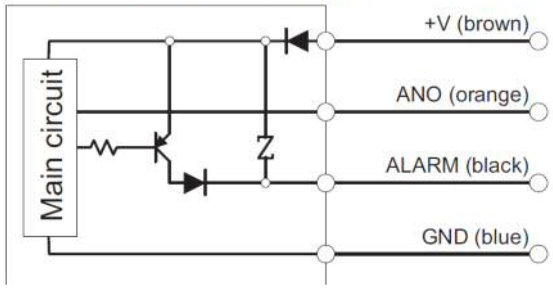
・・・Connect to (+) of DC power supply : 12 to 24 VDC±10%
(OptionA3:
15 to 24 VDC ± 10%)
・・・Analog output : Voltage in proportion to flow rate is output
・・・Switch (OUT) output : MAX 30VDC•50mA
・・・Connect to (-) of DC power supply : 0 VDC

● WFK3***C (sensor type voltage output: -A1, switch type NPM output: N0, N1)



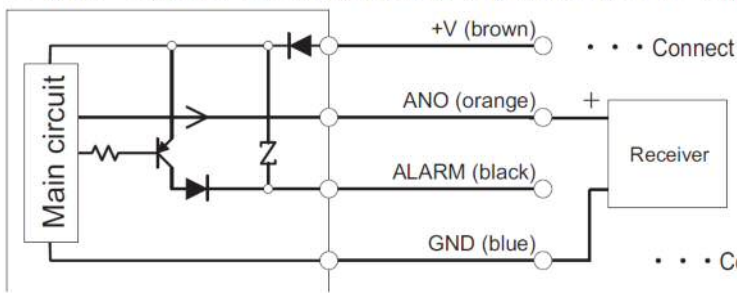
・・・Connect to (+) of DC power supply : 12 to 24 VDC±10%
・・・Connect to 4-20 mA input unit
・・・Switch (OUT) output
: MAX 30 VDC•50mA
・・・Connect to (-) of DC power supply : 0 VDC

● WFK3***C (sensor type voltage output : -A0, -A2, -A3, switch type PNP output: P0, P1)



・・・Connect to (+) of DC power supply : 12 to 24 VDC±10%
(OptionA3:
15 to 24 VDC ± 10%)
・・・Analog output : Voltage in proportion to flow rate is output
・・・Switch (OUT) output : MAX 30 VDC•50mA
・・・Connect to (-) of DC power supply : 0 VDC

● WFK3***C (sensor type voltage output: -A1, switch type PNP output: P0, P1)



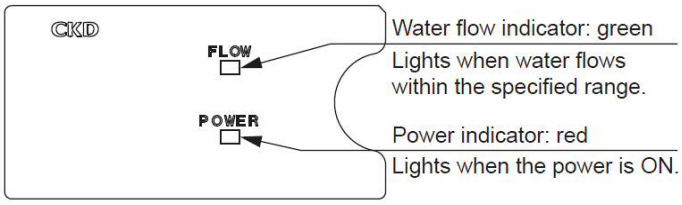
・・・Connect to (+) of DC power supply : 12 to 24 VDC±10%
・・・Connect to 4-20 mA input unit
・・・Switch (OUT) output
: MAX 30 VDC•50mA
・・・Connect to (-) of DC power supply : 0 VDC

[SM-328088-A]

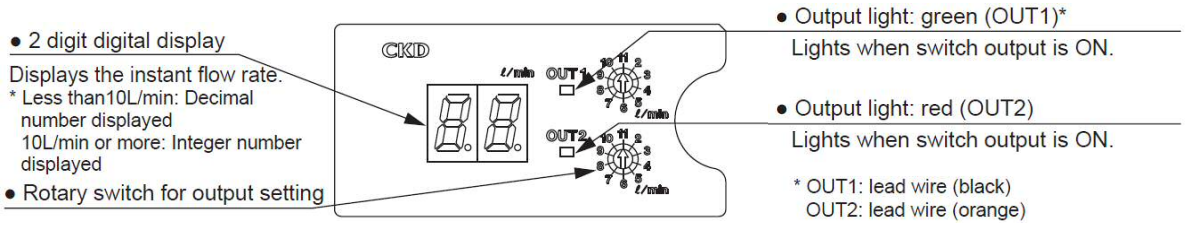
5. Operation

5-1 Functions

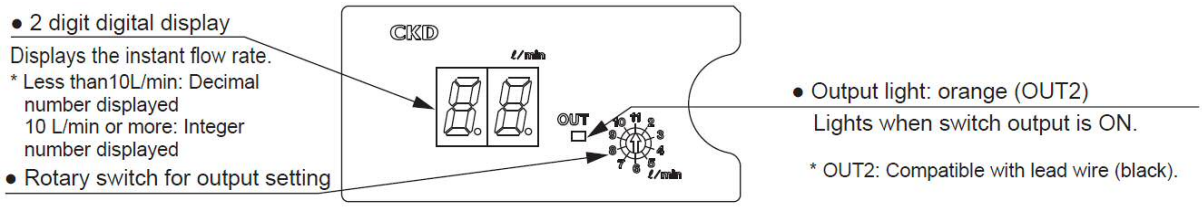
5-1-1 Sensor type（WFK3000S）



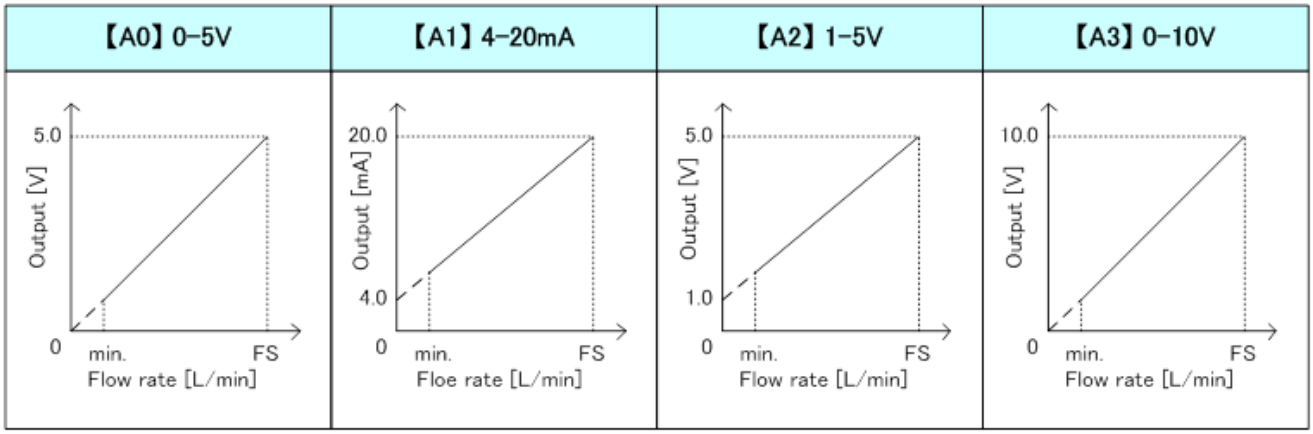
5-1-2 Switch type（WFK3000M）



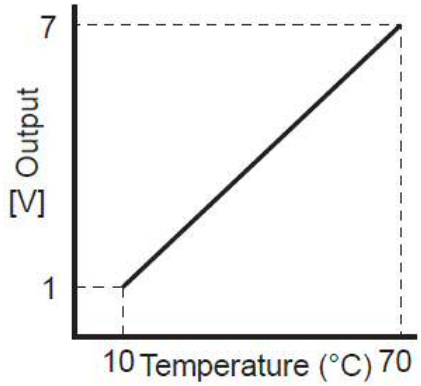
5-1-3 Sensor Switch type（WFK3000C）



5-1-4 Analog output



● Water temperature measuring function (option)



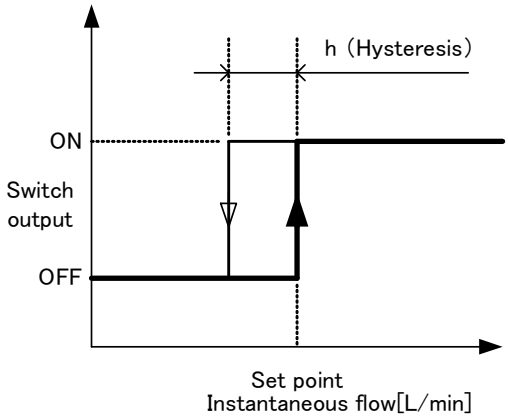
● Connection resistance conditions

item	-A0 [0～5V]	-A1 [4～20mA]	-A2 [1～5V]	-A3 [0～10V]
Allowable load	50kΩ or more	500 Ω or less	50kΩ or more	50kΩ or more

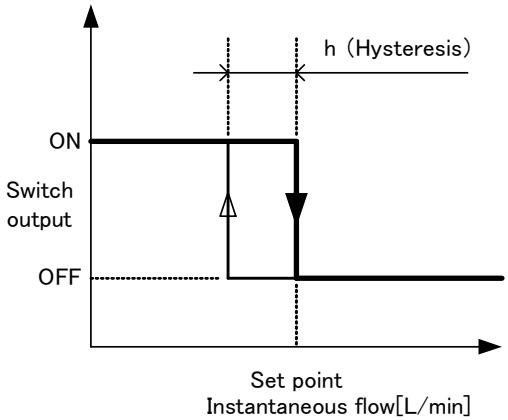
5-1-5 Alarm output

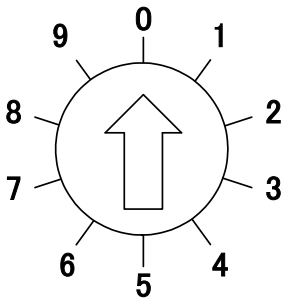
●Switch type (WFK3000M) and Sensor Switch type (WFK3000C)

＜Output option：N0/P0＞



＜Output option：N1/P1＞





●Alarm set point[L/min]

Rotary sw. Disp. number	WFK3004M/C	WFK3012M/C	WFK3032M/C	WFK3060M/C
1	0.6	2.0	5.0	10
2	0.7	3.0	9.0	15
3	0.8	4.0	12	20
4	0.9	5.0	14	25
5	1.0	6.0	16	30
6	1.5	7.0	18	35
7	2.0	8.0	21	40
8	2.5	9.0	24	45
9	3.0	10	27	50
0	3.5	11	30	55
Hysteresis [L/min]	0.1	0.5	1	3

※ The switch output settings are made using rotary switch at the upper portion of the sensor
※ The rotary switch is set using a precision screwdriver.
At this time, great care should be taken since the contact fault may occur it an excessive force is applied to the rotating part.
※ Flow rate setting has been fixed as of the table.
※ When a cover is closed after setting, the set flow rate is indicated.

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

7-1 Cause of trouble and corrective action

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 10V or less, It will not be displayed. 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 20m/s^2 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.	Please 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.
	The lamp flashes. [WFK3000S]	Memory abnormality inside the product.	If it does not recover after turning the power on again, we will need to investigate.
		More flow than F.S. is detected.	Use the flow rate within the range of FS.
	The lamp flashes. [WFK3000M,C]	Refer to the error code.	Refer to the error code.
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 5 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 "5-1-4 Analog output" 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.

7-2 Error Code

WFK3000M, C Same Content

Error code	Name	Contents	Treatment method
E0	Memory error	Memory abnormality inside the product.	If it does not recover after turning the power on again, we will need to investigate.
E1	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.
E2	OUT2 is overcurrent condition		
E3	OUT1 and OUT2 are overcurrent condition		
E4	Memory error	Memory abnormality inside the product.	If it does not recover after turning the power on again, we will need to investigate.
E5	Overflow	Flow rate is over 1.2 times of FS.	Use the flow rate within the range of FS.