

Flow Sensor for Water WFK2 Series



Diversified and Unrestricted Output



 **IO-Link** Compatible

New

DIVERSIFIED

Diversified

Compatible with flow rates of 0.4 to 250 L/min

Compatible with a wide range of flow rates.

Easy flow rate adjustment (option)

Can be adjusted with a manual valve.



Water temperature measuring feature is standard for all models

There is no need to for an external water temperature sensor, reducing space and wiring work.

Handles water up to 95 °C



Molding machine cooling



Heated water for mold temperature controlling



Laser oscillator cooling

Various output functions available

OUT1

Analog output

- › Instantaneous flow rate
- › Temperature

Switch output NPN/PNP switchable

- › Instantaneous flow rate 1, 2
- › Temperature 1, 2
- › Integrating flow

Pulse output

- › Integrating flow

External input

- › Integrating flow reset
- › Peak hold reset

OUT2

Analog output

- › Instantaneous flow rate
- › Temperature

Pulse output

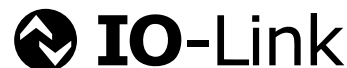
- › Integrating flow

Switch output NPN/PNP switchable

- › Instantaneous flow rate 1, 2
- › Temperature 1, 2
- › Integrating flow

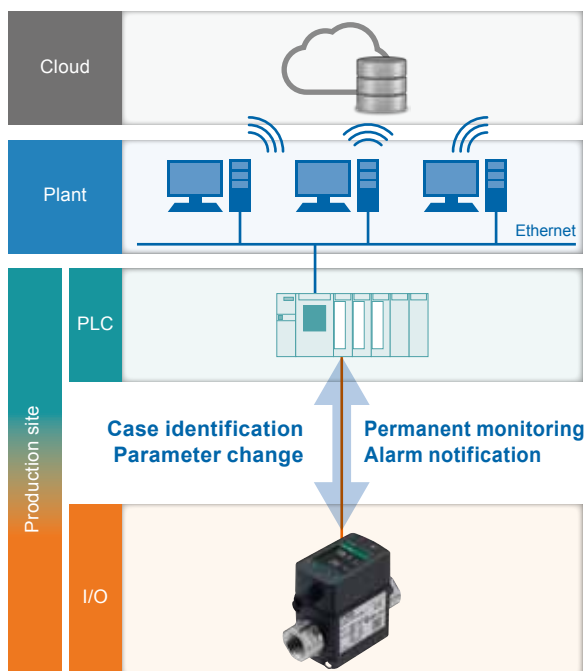
IO-Link

IO-Link model released



IO-Link is a digital communication standard for factory sensors and actuators. (IEC61131-9)

Parameters and event data that could not be transmitted by analog communication can now be transmitted.



Features of IO-Link



Permanent monitoring made possible by digital data.



Parameters can be set and changed from the network, so the system can be operated remotely.



Model No. and serial No. can be checked via the network.



Settings can be copied from the master, making cumbersome resetting of parameters during maintenance unnecessary.



Malfunctions and disconnections of the device can be checked.



Connection to an Ethernet network is possible, enabling the creation of an IoT system.

USER-FRIENDLY

Easier to use

Display screen rotation

The liquid crystal display can be rotated in 90° increments without moving the body. There is no interference even when installed parallel.



Easy to read 2-screen color liquid crystal display

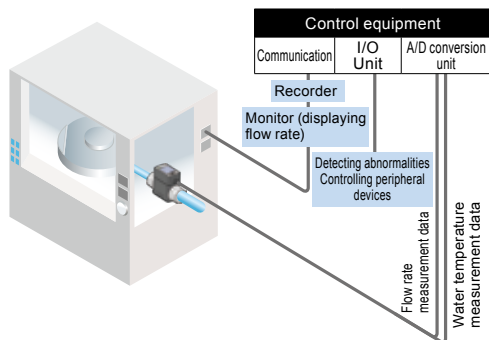
Set values, temperature, etc., can be displayed simultaneously.



Example of applications

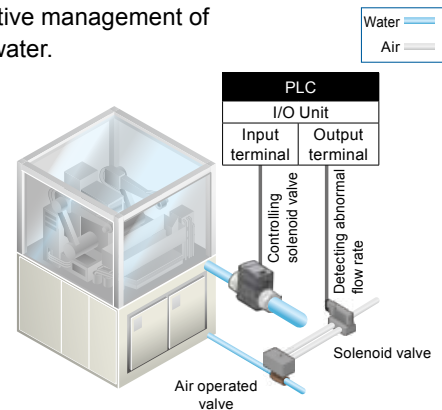
Semiconductor Semiconductor manufacturing equipment

Cooling and temperature control of semiconductor manufacturing equipment. Etching, grinder, dicer, CVD.



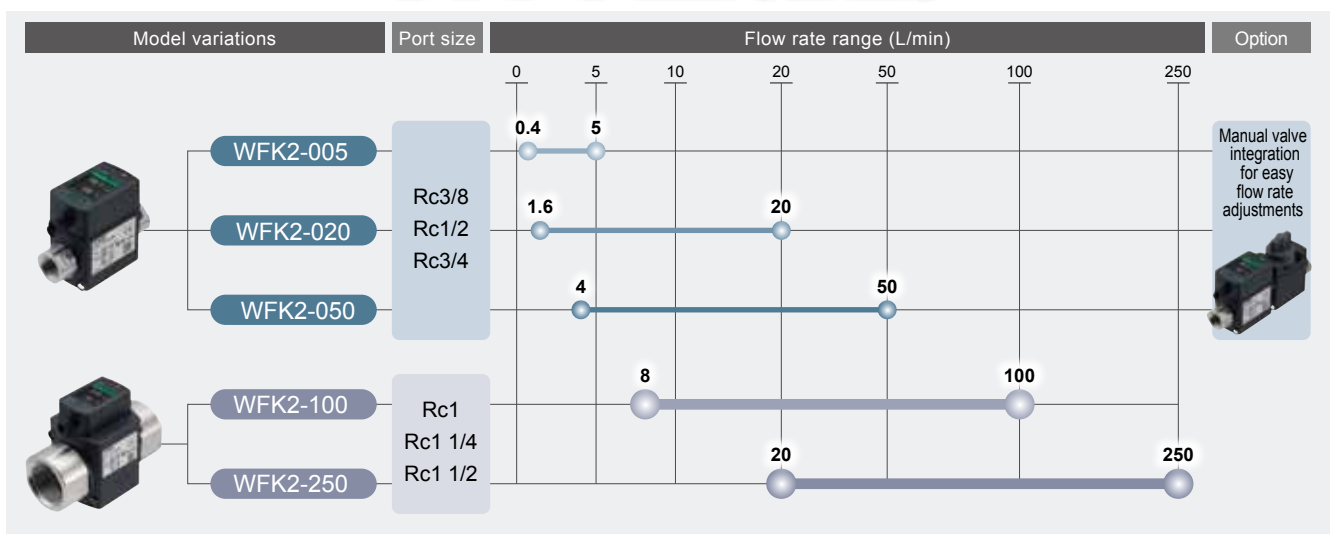
Hardening Induction hardening device

Quantitative management of cooling water.

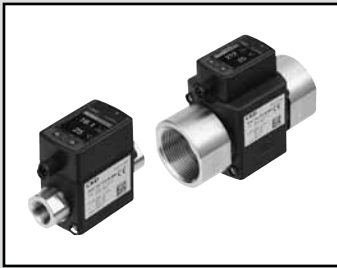


Karman vortex flow rate sensor for water FLUEREX

WFK2 SERIES



Contact CKD for support for food manufacturing processes FP Series.



FLUEREX (Karman vortex flow rate sensor for water)

WFK2 Series

● Flow rate range: 0.4 to 5, 1.6 to 20, 4 to 50, 8 to 100, 20 to 250 L/min



Specifications

Descriptions		WFK2-005	WFK2-020	WFK2-050	WFK2-100	WFK2-250
Connection	Port size Rc, G, NPT	3/8, 1/2, 3/4			1, 1 1/4, 1 1/2	
	Port material	Stainless steel: SUS304				
Working conditions	Applicable fluid	Pure water, industrial water				
	Max. working pressure MPa	1.0				
	Proof pressure MPa	1.5				
	Manual valve internal leakage mL/min	0			No manual valve settings	
	Manual valve allowable back pressure MPa	0.3			No manual valve settings	
	Ambient temperature °C	0 to 50 (85% RH or less, no condensation)				
Flow rate	Fluid temperature °C	1 to 95				
	Flow rate range L/min	0.4 to 5	1.6 to 20	4 to 50	8 to 100	20 to 250
	Repeatability (*1)	Analog accuracy: ±2.5%F.S. Display accuracy: ±2.5%F.S. ±1 digit (min. display unit)				
	Temperature characteristics (*1)	±5%F.S. (base temperature 25°C, 10 to 50°C)				
	Low flow cut	5% of F.S.				
	Integrating flow range	99,999 L or 99,999 m ³ (unit selectable), reset when the power is turned off.				
	Integrated pulse rate L/pulse	0.1, 0.5, 1	0.1, 0.5, 1, 10	0.5, 1, 10, 50	1, 10, 50, 100	10, 50, 100
	Pressure loss MPa	0.07 (at F.S.)	0.05 (at F.S.)	0.05 (at F.S.)	0.05 (at F.S.)	0.03 (at F.S.)
	Response time (*2) sec	0.25, 0.5, 1, 5, 10 (Initial value 1)				
Temperature	Measurable temperature range °C	0 to 100				
	Accuracy	Less than 50: analog accuracy ±2, display accuracy ±2 ±1 digit (min. display unit 1) 50 to 100: analog accuracy ±3, display accuracy ±3 ±1 digit (min. display unit 1)				
Output	Display	Two-screen LCD display, instantaneous flow rate: 3 digits, water temperature: 2 digits, integrating flow: 5 digits, with screen rotation				
	Analog output (*3)	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 (can be switched from settings)				
	Max. load current	50 mA				
	Max. applied voltage	30 VDC				
Power supply voltage	Internal voltage drop	2.0 V or less				
	Power supply voltage	Analog output standard: 12 to 24 VDC ±10%, analog output option: 24 VDC ±10%				
	Current consumption (*4)	50 mA or less				
Mounting	Mounting orientation	Unrestricted in vertical/horizontal direction				
	Straight piping section	None			IN side: 10 D, OUT side: 5 D	
	Degree of protection	IP65 or equiv.				
	Weight g	3/8 (Rc, G, NPT): approx. 320 1/2 (Rc, G, NPT): approx. 320 3/4 (Rc, G, NPT): approx. 400			1 (Rc, G, NPT): approx. 870 1 1/4 (Rc, G, NPT): approx. 1,010 1 1/2 (Rc, G, NPT): approx. 1,100	

*1: Accuracy is the average value over 10 sec (for conditions not containing air bubbles). F.S. stands for full scale flow rate.

*2: The time to attain 70% of the original output after the normal flow rate (used) drops instantly to 0.

*3: Check the allowable load on the wiring method page.

*4: Current for when 24 VDC is connected, and no load is applied. The current consumption will vary depending on how the load is connected.

How to order

WFK2 - **005** **AA** **A** **A** **N** - **A** **C**

A Flow rate range

B Port size

C IO-Link analog output

D Display unit

E Manual valve

F Option (attached cable)

G Bracket (attached bracket)

⚠ Precautions for model No. selection

- *1: The unit display "B" is for overseas use and cannot be used in Japan.
- *2: Option A (with manual valve) has a flow rate range of 005, 020, or 050 only.
- *3: When selecting option A and the bracket (C), it is a bracket 2 set attachment.

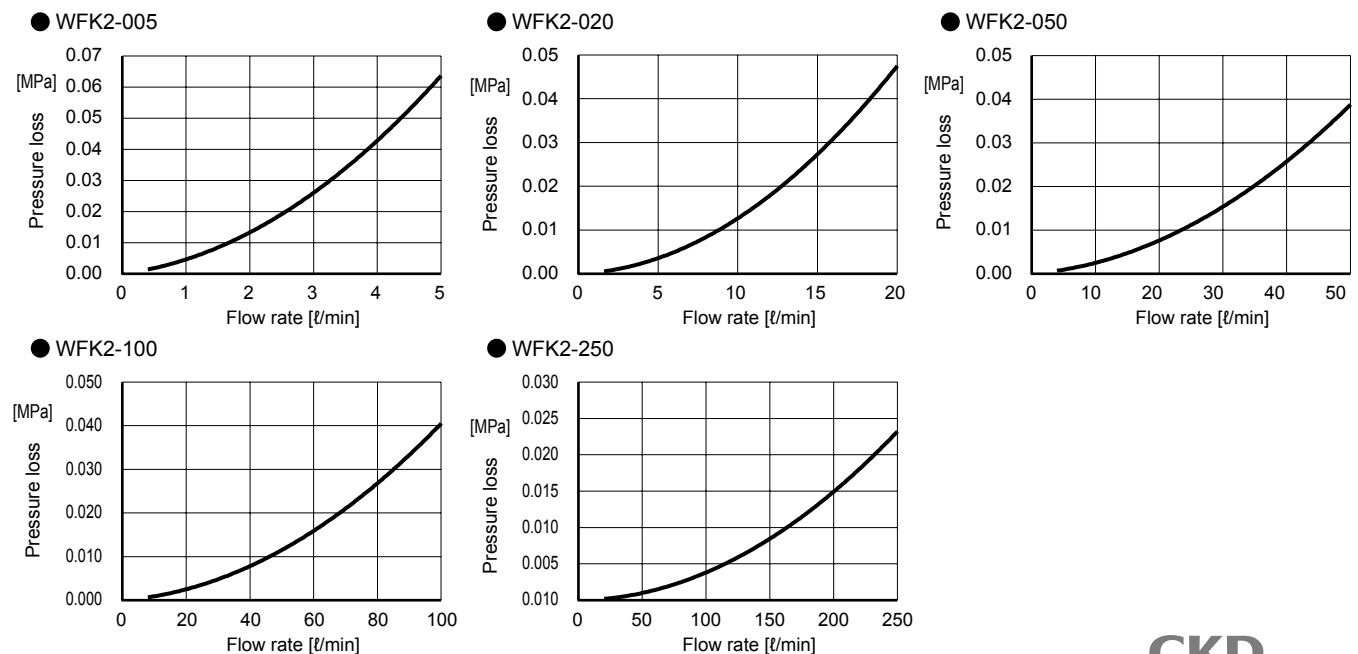
[Example of model No.]

WFK2-005AAAAN-AC

- A** Flow rate range: 0.4 to 5 L/min
- B** Port size: Rc3/8
- C** IO-Link analog output:
Switch/analog output
0 to 5 VDC/1 to 5 VDC
- D** Display unit : L/min L m³ °C
- E** Manual valve : sensor only
- F** Option : standard cable attached
- G** Option : attached bracket

Code	Content	
A Flow rate range		
005	0.4 to 5 L/min	
020	1.6 to 20 L/min	
050	4.0 to 50 L/min	
100	8.0 to 100 L/min	
250	20 to 250 L/min	
B Port size		
AA	Rc3/8	Flow rate range: 005, 020, 050
BA	Rc1/2	
CA	Rc3/4	
DA	Rc1	Flow rate range: 100, 250
EA	Rc1 1/4	
FA	Rc1 1/2	
AB	G3/8	Flow rate range: 005, 020, 050
BB	G1/2	
CB	G3/4	
DB	G1	Flow rate range: 100, 250
EB	G1 1/4	
FB	G1 1/2	
AC	NPT3/8	Flow rate range: 005, 020, 050
BC	NPT1/2	
CC	NPT3/4	
DC	NPT1	Flow rate range: 100, 250
EC	NPT1 1/4	
FC	NPT1 1/2	
C IO-Link analog output		
* "D", "E", and "F" have the analog output specifications from before IO-Link is used.		
A	Switch/analog output 0 to 5 VDC/1 to 5 VDC	
B	Switch/analog output 4 to 20 mA DC	
C	Switch/analog output 0 to 10 VDC/1 to 10 VDC	
D	IO-Link compatible 0 to 5 VDC/1 to 5 VDC	
E	IO-Link compatible 4 to 20 mA DC	
F	IO-Link compatible 0 to 10 VDC/1 to 10 VDC	
D Display unit		
A	L/min L m ³ °C	
B	L/min us gal/min L m ³ us gal °C °F *1	
E Manual valve		
N	Sensor only	
A	With manual valve (cock type) *2	
F Option (attached cable)		
Blank	None	
A	Standard cable (M12/4-conductor/ 3 m) attached	
B	Double ended connector cable (M12/4-conductor/ 3 m) attached	
G Option (attached bracket)		
Blank	None	
C	Attached bracket *3	

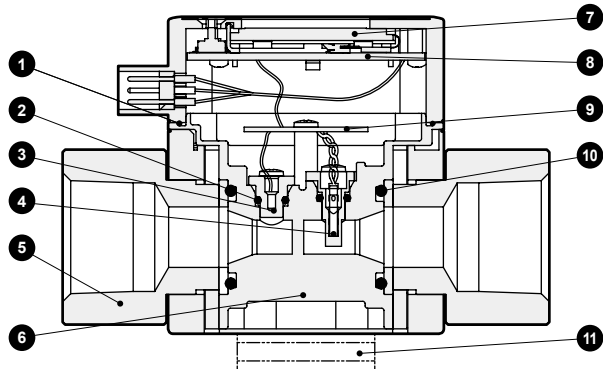
Pressure loss



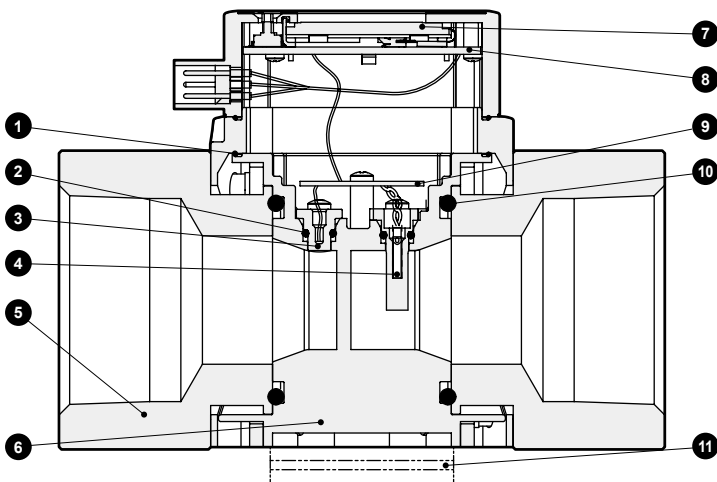
WFK2 Series

Internal structure and list

● WFK2-005, 020, 050



● WFK2-100, 250

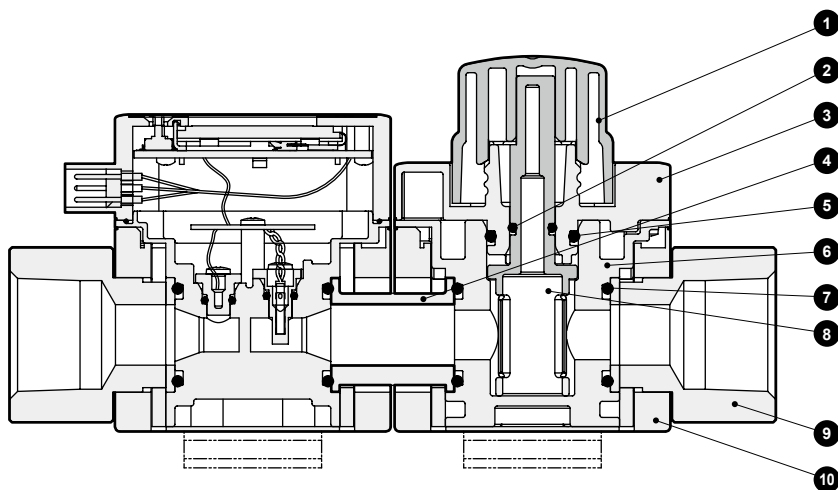


Cannot be disassembled

No.	Part name	Material	Quantity	No.	Part name	Material	Quantity
1	Packing	FKM Fluoro rubber	1 or 2	7	Liquid crystal		1
2	O-ring	FKM Fluoro rubber	2	8	CPU Base		1
3	Temperature sensor	SUS316L Thermistor	1	9	Sensor board		1
4	Karman's vortex street detection sensor	PPS Resin Piezoelectric element	1	10	O-ring	FKM Fluoro rubber	2
5	Attachment	SUS304	2	11	Bracket (option)	SUS304 or SPCC	(1)
6	Sensor body	PPS Resin GF40%	1				

* The wetted parts are ②, ③, ④, ⑤, ⑥ and ⑩.

● WFK2-005, 020, 050****A



Cannot be disassembled

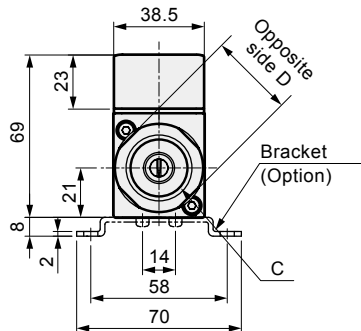
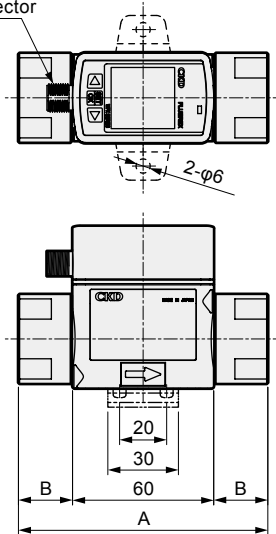
No.	Part name	Material	Quantity	No.	Part name	Material	Quantity
1	Handle	POM Resin	1	7	O-ring	FKM Fluoro rubber	2
2	O-ring	FKM Fluoro rubber	1	8	Cock	PPS Resin GF40% FKM Fluoro rubber	1
3	Stuffing	PPS Resin GF40%	1	9	Attachment	SUS304	2
4	Spacer	SUS304	1	10	External case	PBT Resin GF30%	1
5	O-ring	FKM Fluoro rubber	1				
6	Cock body	PPS Resin GF40%	1				

* The wetted parts are ②, ③, ④, ⑤, ⑥, ⑦, ⑧, ⑨ and ⑩.

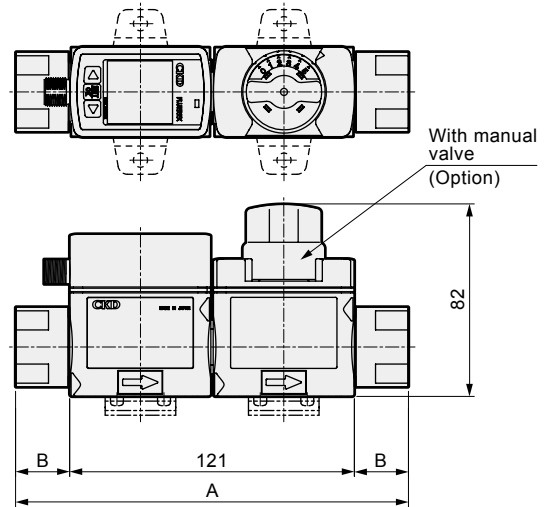
Dimensions

● WFK2-005, 020, 050

M12 Connector

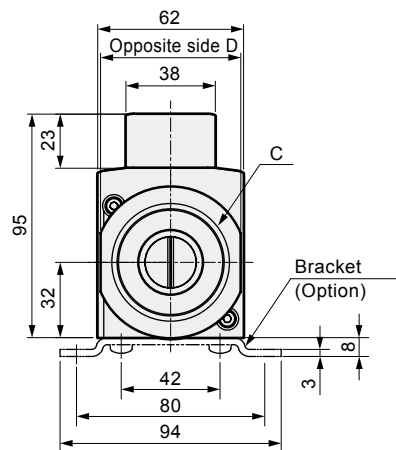
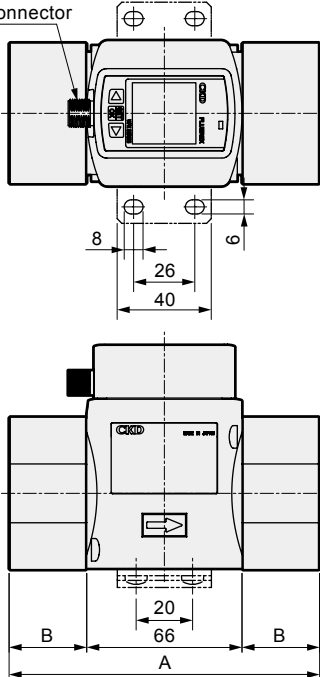


• With manual valve (cock type)



● WFK2-100, 250

M12 Connector



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

[*1]: Select from 005, 020, and 050

[*2]: Select from 100 and 250

[*3]: Select from A, G, and N (dimension lines of the G screw and NPT screw are the same)

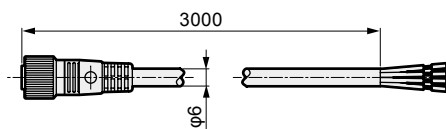
Optional dimensions

● Cable option

Common for WFK2

- Standard cable

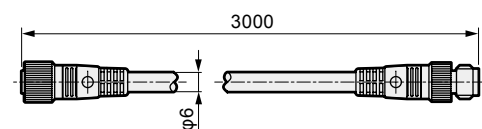
Discrete option model No.: **WF-FL-280741**



Finished outer diameter 6 mm, core wire 0.5 mm², insulator outer diameter 1.9 mm

- Double ended connector cable

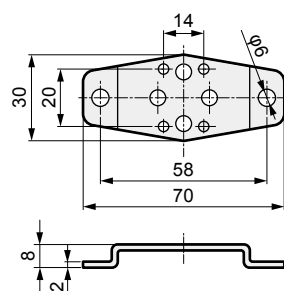
Discrete option model No.: **WF-FL-662453**



● Bracket option

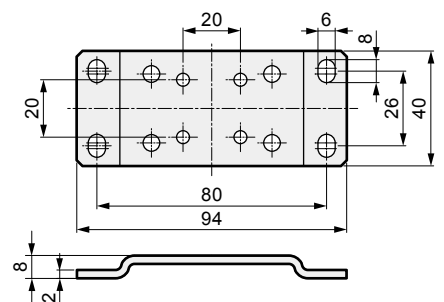
WFK2-005, 020, 050

Discrete option model No.: **WF-FL-315544**



WFK2-100, 250

Discrete option model No.: **WF-FL-636342**

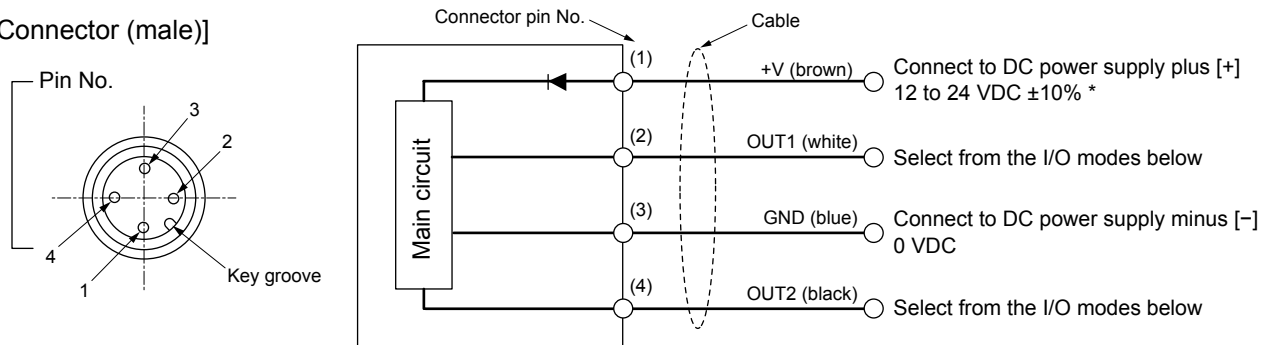


Wiring method

- Always read the safety precautions before wiring.
- The cable used is a 4-conductor cable with a core wire of 0.5 mm².

*** Keep the cable far away from power cords or other things that may cause noise.
Noise can cause malfunctions.**

[Connector (male)]



* With a standard analog output (0 to 5 V/1 to 5 V). With option (4 to 20 mA/0 to 10 V/1 to 10 V), it is 24 VDC ±10%.

I/O mode

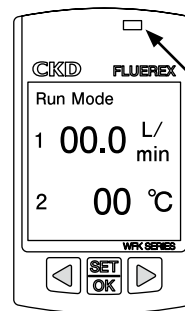
- OUT 1: analog flow output, analog temperature output, flow switch 1 output, flow switch 2 output, temperature switch 1 output, temperature switch 2 output, integrated pulse output, integrated switch output, external input, Off
- OUT 2: analog flow output, analog temperature output, flow switch 1 output, flow switch 2 output, temperature switch 1 output, temperature switch 2 output, integrated pulse output, integrated switch output, IO-Link, Off

Descriptions	[A, D] 0 to 5 V/ 1 to 5 V	[B, E] 4 to 20 mA	[C, F] 0 to 10 V/ 1 to 10 V
Allowable load weight	50 kΩ or more	500 Ω or less	50 kΩ or more

IO-Link parameter specifications

1. General

Descriptions	Details
Communication protocol	IO-Link
Communication protocol version	V1.1
Transmission bit rate	COM2 (38.4 kbps)
Port	M12 Class A
Process data (input)	4 byte
Process data (output)	0 byte
Min. cycle time	5 ms
Data storage	1 kbyte
SIO mode support	None



Power light (green)

- Lights when the power is on.
- Blinks during IO-Link communication.

2. Process data

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16								
Data	MSB															LSB								
Data range	Instantaneous flow rate [Flow Rate]																							
Format	Refer to Table 1																							
Format	Integer 16																							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0								
Data	Error	WARNING	-	-	Switch output				MSB								LSB							
Data range	True/False				4				3				2				1				Fluid temperature [Temperature]			
Format	Boolean				Integer 4				Integer 4				Integer 4				Integer 8							
Data range																	-10 to 110 °C							

Data range (Table 1)

Bit	005	020	050	100	250
Data range	0.00 to 5.50 L/min	0.0 to 22.0 L/min	0.0 to 55.0 L/min	0 to 110 L/min	0 to 275 L/min

* IODD files can be downloaded from the CKD website. (<http://www.ckd.co.jp/>)

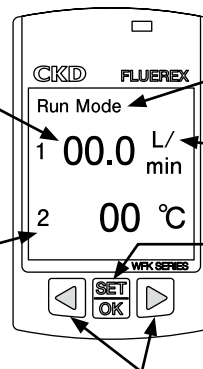
Names and functions of display/operation section

Main screen

The state of instantaneous flow rate, integrating flow, temperature, and various settings are displayed.

Output display

Indicates the switch output status.



Mode display

Display the screen mode.

Unit display

Display the value units.

Selection key

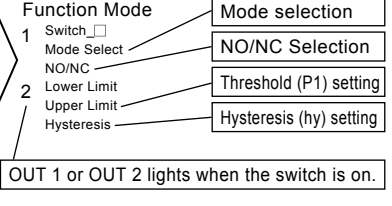
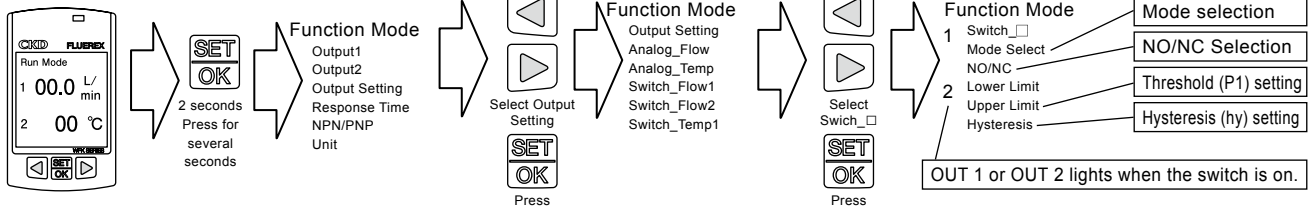
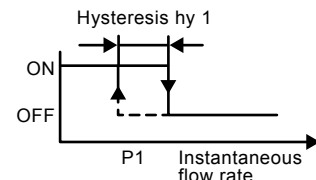
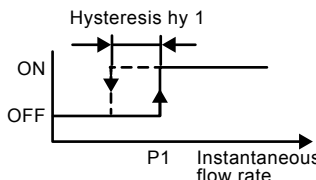
Up/down changes depending on the orientation of the screen display.

Output mode and output operation

1. Switch output

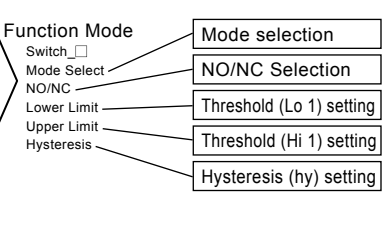
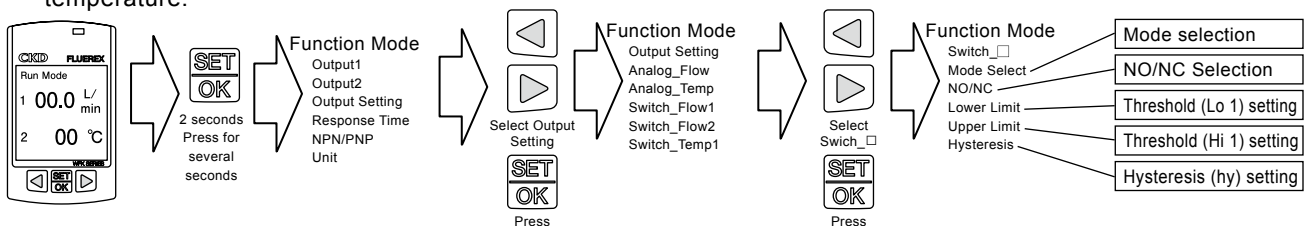
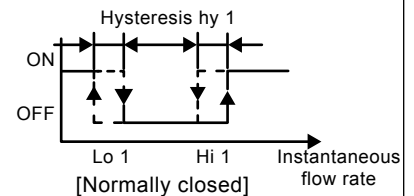
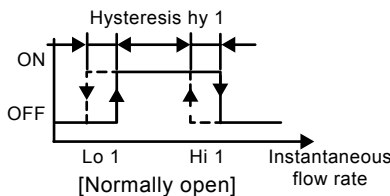
(1) Hysteresis mode

OUT 1 and 2 can both be set.
Can be set with instantaneous flow rate and temperature.
Can memorize 2 types each of instantaneous flow rate and temperature.



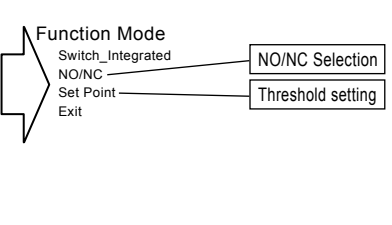
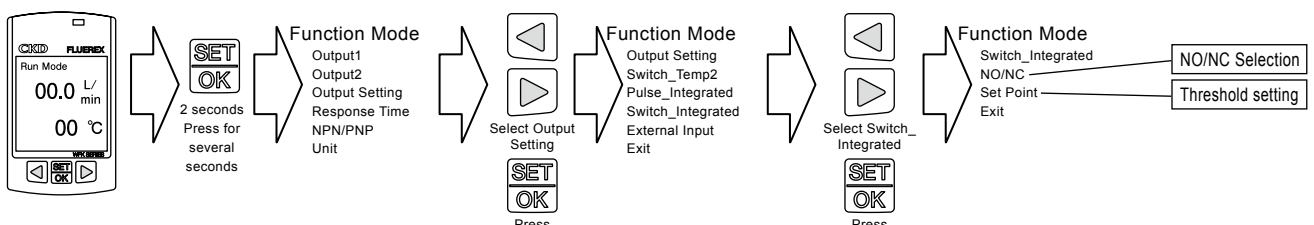
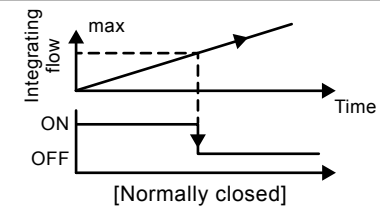
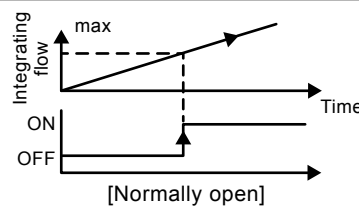
(2) Window mode

OUT 1 and 2 can both be set.
Can be set with instantaneous flow rate and temperature.
Can memorize 2 types each of instantaneous flow rate and temperature.



(3) Integrated output mode

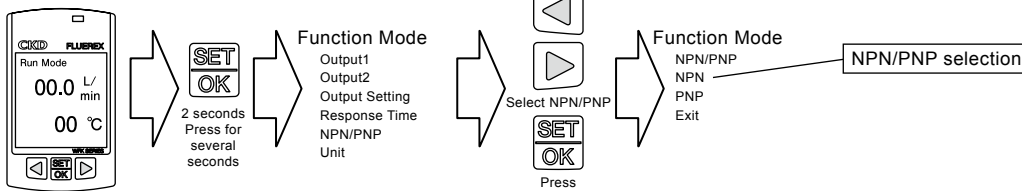
OUT 1 and 2 can both be set.
Integrating flow can be reset through turning the power OFF, button operation, or external input.



(4) NPN/PNP conversion

NPN and PNP can be converted.

* Perform NPN and PNP conversion when the switch output is OFF. Conversion settings are applied when the power is turned back ON.

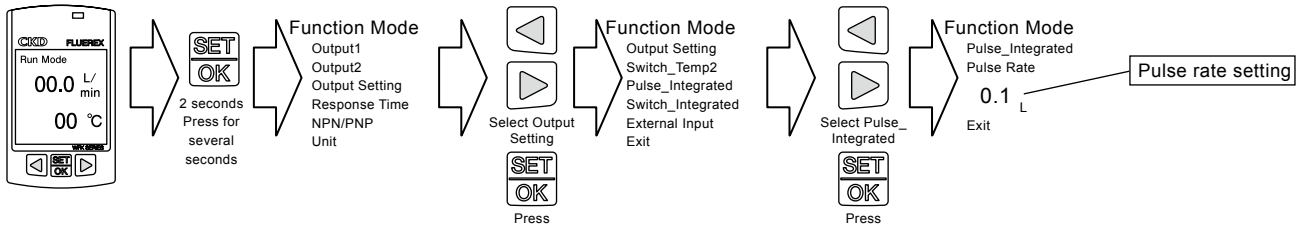
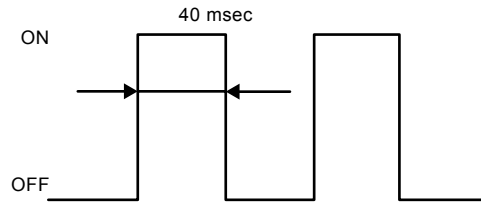


2. Integrated pulse output

Pulse output matches the integrating flow count.

Selectable pulse rates

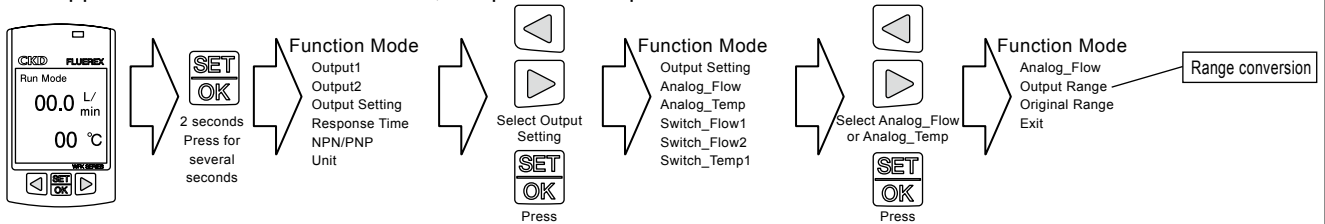
Model	5 L	20 L	50 L	100 L	250 L
0.1 L	○	○	/	/	/
0.5 L	○	○	○	/	/
1 L	○	○	○	○	/
10 L	/	○	○	○	○
50 L	/	/	○	○	○
100 L	/	/	/	○	○



3. Analog output

(1) Output conversion

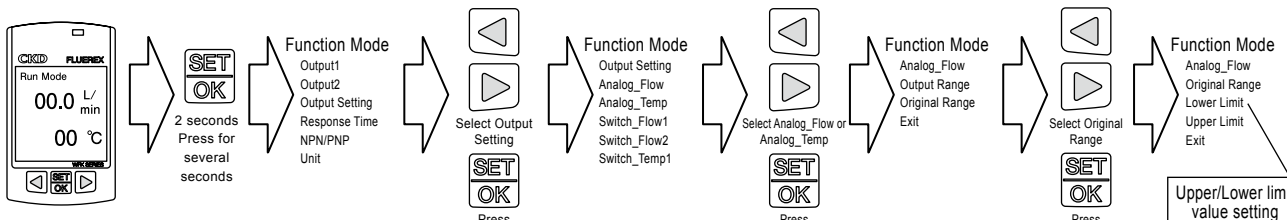
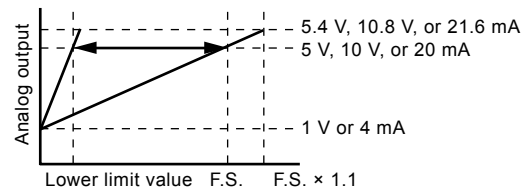
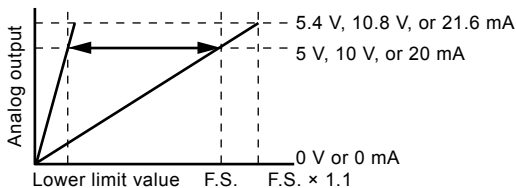
- 0 to 5 V/1 to 5 V select between 0 to 5 V output and 1 to 5 V output
 - 4 to 20 mA no output conversion
 - 0 to 10 V/1 to 10 V select between 0 to 10 V output and 1 to 10 V output
- Applied to instantaneous flow rate, temperature output



(2) Original analog output

An analog output function that freely sets the upper and lower limits of normal analog output.

* The set range cannot be greater than the max. flow rate of each flow rate range



4. Span adjustment

Span adjustment can be set from 0.1 to 2.5 times with the initial flow rate value.
 [Ex.] When set to 2.0 times

The diagram illustrates the process of adjusting the span. On the left, a graph shows a flow rate of 5 L/min at 500 Hz. An arrow points to a second graph showing a flow rate of 10 L/min at 500 Hz, indicating a 2x span adjustment.

The navigation steps are as follows:

- Press **SET/OK** for 2 seconds.
- Function Mode: Output1, Output2, Output Setting, Response Time, NPN/PNP, Unit.
- Change the page with left/right arrows.
- Function Mode: Span Adjustment, Display, Color, Peak Hold_Q, Peak Hold_T, Operating Time.
- Select Span Adjustment with left/right arrows.
- Function Mode: Span Adjustment, 1.0 Times, Exit.
- Press **SET/OK**.

The final setting is **Span magnification settings** set to 1.0 Times.

5. Setting response time

(1) Timer selection
 Instantaneous flow rate response time (average movement time) can be changed.
 Select from 0.25 sec, 0.5 sec, 1 sec, 5 sec, and 10 sec (1 sec at factory settings)

(2) Duration....can be set from 0 to 9 sec
 During switch output, the time it takes for the output to occur after exceeding the threshold can be set.

The diagrams show two scenarios for duration setting:

- When the time after exceeding the threshold is shorter than the set duration, switch output is off.
- When the time after exceeding the threshold is greater than the set duration, switch output is on.

The navigation steps are as follows:

- Press **SET/OK** for 2 seconds.
- Function Mode: Output1, Output2, Output Setting, Response Time, NPN/PNP, Unit.
- Select Response Time with left/right arrows.
- Function Mode: Response Time, Timer, 0.2 Sec, Duration, 9 Sec, Exit.
- Timer selection: 0.2 Sec.
- Duration setting: 9 Sec.
- Press **SET/OK**.

6. Peak hold

The max. and min. flow rates of instantaneous flow rate and temperature can be confirmed.
 The max. and min. flow rates can be reset through turning the power OFF, button operation, or external input.

The navigation steps are as follows:

- Press **SET/OK** for 2 seconds.
- Function Mode: Output1, Output2, Output Setting, Response Time, NPN/PNP, Unit.
- Change the page with left/right arrows.
- Function Mode: Span Adjustment, Display, Color, Peak Hold_Q, Peak Hold_T, Operating Time.
- Select Peak Hold_Q with left/right arrows.
- Function Mode: Peak Hold_Q, Max, Min, Reset, Exit.
- Upper limit value (display only): Max L/min.
- Lower limit value (display only): Min L/min.
- Peak hold Reset: Press **SET/OK**.

Labels in the diagram include: Peak hold instantaneous flow rate, Peak hold temperature, Upper limit value (display only), Lower limit value (display only), and Peak hold Reset.

7. Energy Saving setting

Energy saving can be set to "ON" or "OFF".
 When set to ON, the liquid crystal backlight turns OFF after 1 minute of inactivity.

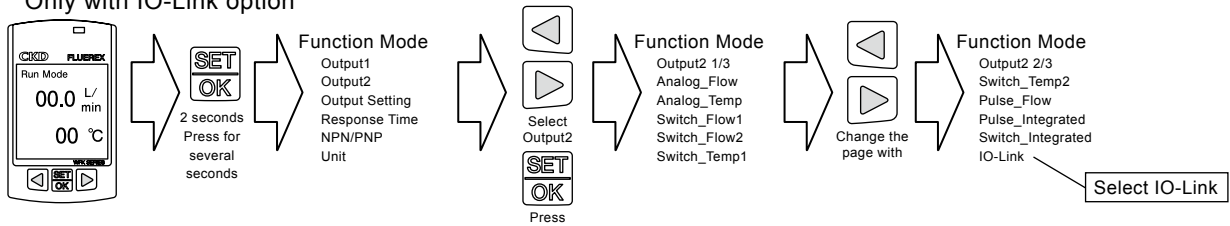
The navigation steps are as follows:

- Press **SET/OK** for 2 seconds.
- Function Mode: Output1, Output2, Output Setting, Response Time, NPN/PNP, Unit.
- Change the page with left/right arrows.
- Function Mode: Span Adjustment, Display, Color, Peak Hold_Q, Peak Hold_T, Operating Time.
- Change the page with left/right arrows.
- Function Mode: Energy Saving, Output Simulation, Copy Mode, Reset Setting, Exit.
- Select Energy Saving with left/right arrows.
- Function Mode: Energy Saving, ON, OFF, Exit.
- ON/OFF selection: Press **SET/OK**.

8. IO-Link

Acquiring measurement data, changing the threshold, and other bi-direction communication are possible with an IO-Link connection (OUT 2 only).

* Only with IO-Link option



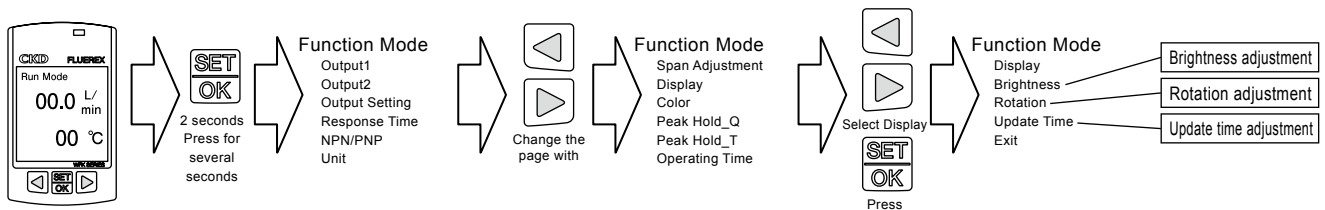
9. Screen display

(1) Display

Brightness select from 25%, 50%, 75%, and 100%.

Rotation select from 0°, 90°, 180°, and 270°.

Update time select from 0.25 sec, 0.5 sec, 1 sec, 5 sec, and 10 sec.



(2) Color

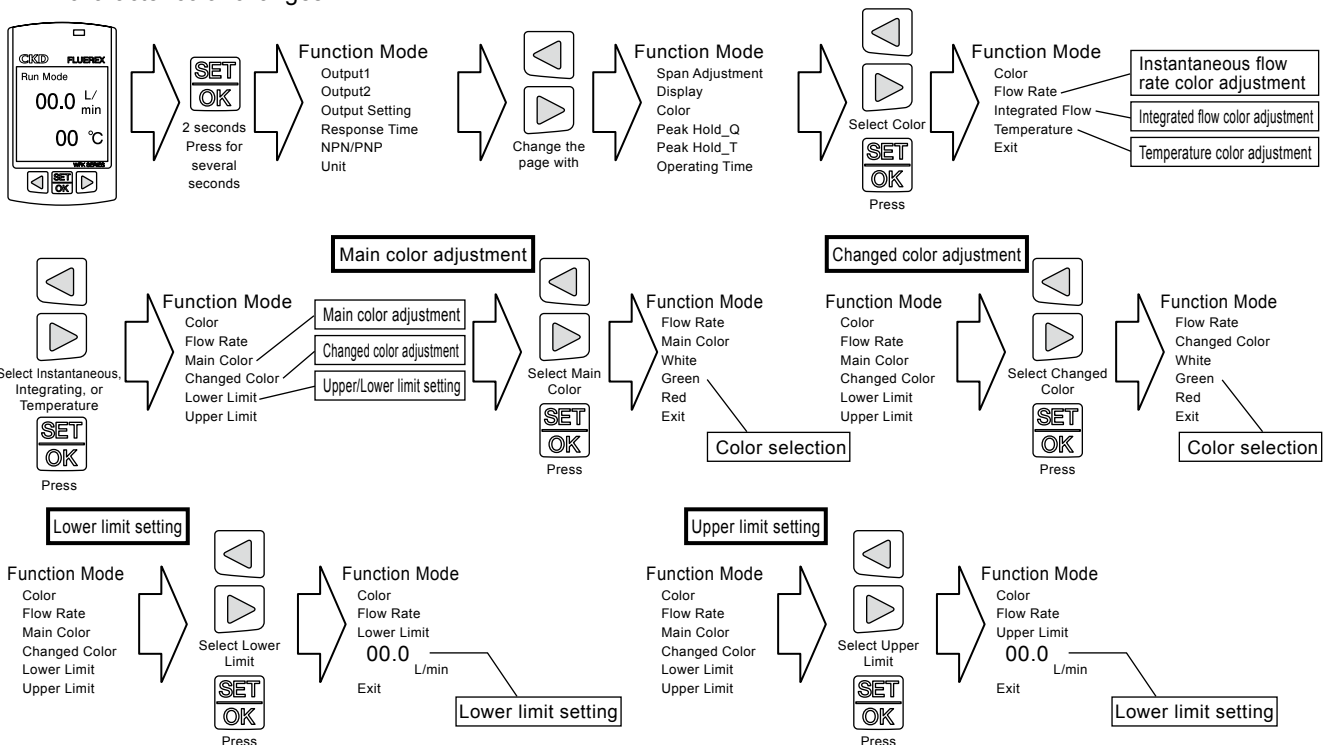
Main Color: change the color of characters on the main display. (Select from white, green, and red)

Changed Color: change the color when the instantaneous flow rate, integrating flow rate, and temperature go above or below their set upper and lower limits.

Change character color select from white, green, and red

- Upper limit setting: the upper limits of instantaneous flow rate, integrating flow rate, and temperature at which character color changes.

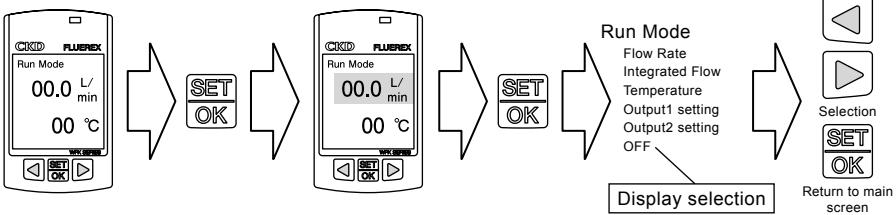
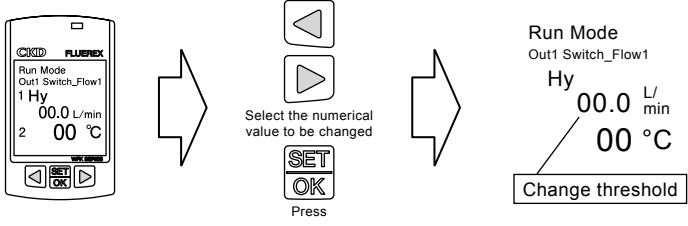
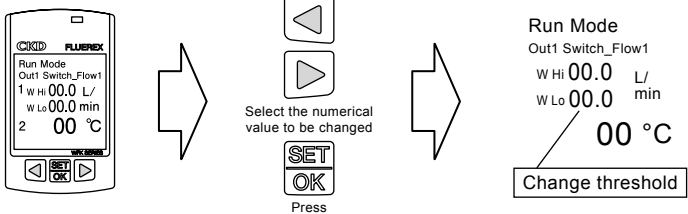
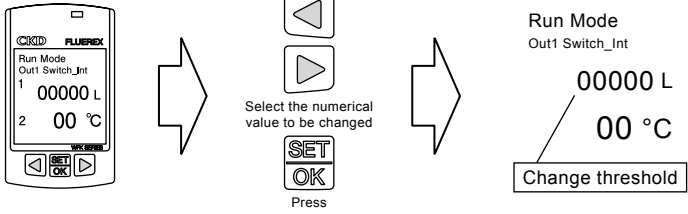
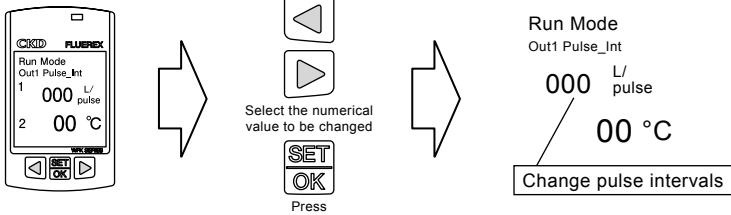
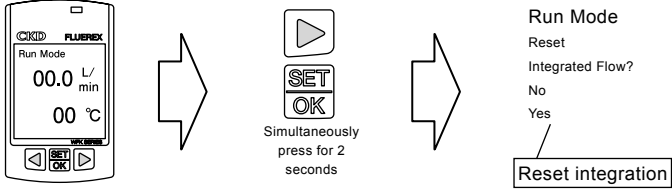
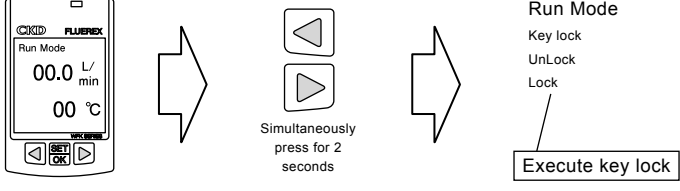
- Lower limit setting: the lower limits of instantaneous flow rate, integrating flow rate, and temperature at which character color changes.



Refer to the instruction manual regarding operation of other functions (setting copy, external input, unit change, simulation output, power ON time display, all reset, etc.).

Easy setting function

Frequently used settings can be set from the normal screen using shortcut operations.

<p>Change main screen display</p>	
<p>Switch setting Hysteresis mode</p> <p>Window mode</p>	 
<p>Integrated Switch setting</p>	
<p>Integrated Pulse setting</p>	
<p>Integration reset</p>	
<p>Key lock</p>	



Safety Precautions

Always read this section before use.

When designing and manufacturing a device using CKD products, the manufacturer is obligated to check that device safety mechanism, pneumatic control circuit, 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 with specifications.
This product must be used within its stated specifications. In addition, never modify or additionally machine this product. This product is intended for use in general industrial machinery equipment or parts. It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments. (Note that this product can be used when CKD is consulted prior to use and the customer consents to CKD product specifications. The customer must provide safety measures to avoid risks in the event of problems.)
 - ①** Use for applications requiring safety, including nuclear energy, railways, aircraft, marine vessels, vehicles, medical devices, devices or applications in contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, and safety devices or applications.
 - ②** Use for applications where life or assets could be significantly affected, and special safety measures are required.
- 3** Observe organization standards and regulations, etc. related to the safety of device design and control, etc.
ISO4414, JIS B 8370 (General rules for pneumatic systems)
JFPS2008 (Principles for pneumatic cylinder selection and use)
Including High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, body 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 all systems 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 note any possible water electricity leakage.
 - 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 in the following pages to prevent accidents.

■ The precautions 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, and when there is a high degree of emergency to a warning.
-  **WARNING:** If handled incorrectly, a dangerous situation may occur, resulting in death or serious injury.
-  **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. Every item provides important information and must be observed.

Limited warranty and disclaimer

- 1** Warranty period
This warranty shall be valid for one year after delivery to the customer's designated site.
- 2** Scope of warranty
If any faults, found to be the responsibility of CKD, occur during the above warranty term, the product shall be replaced, the required replacement parts provided free of charge, or shall be repaired at the CKD factory free of charge.
This Limited Warranty will not apply to:
 - (1) Failures due to use outside the conditions and environments set forth in the catalog or these specifications.
 - (2) Failures resulting from factors other than this product.
 - (3) Failures caused by improper use of the product.
 - (4) Failures resulting from modifications or repairs made without CKD consent.
 - (5) Failures caused by matters that could not be predicted with the technologies in practice when the product was delivered.
 - (6) Failures resulting from natural disasters or accidents for which CKD is not liable.The warranty covers the actually delivered product, and does not cover any damage resulting from losses induced by faults in the delivered product.
- 3** Compatibility check
The customer is responsible for confirming the compatibility of CKD products with the customer's systems, machines and equipment.



Water-use equipment

Safety Precautions

Always read this section before use.

Design/selection

1. Working fluids

⚠ DANGER

- Do not use in drinking water. As it does not conform to the requirements of the Food Sanitation Act, do not use this product for applications that measure water entering the human body. Intended applications include industrial sensors.
- Do not use this product for flammable fluids.

⚠ WARNING

- This product cannot be used as a business meter. This product does not comply with Measurement Laws, and cannot be used for commercial business. It cannot be calibrated, so use it as an industrial sensor.
- Applicable fluid is water (industrial water, pure water); do not use with any other fluid.

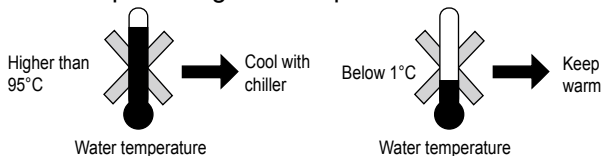
2. Working environment

⚠ DANGER

- Explosion-proof environment. Never use this product in an explosive gas atmosphere. The structure is not explosion-proof, and explosions or fires could occur.

⚠ WARNING

- Corrosive environment. Do not use this product in an atmosphere containing corrosive gases such as sulfur dioxide.
- Fluid temperature and ambient temperature. Use in a fluid temperature range of 1 to 95°C, and an ambient temperature range of 0 to 50°C. If the fluid temperature rises to 95°C or higher, cool it down using a cooling system such as a chiller. As well, if there is a risk of freezing, drain the product or keep it warm to prevent freezing. When the fluid and ambient temperatures are high, the product may also get hot. There is a risk of burns if it is touched directly. Even if the ambient temperature is within the specified range, do not use this product in a location where rapid changes in temperature can occur.



- Max. working pressure. Do not use at a pressure exceeding the max. working pressure, as excessive pressure can cause product failure. To prevent the pressure from reaching the max. working pressure, particularly due to water hammer, take the following measures:
 - Using a water hammer reduction valve or other similar mechanism, reduce the valve closing speed.
 - Using elastic piping material, e.g. rubber hose, and an accumulator, absorb the impact pressure.
 - Make the pipe length as short as possible.
- Drip-proof environment. This product employs a dust-proof, drip-proof structure that provides reliability during maintenance and cleaning, during which it may be exposed to water splashing. However, avoid using this product in a location where it may be constantly exposed to water or intense splattering of water and/or oil.

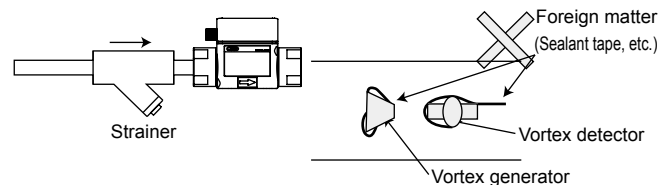
- CE-compliant working conditions. This product is CE-marked, indicating conformity with the EMC Directives. The standard for the immunity for industrial environments applied to this product is EN61000-6-2; the following requirements must be satisfied in order to conform to this standard:

Conditions

- The assessment of this product is performed by using a cable pairing a power supply line and a signal line, treating this cable as a signal line.
- This product is not equipped with surge protection. Implement surge protection measures on the system side.

⚠ 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 or vortex detector, measurement accuracy can be compromised.

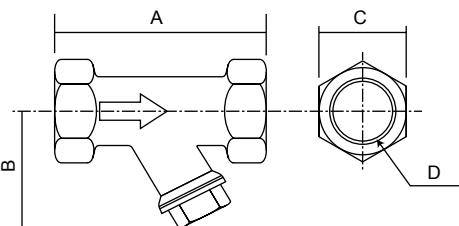


Strainer specifications

Descriptions	Usage
Specification fluid	Water
Pressure resistance	MPa 2
Working pressure range	MPa 0 to 1
Operating ambient temperature range	°C 1 to 90
Main material	Usage
Body	Copper alloy casting
Strainer	Stainless steel

When using after adjusting to a small flow rate with the manual valve, the valve's opening (clearance) becomes very small. If there are large foreign bodies in the fluid, they may clog the clearance and reduce the flow rate.

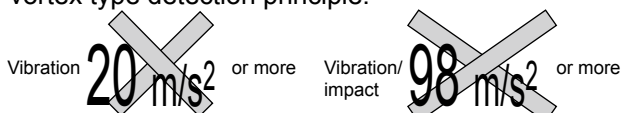
External view of strainer



Model No.	A	B	C	D
WF-FL-280730	70	44	23	Rc3/8
WF-FL-280731	80	49	28	Rc1/2
WF-FL-280732	100	57	35	Rc3/4
WF-FL-280733	115	72	43	Rc1
WF-FL-280734	135	82	52	Rc1 1/4
WF-FL-280735	160	98	59	Rc1 1/2

■ Vibration/impact

Do not use this product in an environment exposed to vibrations of 20 m/s² and over and shocks of 98 m/s² and over. This may cause malfunction and/or damage, as this product uses the Karman's vortex type detection principle.



Mounting, installation and adjustment

1. Wiring

⚠ DANGER

- Use with power supply voltage and output in the specified range.
Applying a voltage that is outside of the specified range may cause malfunction, damage to the sensor, electrical shock, and/or fire.
Do not use any load that exceeds the rated output. Using such a load may result in damage to the output part or fire.

⚠ WARNING

- Check the wire color and terminal No. when connecting wires.
An overcurrent protection circuit for the output transistor and a protection circuit for erroneous wiring, which uses diodes to prevent reverse connection, are implemented, but 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 wiring colors and terminal numbers in order to ensure correct wiring.
- Check wiring insulation.
Check that wires do not come into contact with other circuits, that no ground faults occur, and that the insulator between terminals is not defective. Otherwise, overcurrent may flow into the sensor, causing damage.

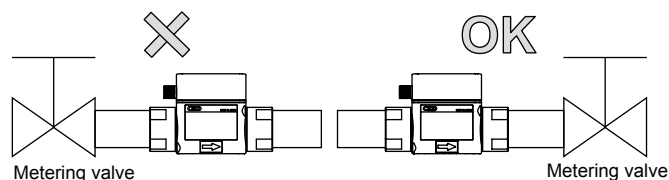
⚠ CAUTION

- Keep the cable far away from power cords or other things that may cause noise. 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 protectionapprox. 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. This may lead to disconnection.

2. Piping

⚠ CAUTION

- Pipes can be installed vertically, horizontally, or in any other orientation. Note that pipes should be installed so that the fluid constantly fills the piping while 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 rate sensor, or if there is a valve or other restricting component on the primary side, cavitation occurs inside the pipe, preventing accurate measurement. For this reason, such piping should be installed on the secondary side of the sensor.
Cavitation...(Vapor cavities that form due to the static pressure at end points, such as a ship propeller, dropping below the vapor pressure of the water. Reduced efficiency or screw damage may result.)



However, operating the pump with the secondary side valve closed may cause the flow rate 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 10 times or more bore size is installed between the valve and the flow rate sensor.

- Using an elbow or bush in the piping
When using an elbow or bush in the piping, provide straight piping sections of at least 10 D on the IN side and 5 D on the OUT side when using a WFK2-100 or WFK2-250 Series model. Note that bore size change by bush should be limited to one size. 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, and WFK2-050 Series. However, it is recommended that a straight pipe is installed to ensure stable measurements.)

* "D" here indicates the inner diameter of the piping material. Refer to the table below for specific values.

Bore size	Rc3/8 (10A)	Rc1/2 (15A)	Rc3/4 (20A)	Rc1 (25A)	Rc1 1/4 (32A)	Rc1 1/2 (40A)
5D	50 mm	75 mm	100 mm	125 mm	160 mm	200 mm
10D	100 mm	150 mm	200 mm	250 mm	320 mm	400 mm

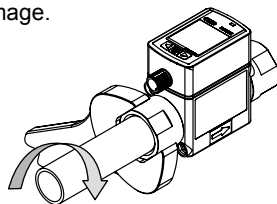
- Use proper torque to tighten the pipes when connecting them.
 - The purpose is to prevent water leakage and screw damage.
 - First tighten the screw by hand to ensure that threads are not damaged, then use a tool.

(Recommended values)

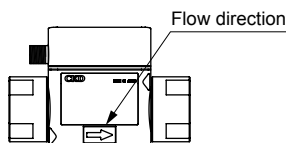
Port thread	Tightening torque N·m
Rc3/8	31 to 33
Rc1/2	41 to 43
Rc3/4	62 to 65
Rc1	83 to 86
Rc1 1/4	94 to 100
Rc1 1/2	104 to 108



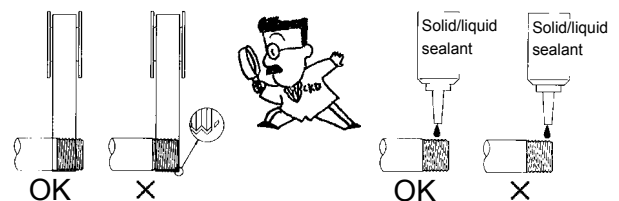
- When mounting piping or fittings to this product, always hold the attachment on the mounting side with a tool. Holding the body of the product or the attachment on the opposite side may lead to damage.



- When installing piping, align the fluid flow direction to the direction marked on the body. Connecting the pipe in the wrong direction prevents correct measurement of the flow rate.



- Before installing piping, clean the pipes to remove foreign matter, cutting chips, residual testing water, etc.
- Make sure that no force is applied to the resin parts when piping.
- Make sure that the self-weight of the piping is not applied to flow rate sensor. It may lead to damage or external leakage. We recommend that piping be fixed during operation.
- Make sure that no sealing tape or adhesive enters the pipes when connecting the piping.
- When freezing may occur, take antifreezing measures with the devices used, such as draining the pipes of water.
- If there is significant difference between the ambient temperature and the fluid temperature, condensation occurs, which can enter wiring parts and cause operation failure. If condensation should occur, ensure that the mounting orientation of the flow rate sensor is horizontal and the display is facing upward.
- When connecting pipes, wrap sealing tape in the opposite direction from threads starting 2 mm inside from the end of piping threads.
 - If sealing tape protrudes from the pipe threads, it could be cut when screwing the bolts in. This could cause the tape to enter the valve, causing failures.
 - When using a liquid sealant, make sure it does not adhere to resin parts. Otherwise resin parts could be damaged, which is dangerous.



During Use & maintenance

1. Common

⚠ CAUTION

- If a problem occurs during operation, immediately turn the power off, stop use, and contact your dealer. The display may become warm (approx. 40°C), but this is not an abnormality.
- Hardware check and other internal settings are performed during approximately the first two seconds after turning the power on. Display and output do not function normally during this period. 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.
- If the output setting value is changed, control system devices could operate unintentionally. Stop devices before changing settings.
- Ensure proper operation through periodic inspections.
- When removing the equipment, shut off the power, make sure that no water pressure is applied, and take other safety precautions beforehand.
- Do not disassemble or modify this product. Doing so could result in faults.
- When cleaning the product, use a low-polluting cleaning agent such as a neutral detergent.
- Be sure to perform air blow from the downstream direction. Set pressure to 0.3 MPa or less.
- After adjusting the flow rate, be sure to fix the manual valve with the push lock.
- Do not turn the flow rate adjustment manual valve forcibly.

2. Applicable fluid

⚠ CAUTION

- Follow the precautions below for the applicable fluids to be measured. If the following water quality standards are not met, performance may be compromised.
- The water quality of the applicable fluid should be as per the "Guideline of Water Quality for Refrigeration and Air Conditioning Equipment" (water quality standard: cooling system - circulating type - circulating water) provided by the Japan Refrigeration and Air Conditioning Industry Association.

Descriptions	Chemical formula	Unit	Water quality standard
pH	-	pH (25°C)	6.5 to 8.2
Electrical conductivity	-	mS/m (25°C)	0.2 to 80 *1
Chloride ion	Cl ⁻	mg/L (ppm)	200 or less
Sulfate ion	SO ₄ ²⁻	mg/L (ppm)	200 or less
Acid consumption (pH4.8)	CaCO ₃	mg/L (ppm)	100 or less
Total hardness	CaCO ₃	mg/L (ppm)	200 or less
Calcium hardness	CaCO ₃	mg/L (ppm)	150 or less
Ionized silica	SiO ₂	mg/L (ppm)	50 or less
Iron	Fe	mg/L (ppm)	1.0 or less
Copper	Cu	mg/L (ppm)	0.3 or less
Sulfide ion	S ²⁻	mg/L (ppm)	Not detected
Ammonium ion	NH ₄ ⁺	mg/L (ppm)	1.0 or less
Residue chlorine	Cl	mg/L (ppm)	0.3 or less
Free carbonic acid	CO ₂	mg/L (ppm)	4.0 or less
Stability index	-	-	6.0 to 7.0

- *1 Electrical conductivity should be 0.2 mS/m and over. For use in the range of 0.05 to 0.2 mS/m, consult with CKD. Do not use for ultrapure water, i.e. water with electrical conductivity below 0.05 mS/m.

Related products

Multi-monitor MD Series

- Compatible with flow rate and pressure without choosing a sensor
- Analog output proportional to the displayed value possible
- Easy to read 3-color display
- Lock function prevents misoperation
- Energy-saving mode
- Display of sensor input can be converted to any value with the scaling function

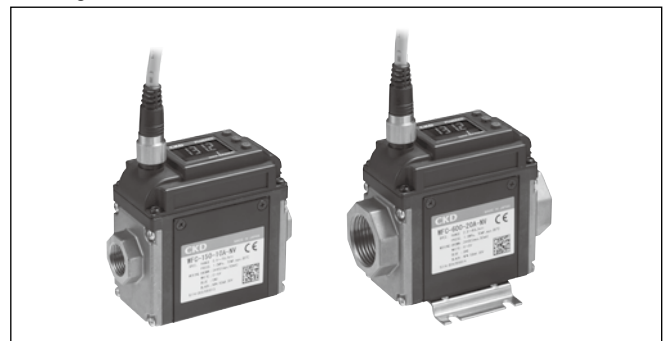
Catalog No. CC-1290A



Capacitance electromagnetic flow sensor WFC Series

- The Flo-Thru structure allows use even with water of poor quality
- The capacitance structure prevents detection failures caused by foreign matter deposited onto the electrode
- Repeatability in elbow piping ensured
- Stabilized power supply and anti-noise ferrite core not required
- Allows zero point adjustment by external input
- With 180° invertible display
- Reverse flow detection function equipped

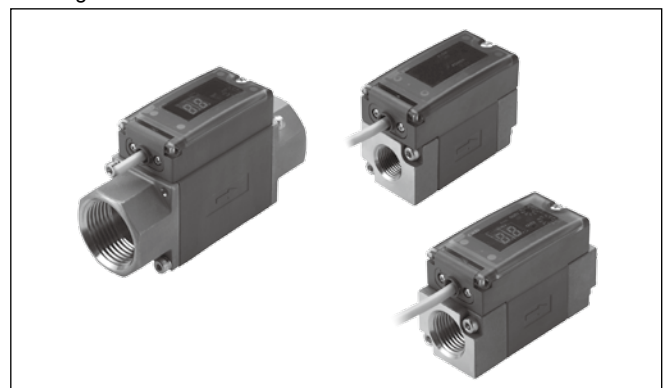
Catalog No. CC-1230A



Karman vortex flow rate sensor for water WFK 3000 Series

- A wide variety of models
 - Sensor type S Series
 - Switch type M Series
 - Sensor/Switch type C Series
- Easy operation that does not require a manual
- Sensor with water temperature measuring function
- Highly reliable Karman's vortex used
- IP65 equiv. protection structure

Catalog No. CC-1292A



Integrated unit for water control WXU Series

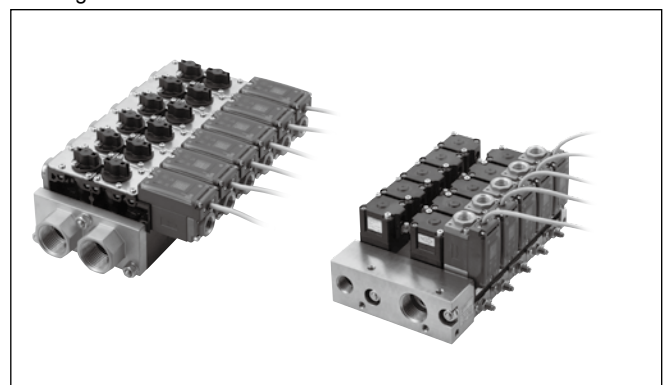
- Space-saving and piping free

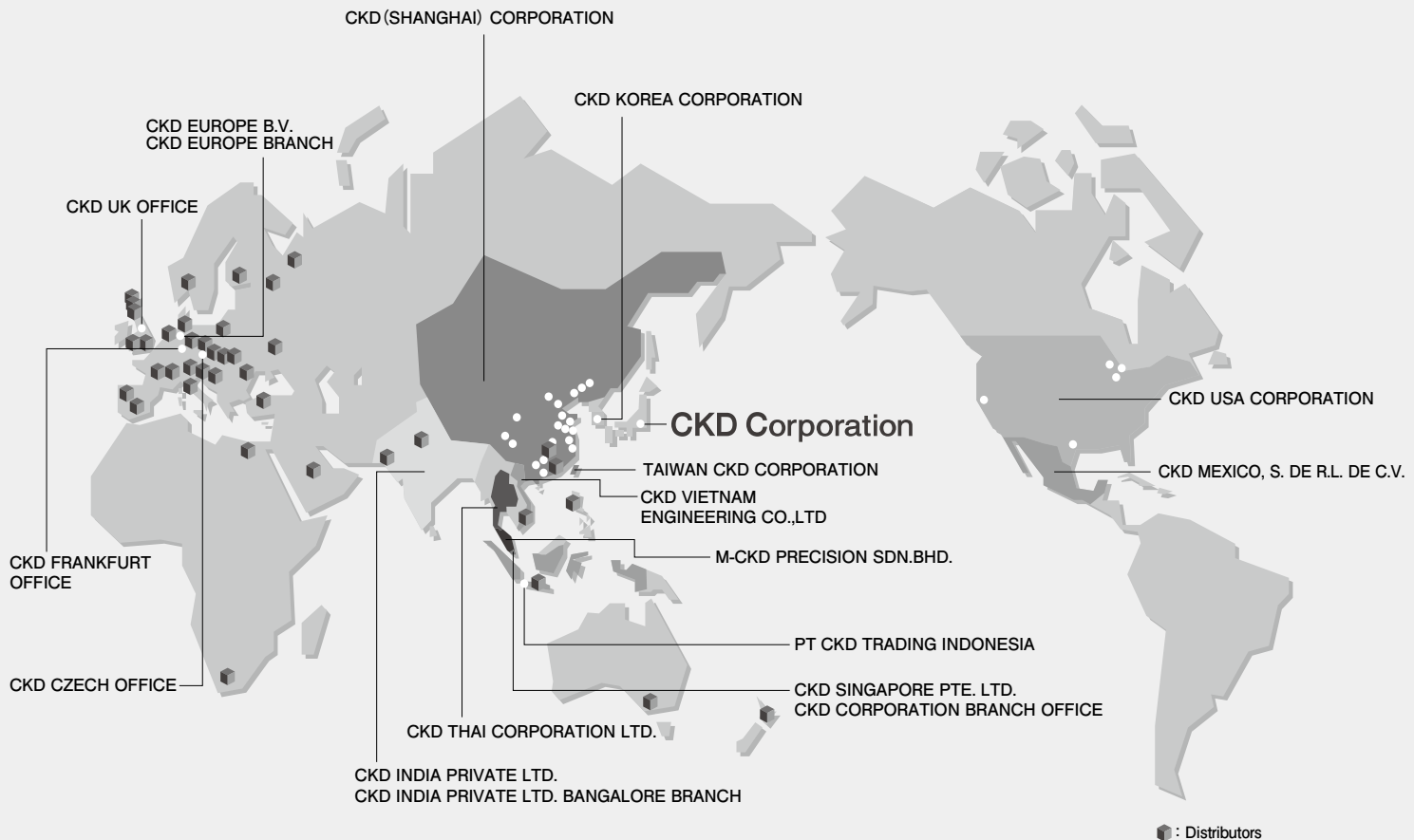
The unitized design without piping has greatly reduced the installation space compared with the discrete. 80% smaller footprint than conventional models (two fluid control)
- Quality improvement

There is no screw-in piping between devices, removing concerns about external leakage. Entry of foreign matter during operation is prevented.
- Reduces workload

Piping design, piping work, material preparation, and other troublesome work reduced significantly

Catalog No. CC-1116A





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