Karman Vortex Flow Rate Sensor

FLUEREX ® WFK2

■ Flow rate sensor

CONTENTS

Flow rate sensor
Compact flow sensor (gas)
Compact flow sensor (air)
Compact flow sensor (liquid)
Water Manifold Unit
Ending

KARMAN VORTEX FLOW SENSOR FLUEREX® WFK2 Series

Diverse and easier to use

2018 Good Design Award

Needle
Manual valve
Compatible

Fluorine
Fluid
compatible

Model variations	Port size	Flow rate range (L/min)	Option
WFK2-005	Rc G NPT 3/8 1/2 3/4	0.4 – 5	Manual valve integrated: Cock type, Needle type
WFK2-020		1.6 – 20	
WFK2-050		4 – 50	
WFK2-100	Rc G NPT 1 1 1/4 1 1/2	8 – 100	
WFK2-250		20 – 250	

Compatible with fluorine liquids

Compatible with fluorine liquids with excellent electrical insulation. Ideal for managing coolant, etc., of semiconductor manufacturing equipment. Compatible with liquids with low global warming potential.

Fluorinert™	Galden®	Novec™	Opteon™
FC-3283	HT135	Novec7300	SF10
FC-40	HT200		

*Compatible models: WFK2-005, WFK2-020, WFK2-050

Compatible with flow rates of 0.4 to 250 L/min

Compatible with a wide range of flow rates.

All models equipped as standard with fluid temperature measuring function

Saves space and wiring time with no need for a separately installed temperature sensor. The product is not easily affected by ambient temperature as there is a temperature sensor inside.

Easy flow rate adjustment (Option)

Cock: Valve can be easily opened and closed.
Needle type: Manual valve for fine adjustment.

Cock type

Needle type

Various output functions available

OUT1		OUT2	
Analog Output	Switch Output NPN/PNP can be switched	Analog Output	Switch Output NPN/PNP can be switched
› Instantaneous flow rate › Temperature	› Instant flow rate1/2 › Temp1/2 › Accumulated flow	› Instantaneous flow rate › Temperature	› Instant flow 1/2 › Temp1/2 › Accumulated flow
Pulse Output	External Input	Pulse Output	IO-Link
› Accumulated flow	› Accumulated flow reset › Peak hold reset	› Accumulated flow	

*Fluorinert ™ Novec ™ is a trademark of 3M Corporation.
*Galden® is a registered trademark of Solvay Specialty Polymers Japan Co., Ltd.
*Opteon ™ is a trademark of Chemours-Mitsui Fluoroproducts.

Easy to read 2-screen color LCD

Temperature, integrating flow, set value, etc., can be displayed simultaneously. The display color can be selected from white, green, and red.

Upper row: Instantaneous flow rate
Lower row: Fluid temperature

Upper row: Instantaneous flow rate (green)
Lower row: Fluid temperature (red)

Upper row: Accumulated flow
Lower row: Instantaneous flow rate

Upper row: Instantaneous flow rate
Lower row: OUT1 output setting value

Indicator screen rotation

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

Easy setting function

Frequently used settings can be set from the normal screen using shortcut operations. Example: Output threshold can be changed while viewing the current flow rate value.

Supports fluid temperatures up to 95°C

Ideal for detecting the return flow of cooling liquid, which tends to get hot.

Casting machine coolant

Heated fluid for mold temperature controlling

Laser oscillator cooling

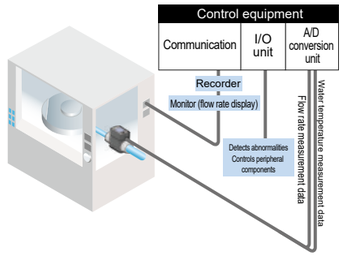
ATEX compliant (option)

ATEX compliant.

Examples of applications

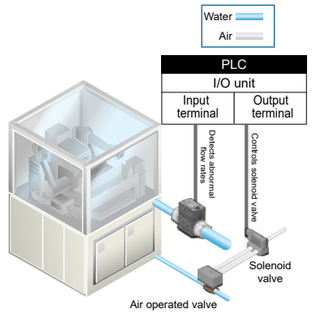
Semiconductor — Semiconductor manufacturing equipment

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



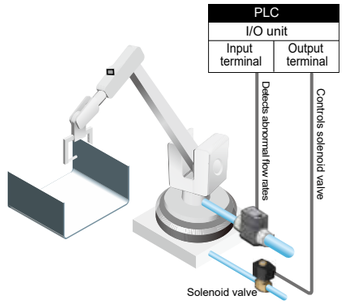
Tempering — Induction hardening device

Quantitative management of cooling fluid.



Welding — Spot welding machine

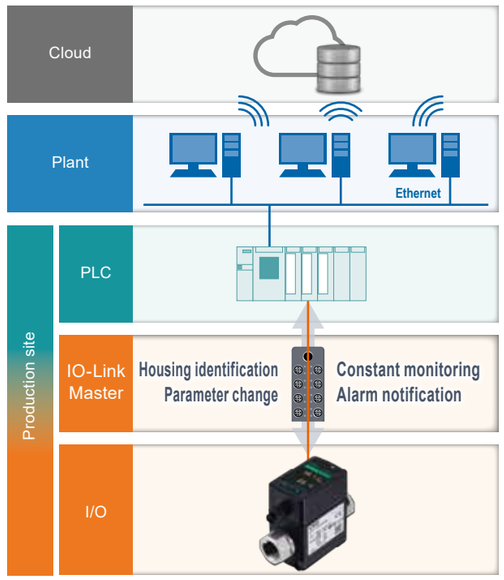
Spot welding machine coolant control and flow rate abnormality detection for chip fallout.



IO-LINK compatible

IO-Link

IO-Link is a digital communication standard for sensors/actuators at factory sites. (IEC 61131-9)
Unlike analog communication, it enables the transmission of parameters and event data.



Features of IO-Link

- Constant monitoring via digital data is possible.
- Parameters can be set and changed via the network, enabling remote equipment operation.
- Models, serial numbers, etc., can be confirmed on the network.
- The settings can be copied from the master, making parameter reconfiguration after maintenance obsolete.
- Device failure and disconnection can be confirmed.
- It can also be converted to Ethernet networks and connected, enabling devices to be IoT-ready.

FP Food Process™

Contact CKD for support for food manufacturing processes FP series.

Karman Vortex Flow Rate Sensor FLUEREX

WFK2 Series

Small body

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

Refer to the CKD website for detailed compatible model Nos.

Model No. Notation Method

WFK2 - 005 AA A A N - A C -

Model No. ❶Flow rate range ❷Port size ❸IO-Link analog output ❹Unit indicated ❺Manual valve ❻Option (cable included) ❼Option (Bracket included) ❽Option (other)

❶Flow rate range

Code	Description
005	0.4 to 5 L/min
020	1.6 to 20 L/min
050	4 to 50 L/min

❷Port size

Code	Description
AA	Rc3/8
BA	Rc1/2
CA	Rc3/4
AB	G3/8
BB	G1/2
CB	G3/4
AC	NPT3/8
BC	NPT1/2
CC	NPT3/4

❸IO-Link / Analog output

Code	Description	
A	Switch / Analog output	0 to 5 VDC, 1 to 5 VDC
B		4 to 20 mA DC
C		0 to 10 VDC, 1 to 10 VDC
D	IO-Link compatible (Note)	0 to 5 VDC, 1 to 5 VDC
E		4 to 20 mA DC
F		0 to 10 VDC, 1 to 10 VDC

Note: IO-Link "D", "E" and "F" after not in use have analog output specifications.

❹Unit indicated

Code	Description
A	L/min L m^3 °C
B	L/min, us gal/min L, m^3us gal °C, °F

Note: The display unit code "B" is for overseas use and cannot be used in Japan.

❺Manual valve

	Code	Description	
	N	Sensor only	
*1 *2	A	With manual valve (cock type)	
*2	B	With manual valve (needle-type)	

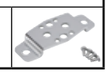
*1: ❸ Manual valve (cock) cannot be selected for the option "SF" (fluorine-based liquid compatible).
*2: Select "A", "B" (with manual valve), ❼ if the included bracket is selected, two sets of brackets are included.

❻Option (attached cable)

Code	Description	
Blank	None	
A	Standard cable (M12/4-conductor/ 3 m) attached	
B	Double ended connector cable (M12/4-conductor/ 3 m) attached	

Note: For ❸option "EX" (ATEX compatible), cable attachment cannot be selected.

❼Option (attached bracket)

Code	Description	
Blank	None	
C	Bracket attached (Note)	

Note: When selecting "A" or "B" with ❺manual valves in Item, two sets of brackets are attached.

❽Option (other)

	Code	Description
	Blank	None
*1 *2	EX	ATEX Compliant
*3	SF	Compatible with fluorinated liquids

*1: For ❻"EX" (ATEX compatible), Item "Cable included" cannot be selected.
*2: For details of specifications, refer to "Options (ATEX compatible)" on Page 445.
*3: Type with manual valve (cock) cannot be selected for "SF" (fluorine-based liquid compatible).

Discrete option model No.

For dimensions diagram, refer to Page 431.

●Cable option

Standard cable

WF-FL-280741

Double ended connector cable

WF-FL-662453

●Bracket option

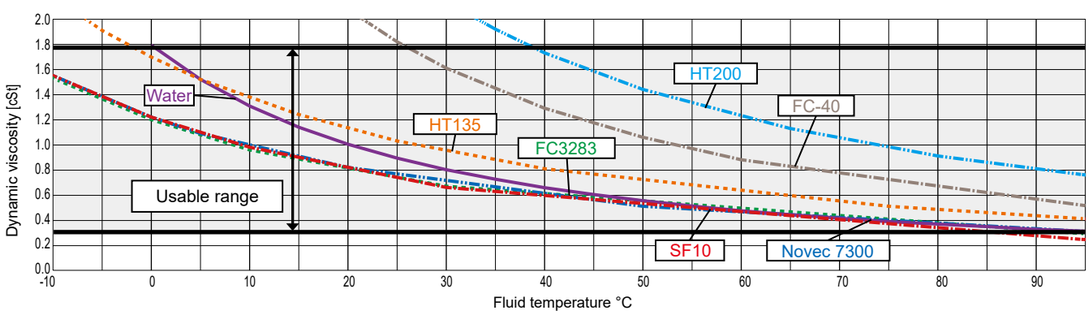
WF-FL-315544

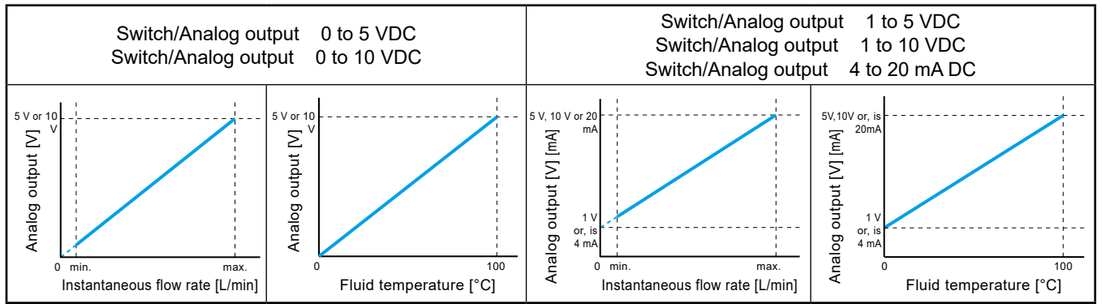
Specifications

Item			WFK2-005	WFK2-020	WFK2-050
Connection	Port size	Rc, G, NPT	3/8, 1/2, 3/4		
	Port material		Stainless steel		
Working Conditions	Applicable fluid		Pure water, industrial water Fluorine liquid compatibility option: Fluorinert™ (FC-3283, FC-40), Galden® (HT135, HT200) Novec™ 7300, Opteon™ SF10 *1		
	Max. working pressure	MPa	1.0		
	Proof pressure	MPa	1.5		
	Manual valve (cock type) Internal leakage	mL/min	0		
	Manual valve (cock type) allowable back pressure	MPa	0.3		
	Ambient temperature	°C	0 to 50 (85% RH or less, no condensation)		
	Fluid temperature *2	°C	Standard: 1 to 95 Fluorine liquid compatibility option: -10 to 95		
Flow rate	Flow rate range	L/min	0.4 to 5	1.6 to 20	4 to 50
	Repeatability *3		Analog output accuracy: ±2.5%F.S. Display accuracy: ±2.5%F.S.±1digit (min. display unit)		
	Temperature characteristics *3, *4		±5%F.S. (base temperature 25°C, 10 to 50°C)		
	Low flow cut		5% of F.S.		
	Accumulated flow range *5		99999 L or 99999 m³ (Unit can be selected) Reset when the power is turned OFF		
	Integrated pulse rate *5	L/pulse	0.1, 0.5, 1	0.1, 0.5, 1, 10	0.5, 1, 10, 50
	Pressure loss (for water)	MPa	0.07 (at F.S.)	0.05 (at F.S.)	0.05 (at F.S.)
	Response time *6	sec	0.25, 0.5, 1, 5, 10 (default 1)		
Temperature	Measurement temperature	°C	−10 to 100		
	Accuracy	°C	0 to 50: analog output accuracy ±2, display accuracy ±2±1digit (min. display unit 1)		
			50 to 100: analog output accuracy ±3, display accuracy ±3±1digit (min. display unit 1)		
Output	Indicator		Two-screen LCD display, instantaneous flow rate: 3 digits, liquid temperature: 2 digits, accumulated flow: 5 digits, with screen rotation		
	Analog output *7		Standard: 0 to 5V, 1 to 5 VDC Option: 4 to 20 mA DC, 0 to 10 V, 1 to 10 VDC		
	Switch Output		NPN or PNP open collector output (can be switched from settings)		
		Max. load current	50 mA		
		Max. applied voltage	30 VDC		
		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 *8			50 mA or less		
Mounting	Mounting orientation		Unrestricted in vertical/horizontal direction		
	Straight piping section		None		
	Degree of Protection		IP 65 or equiv.		
	Weight	g	3/8 (Rc, G, NPT): approx. 320, approx. 510 with manual valve (cock type), approx. 820 with manual valve (needle type) 1/2 (Rc, G, NPT): approx. 320, approx. 510 with manual valve (cock type), approx. 820 with manual valve (needle type) 3/4 (Rc, G, NPT): approx. 400, approx. 590 with manual valve (cock type), approx. 880 with manual valve (needle type)		

*1: Fluorinert™ Novec™ is a trademark of 3M Corporation. Galden® is a registered trademark of Solvay Specialty Polymers Japan Co., Ltd. Opteon™ is a trademark of Chemours-Mitsui Fluoroproducts.
*2: For fluorine liquids, depending on the type, the measurable fluid temperature range will differ. Refer to the measurable fluid temperature range graph.
*3: Accuracy is the average value over 10 sec. (for conditions not containing air bubbles). F.S. stands for full scale flow rate.
*4: This temperature characteristic is for water. For fluorine liquids, check the corresponding dynamic viscosity range.
*5: The integrating flow is a calculated (reference) value. It is reset when the power is turned OFF. Errors may occur between the accumulated flow display and integrated pulse output.
*6: The time to attain 70% of the original output after the normal flow rate (used) drops instantly to 0.
*7: Check the allowable load on the wiring method page.
*8: Current for when 24 VDC is connected, and no load is applied. Please note that the current consumption changes depending on the load connection status.

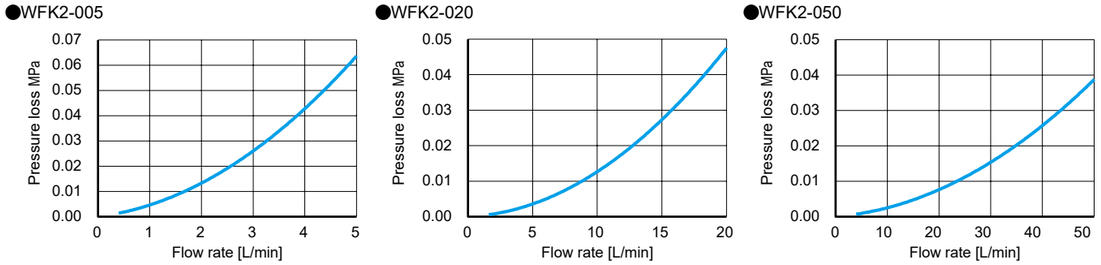
Measurable fluid temperature range





Note: Output value without adjustment of original range analog output or span.

Pressure loss (when the fluid is water)



Note: Conversion to fluorine liquid If the flow path volume and flow rate are the same, the pressure loss is proportional to the specific gravity because the formula below holds.

$$\frac{\Delta p_1}{G_1} = \frac{\Delta p_2}{G_2}$$

Δp: Pressure loss (MPa)
G: Specific gravity (ratio of density to water)

Manual valve (needle) Flow characteristics (when the fluid is water)

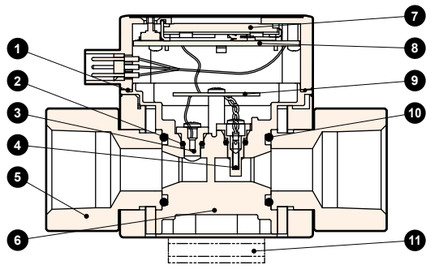
*1: Internal leakage occurs even when the needle valve is at 0 rotation speed (fully closed).
*2: Needle flow characteristics conversion
The following formula is valid when the number of knob rotations is the same as the pressure loss.
Thus, the fluorine liquid flow rate Q_2can be calculated as the square root of the flow rate of water Q_1 divided by the specific gravity G_2 of the liquid.

$$Q_1^2 G_1 = Q_2^2 G_2$$

Q: Flow rate (L/min)
G: Specific gravity (ratio of density to water)
G_1: Specific gravity of water = 1

Internal Structure Diagram / Material

●WFK2-005,020,050

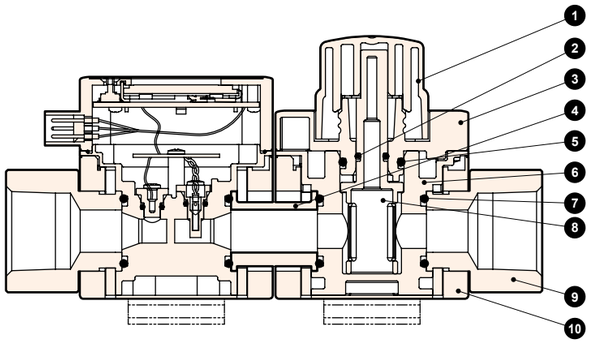


Cannot be disassembled

Part No.	Part name	Material		Quantity
1	Packing	FKM	Fluoro rubber	1 or 2
2	O-ring *1	FKM	Fluoro rubber	2
3	Temperature sensor	SUS316L	Thermistor	1
4	Karman's vortex street detection sensor	PPS resin	Piezoelectric element	1
5	Attachment	SUS304 or SCS13		2
6	Sensor body	PPS resin		1
7	Liquid crystal			1
8	CPU board			1
9	Sensor board			1
10	O-ring *1	FKM	Fluoro rubber	2
11	Bracket (option)	SUS304 or SPCC		(1)

*1: EPDM (ethylene propylene diene rubber) is used for fluorine-based liquids.
*2: Wetted parts are②,③,④,⑤,⑥,⑩.

●WFK2-005,020,050□□□□A (cock)

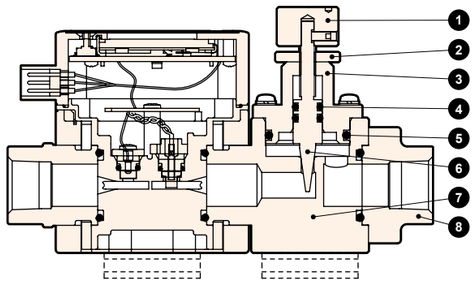


Cannot be disassembled

Part No.	Part name	Material		Quantity
1	Handle	POM resin		1
2	O-ring	FKM	Fluoro rubber	1
3	Stuffing	PPS resin		1
4	Spacer	SUS304 or SCS13		1
5	O-ring	FKM	Fluoro rubber	1
6	Cock body	PPS resin		1
7	O-ring	FKM	Fluoro rubber	2
8	Cock	PPS resin		1
		FKM	Fluoro rubber	
9	Attachment	SUS304 or SCS13		2
10	External case	PBT resin		1

Note: Wetted parts are ②, ③, ④, ⑤, ⑥, ⑦, ⑧ and ⑨.

●WFK2-005,020,050□□□□B (needle type)



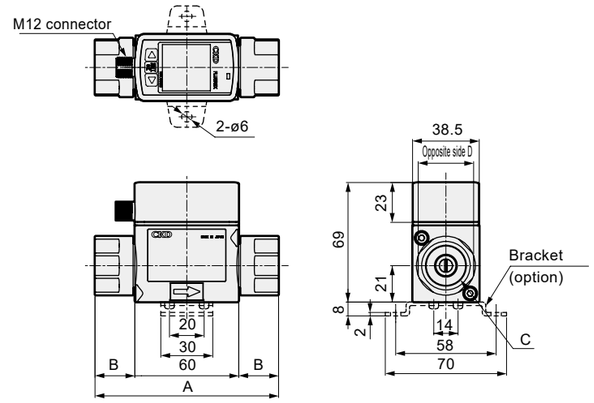
Cannot be disassembled

Part No.	Part name	Material		Quantity
1	Knob	Aluminum		1
2	Lock nut	SUS303		1
3	Needle guide	SUS304		1
4	O-ring *1	FKM	Fluoro rubber	1
5	O-ring *1	FKM	Fluoro rubber	2
6	Needle	SUS304		1
7	Needle body	SUS304		1
8	Attachment	SUS304 or SCS13		1

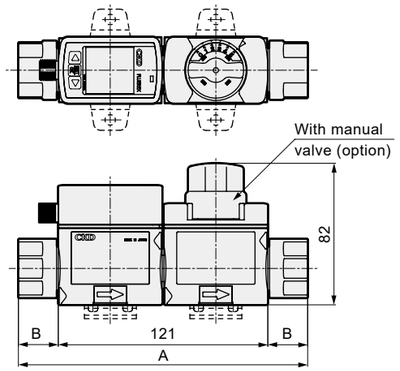
*1: For fluorine liquid compatibility, EPDM (ethylene propylene diene rubber) is used.
*2: Wetted parts are③,④,⑤,⑥,⑦,⑧.

Dimensions

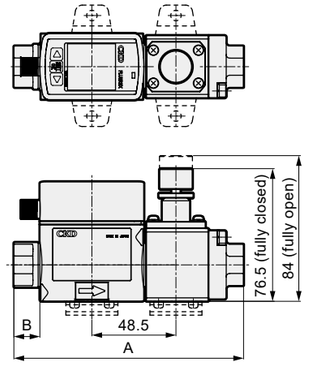
●WFK2-005,020,050



・With manual valve (cock type)



・With manual valve (needle type)



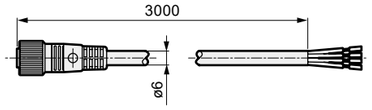
Model No.	A	B	C	Opposite side D
WFK2-[*1]A[*2]□□N	90	15	Rc3/8	24
WFK2-[*1]B[*2]□□N	90	15	Rc1/2	27
WFK2-[*1]C[*2]□□N	106	23	Rc3/4	32
WFK2-[*1]A[*2]□□A	151	15	Rc3/8	24
WFK2-[*1]B[*2]□□A	151	15	Rc1/2	27

Model No.	A	B	C	Opposite side D
WFK2-[*1]C[*2]□□A	167	23	Rc3/4	32
WFK2-[*1]A[*2]□□B	132.5	15	Rc3/8	24
WFK2-[*1]B[*2]□□B	132.5	15	Rc1/2	27
WFK2-[*1]C[*2]□□B	148.5	23	Rc3/4	32

[*1]: Select from 005, 020, and 050
[*2]: Select from A, B, and C (G thread and NPT thread also have the same Dimensions)

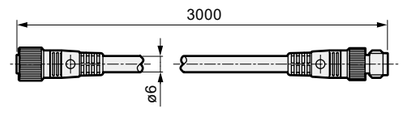
Optional dimensions

●Cable option
Common for WFK2
・Standard cable
Discrete option model No.: **WF-FL-280741**

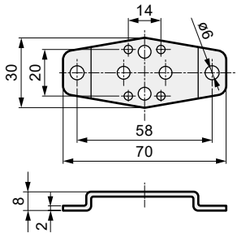


Finished outer diameter 6 mm, core wire 0.5 mm², insulator O.D. 1.9 mm

・Double ended connector cable
Discrete option model No.: **WF-FL-662453**



●Bracket option
WFK2-005,020,050
Discrete option model No.: **WF-FL-315544**



Karman Vortex Flow Rate Sensor FLUEREX

WFK2 Series

Large body

●Flow rate range: 8 to 100, 20 to 250 L/min

Refer to the CKD website for detailed compatible model Nos.

Model No. Notation Method

WFK2 - 100 DA A A N - A C -

Model No. ❶Flow rate range ❷Port size ❸IO-Link analog output ❹Unit indicated Sensor only ❺Option (cable included) ❻Bracket (included) ❼Option (other)

❶Flow rate range

Code	Description
100	8 to 100 L/min
250	20 to 250 L/min

❷Port size

Code	Description
DA	Rc1
EA	Rc1 1/4
FA	Rc2 1/2
DB	G1
EB	G1 1/4
FB	G2 1/2
DC	NPT1
EC	NPT1 1/4
FC	NPT1 1/2

❸IO-Link / Analog output

Code	Description	
A	Switch / Analog output	0 to 5 VDC, 1 to 5 VDC
B		4 to 20 mA DC
C		0 to 10 VDC, 1 to 10 VDC
D	IO-Link compatible (Note)	0 to 5 VDC, 1 to 5 VDC
E		4 to 20 mA DC
F		0 to 10 VDC, 1 to 10 VDC

Note: IO-Link "D", "E" and "F" after not in use have analog output specifications.

❹Unit indicated

Code	Description
A	L/min L m^3 °C
B	L/min, us gal/min L, m^3, us gal °C, °F

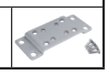
Note: The display unit code "B" is for overseas use and cannot be used in Japan.

❺Option (attached cable)

Code	Description	
Blank	None	
A	Standard cable (M12/4-conductor/ 3 m) included	
B	Double ended connector cable (M12/4-conductor/ 3 m) included	

Note: For option "EX" (ATEX compatible), cable attachment cannot be selected.

❻Option (attached bracket)

Code	Description	
Blank	None	
C	Bracket included	

❼Option (other)

Code	Description
Blank	None
EX	ATEX Compliant

*1 *2

*1: For "EX" (ATEX compatible), cable attachment cannot be selected.

*2: For details of specifications, refer to "Options (ATEX compatible)" on P. 445.

Discrete option model No.

For dimensions diagram, refer to Page 436.

●Cable option

Standard cable

WF-FL-280741

Double ended connector cable

WF-FL-662453

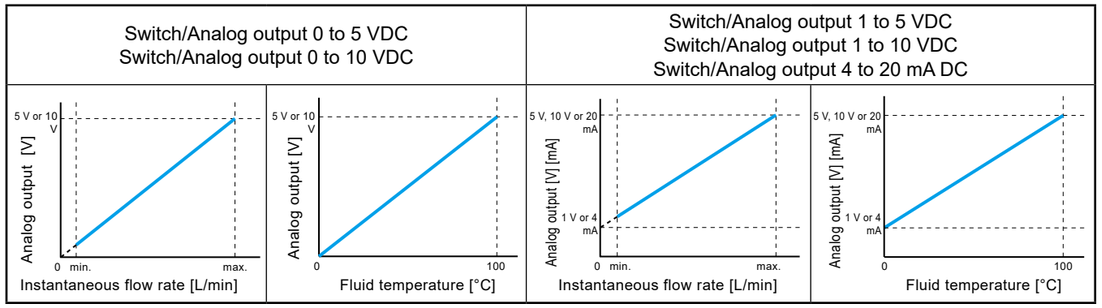
●Bracket option

WF-FL-636342

Specifications

Item			WFK2-100	WFK2-250
Connection	Port size	Rc, G, NPT	1, 1 1/4, 1 1/2	
	Port material		Stainless steel	
Working Conditions	Applicable fluid		Pure water, industrial water	
	Max. working pressure	MPa	1.0	
	Proof pressure	MPa	1.5	
	Ambient temperature	°C	0 to 50 (85% RH or less, no condensation)	
	Fluid temperature	°C	1 to 95	
Flow rate	Flow rate range	L/min	8 to 100	20 to 250
	Repeatability *1		Analog output accuracy: ±2.5%F.S. Display accuracy: ±2.5%F.S.±1digit (min. display unit)	
	Temperature characteristics *1		±5%F.S. (base temperature 25°C, 10 to 50°C)	
	Low flow cut		5% of F.S.	
	Accumulated flow range *2		99999 L or 99999 m³ (Unit can be selected) Resets when the power is turned OFF	
	Integrated pulse rate *2	L/pulse	1, 10, 50, 100	10, 50, 100
	Pressure loss	MPa	0.05 (at F.S.)	0.03 (at F.S.)
	Response time *3	sec	0.25, 0.5, 1, 5, 10 (default 1)	
Temperature	Measurement temperature	°C	0 to 100	
	Accuracy	°C	0 to 50: analog output accuracy ±2, display accuracy ±2±1digit (min. display unit 1)	
			50 to 100: analog output accuracy ±3, display accuracy ±3±1digit (min. display unit 1)	
Output	Indicator		Two-screen LCD display, instantaneous flow rate: 3 digits, liquid temperature: 2 digits, accumulated flow: 5 digits, with screen rotation	
	Analog output *4		Standard: 0 to 5 V, 1 to 5 VDC Option: 4 to 20 mA DC, 0 to 10 V, 1 to 10 VDC	
	Switch Output		NPN or PNP open collector output (can be switched from settings)	
		Max. load current	50 mA	
		Max. applied voltage	30 VDC	
		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 *5			50 mA or less	
Mounting	Mounting orientation		Unrestricted in vertical/horizontal direction	
	Straight piping section		IN side: 10 D, OUT side: 5 D	
	Degree of Protection		IP 65 or equiv.	
	Weight	g	1 (Rc, G, NPT): approx. 870 1 1/4 (Rc, G, NPT): approx. 1010 1 1/2 (Rc, G, NPT): approx. 1,100	

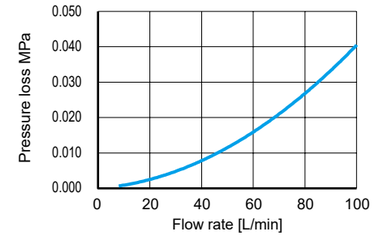
*1: Accuracy is the average value over 10 sec. (for conditions not containing air bubbles). F.S. stands for full scale flow rate.
*2: The integrating flow is a calculated (reference) value. It is reset when the power is turned OFF. Errors may occur between the accumulated flow display and integrated pulse output.
*3: The time to attain 70% of the original output after the normal flow rate (used) drops instantly to 0.
*4: Check the allowable load on the wiring method page.
*5: Current for when 24 VDC is connected, and no load is applied. Please note that the current consumption changes depending on the load connection status.



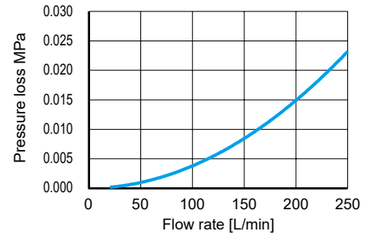
Note: Output value without adjustment of original range analog output or span.

Pressure loss (when the fluid is water)

●WFK2-100



●WFK2-250



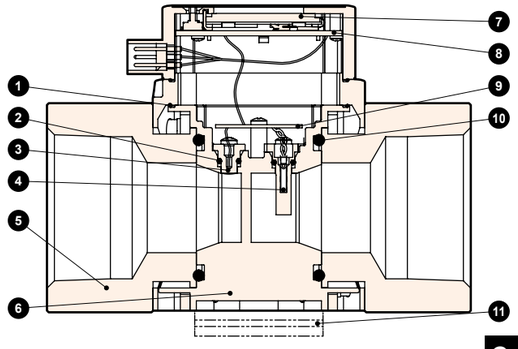
Note: Conversion to fluorine liquid If the flow path volume and flow rate are the same, pressure loss is proportional to specific gravity because the formula below holds.

$$\frac{\Delta p_1}{G_1} = \frac{\Delta p_2}{G_2}$$

Δp: Pressure loss (MPa)
G: Specific gravity (ratio of density to water)

Internal Structure Diagram / Material

●WFK2-100,250



Cannot be disassembled

Part No.	Part name	Material		Quantity	Part No.	Part name	Material		Quantity
1	Packing	FKM	Fluoro rubber	1 or 2	7	Liquid crystal			1
2	O-ring *1	FKM	Fluoro rubber	2	8	CPU board			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 *1	FKM	Fluoro rubber	2
5	Attachment	SUS304 or SCS13		2	11	Bracket (option)	SUS304 or SPCC		(1)
6	Sensor body	PPS resin		1					

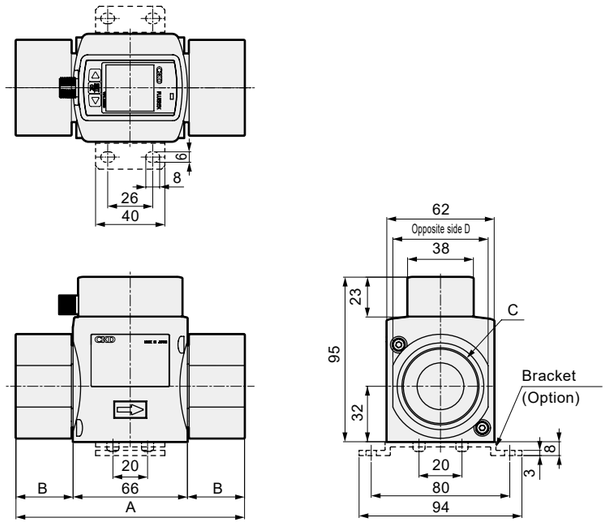
*1: EPDM (ethylene propylene diene rubber) is used for fluorine-based liquids.
*2: Wetted parts are ②,③,④,⑤,⑥,⑩.

WFK2 Series

Large body

Dimensions

●WFK2-100,250



Model No.	A	B	C	Opposite side D
WFK2-[*1]D[*2]□□N	106	20	Rc1	46
WFK2-[*1]E[*2]□□N	125	29.5	Rc1 1/4	50
WFK2-[*1]F[*2]□□N	132	33	Rc1-1/2	55

[*1]: Select from 100,250
[*2]: Select from A, B, and C (G thread and NPT thread also have the same Dimensions)

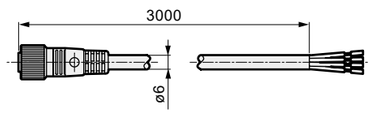
Optional dimensions

●Cable option

Common for WFK2

・Standard cable

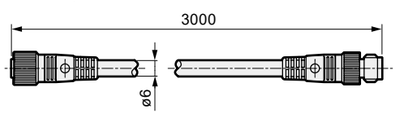
Discrete option model No.: **WF-FL-280741**



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

・Double ended connector cable

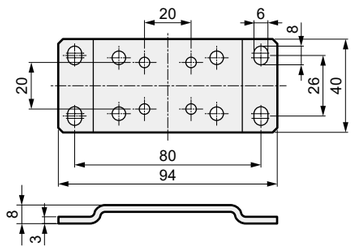
Discrete option model No.: **WF-FL-662453**



●Bracket option

WFK2-100,250

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



MEMO

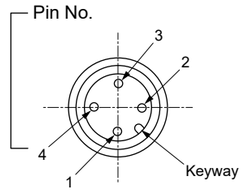
Flow rate sensor
Compact flow sensor (gas)
Compact flow sensor (air)
Compact flow sensor (liquid)
Water Manifold Unit
Ending

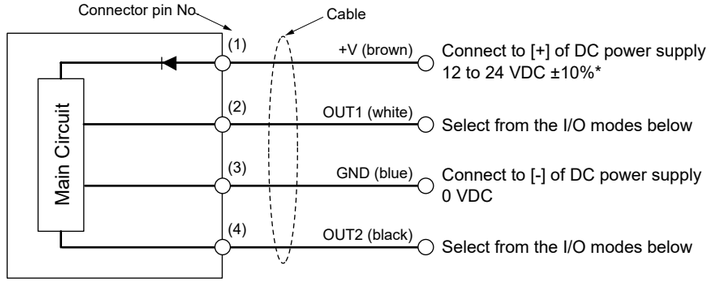
Wiring method

· Always read the safety precautions before wiring.
· The cable is a 4-conductor cabtyre cable with a core wire of 0.5 mm² made by Correns Corporation.
***Keep the cable far away from power cords or other things that may cause noise.**

Noise can cause malfunctions.

[Connector (male)]





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

I/O mode

OUT1: 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

OUT2: 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

Item	[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

The default settings (shipped) are as follows:

IO-Link / Analog output	OUT1	OUT2
Switch / Analog output	Analog flow rate output	Analog temperature output
IO-Link compatible	OFF	IO-Link

IO-Link parameter specifications

1. General

Item	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 lamp (green)
• Lights when power supply 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 name	MSB															LSB
	Instantaneous flow rate [Flow Rate]															
Data range	Refer to Table 1															
Format	UInteger16															

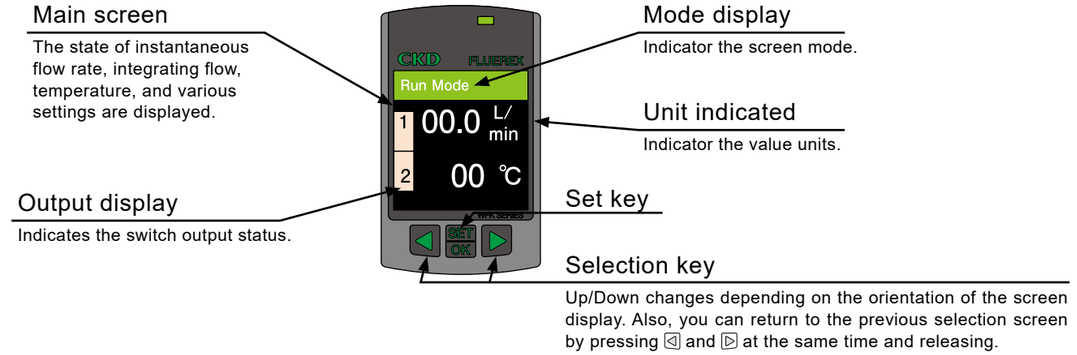
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data name	Error	WARNING	–	–	Switch Output				MSB							LSB
					4	3	2	1	Fluid temperature							
Data range	True/False								-10 to 110°C							
Format	Boolean								Integer8							

Data range (Table 1)

Flow rate range	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

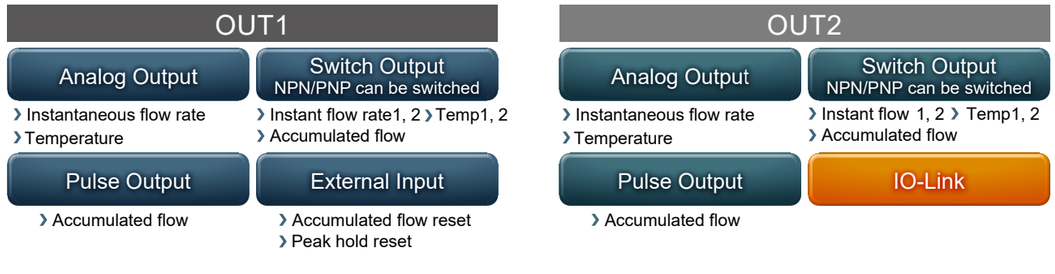
Note: IODD files can be downloaded from the CKD website. (https://www.ckd.co.jp/en/)

Names and functions of display / operation section

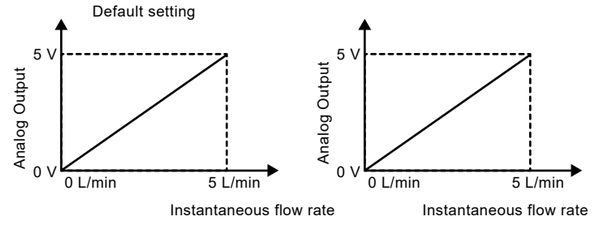
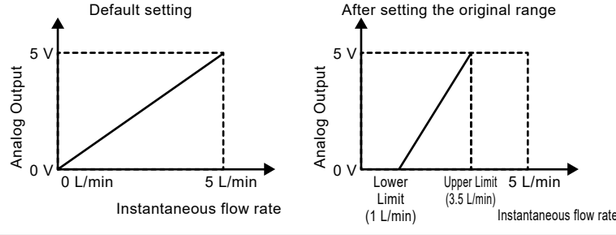


I/O setting method

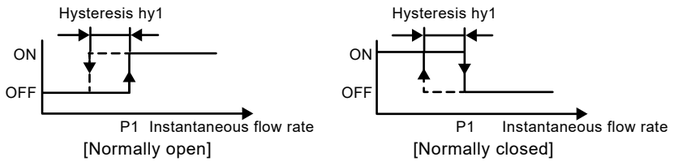
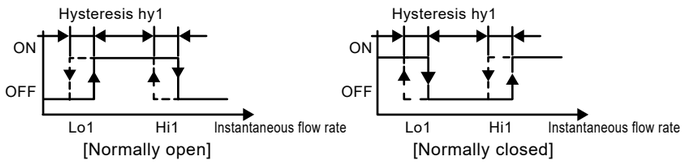
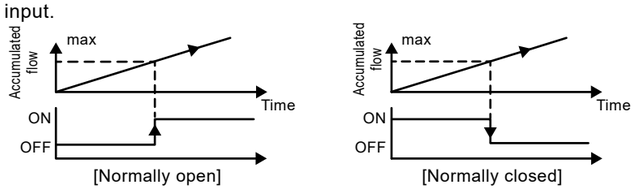
Input and output to be assigned to wiring OUT1 and OUT2 can be set randomly.



1. Analog output

(1) Output conversion *The output of 4 to 20 mA analog output cannot be switched.	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 types...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 setting range is equal to or less than the max. flow rate of each flow rate range [Ex.] When set to Lower Limit=1 L/min, Upper Limit=3.5 L/min 

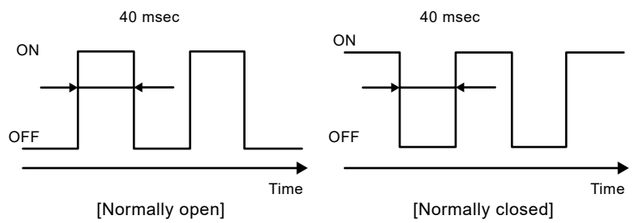
2. Switch output

(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) Accumulated 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.

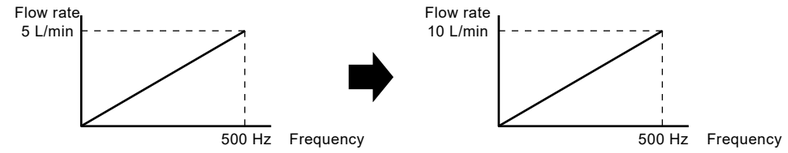
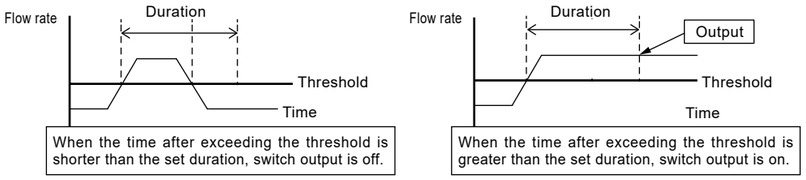
3. Pulse output

Accumulated flow	Pulse output matches the integrating flow count. Selectable pulse rates

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



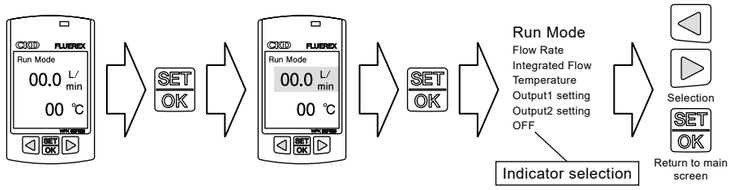
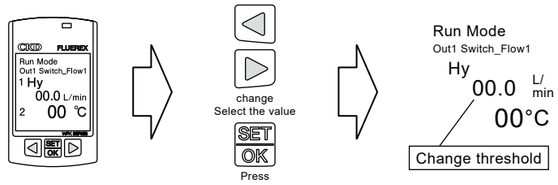
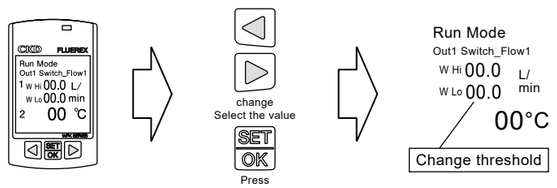
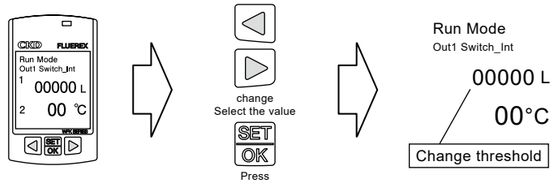
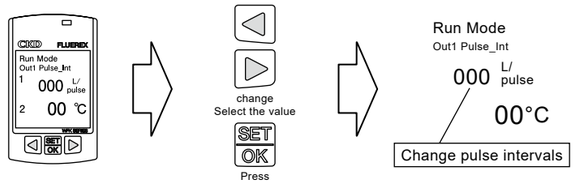
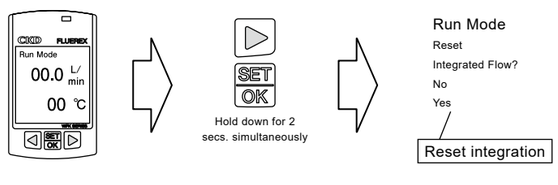
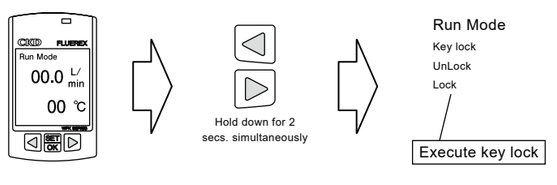
4. Details of functions and setting Items

(1) 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 
(2) 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 During switch output, the time it takes for the output to occur after exceeding the threshold can be set. Select from 0 to 9 seconds. 
(3) Peak hold function	The max. and min. values of instantaneous flow rate and fluid temperature can be displayed. The maximum and minimum values can be reset through turning the power OFF, button operation, or external input.
(4) Energy saving setting	Energy saving setting ON/OFF can be set. When the energy saving setting is ON, the liquid crystal backlight turns OFF after 1 minute of inactivity.
(5) IO-Link	Acquiring measurement data, changing the threshold, and other bi-direction communication are possible with an IO-Link connection (OUT2 only). *Option with IO-Link only
(6) Display	Brightness, rotation angle, and update time can be changed.
(7) Color	The display colors of the instantaneous flow rate, fluid temperature, and accumulated flow can be changed. (Select from white, green, and red) The display color can be changed when the value is above or below the upper limit.
(8) Output simulation	The switch output can be forced to turn ON.
(9) Copy mode	Two WFK2 units can be connected and the setting of the master can be copied to the device.
(10) External input	Integrating flow reset or peak hold value reset is possible from an external input.

For details on operation and setting method, refer to CKD components product website (https://www.ckd.co.jp/kiki/en/) → "Model No."→ Instruction manual

Easy setting function

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

Change main screen display	
Switch setting Hysteresis mode	
Window mode	
Integrated Switch setting	
Integrated Pulse setting	
Accumulation reset	
Key lock	

Water-use components

Safety Precautions

Be sure to read this section before use.
Refer to Intro 17 for General Precautions.

Design / Selection

1. Working fluids

DANGER

■Do not use the water as 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.

■Never use this product with flammable fluids.

WARNING

■This product cannot be used as a billing meter. Do not use this product for commercial transactions as it is not compliant with the Measurement Act. 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. When supporting fluorine-based fluids, the product can be used only with the fluids described in the applicable fluid.

2. Working environment

DANGER

■Flammable environment
Never use this product in an explosive gas atmosphere. The structure is not explosion-proof, and explosions or fires could occur. II3G Ex ec II C T4 Gc 0°C when option (ATEX compatible) is selected ≤Ta≤ Can be used in 50°C environments. Refer to "Options (ATEX compatible)" on P. 445 for use conditions.

WARNING

■Corrosive environment
Do not use this product in an atmosphere containing corrosive gases such as sulfur dioxide.

■Fluid/ambient temperatures
Use in a fluid temperature range of 1 to 95°C (-10 to 95°C for fluorine-based liquid) 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.

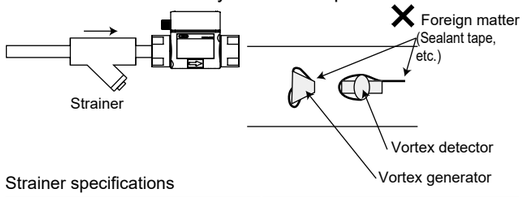
■Max. working pressure
Do not use at a pressure exceeding the max. working pressure, as excessive pressure can cause product failure. To prevent the pressure from reaching the max. working pressure, particularly due to water hammer, take the following measures:
(1) Using a water hammer reduction valve or other similar mechanism, reduce the valve closing speed.
(2) Using elastic piping material, e.g. rubber hose, and an accumulator, absorb the impact pressure.
(3) 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-compliance 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 evaluation of this product is performed by using a cable that has a power supply line and a signal line paired to assess the product's performance.
●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.

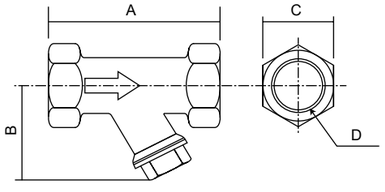


Strainer specifications

Item	Specifications
Specification fluid	Water
Proof pressure MPa	2
Working pressure range MPa	0 to 1
Ambient temperature°C	1 to 90
Main material	**Specifications**
Body	Bronze 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	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	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 vibration of 20 m/s^2 and over, and shock of 98 m/^{2} and over. This may cause malfunction and/or damage, as this product uses the Karman's vortex type detection principle.

■Hardware check and other internal settings are performed during the first two seconds or so after turning ON the power. 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.

3. Regarding manual valves

⚠CAUTION

■Since the manual valve (needle) does not have a closing function, internal leakage will occur even when the valve is fully closed. If a closing function is required, select the manual valve (cock).

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

■Do not use the manual valve continuously.

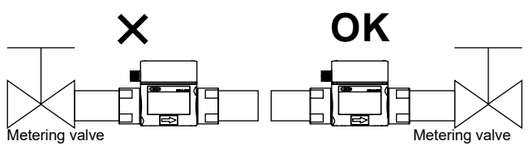
■The position of the dial mark on the needle type varies depending on the individual model. It does not indicate an absolute opening.

4. Piping

⚠CAUTION

■Pipes can be installed in any orientation, vertical, horizontal, etc. 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. When it is unavoidable and the valve is arranged on the primary side, provide a straight pipe with a diameter of 10 times or more between the valve and the flow rate 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.)

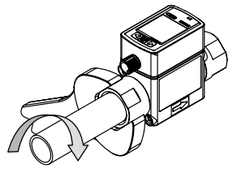


■Operating the pump with the secondary side valve closed may cause the flow rate sensor to detect pressure waves from the pump, resulting in incorrect indication. If this occurs, install the valve on the primary side. When doing so, ensure that a straight pipe with a diameter of 10 times or more bore 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 10D on the IN side and 5D 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.)
* Where "D" indicates the inner diameter of the piping material. Refer to the table below for specific values.

Bore size	Rc3/8 (10 A)	Rc1/2 (15 A)	Rc3/4 (20 A)	Rc1 (25 A)	Rc1 1/4 (32 A)	Rc1-1/2 (40 A)
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

■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.



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

Option (ATEX compatible)

■The following are supported.
II3 G Ex ec II C T4 Gc 0°C ≤ Ta ≤ 50°C

■Working conditions
1) When using, store in a protection box and protect the flow rate sensor from all directions.
Protection box strength: Higher than DC01, DC03, DC04, DC05, DC06, DC07.
Plate thickness: 1 mm or more
Clearance between flow rate sensor and plate: 70 mm or more
2) There is a risk of static electric discharge. Attach to grounded metal and wipe with a wet cloth.
3) Use in a clean environment with a contamination level of 2 or more.

■Fluid temperature rating
The temperature of the fluid measured for explosion-proof specifications is 95°C.

■ATEX Directive
EN standards for explosive atomosheres
EN IEC 60079-0:2018
EN 60079-7:2015

⚠WARNING

■Do not remove or insert cables while energized in an explosive atmosphere.

⚠CAUTION

■Use an M12 cable compliant with the ATEX Directive.

For precautions during mounting, installation, adjustment, use and maintenance, refer to the CKD Components Product Site (https://www.ckd.co.jp/kiki/en/) → "Model No.→ Instruction Manual