

KEYENCE

Separate-amplifier type
digital flow sensor
FD-V70 Series

Digital Flow Sensor

Expanded product lineup



Flow rates up to
100 litres / minute

PPS



5L



20L



50L



100L

PFA



4L



20L



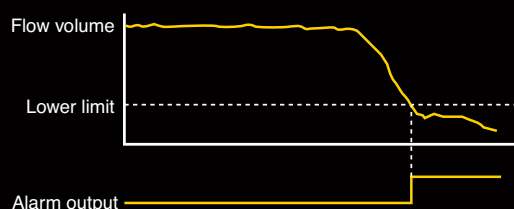
50L



The FD-V70 Series makes equipment protection, quality control and cost reduction a reality by monitoring flow volume control.

**Advantage of
accurately
controlling
flow volumes**

Equipment Protection



If the flow of water in equipment stops, overheating will cause equipment damage. The FD-V can output an alarm when the flow falls below the minimum level.

**Cooling
water**



Management of cooling water flow volume for high-frequency hardening equipment.

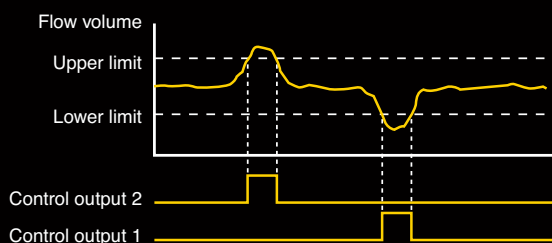
Compact sensor head

Small, space-saving device allows installation in a wide variety of mounting spots.

PPS 100 litres/min. type
FD-P100

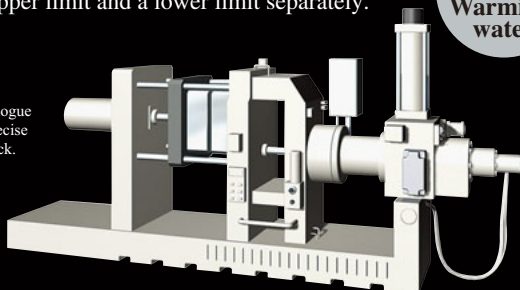
PFA 50 litres/min. type
FD-F50

Quality control



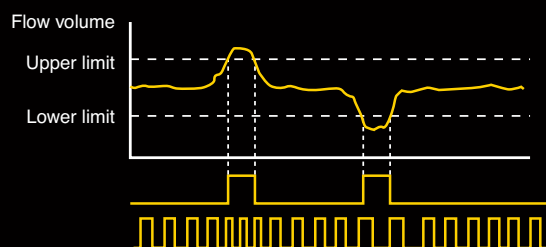
Keeping the temperature of a mould at a specified level is vital to producing quality moulded parts. FD-V can keep flow volumes at a specified level by detecting an upper limit and a lower limit separately.

* FD-V features analogue output for more precise control and feedback.



Managing cooling water and warming water of a moulding machine

Cost reduction



Poor flow leads to insufficient washing, and excess flow leads to waste of expensive pure water and refined water. FD-V detects whether the flow volume is within a specified range.

A pulse output can be connected to an external counter to determine cumulative water use.

Washing water



Control over wafer washing liquid supply

Digital amplifier

Separate amplifier allows monitoring flow volumes from a distance.



New selectable display mode.

Applications

High-temperature liquid



Controlling the flow in a mould heater

Controls the flow of hot water sent from a mould heater. The FD-V70 Series resists temperatures up to 100°C, providing detection of hot liquids such as hot water for heating plastic moulding dies.

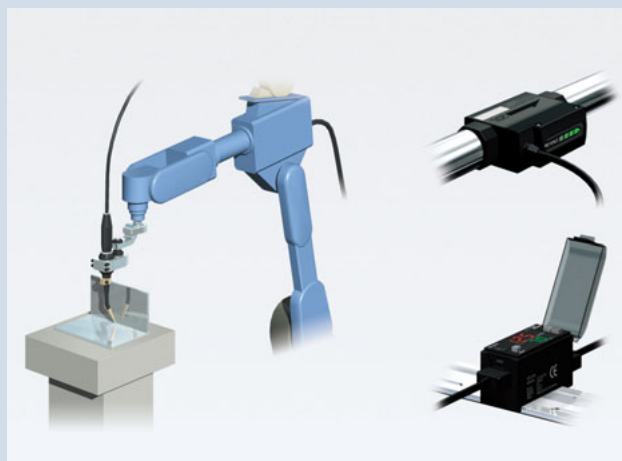
Cooling water



Blow-moulding mould cooling water

The system manages flow volumes of cooling water supplied to moulds. A small head allows installation in a limited space.

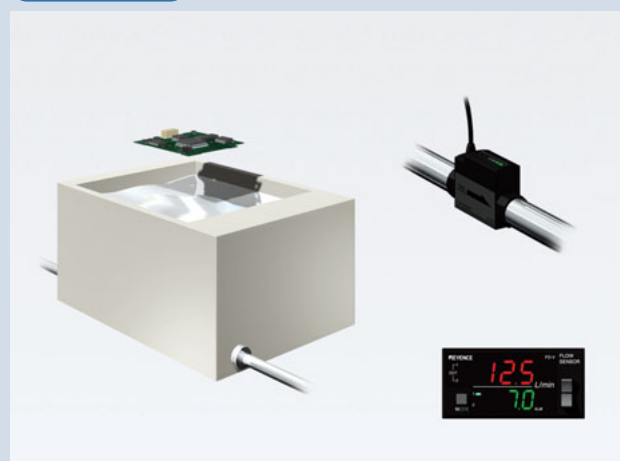
Cooling water



Controlling flow of cooling water for a welding machine

The system manages flow volumes of cooling water for welding guns. The amplifier can be mounted in a more appropriate environment for easy viewing.

Cooling water



Controlling temperature of a solder bath

The system circulates cooling water to keep the soldering bath within a specified temperature range. Analogue output allows controlling flow volumes even more precisely.

De-ionised water



Controlling supply of washing water for bottles

The system controls flow volumes of refined water used for washing bottles. Hybrid detection system of vortex and ultrasonic allows stable detection of near pure water.

Pure water/chemicals



Controlling the supply of solution in a PC board cleaner

Controls the flow of cleaning solution used in a single wafer processing cleaner. Since the PFA type sensor head is made of fluorine plastic, it can be used for detection of various chemical solutions and pure water.

Lineup

Sensor head

Model	Shape	Wetted Material	Detectable Flow Rate	Mounting pipe diameter
FD-P05		PPS	 0.5 to 5 litres/min.	PT3/8 (10A)
FD-P20			 2 to 20 litres/min.	PT1/2 (15A)
FD-P50			 5 to 50 litres/min.	PT3/4 (20A)
FD-P100			 10 to 100 litres/min.	PT1" (25A)
FD-F04		PFA	 0.4 to 4 litres/min.	1/8 inch (9.5 mm)
FD-F20			 2 to 20 litres/min.	1/2 inch (12.7 mm)
FD-F50			 5 to 50 litres/min.	3/4 inch (19 mm)

Amplifier

Model	Shape	Type
FD-V70A FD-V70AP		DIN-rail mounting

Model	Shape	Type
FD-V75A FD-V75AP		Panel mounting

Sensor lineup

Pure water and chemical solutions

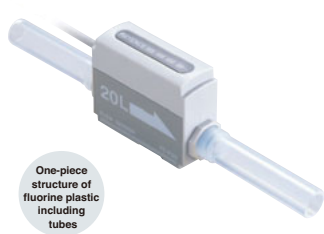
General purpose or harsh-duty models

PPS models are rated for general liquid coolants such as water and water-solution coolants. PFA models allow for corrosive liquids such as chemical solutions.

PPS head



PFA head



Selectable mounting

DIN-rail and panel mounting available

Two types of mounting methods can be selected: DIN-rail mounting and panel mounting.

DIN-rail mounting type FD-V70A/V70AP



The FD-V70A (P) can be mounted easily onto a DIN-rail.

Ready for high-temperature liquids

Liquid temperature: 100°C (all heads)

Detecting high-temperature liquid (up to 100°C) such as warming water for resin moulding is possible.

Panel mounting type FD-V75A/V75AP



The FD-V75A (P) is designed to be mounted on a control panel. The amplifiers can be mounted in contact with each other, thus saving space when several amplifiers are mounted.



State-of-the-art features

Compact sensor head FD-P/F

One-piece structure

Seamless one-piece water passage eliminates trapped liquid and allows easy maintenance.

Flow indicator

Flow display



Displays the flow condition with indicator movement that visually shows the instantaneous flow rate

Alarm display



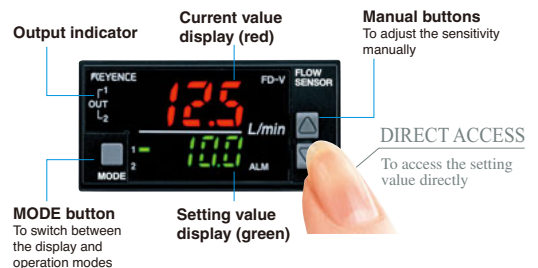
Displays the condition of detected errors such as water shortage

Digital amplifier FD-V70A/V75A

First in its class

2-level display & direct access

The bright, viewer-friendly 2-level display allows you to adjust the setting value while checking the current flow. Pressing the manual button enables direct access for adjusting the setting



Abnormal condition alarm ALM

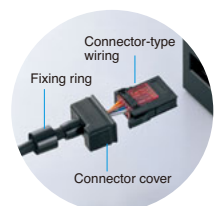
When detection is disabled due to water shortage or bubbles, the abnormal condition alarm will activate.



Easy connection

Connector-type wiring

Connectors are used for easy insertion and removal. Easy installation and maintenance is made possible.



Selectable detection modes

Built-in operating modes were designed for your specific application.



Selectable output modes

"Adjustable-range analogue" allowing free setting on analogue output ranges, and "cumulative pulse output" are standard functions.



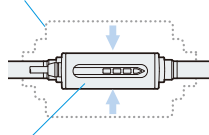
Industry
thinnest

Space-saving 20-mm width

20 mm wide sensor heads trim down the amount of space taken up in a chassis. This allows several sensor heads to be mounted side-by-side onto pipes that are in close proximity to each other.

*FD-F04/F20 (PFA head)

Conventional model:
The sensor head takes up a lot of space.



FD-P/F: The sensor head requires an extremely small mounting space.



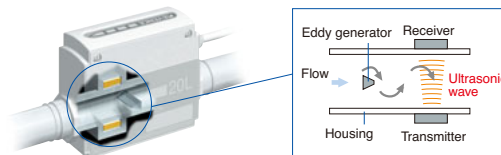
Can be mounted onto pipes installed in close proximity to each other

High-accuracy

Hybrid detection system using “eddy + ultrasonic”

The FD-V70 Series has adopted the “eddy + ultrasonic” detection method. It ensures stable and accurate flow rate measurement by detecting eddies with an ultrasonic device instead of a piezoelectric device that is easily affected by vibration.

Internal structure



The sensor uses ultrasonic waves to detect eddies that are generated when the liquid flow hits the eddy generator.

Easy maintenance

Convenient quick disconnect sensor head wiring (PPS head only)

The quick disconnect design simplifies installation, preventing cables from becoming tangled or twisted.

* A 10 m extension cable is also available (optional, OP-51475).



Clean pack

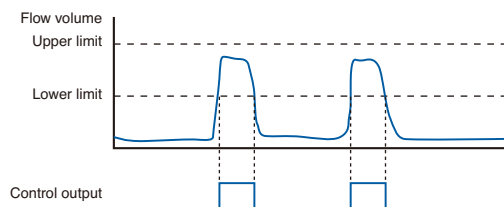
The sensor head is shipped in a clean pack (vacuum-sealed pack). There is no problem with using it for flow control in the semiconductor process line.



Selectable display modes

Standard display mode

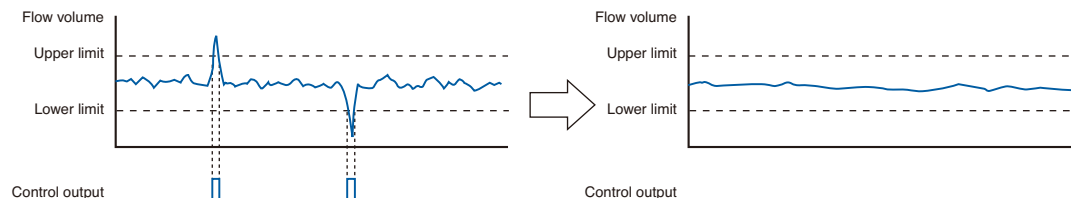
Display mode same as conventional amplifier. High-speed response allows detection of rapid changes.



Checking amount of mould release agent.

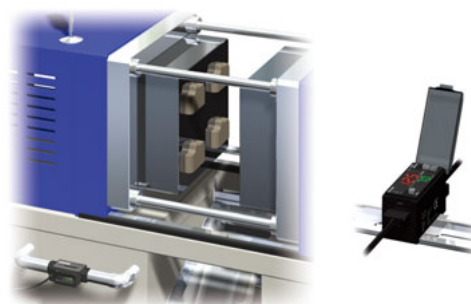
Averaging display mode

This mode averages flow volume signals. Fluctuating display due to turbulent flow and pulsing stream is stabilised.



Averaged two-digit display mode

This mode averages the flow volume signals in order to further stabilise the resulting values.



Controlling flow volume of cooling water for moulding die

Specifications



Sensor head

Model		FD-P05	FD-P20	FD-P50	FD-P100	FD-F04	FD-F20	FD-F50
Detectable flow rate		0.5 to 5 litres/min.	2 to 20 litres/min.	5 to 50 litres/min.	10 to 100 litres/min.	0.4 to 4 litres/min.	2 to 20 litres/min.	5 to 50 litres/min.
Pressure resistance		1.0 MPa				0.7 MPa		
Detectable fluid ¹		Liquids compatible with PPS plastic				Liquids compatible with PFA plastic		
Acceptable fluid temperature ²		0 to +100°C (No freezing or boiling)						
Applicable pipe diameter		PT 3/8	PT 1/2	PT 3/4	PT 1"	ø3/8 inch (9.5 mm)	ø1/2 inch (12.7 mm)	ø3/4 inch (19 mm)
Display		Flow indicator: Green LED, Error display: Red LED						
Environmental resistance	Ambient temperature	0 to 60°C, No freezing						
	Relative humidity	5 to 80%, No condensation						
	Vibration	10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions, 3 hours respectively						
	Shock	300m/s ² in X, Y and Z directions, 10 times respectively (Total: 60 times)						
Material		Glass reinforced PPS				Piping section: New PFA, Case: Polysulfone		
Weight		Approx. 175 g	Approx. 180 g	Approx. 200 g	Approx. 270 g	Approx. 135 g	Approx. 140 g	Approx. 180 g
		Including an M12 connector and 3-m cable				Including a connector and 3-m cable		
Enclosure rating		IP65						
Accessories		M12 joint connector cable 3 m, one head connector				One head connector, two mounting brackets		

1. Measurement is impossible for high viscosity fluid. Refer to "Precision guaranteed detection range" table separately for details.

2. The sensor head may become damaged if liquid freezes inside the piping.

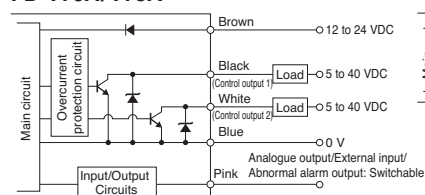
Amplifier

Model		FD-V70A (DIN-rail mounting type)/FD-V75A (Panel mounting type)						
		FD-V70AP (DIN-rail mounting type)/FD-V75AP (Panel mounting type)						
Sensor head combination		FD-P05	FD-P20	FD-P50	FD-P100	FD-F04	FD-F20	FD-F50
Power supply		12 to 24 VDC, Ripple (P-P): 10% max.						
Current consumption				At 12 V		At 24 V		* Analogue output part not included. Including head
		Normal		1500 mW (125 mA) max.		2000 mW (83 mA) max.		
		ECO mode		1320 mW (110 mA) max.		1700 mW (70 mA) max.		
Display method		2-level display with a 3-digit, 7-segment LED (Character height: Upper level: 8 mm, red, Lower level: 5.7 mm, green), Display cycle: 5 updates/sec. (10 updates/sec. when the response time is 0.5 sec.)						
Operation indicator		Red LED x 3 (Control output 1/Control output 2/Error alarm)						
Detectable flow rate		0.5 to 5 litres/min.	2 to 20 litres/min.	5 to 50 litres/min.	10 to 100 litres /min.	0.4 to 4 litres/min.	2 to 20 litres/min.	5 to 50 litres/min.
Resolution	Standard display mode When averaging display mode is selected	0.01 litre	0.1 litre			0.01 litre	0.1 litre	
	When averaging 2-digit display mode is selected	0.1 litre	1 litre			0.1 litre	1 litre	
Hysteresis		Variable						
Response time (chattering prevention function)		Selectable from 0.5, 1, 2, 5, 20, and 60 seconds						
Displayed value multipliers		Selectable from 0.01, 0.1, 1, 10, and 100 (litres)	Selectable from 0.1, 1, 10, 100 and 1000 (litres)			Selectable from 0.01, 0.1, 1, 10, and 100 (litres)	Selectable from 0.1, 1, 10, 100 and 1000 (litres)	
Cumulation reset/bank input		Input interval: 20 ms min. (can be switched between analogue output/abnormal alarm input)						
Control output/multiplied pulse output		NPN (PNP) open-collector 50 mA max. (NPN: 40 V max., PNP: 30 V max.), Residual voltage: 1 V max., 2 outputs (N.O./N.C. selectable)						
Abnormal alarm output ¹		NPN open-collector 20 mA max. (27 V max.), Residual voltage: 1 V max. (can be switched between N.O. fixed/analogue output and cumulation reset/bank input)						
Analogue output		4 to 20 mA Maximum load resistance: 260 Ω The analogue output range can be set as desired in increments of 10% of F.S.						
Repeatability		0.5% of F.S. max. (at a fluid temperature of 20°C, and an ambient temperature of 25°C)						
Environmental resistance	Ambient temperature	0 to +50°C, No freezing						
	Relative humidity	35 to 85%, No condensation						
	Vibration	10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions, 2 hours respectively						
Material		Main unit and cover: Polycarbonate, Key top: Silicon rubber						
Weight		FD-V70A(P): Approx. 85 g (including power cable), FD-V75A(P): Approx. 85 g (including the panel mounting bracket, front protection cover and power supply cable)						
Accessories		FD-V70A(P): DIN-rail mounting bracket, power supply cable, FD-V75A(P): Panel mounting bracket, front protection cover and power supply cable						

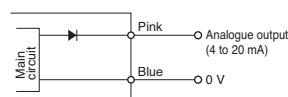
1. PNP type is not provided with error alarm output.

Input/Output Circuits

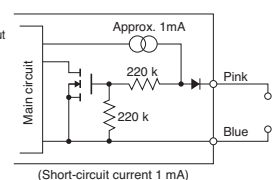
Input/Output Circuits FD-V70A/V75A



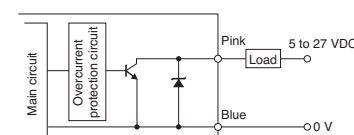
Analogue output circuit



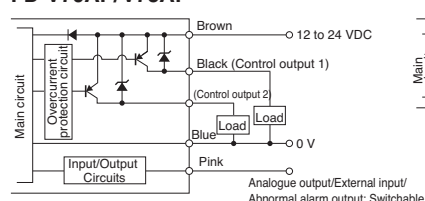
External input circuit (Cumulation reset/bank switching)



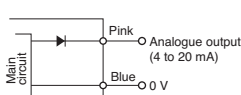
Error alarm output



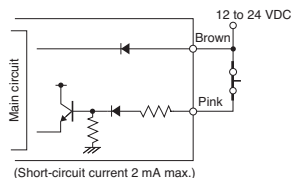
Input/Output Circuits FD-V70AP/V75AP



Analogue output circuit



External input circuit (Cumulation reset/bank switching)

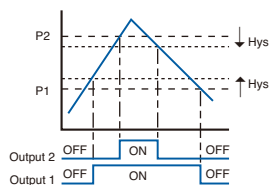


* FD-V70AP/V75AP does not have abnormal output alarm.

Selectable operation mode/output mode

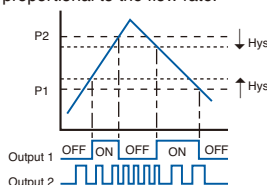
F-1 (Upper/lower limit detection mode)

Two detection points of instantaneous flow rate can be specified as desired. The hysteresis range can also be specified.



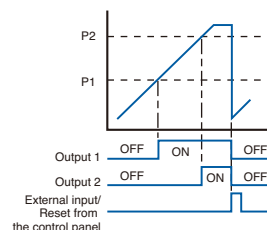
F-2 (Window mode)

The upper limit value (P2) and the lower limit value (P1) can be specified as desired. When the instantaneous flow rate goes out of range between P2 and P1, the sensor turns off. The hysteresis range can also be specified. This mode provides a pulse output proportional to the flow rate.



F-3 (Cumulative flow mode)

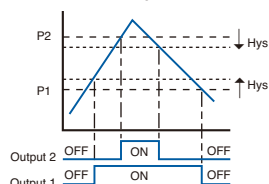
This mode is used to specify two detection points of the cumulative flow rate.



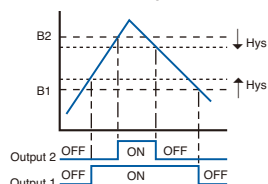
F-4 (Bank switching mode)

The upper/lower limits like the F-1 mode can be specified as two settings. These settings can be switched by turning the external input on or off. The hysteresis range can also be specified.

When the external input is turned off



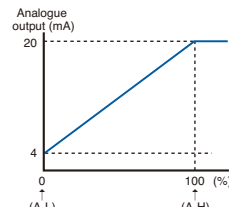
When the external input is turned on



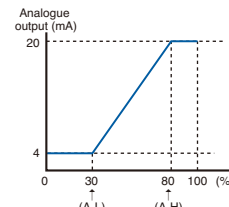
Analogue output/Adjustable-range analogue output

- In the F-1/F-2 mode, disabling the abnormal condition alarm enables the analogue output.
- The analogue output produces 4 to 20mA output for values between the lower limit (A-L) and upper limit (A-H).
- A-L and A-H can be specified in 10% increments to full scale.
- The initial values are: A-L is 0% and A-H is 100%.

When A-L is 0% and A-H is 100% (initial setting)



When A-L is 30% and A-H is 80%



Note: Accuracy is not guaranteed for values lower than the minimum value of the detectable flow rate.

Function selection for the pink cable

The function of the pink cable in each mode varies as follows:

FD-V70A/V75A

Detection mode	When the abnormal alarm output is set to off	When the abnormal alarm output is set to on
F-1/F-2	Analogue output	Abnormal alarm output
F-3	Cumulative reset input	
F-4	Bank input (The abnormal alarm output cannot be selected.)	

FD-V70AP/V75AP

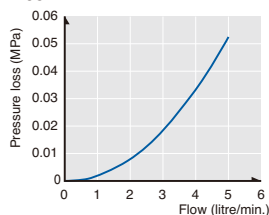
Detection mode	Function of pink cable
F-1/F-2	Analogue output
F-3	Cumulation reset input
F-4	Bank input

Detectable flow rate accuracy (Detectable flow rate according to the liquid viscosity)

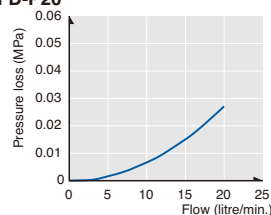
Model	Minimum flow rate (litre/min.)									Maximum flow rate (litre/min.)
	Dynamic viscosity of target fluid (x10 ⁻⁶ m ² /s)									
	0.3	0.5	0.7	1	2	3	4	5	7	
FD-P05	0.3	0.3	0.4	0.5	1.0	1.5	2.0	2.5	3.5	5.0
FD-P20	1.0	1.0	1.4	2.0	4.0	6.0	8.0	10.0	14.0	20.0
FD-P50	2.5	2.5	3.5	5.0	10.0	15.0	20.0	25.0	35.0	50.0
FD-P100	8.0	8.0	8.0	10.0	20.0	30.0	40.0	50.0	70.0	100.0
FD-F04	0.3	0.3	0.3	0.4	0.8	1.2	1.6	2.0	2.8	4.0
FD-F20	1.0	1.0	1.4	2.0	4.0	6.0	8.0	10.0	14.0	20.0
FD-F50	2.5	2.5	3.5	5.0	10.0	15.0	20.0	25.0	35.0	50.0

Flow characteristics (pressure loss)

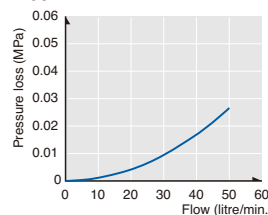
FD-P05



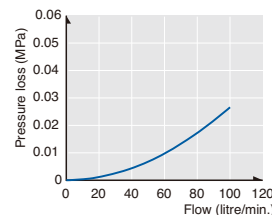
FD-P20



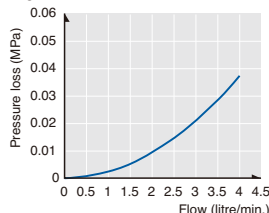
FD-P50



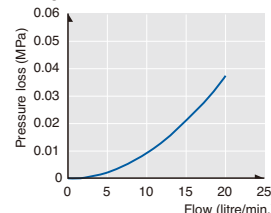
FD-P100



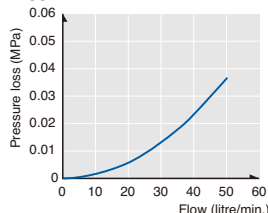
FD-F04



FD-F20



FD-F50

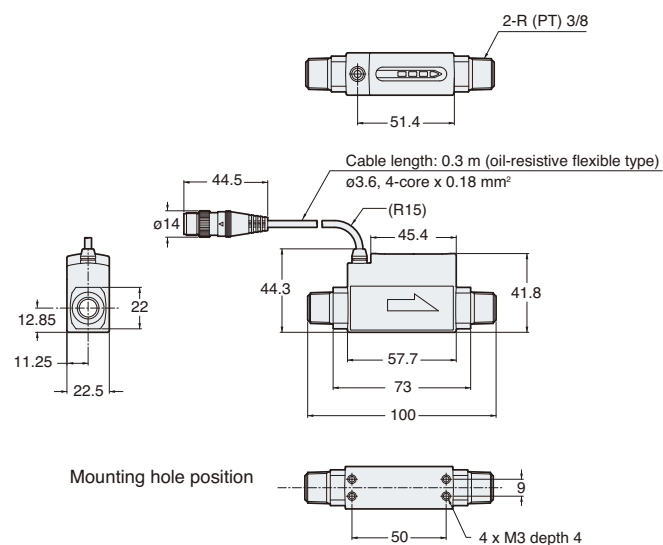


Dimensions

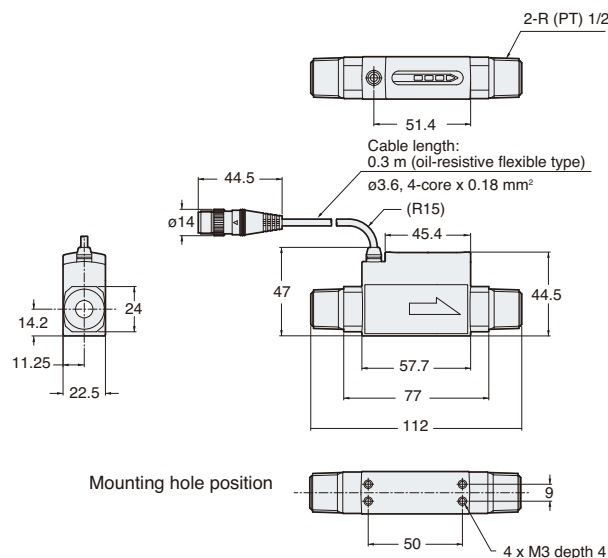
Sensor head

Unit: mm

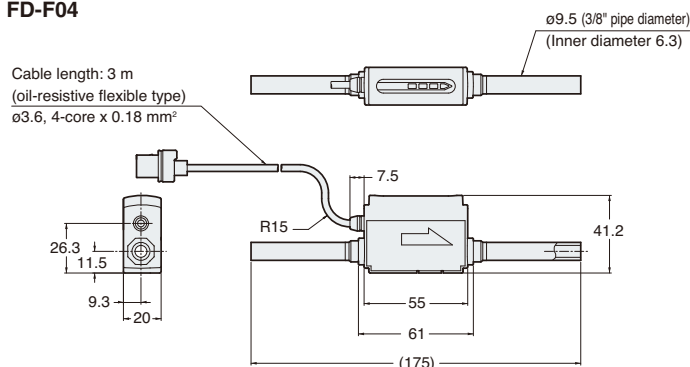
FD-P05



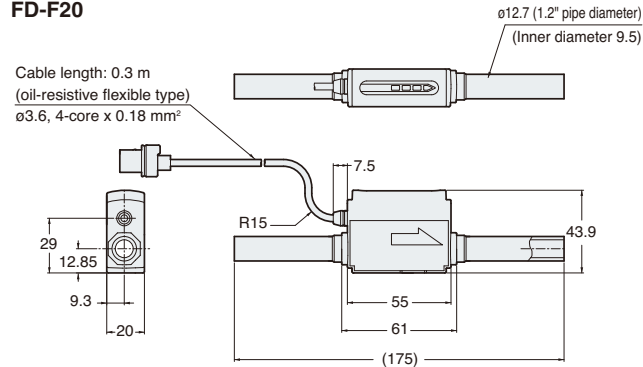
FD-P20



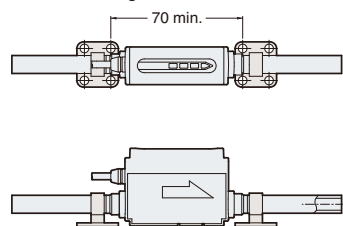
FD-F04



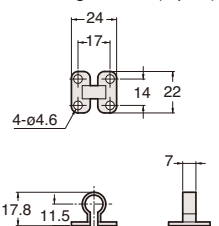
FD-F20



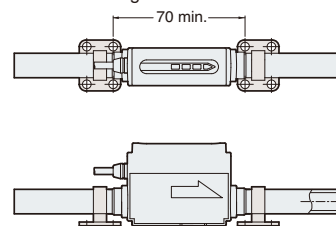
When mounting bracket is attached



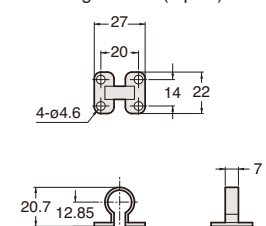
Mounting bracket (2 pcs.)



When mounting bracket is attached



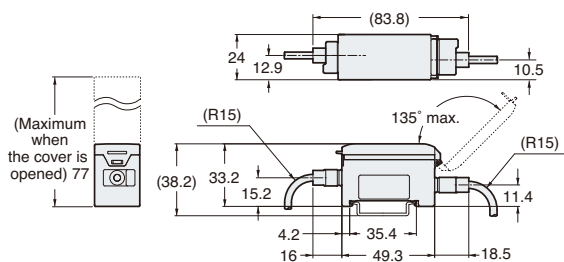
Mounting bracket (2 pcs.)



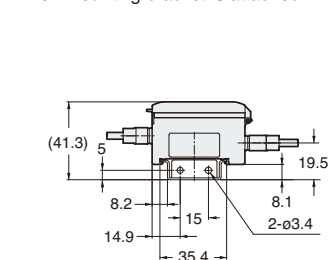
Amplifier

FD-V70A/V70AP (DIN installation)

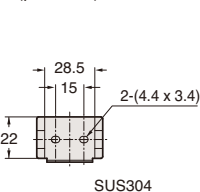
Mounted on DIN rail



When mounting bracket is attached



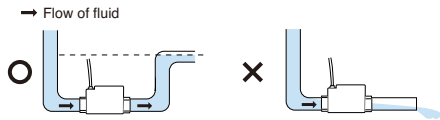
Mounting bracket (provided)



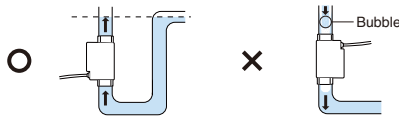
Notes on pipe arrangement

Maintaining flow and measures against bubbles

Provide pipe arrangement so that the measuring cavity is always filled with fluid.

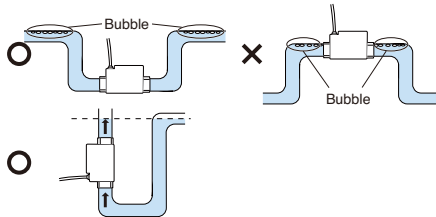


If the line is not properly filled and a constant pressure maintained, the flow sensor may give erroneous data due to bubbles or turbulent flow.



If a device is mounted where fluid flows from top to bottom, an interstice in fluid may generate bubbles or turbulent flow easily. When installing a device vertically, be sure to mount it where a fluid flows from bottom to top.

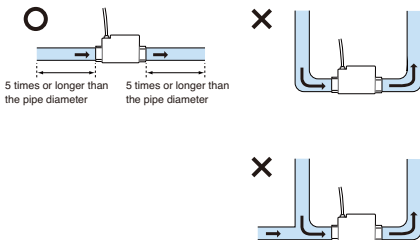
Arrange piping so that bubbles will not enter. If fluid contains bubbles, place piping where the device will not be affected by bubbles as much as possible.



Securing straight piping

Provide straight piping immediately before and after a sensor for a length of 5 times or longer than the pipe diameter.

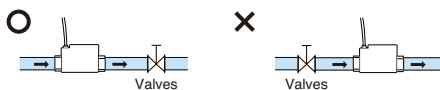
If turbulence is strong, secure straight piping for a length of 20 times or longer than the pipe diameter.



Installing valves and thermocouples

Installing valves

Install flow control valves downstream from the sensor.



If a valve is clogged halfway, a turbulent flow may occur. Secure straight piping for a length of 5 to 20 or more times the pipe diameter.

Installing thermocouple

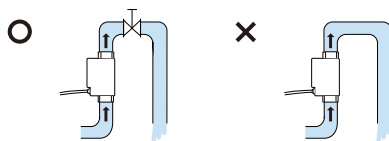
Be sure to install a thermocouple downstream of a sensor.

If a thermocouple is installed downstream of a sensor, secure straight piping for a length of at least 5 times the pipe diameter.



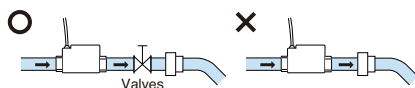
Opening downstream

If a final end of piping is left open, secure line pressure by inserting a valve before an opening end.



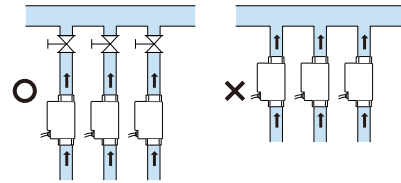
Piping with soft resin tube

If piping is provided using soft tubes, securing line pressure by inserting a valve downstream to prevent influences of vibrations specific to tubes.



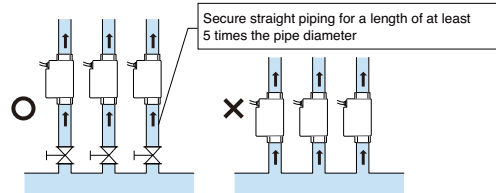
Concentric piping

Due to turbulent flows, unstable line pressure is possible when using concentric piping.



To reduce this unstable line pressure, it is recommended to install valves as shown if concentric piping occurs downstream.

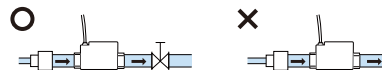
If concentric piping exists upstream



Again to reduce this unstable line pressure, it is recommended to install valves as shown if concentric piping occurs upstream. However, secure straight piping for a length of at least 5 times the pipe diameter to prevent influences from turbulent flows at the valve. If turbulence is strong, secure straight piping for a length of at least 20 times the pipe diameter. If turbulent flow is even stronger still, insert a valve on the secondary side to increase the line pressure.

Changing diameters

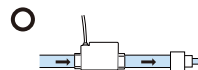
Increasing diameter from capillary upstream



If line pressure suddenly decreases when a capillary is extended into a thicker pipe, turbulent flow or cavitation may occur. Inserting a valve downstream to secure a line pressure can reduce influences of such problem.

Secure straight piping for a length of at least 5 times the pipe diameter.

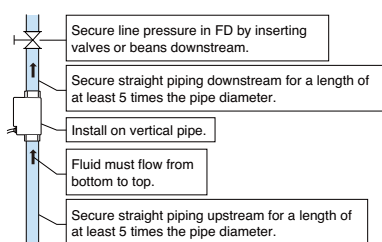
Decreasing diameter into capillary downstream



If a flow goes into a capillary, no measure is required in particular because line pressure is maintained.

Secure straight piping for a length of at least 5 times the pipe diameter.

Example of standard pipe arrangement



To secure line pressure it is recommended to install a valve on the water feeding side. Utilise a sufficient straight pipe length to minimise the influence of turbulent flow.

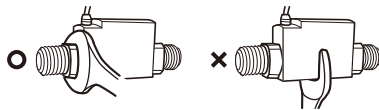
Installing sensor head

■ FD-P05/P20/P50/P100 (PPS type)

When installing a sensor head onto piping, hold the flat part at the base of the screw with a wrench and tighten the screw. DO NOT hold the body of the sensor, as damage will result.

* The following lists tightening torques.

FD-P05	FD-P20	FD-P50	FD-P100
10N·m	20N·m	30N·m	30N·m



To hold down the sensor head body, use the holding down screw on the back.

* The following lists tightening torques.

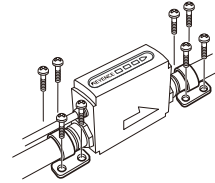
FD-P05/P20/P50	FD-P100
0.3N·m	1N·m

■ FD-F04/F20/F50 (PFA type)

Use joints when connecting tubing.

FD-F04/F20/F50 Tube size

	Outer diameter	Inner diameter
FD-F04	ø9.5 mm (3/8inch)	ø6.3 mm
FD-F20	ø12.7 mm (1/2inch)	ø9.5 mm
FD-F50	ø19.0 mm (3/4inch)	ø15.8 mm



- To hold down the unit, use the provided mounting bracket.
- Mount the mounting bracket as close to the sensor head unit as possible.

Precautions

	Danger	Handling a unit improperly ignoring descriptions under this symbol may cause death or serious injury.
	Warning	Handling a unit improperly ignoring descriptions under this symbol may cause injury.
	Caution	Handling a unit improperly ignoring descriptions under this symbol may cause damage to property (failure of product, etc.).

Danger

1. Do not use the product exceeding a range of defined specifications. Use the product in compliance with this operating manual.
2. Avoid using the product for applications requiring safety performances, such as nuclear power plant, railroad, aircraft, vehicle, or amusement equipment.
3. Do not modify the product.
4. This product has no sanitary specifications. Verify sanitary standards of facility.
5. This product has no flameproof specifications. Do not use the product in a dangerous environment of flammable gas, etc.
6. Do not use liquids that may cause corrosion of wetted materials.

Caution

1. This product cannot be used as a regular metre for commercial purposes.

About operating environment

Caution

1. Use the product within specified temperature limits. Provide anti-freezing measures if it is used under low temperatures. Freezing may damage a body and may cause leakage.
2. Use the product within specified pressures.
3. Use the product within specified flow rates. Use of the product in excess of these limits may result in false readings, and may cause alarms due to cavitation.
4. At high temperatures, where liquid viscosity is lower in comparison to that in lower temperatures, the unit becomes vulnerable to cavitation. If variation of values becomes greater at high temperatures, increase a line pressure by installing the unit on the fluid feeding side or by installing a valve on the secondary side.

Cautions in handling

Caution

1. Do not expose to excessive shock by dropping or hitting the unit. Hold the body when handling the unit.
2. Do not pull on the cable.
3. Do not press the buttons with sharp tools.

About detecting fluids

Caution

1. Fluids such as hydrochloric acid, chloroform, ozone water, and hot acid or alkali may penetrate the body and cause corrosion of sensor and circuits. Do not use fluids with strong chemical properties
2. Ranges of guaranteeing precision of flow volumes depend on kinematic viscosity of a fluid. Refer to Detecting range with guaranteed precision on page 7.
3. Measuring certain fluorine liquids may not be possible.
4. Resistance to chemicals depends on conditions. Please contact us for use of chemical solutions.

About wiring

Danger

1. Check colours of wires when placing wiring.
2. Use the unit within the rated range. Do not exceed output load ratings.

Caution

1. Use an insulated stabilised power supply.
2. Do not apply excessive tensile force to the cable.
3. Do not immerse the cable tip in water while wiring.
4. Do not run wiring together with a power line.
5. Keep the unit away from noise sources as much as possible.
6. Keep the total length of the sensor head cable within 10 metres.

About piping

Danger

1. Do not install pipes where they may be used as scaffolding.

Caution

1. Provide piping so that a direction of flow agrees with that indicated on a sensor body.
2. Provide piping so that a measuring pipe is always filled with liquid.
3. Provide piping so that no gas gets into the pipes. If a liquid contains bubbles, install the unit where it is not affected by bubbles.
 - (1) When installing a unit on a pipe arranged vertically, let the fluid flow from bottom to top.
 - (2) Do not install a unit where air bubbles can be trapped.
4. After installation, do not mount the system where strong compression, tensile, or loading force is applied.
5. Prevent sealing tape and adhesive from squeezing out of piping screws.
6. Provide straight pipes of the same diameter immediately before and after the sensor. Pay attention to avoid turbulent flow caused by blocking with packing. Provide straight piping for a length of 5 times or longer than the pipe diameter.
7. Install flow control valves downstream of the sensor.
8. For easy maintenance, making maintenance space at the installing position is recommended.
9. Do not install the sensor on a pipe system that may receive impacts.
10. If foreign matter or oil exists in pipes, wash them away before installing the sensor.
11. If thermal expansion of pipes occurs, relieve the stresses by arranging pipes.
12. A turbulent flow or pulsing stream may cause fluctuation of display or an error. Take measures such as providing straight piping.
13. Note that if micro bubbles (invisible fine bubbles) stay in piping, it may cause scrolling or display of flow volume of flow indicator upon halt of a fluid.

About installation

Caution

1. If a force is applied to the unit during pipe installation, hold the flat part at the base of the screw with a wrench.
2. Refer to the following values for tightening torques for each type. Do not apply an excessive torque.

Model	Tightening torque
FD-P05	10N·m
FD-P20	20N·m
FD-P50	30N·m
FD-P100	30N·m

If leakage occurs after installing pipes with the specified tightening torque, do not retighten but check screws and sealing tapes for faults.

3. Do not install the unit where it is exposed to intensive light such as direct sunlight or a heat source.
4. Do not install the unit where submersion in water may occur.

Others

Caution

1. A period of 3 seconds after turning on the power is time for power-on resetting. Do not use the output signals in this period.



Please visit: www.keyence.com



SAFETY INFORMATION
Please read the instruction manual carefully in order to safely operate any KEYENCE product.

KEYENCE GLOBAL HEADQUARTERS

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BELGIUM Phone: +32 27 16 40 63 Fax: +32 27 16 47 27	HONG KONG Phone: +852-3104-1010 Fax: +852-3104-1080	MEXICO Phone: +52-81-8220-7900 Fax: +52-81-8220-9097	TAIWAN Phone: +886-2-2718-8700 Fax: +886-2-2718-8711
CANADA Phone: +1-905-696-9970 Fax: +1-905-696-8340	HUNGARY Phone: +36 1 802 73 60 Fax: +36 1 802 73 61	NETHERLANDS Phone: +31 40 20 66 100 Fax: +31 40 20 66 112	THAILAND Phone: +66-2-369-2777 Fax: +66-2-369-2775
CHINA Phone: +86-21-68757500 Fax: +86-21-68757550	ITALY Phone: +39-02-6688220 Fax: +39-02-66825099	POLAND Phone: +48 71 36861 60 Fax: +48 71 36861 62	UK & IRELAND Phone: +44-1908-696900 Fax: +44-1908-696777
CZECH REPUBLIC Phone: +420 222 191 483 Fax: +420 222 191 505	JAPAN Phone: +81-6-6379-2211 Fax: +81-6-6379-2131	SINGAPORE Phone: +65-6392-1011 Fax: +65-6392-5055	USA Phone: +1-201-930-0100 Fax: +1-201-930-0099
FRANCE Phone: +33 1 56 37 78 00 Fax: +33 1 56 37 78 01	KOREA Phone: +82-31-642-1270 Fax: +82-31-642-1271	SLOVAKIA Phone: +421 2 5939 6461 Fax: +421 2 5939 6200	