STACK INDUSTRY

ALL YOU NEED TO DO IS

CLAMP-ON

STACK INDUSTRY
276/1, G.I.D.C, MAKARPURA, VADODARA-390010
Mo.:9722165300 Email: stack.industry@outlook.com

CLAMP-ON FLOW SENSOR **FD-Q Series**

1 EASY TO INSTALL FOR ANY USER

- No need for special tools or parts
- No special knowledge required
- No machine downtime

2 EASY TO INTEGRATE INTO EXISTING PROCESSES

- No pressure loss or contamination
- Detect water (DI), oil, chemicals, etc.
- Detect through metal and resin pipes

3 EASY TO SET UP AND USE

- Preprogrammed detection modes
- Live monitoring of instantaneous flow
- Quick setting codes

WHY IS FLOW IMPORTANT?

COMMON USES FOR FLUIDS IN FACTORY ENVIRONMENTS

Fluids are used all throughout facilities, each with its own usage and purpose. Example: Water to cool a die in an injection molding machine.

What types of FLUIDS do you utilize in your processes?

WATER | OIL | CHEMICAL | PRODUCT

How are these fluids used?

COOLING | CLEANSING | HANDLING | OTHER

How are you addressing these common flow issues?

QUALITY CONTROL | MACHINE PROTECTION | USAGE OF ACTUAL FLUID

FACTORS THAT CAUSE VARIATIONS IN FLOW

Scenarios that lead to inconsistent flow amounts:

Equipment Related

Example **STRAINER**

A clogged basket may lead to slower flow.

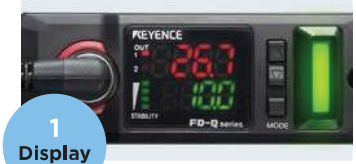
Human Error/Deviation

Example **IMPROPER VALVE POSITION**

Improper valve control can lead to very costly mistakes.

HOW FLOW SENSORS CAN HELP CONTROL FLOW

Digital flow sensors provide several layers of benefits for any flow application.



1 Display

Monitor flow directly on unit

2 Alert

Send signals to a PLC, light, etc.

3 Record

Track operations to improve efficiency

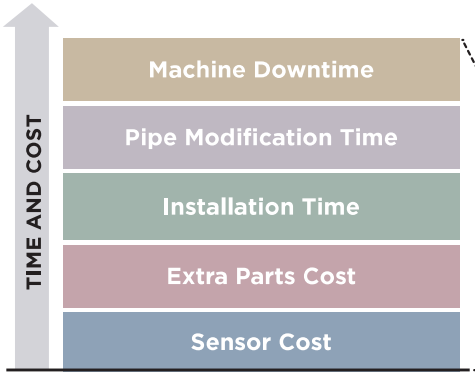
EASY TO INSTALL FOR ANY USER

SIMPLE AND EASY MOUNTING

FD-Q can be mounted quickly and easily with only a screw driver, no pipe modifications necessary.

Installing a conventional flow sensor

Extremely difficult, requiring special knowledge, tools, and machine downtime



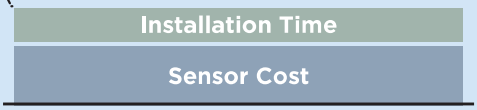
Conventional Method

- Shut down machine and remove liquid from pipe
- Cut the pipe
- Thread each end of the pipe
- Attach the sensor to a union joint
- Attach the sensor and union joint to the pipe
- Turn on machine and allow liquid to fill the pipe
- Adjust flow amount to the original value
- Check for fluid leakage

Installing FD-Q Series

Anyone can easily mount with just a screwdriver

Total Cost Reduction



FD-Q Series

- Attach the bracket with 4 screws
- Attach the controller to the bracket with 2 screws

EASY TO INTEGRATE INTO EXISTING PROCESSES

COMPATIBLE WITH COUNTLESS FLOW SETUPS

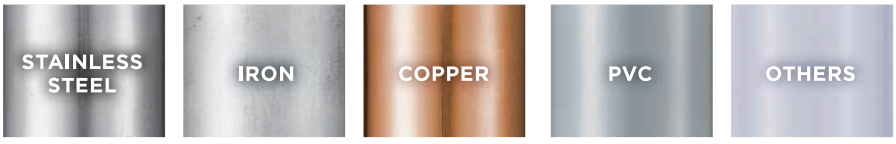
FD-Q can detect and handle all sorts of fluids, pipe materials, and pipe sizes.

1 Detectable fluids

2 Compatible pipe materials

METAL PIPES Stainless Steel/Iron/Copper

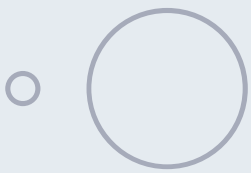
RESIN PIPES PVC/Others



3 Compatible pipe sizes

1/4″ to **2″**

(13.8 mm to 60.5 mm)*1



*1 Outer Pipe Diameter Size

COMMON ISSUES WITH CONVENTIONAL FLOW SENSORS

Mechanical Types

(i.e. paddle wheel type, floating element type, etc.)

Pressure Loss

Continual Maintenance

Contamination

The moving parts lead to pressure losses. Also, continual maintenance is required to prevent clogging around the moving parts.

Thermal Types

Pressure Loss

Extra Maintenance

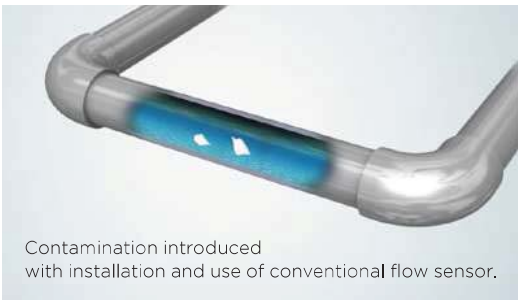
Unstable Readings

Temperature variations often lead to unstable readings. The probe portion of the sensor also causes pressure losses and requires continual maintenance.

INNOVATIVE CLAMP-ON DESIGN PREVENTS THESE COMMON ISSUES

The clamp-on style of the FD-Q prevents pressure losses, contamination, and excessive downtime associated with conventional flow sensors. This is due to the non-contact, clamp-on design of the FD-Q Series.

Pressure loss caused
by sensor impeding flow.



Contamination introduced
with installation and use of conventional flow sensor.

EASY TO SET UP AND USE

1
Display Selection

EASY TO READ DISPLAYS

2
I/O Selection

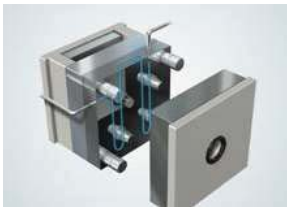
SELECTABLE I/O

1 Control Output	2 Control Outputs	1 Control Output + 1 External Input	1 Control Output + 1 Analog Output

3
Operation Mode Selection

SELECTABLE OPERATION MODES

Typical flow control
[STANDARD]
Output turns ON below or above a user defined threshold



Flow rate monitoring
[AREA]
Output turns ON outside of a user defined window

Consumption management
[ACCUMULATION]
Output turns ON after a user defined amount of flow has passed

4
Sensor Settings Duplication

QUICK SETTING CODE

Easily copy the settings from one sensor to a new one by simply inputting an 8 digit code.

ADDITIONAL FEATURES

WITHSTAND HARSH ENVIRONMENTS

High water resistance enables use in even the harshest environment

COMPACT DESIGN

The slim design enables mounting in close proximity or in tight spaces

3 STATE LARGE INDICATOR

The FLASHING indicator is useful for indicating the need for Preventive Maintenance (PM)

SIMULATION MODE

Easily test the operation of the outputs without the need for actual flow

OTHER PLACES TO MOUNT AND SPECIFIC USAGES

NEAR IMPORTANT EQUIPMENT

FILTER

Filter contamination or saturation can lead to a decrease in flow

BALL/NEEDLE VALVE

Valve positioning may be incorrect or left unopened due to operator error

CURRENT SENSOR

The mechanical portion of these flow sensors may cause inconsistencies in flow rates

DIFFICULT MOUNTING SITUATIONS

DIVERGING PIPES

Mounting several flow sensors in close proximity was nearly impossible with bulky conventional flows sensors

BACK OF THE MACHINE

These tight spaces made pipe modification problematic

HIGH PRESSURE PIPES

These pipes are hard to modify and require pressure resistant sensors

SPECIFIC FLUID

CHEMICALS

Pipe modifications can cause unsafe exposure to hazardous chemicals

EASILY CONTAMINATED LIQUIDS

The detection of flow where contact with the flow sensor can cause contamination

PROPRIETARY FLUIDS

Controlling the amount of flow for proprietary fluids is needed to prevent costly waste

OTHER USAGES

CONTRACTED EQUIPMENT

Pipe modifications may not be possible if the equipment is contracted

MACHINE WITH WARRANTY

Physical changes made to the equipment could potentially void the machine warranty

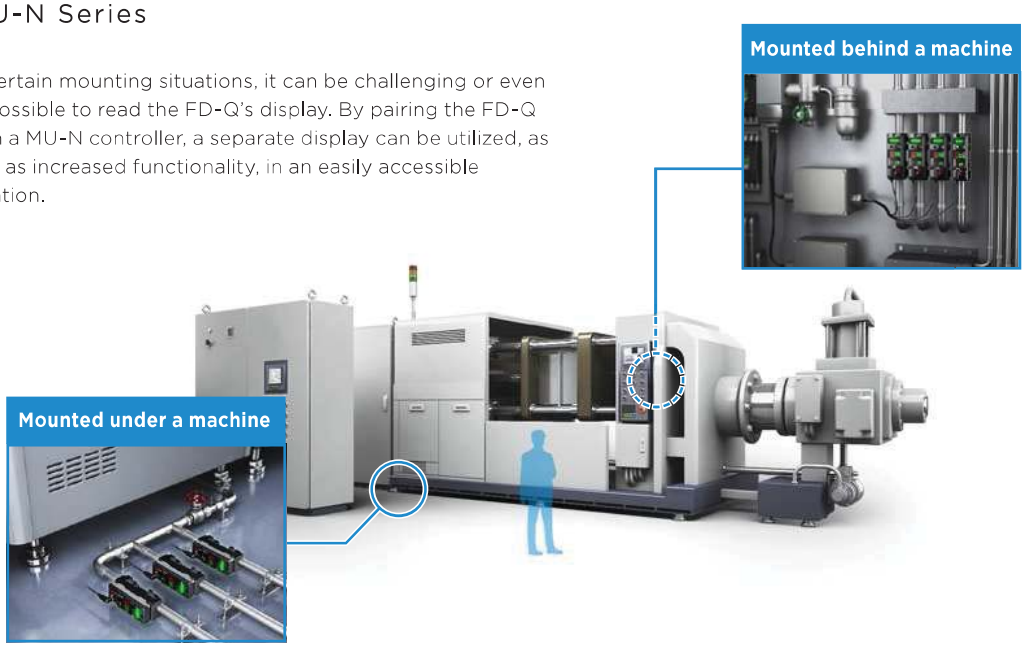
KEEPING PROCESS NOTES

Requiring an operator to keep process notes is costly and inefficient.

Remote Display with Added Functionality

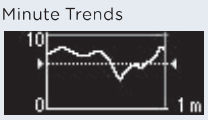
Multi-Sensor Controller
MU-N Series

In certain mounting situations, it can be challenging or even impossible to read the FD-Q's display. By pairing the FD-Q with a MU-N controller, a separate display can be utilized, as well as increased functionality, in an easily accessible location.



Intuitive Displays

The MU-N features a clear, OLED display that offers real time graphing for simplified flow monitoring.



Settings Back-Up Function

The Settings Back-Up Function allows users to save sensor settings on the MU-N and quickly transfer them to new sensors.

Sensor Identification Function

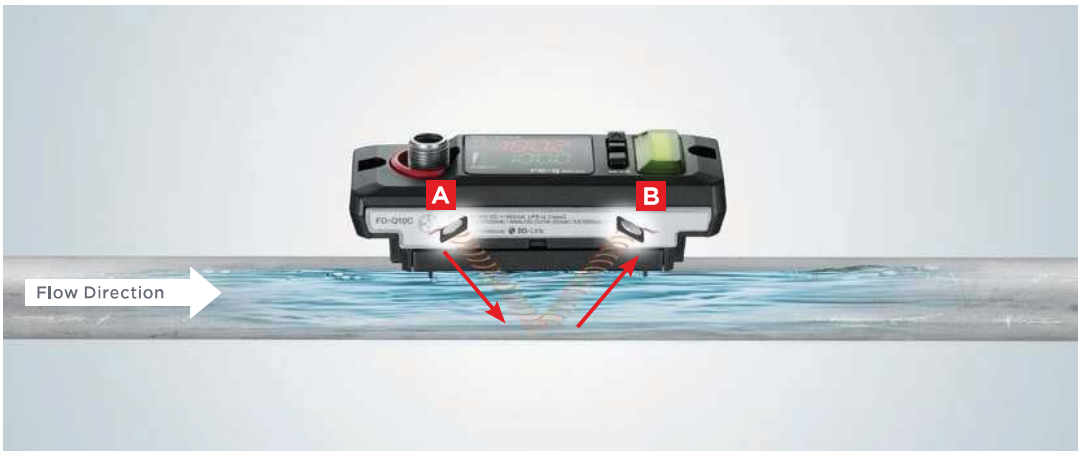
Easily identify which FD-Q is connected to a given MU-N controller by making that unit's indicator flash.

Network Compatibility

By combining the MU-N Series with the KEYENCE NU Series, users can transmit data over a standard industrial network.

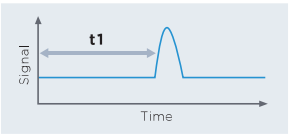
OPERATING PRINCIPLE AND TECHNOLOGY

BASIC OPERATING PRINCIPLE

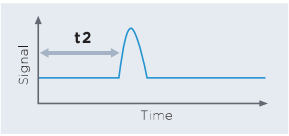


The FD-Q measures the time it takes an ultrasonic signal to transmit from point A on the sensor to point B(t_1). When the flow rate increases, the signal is accelerated, leading to less time for the transmission from A to B(t_2). Using the correlation between the time duration and the speed of the flow, the FD-Q measures the instantaneous flow rate.

LOW FLOW



HIGH FLOW



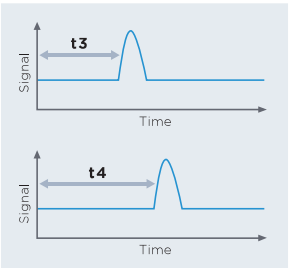
TECHNOLOGY FOR STABLE DETECTION

dTOF technology

Conventional ultrasonic flow sensors are known for their unstable detection. This is due to the fact that the speed of the ultrasonic signal is not only affected by the flow of the liquid, but also external factors such as clogging or temperature change. Instead of simply measuring the duration of a single pulse, FD-Q emits and receives two different sets of ultrasonic pulses. One traveling from A to B and the other traveling from B to A. By doing this, the FD-Q can stably monitor flow by comparing the two signal. This method of detection minimizes the effects of any external factors.

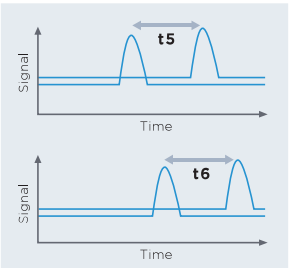
Basic Principle

The duration of the pulse is easily influenced by external factors.



Delta TOF

External factors do not affect detection as the time DIFFERENCE between A to B and B to A remains the same.



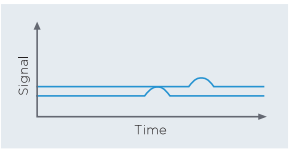
DSS Function

The stable transmission of the ultrasonic signal is imperative for consistently stable detection. Build up or rust on the inside a pipe can become problematic overtime for conventional flow sensors. By utilizing the DSS Function, the FD-Q automatically adjusts its power to compensate for this build-up and provide long periods of stable detection.

[What happens after any clogging occurs or the pipe rusts]

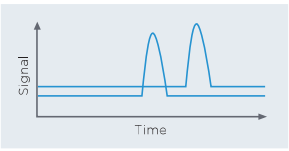
Without DSS

The received ultrasonic waves become weaker, leading to unstable detection.



With DSS

When FD-Q recognizes weak signals, it automatically increases the power of the ultrasonic pulses.



LINEUP

Sensor

Appearance	Model	Rated flow range	Connection Bore Diameter
	FD-Q10C	20 L/min 5.2 gal/min	1/4"(8 A) ø13 mm to ø16 mm
		30 L/min 7.9 gal/min	3/8"(10 A) ø16 mm to ø18 mm
	FD-Q20C	60 L/min 15.9 gal/min	1/2"(15 A) ø18 mm to ø23 mm
		100 L/min 26.4 gal/min	3/4"(20 A) ø23 mm to ø28 mm
	FD-Q32C	200 L/min 52.8 gal/min	1"(25 A) ø28 mm to ø37 mm
		300 L/min 79.3 gal/min	1 1/4"(32 A) ø37 mm to ø44 mm
	FD-Q50C	400 L/min 105.7 gal/min	1 1/2"(40 A) ø44 mm to ø52 mm
		500 L/min 132.1 gal/min	2"(50 A) ø52 mm to ø64 mm

Protection cover

Appearance	Model	Name	Material
	FD-QP1	Display Protection Cover	Polysulfone

When using the sensor without the controller: Select a suitable power supply cable from the table below.

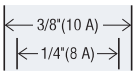
Power supply cable

Appearance	Model	Material	Connector type	Cable termination	Length
	OP-75722	PVC (Polyvinyl chloride)	M12 4 pins L-shape	Loose wire	2 m 6.6'
	OP-87274				10 m 32.8'
	OP-87640	PUR (Polyurethane) (Oil Resistant)	M12 4 pins L-shape	Loose wire	2 m 6.6'
	OP-87641				10 m 32.8'

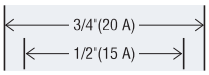
Bore Diameter Guide [The diagrams below display the applicable pipe widths]

(Each model contains a mounting bracket that can accommodate two different pipe sizes)

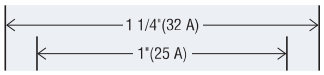
FD-Q10C



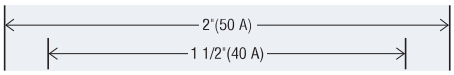
FD-Q20C



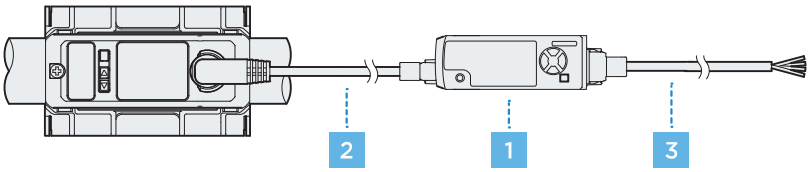
FD-Q32C



FD-Q50C



When using the sensor with the controller: Select a controller and the appropriate cables from the tables below.



1 Controller

Appearance	Model	Type	Control output	External input	Analog output
	**MU-N11**	Main unit	2 outputs max.	1 input max.	1 output max.
	**MU-N12**	Expansion unit			—

* Power supply cable is not included.

2 Sensor-to-controller cable

Appearance	Model	Cable material	Sensor side	Controller side	Length
	**OP-88027**	PVC (Polyvinyl chloride)	M12 4-pin L-shape	Connector	2 m 6.6'
	OP-88028*				10 m 32.8'

* The 10 m 32.8' cable includes one spare connector for the controller side.

3 Power supply cable for controller

Appearance	Model	Applicable unit	Cable material	Controller side	Cable end	Length
	**MU-CB4**	Main unit	PVC (Polyvinyl chloride)	Connector	4-core loose wires	2 m 6.6'
	MU-CB2	Expansion unit			2-core loose wires	2 m 6.6'
	**MU-CC4**	Main unit			M12 4-pin straight	0.3 m 1.0'

Optional accessories

Appearance	Model	Type	Applicable model	Description
	**OP-76877**	Mounting adapter (for main unit)	MU-N11	Allows the main unit to be mounted without a DIN rail.
	**OP-26751**	End unit (for expansion)	MU-N11/N12	Used to secure the main and expansion units to DIN rail from both ends. End units must be used when an expansion unit is connected. (2 pieces included)
	**OP-88029**	Connector set for sensor-to-controller connection for PVC (Polyvinyl chloride) cable	OP-75722/87274	This set is required when the sensor cable end is loose wires or when the sensor-to-controller cable is cut.
	**OP-88030**	Connector set for sensor-to-controller connection for PUR (Polyurethane) cable	OP-87640/87641	

SPECIFICATIONS

Sensor

Model			FD-Q10C		FD-Q20C		FD-Q32C		FD-Q50C	
Supported pipe diameter	Outer diameter of pipe (mm)		ø13 to ø16	ø16 to ø18	ø18 to ø23	ø23 to ø28	ø28 to ø37	ø37 to ø44	ø44 to ø52	ø52 to ø64
	NPS (Nominal Pipe Size)		1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
	DN (Diameter Nominal)		8 A	10 A	15 A	20 A	25 A	32 A	40 A	50 A
Supported pipe materials			Metal pipe/Resin pipe*1							
Supported fluids			Various liquid [i.e. water (including DI), oils, chemicals, etc.]*1							
Supported fluid temperature (Pipe surfacetemperature)			0 to 85°C 32 to 185°F (No freezing on the pipe surface)*2							
Maximum rated flow			20 L/min 5.2 gal/min	30 L/min 7.9 gal/min	60 L/min 15.9 gal/min	100 L/min 26.4 gal/min	200 L/min 52.8 gal/min	300 L/min 79.3 gal/min	400 L/min 105.7 gal/min	500 L/min 132.1 gal/min
Zero cut flow rate (Default) *3			1.0 L/min		2.5 L/min		5 L/min		25 L/min	
Display method			Status indicator, output indicator, dual row display with 4-digit, 7 segment LED, stability level indicator							
Display update cycle			Approx. 3 Hz							
Display resolution (L/min)			0.01/ 0.1/ 1 (Default: 0.1)		0.1/ 1 (Default: 0.1)		0.1/ 1 (Default: 1)			
Response time			0.5 s / 1.0 s / 2.5 s / 5 s / 10 s / 30 s / 60 s							
Repeatability /F.S.*4 (Specific to selected response time)			0.5 s: ±2.0%, 1 s:±1.5%, 2.5 s: ±1.0%, 5 s: ±0.5%, 10 s: ±0.35%, 30 s: ±0.2%, 60 s: ±0.15%							
Hysteresis			Variable							
Integrated flow unit display (L)			0.1/ 1/ 10/ 100/ 1000 (Default: 1)				1/ 10/ 100/ 1000/ 10000 (Default: 1)			
Integrated flow data storage cycle			Save to memory every 10 seconds							
Memory backup			EEPROM (Data storage length: 10 years or longer, Data read/write frequency: 1 million times or more)							
Power I/O connector			M12 4-pin connector							
Input/ Output (Selectable)*5	Output (ch.1/ch.2)		Control output/ Pulse output/ Error output (Selectable, Default: ch.1 control output/ ch.2 not used), NPN/PNP setting switchable,open collector output 30 V or less, max. 100 mA/ch., residual voltage 2.5 V or less							
	Analog output (ch.2)		4 to 20 mA / 0 to 20 mA (Selectable, Default: not used), load resistance 500 Ω or less							
	External input (ch.2)		Integrated flow reset input/ Flow rate zero input/ Origin adjustment input (Selectable, Default: not used), short-circuit current 1.5 mA or less, input time 20 ms or more							
Power source	Power supply voltage		20 to 30 VDC , ripple (P-P) 10% max, Class2/LPS							
	Current consumption		100 mA or less (Load current excluded)*6				130 mA or less (Load current excluded)*6			
Protection circuit			Power supply reverse connection protection, power supply surge protection, each output short-circuit protection, each output surge protection							
Environmental resistance	Enclosure rating		IP65/IP67 (IEC60529)							
	Ambient temperature		-10 to 60°C 14 to 140°F (No freezing)							
	Ambient humidity		35 to 85%RH (No condensation)							
	Vibration resistance		10 to 55 Hz, compound amplitude 1.5 mm 0.06", XYZ axes 2 hours for each axis							
	Shock resistance		100 m/s^2 16 ms pulse X, Y, Z 1000 times for each axis							
Material	Sensor main unit		PPS/PES/PBT/SUS303/SUS304/SUSXM7							
	Sensor surface		Rubber							
	Mounting bracket		SUS304/PA/SUSXM7				SUS304/PA/POM/SUSXM7			
Weight (including mounting bracket)			Approx. 340 g		Approx. 400 g		Approx. 530 g		Approx. 640 g	

*1 Liquid must allow for the passage of an ultrasonic pulse, as well as not contain large air pockets or excessive bubbles. Detection may be unstable on certain non-standard pipes. (i.e. lined pipes)

*2 Contact KEYENCE when the temperature of the pipe is greater than 85°C 185°F.

*3 The zero cut flow rate can be changed in the settings. When using the unit with a low flow rate range, perform an origin adjustment when the fluid is not moving if you change the zero cut flow rate.

*4 This specification is valid when the flow velocity distribution is stable. This value does not take into account the effects of pulsation or fluctuations in flow velocity distribution due to facility factors. Convert the F.S. (full scale) listed in the table according to the rated flow range.

*5 IO-Link: Compatible with Specification v1.1 / COM2 (38.4 kbps) The setting file can be downloaded from the KEYENCE website. (http://www.keyence.com) If using the unit in the environment where downloading the file is not possible via internet, contact your nearest KEYENCE office. IO-Link is either registered trademarks or trademarks of PROFIBUS Nutzerorganisation e.V. (PNO)

*6 When including the loads, please add 200 mA to this value.

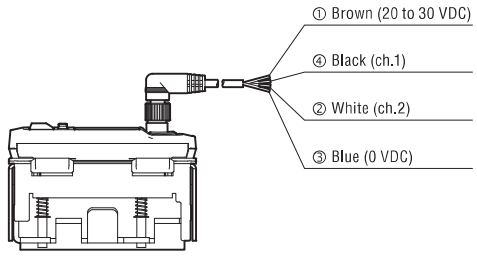
Controller

Model			MU-N11	MU-N12
Type			Main unit	Expansion unit
Response time			0.5 s / 1.0 s / 2.5 s / 5 s / 10 s / 30 s / 60 s	
Power supply	Power voltage		24 VDC, ripple (P-P) 10% or less, Class 2 or LPS	
	Current consumption	with FD-Q10C/ Q20C	170 mA or less (without load)*1	155 mA or less (without load)*2
		with FD-Q32C/ Q50C	200 mA or less (without load)*1	185 mA or less (without load)*2
Input/Output (Selectable)	Output (ch.1/ch.2)		Control output/Pulse output/Error output (Selectable, Default : ch.1 control output/ch.2 not used), NPN/PNP setting switchable, open collector output 24 V or less, Main unit: max. 50 mA/ch*3., Expansion unit: 20 mA/ch., residual voltage 2 V or less	
	Analog output (ch.2)		4 to 20 mA, load resistance: 450 Ω or less/0 to 10 V External load resistance: 5 kΩ or more (Selectable, Default: not used)	—
	External input (ch.2)		Integrated flow reset input/Flow rate zero input/Origin adjustment input (Selectable, Default: not used), short-circuit current NPN: 1 mA or less/PNP: 2 mA or less	
Protection circuit			Protection against reverse power connection, power supply surge, output overcurrent, output surge, and reverse output connection	
Unit expansion			Up to 4 units per main unit*4	
Environmental resistance	Ambient temperature		-20 to +50°C -4 to 122°F (no freezing)	
	Ambient humidity		35 to 85%RH (no condensation)	
	Shock resistance		1000 m/s^2 in X, Y, Z axis directions respectively 6 times	
	Vibration resistance		10 to 55 Hz Double amplitude 1.5 mm 0.06" in the X, Y, Z axis directions respectively, 2 hours	
Material			Case and dust cover: Polycarbonate, Button: Polyacetal, Display panel: Acrylic	
Weight			Approx. 70 g	

*1 When including the loads, please add 100 mA to this value.
*2 When including the loads, please add 40 mA to this value.
*3 20 mA/ch. or less when an expansion unit is connected.
*4 Up to 5 N-bus devices, including the main unit (or network unit), can be linked together.

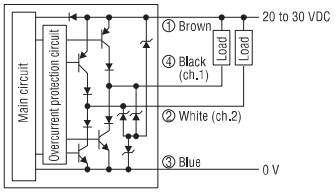
I/O CIRCUIT DIAGRAM

When using the sensor without the controller

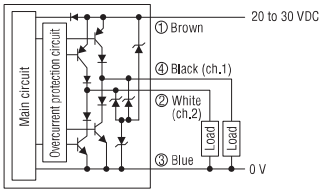


■ When "Control Output" is selected for ch.2*

When NPN is selected

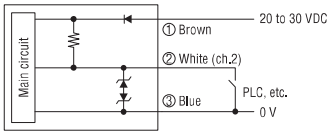


When PNP is selected

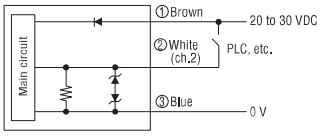


■ When "External Input" is selected for ch.2*

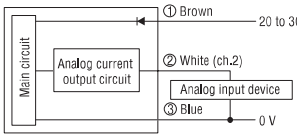
When NPN is selected



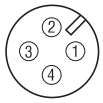
When PNP is selected



■ When "Analog Output" is selected for ch.2*

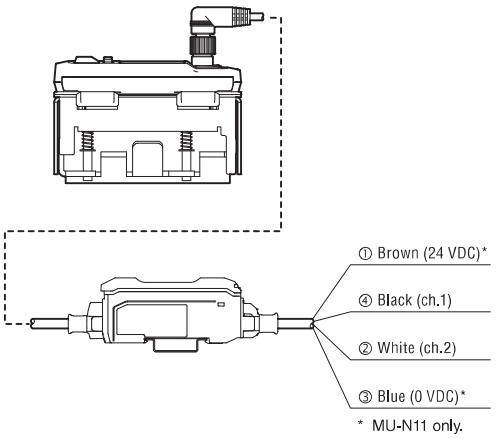


■ M12 Connector pin layout



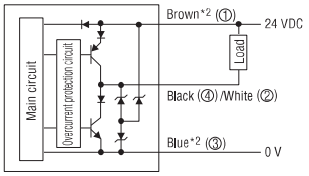
*When "OFF" is selected for ch.2 (default), ② White will not be used.

When using the sensor with the controller

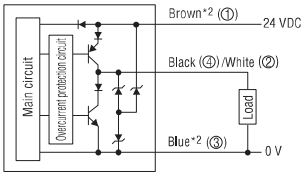


■ When "Control Output" is selected for ch.2*1

When NPN is selected

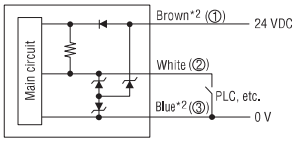


When PNP is selected

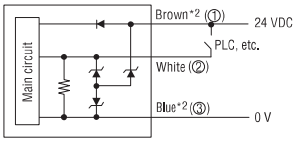


■ When "External Input" is selected for ch.2*1

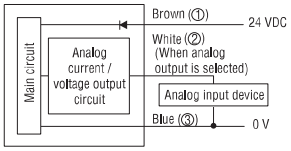
When NPN is selected



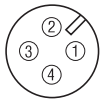
When PNP is selected



■ When "Analog Output" is selected for ch.2*1*2



■ Pin layout when the M12 connector (4-pin) cable is used



*1 When "OFF" is selected for ch.2 (default), ② White will not be used.
*2 MU-N11 only.