NO PIPE MODIFICATION NECESSARY

Multi-Sensor Controller
MU-N Series
ALL YOU NEED TO DO IS
CLAMP-ON
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 moulding machine.

What types of FLUIDS do you utilise 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:

<table>
<thead>
<tr>
<th>EQUIPMENT RELATED</th>
<th>HUMAN ERROR/DEVIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXAMPLE: STRAINER</td>
<td>EXAMPLE: IMPROPER VALVE POSITION</td>
</tr>
<tr>
<td>A clogged basket may lead to slower flow.</td>
<td>Improper valve control can lead to very costly mistakes.</td>
</tr>
</tbody>
</table>

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 screwdriver, no pipe modifications necessary.

Installing a conventional flow sensor

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

Installing FD-Q Series

Anyone can easily mount with just a screwdriver

TIME AND COST

MACHINE DOWNTIME
PIPE MODIFICATION TIME
INSTALLATION TIME
EXTRA PARTS COST
SENSOR COST

TOTAL COST REDUCTION

INSTALLATION TIME
SENSOR COST

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

FD-Q Series

- Attach the bracket with 4 screws
- Attach the controller to the bracket with 2 screws
**EASY TO INTEGRATE INTO EXISTING PROCESSES**

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

**COMPATIBLE WITH COUNTLESS FLOW SETUP**

<table>
<thead>
<tr>
<th>1. DETECTABLE FLUIDS</th>
<th>2. COMPATIBLE PIPE MATERIALS</th>
<th>3. COMPATIBLE PIPE SIZES</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER</td>
<td>METAL PIPES: Stainless Steel/Iron/Copper</td>
<td>1/4&quot; to 2&quot; (13.8 mm to 60.5 mm)*1</td>
</tr>
<tr>
<td>OIL</td>
<td>RESIN PIPES: PVC/Others</td>
<td></td>
</tr>
<tr>
<td>CHEMICAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 Outer Pipe Diameter Size
COMMON ISSUES WITH CONVENTIONAL FLOW SENSORS

MECHANICAL TYPES
(i.e. Paddle wheel type, floating element type, etc.)

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

THERMAL TYPES

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

- STANDARD
  Actual Flow Amount

- CONDITION MONITORING
  Relative Flow Amount

2 I/O SELECTION

SELECTABLE I/O

- 1 CONTROL OUTPUT
- 1 CONTROL OUTPUT + 1 EXTERNAL INPUT
- 2 CONTROL OUTPUTS
- 1 CONTROL OUTPUT + 1 ANALOGUE 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

IP65: Light Washdown  IP67: Submersion in Water

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

STATE 1
LIT IN GREEN

STATE 2
FLASHING IN GREEN

STATE 3
LIT IN RED

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

<table>
<thead>
<tr>
<th>FILTER</th>
<th>BALL/NEEDLE VALVE</th>
<th>CURRENT SENSOR</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Filter" /></td>
<td><img src="image2.png" alt="Ball/Needle Valve" /></td>
<td><img src="image3.png" alt="Current Sensor" /></td>
</tr>
</tbody>
</table>

Filter contamination or saturation can lead to a decrease in flow. Valve positioning may be incorrect or left unopened due to operator error. The mechanical portion of the flow sensors may cause inconsistencies in flow rates.

## DIFFICULT MOUNTING SITUATIONS

<table>
<thead>
<tr>
<th>DIVERGING PIPES</th>
<th>BACK OF THE MACHINE</th>
<th>HIGH PRESSURE PIPES</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Diverging Pipes" /></td>
<td><img src="image5.png" alt="Back of the Machine" /></td>
<td><img src="image6.png" alt="High Pressure Pipes" /></td>
</tr>
</tbody>
</table>

Mounting several flow sensors in close proximity was nearly impossible with bulky conventional flows sensors. These tight spaces made pipe modification problematic. These pipes are hard to modify and require pressure resistant sensors.

## SPECIFIC FLUID

<table>
<thead>
<tr>
<th>CHEMICALS</th>
<th>EASILY CONTAMINATED LIQUIDS</th>
<th>PROPRIETARY FLUIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7.png" alt="Chemicals" /></td>
<td><img src="image8.png" alt="Easily Contaminated Liquids" /></td>
<td><img src="image9.png" alt="Proprietary Fluids" /></td>
</tr>
</tbody>
</table>

Pipe modifications can cause unsafe exposure to hazardous chemicals. The detection of flow where contact with the flow sensor can cause contamination. Controlling the amount of flow for proprietary fluids is needed to prevent costly waste.

## OTHER USAGES

<table>
<thead>
<tr>
<th>CONTRACTED EQUIPMENT</th>
<th>MACHINE WITH WARRANTY</th>
<th>KEEPING PROCESS NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image10.png" alt="Contracted Equipment" /></td>
<td><img src="image11.png" alt="Machine with Warranty" /></td>
<td><img src="image12.png" alt="Keeping Process Notes" /></td>
</tr>
</tbody>
</table>

Pipe modifications may not be possible if the equipment is contracted. Physical changes made to the equipment could potentially void the machine warranty. 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 utilised, 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.

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

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.

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(t1). When the flow rate increases, the signal is accelerated, leading to less time for the transmission from A to B(t2). Using the correlation between the time duration and the speed of the flow, the FD-Q measures the instantaneous flow rate.

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 minimises the effects of any external factors.

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 utilising the DSS Function, the FD-Q automatically adjusts its power to compensate for this build-up and provide long periods of stable detection.

TECHNOLOGY FOR STABLE DETECTION

Basic Principle

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

Without DSS

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

With DSS

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

Delta TOF

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

What happens after any clogging occurs or the pipe rusts

LOW FLOW

HIGH FLOW
### Sensor

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Model</th>
<th>Rated flow range</th>
<th>Connection Bore Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FD-Q10C</td>
<td>20 L/min</td>
<td>1/4&quot;(8 A) ø13 to ø16 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 L/min</td>
<td>3/8&quot;(10 A) ø16 to ø18 mm</td>
</tr>
<tr>
<td></td>
<td>FD-Q20C</td>
<td>60 L/min</td>
<td>1/2&quot;(15 A) ø18 to ø20 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 L/min</td>
<td>3/4&quot;(20 A) ø20 to ø28 mm</td>
</tr>
<tr>
<td></td>
<td>FD-Q32C</td>
<td>200 L/min</td>
<td>1 1/4&quot;(32 A) ø28 to ø37 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300 L/min</td>
<td>1 1/2&quot;(40 A) ø37 to ø44 mm</td>
</tr>
<tr>
<td></td>
<td>FD-Q50C</td>
<td>400 L/min</td>
<td>2&quot;(50 A) ø44 to ø52 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500 L/min</td>
<td>2 1/2&quot;(60 A) ø52 to ø64 mm</td>
</tr>
</tbody>
</table>

### Protection cover

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Model</th>
<th>Name</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FD-QP1</td>
<td>Display Protection Cover</td>
<td>Polysulfone</td>
</tr>
</tbody>
</table>

### Power supply cable

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Model</th>
<th>Material</th>
<th>Connector type</th>
<th>Cable termination</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OP-76722</td>
<td>PVC (Polyvinyl chloride)</td>
<td>M12 4 pins</td>
<td>L-shape</td>
<td>2 m</td>
</tr>
<tr>
<td></td>
<td>OP-87274</td>
<td>PUR (Polyurethane)</td>
<td>M12 4 pins</td>
<td>L-shape</td>
<td>10 m</td>
</tr>
<tr>
<td></td>
<td>OP-87640</td>
<td>PUR (Polyurethane) (Oil Resistant)</td>
<td>M12 4 pins</td>
<td>L-shape</td>
<td>2 m</td>
</tr>
<tr>
<td></td>
<td>OP-87641</td>
<td></td>
<td></td>
<td>L-shape</td>
<td>10 m</td>
</tr>
</tbody>
</table>

### Bore Diameter Guide

(The diagrams below display the applicable pipe widths)

(Each model contains a mounting bracket that can accommodate two different pipe sizes)
When using the sensor with the controller: Select a controller and the appropriate cables from the tables below.

### Controller

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Model</th>
<th>Type</th>
<th>Control output</th>
<th>External input</th>
<th>Analogue output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MU-N11</td>
<td>Main unit</td>
<td>2 outputs max.</td>
<td>1 input max.</td>
<td>1 output max.</td>
</tr>
<tr>
<td></td>
<td>MU-N12</td>
<td>Expansion unit</td>
<td></td>
<td></td>
<td>—</td>
</tr>
</tbody>
</table>

* Power supply cable is not included.

### Sensor-to-controller cable

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Model</th>
<th>Cable material</th>
<th>Sensor side</th>
<th>Controller side</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OP-88027</td>
<td>PVC (Polyvinyl chloride)</td>
<td>M12 4-pin L-shape</td>
<td>Connector</td>
<td>2 m</td>
</tr>
<tr>
<td></td>
<td>OP-88028 *</td>
<td>PVC (Polyvinyl chloride)</td>
<td>M12 4-pin L-shape</td>
<td>Connector</td>
<td>10 m</td>
</tr>
</tbody>
</table>

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

### Power supply cable for controller

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Model</th>
<th>Applicable unit</th>
<th>Cable material</th>
<th>Controller side</th>
<th>Cable end</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MU-CB4</td>
<td>Main unit</td>
<td>PVC (Polyvinyl chloride)</td>
<td>Connector</td>
<td>4-core loose wires</td>
<td>2 m</td>
</tr>
<tr>
<td></td>
<td>MU-CB2</td>
<td>Expansion unit</td>
<td>PVC (Polyvinyl chloride)</td>
<td>Connector</td>
<td>2-core loose wires</td>
<td>2 m</td>
</tr>
<tr>
<td></td>
<td>MU-CC4</td>
<td>Main unit</td>
<td>PVC (Polyvinyl chloride)</td>
<td>Connector</td>
<td>M12 4-pin straight</td>
<td>0.3 m</td>
</tr>
</tbody>
</table>

### Optional accessories

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Model</th>
<th>Type</th>
<th>Applicable model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OP-76877</td>
<td>Mounting adapter (for main unit)</td>
<td>MU-N11</td>
<td>Allows the main unit to be mounted without a DIN rail.</td>
</tr>
<tr>
<td></td>
<td>OP-26751</td>
<td>End unit (for expansion)</td>
<td>MU-N11/N12</td>
<td>Used to secure the main and expansion units to DIN rail from both ends.</td>
</tr>
<tr>
<td></td>
<td>OP-88029</td>
<td>Connector set for sensor-to-controller connection for PVC (Polyvinyl chloride) cable</td>
<td>OP~75722/87274</td>
<td>This set is required when the sensor cable end is loose wires or when the sensor-to-controller cable is cut.</td>
</tr>
<tr>
<td></td>
<td>OP-88030</td>
<td>Connector set for sensor-to-controller connection for PUR (Polyurethane) cable</td>
<td>OP~87640/87641</td>
<td></td>
</tr>
</tbody>
</table>

* The 10 m cable includes one spare connector for the controller side.
When including the loads, please add 200 mA to this value.

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)

Convert the F.S. (full scale) listed in the table according to the rated flow range.

- Liquids 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).
- 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.
- This specification is valid when the fluid flow velocity distribution is stable. This value does not take into account the effects of pulsations or fluctuations in flow velocity distribution due to facility factors.
- Sensor surface

Vibration resistance
10 to 55 Hz, compound amplitude 1.5 mm, XYZ axes 2 hours for each axis

Shock resistance
100 m/s² / 60 ms pulse X, Y, Z axis 1000 times for each axis

Supported fluids
Various liquids: e.g. water (including DI), oils, chemicals, etc. 

Supported fluid temperature
Pipe surface temperature
0 to 85°C (No freezing on the pipe surface)

Supported pipe diameter
NPS (Nominal Pipe Size)
1/4" 3/8" 1/2" 3/4" 1" 1 1/4" 1 1/2" 2" 

Environmental resistance

Ambient temperature
-20 to +50°C (no freezing)

Ambient humidity
35 to 85%RH (no condensation)

Shock resistance
1000 m/s² / 1000 (axis) 2, 2 axis directions respectively 6 times

Vibration resistance
10 to 55 Hz, double amplitude 1.5 mm in X, Y, Z axes directions respectively, 2 hours

Material
Case and dust cover: Polycarbonate, Button: Polyacetal, Display panel: Acrylic

Weight
Approx. 70 g

SPECIFICATIONS

Sensor

Model | FD-Q10C | FD-Q20C | FD-Q32C | FD-Q50C
--- | --- | --- | --- | ---
Supported pipe diameter | NPS (Nominal Pipe Size) | NPS (Nominal Pipe Size) | NPS (Nominal Pipe Size) | NPS (Nominal Pipe Size)
1/4" | 3/8" | 1/2" | 3/4" | 1" | 1 1/4" | 1 1/2" | 2"
Supported pipe materials | Metal pipe/resin pipe | Metal pipe/resin pipe | Metal pipe/resin pipe | Metal pipe/resin pipe
Supported fluids | Various liquids: e.g. water (including DI), oils, chemicals, etc. | Various liquids: e.g. water (including DI), oils, chemicals, etc. | Various liquids: e.g. water (including DI), oils, chemicals, etc. | Various liquids: e.g. water (including DI), oils, chemicals, etc.
Supported fluid temperature | Pipe surface temperature | 0 to 85°C (No freezing on the pipe surface) | 0 to 85°C (No freezing on the pipe surface) | 0 to 85°C (No freezing on the pipe surface)
Maximum rated flow | 20 L/min | 30 L/min | 60 L/min | 100 L/min | 200 L/min | 300 L/min | 400 L/min | 500 L/min
Zero cut flow rate (Default) | 1.0 L/min | 2.5 L/min | 5.0 L/min | 10 L/min
Display method | Status indicator, output indicator, dual row display with 4-deg. / segment LED, rotary switch, level indicator
Display update cycle | Approx. 3 s
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%
Repeatability: A.S. (%) | 0.5: ±0.2%, 1 s: ±1.5, 2.5 s: ±0.1%, 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 / 0.1 / 0.1 / 0.1 / 0.1 / 0.1 / 0.1 / 0.1
Integrated flow data storage capacity | 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. 10 mA/ch., residual voltage 2.5 V or less
Analog output (ch.3) | 4 to 20 mA/ch. (Selectable, Default: not used), load resistance 100Ω 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, Class2/1PS
Current consumption | 100 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 | IP55/IP65/IP67
Ambient temperature | 30 to 50°C (No condensation)
Ambient humidity | 35 to 85% RH (No condensation)
Vibration resistance | 10 to 55 Hz, compound amplitude 1.5 mm, XYZ axes 2 hours for each axis
Shock resistance | 100 m/s² / 60 ms pulse X, Y, Z, 1000 times for each axis
Material | Sensor main unit | PPS/PES/PB/SUS303/SUS304/SUSXM7
Sensor surface | Rubber
Mounting bracket | SUS304/SUS321/SUS316/SUSXM7
Weight (including mounting bracket) | Approx. 340 g
| Approx. 400 g | Approx. 530 g | Approx. 640 g
| Approx. 640 g

Controller

Model | MU-N11 | MU-N12
--- | --- | ---
Type | Main unit | Expansion unit
Response time | 0.5 s / 0.5 s / 0.5 s / 0.5 s / 0.5 s / 0.5 s / 0.5 s / 0.5 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
with FD-Q32C/Q50C | 200 mA or less (without load)*1
155 mA or less (without load)*2
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 30 V or less, max. 10 mA/ch., residual voltage 2.5 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 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 less
Protection circuit | Protection against reverse power connection, power supply surge, output current, output surge, and reverse output connection
Unit expansion | up to 4 units per main unit*4
Environmental resistance | Ambient temperature | -20 to +50°C (no freezing)
Ambient humidity | 35 to 95%RH (no condensation)
Shock resistance | 1000 m/s² / 1000 (axis) 2, 2 axis directions respectively 6 times
Vibration resistance | 10 to 55 Hz, double amplitude 1.5 mm in X, Y, Z axes 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 2 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.
When using the sensor without the controller

- **When "Control Output" is selected for ch.2**
  - When NPN is selected
    - [Diagram showing connection details]
  - When PNP is selected
    - [Diagram showing connection details]

- **When "External Input" is selected for ch.2**
  - When NPN is selected
    - [Diagram showing connection details]
  - When PNP is selected
    - [Diagram showing connection details]

- **When "Analogue Output" is selected for ch.2**
  - [Diagram showing connection details]

---

When using the sensor with the controller

- **When "Control Output" is selected for ch.2**
  - When NPN is selected
    - [Diagram showing connection details]
  - When PNP is selected
    - [Diagram showing connection details]

- **When "External Input" is selected for ch.2**
  - When NPN is selected
    - [Diagram showing connection details]
  - When PNP is selected
    - [Diagram showing connection details]

- **When "Analogue Output" is selected for ch.2**
  - [Diagram showing connection details]

---

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

MU-N11 only.

---

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

*2 MU-N11 only.
Sensor

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD-Q10C</td>
<td>2*</td>
<td>38</td>
<td>25.3</td>
</tr>
<tr>
<td>FD-Q20C</td>
<td>max.2.5</td>
<td>48</td>
<td>30</td>
</tr>
<tr>
<td>FD-Q32C</td>
<td>max.4.2</td>
<td>67</td>
<td>46.7</td>
</tr>
<tr>
<td>FD-Q50C</td>
<td>max.3.6</td>
<td>88</td>
<td>56</td>
</tr>
</tbody>
</table>

* When installing the unit on a 1/4" pipe, the threaded portion of the screw will protrude by approximately 0.8 mm.

Pipe outside diameter

A: 36
B*: 25.3
C: 48

12 (When a slide cover is opened)  
* FD-Q20C/Q32C only

<for securing the main body>
M4 thread ×2  
(P0.7, length 16 mm, SUSXM7)

<for securing the bracket>
FD-Q10C : M4 thread ×4 (P0.7, length 13 mm, SUSXM7)  
FD-Q20C : M4 thread ×4 (P0.7, length 19 mm, SUSXM7)  
FD-Q32C : M5 thread ×4 (P0.8, length 30 mm, SUSXM7)  
FD-Q50C : M5 thread ×4 (P0.8, length 38 mm, SUSXM7)

* When using the FD-Q10C, the width of the sensor and the bracket are the same.

M12 connector cable PVC (polyvinyl chloride)
OP-76722/87274

M12 connector cable PUR (polyurethane)
OP-87640/87641

Protective cover
FD-QP1
Controller

MU-N11 (Main unit)/MU-N12 (Expansion unit)

When expansion units are connected

Sensor-to-controller cable

OP-88027/88028

Power supply cable for controller

MU-C84/C82

MU-CC4

DIMENSIONS

Unit: mm
**PRECAUTIONS FOR INSTALLATION**

**INSTALLATION METHOD**

**STEP 1** Align the base bracket direction according to the bore diameter
- By inverting the base bracket 180 degrees, supported diameters will change.
- Adjust the bore diameter of the pipe to be used with the corresponding diameter printed on the sides of upper and base brackets.

*(Example of FD-Q10C)*

[1] 1/4" (6A)

[2] 3/8" (10A)

Inverting the bracket 180 degrees

**STEP 2** Fix the brackets to the pipe
- Secure the brackets together uniformly to prevent uneven mounting.

**STEP 3** Fix the sensor main unit to the brackets
- Secure the unit uniformly to prevent uneven mounting.

**POINT**

- Align the position so that the base bracket is completely covered by the upper bracket.

**Upper bracket**

**Base bracket**

**Available bore diameters for each model**

<table>
<thead>
<tr>
<th>Model</th>
<th>[1]</th>
<th>[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD-Q10C</td>
<td>1/4&quot; (6A) ø13 to ø16 mm</td>
<td>3/8&quot; (10A) ø16 to ø18 mm</td>
</tr>
<tr>
<td>FD-Q20C</td>
<td>1/2&quot; (16A) ø16 to ø22 mm</td>
<td>5/8&quot; (16A) ø22 to ø28 mm</td>
</tr>
<tr>
<td>FD-Q32C</td>
<td>1/2&quot; (32A) ø22 to ø37 mm</td>
<td>1 1/2&quot; (64A) ø37 to ø44 mm</td>
</tr>
<tr>
<td>FD-Q50C</td>
<td>1 1/2&quot; (64A) ø44 to ø52 mm</td>
<td>2&quot; (50A) ø52 to ø64 mm</td>
</tr>
</tbody>
</table>

**POINT**

- Align the position so the base bracket is completely covered by the upper bracket.

**PRECAUTIONS FOR PIPING AND INSTALLATION**

- Installing the sensor as above is not recommended, because the detection becomes unstable when the pipe is not completely filled with fluid.
- If there is rust or contaminants on the pipe surface, please try to remove it prior to installation or move the unit to an area without these characteristics.
- When installing the sensor, ensure that there are no seams in line with the main unit of the sensor.
- To improve the detection stability, it is recommended that the sensor be installed in a location with straight sections of pipe upstream that are at least five times the length of the inside diameter.

**OTHER PRECAUTIONS**

- When power is applied to the sensor, it enters a 6-second "start-up" process before it is ready to use. Do not use the outputs from the sensor during this period.
- Initial drift may occur after the start-up process. To detect a subtle difference in the flow rate, the FD-Q Series warms up for approx. 15 to 30 minutes before use.
- Do not bring a strong magnet or magnetic field close to the main body of the FD-Q Series.
- Do not use the FD-Q Series for facilities where death or serious property damage is possible, such as nuclear power, generation, aviation, ships, vehicles, medical equipment, playground equipment, etc.
- Do not use this product for the purpose of protecting a human body or a part of human body.
- This product is not intended to be used as an explosive-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.

**GENERAL CAUTIONS**

- Do not exceed recommended torque rating. Apply torque until the unit is sufficiently secured to the pipe. If you are mounting to thin-walled metal pipes or brittle resin pipes, contact KEYENCE for detail as damage may occur to the pipe even under the recommended torque rating.

**PRECAUTIONS FOR HANDLING**

- Do not drop the FD-Q Series, hit it against something, or apply excessive force.
- Do not use a sharply pointed object to press the setting keys.

**PRECAUTIONS FOR DETECTABLE FLUID**

- High-velocity, high-bubble, or operating fluids may cause unstable detection. Keep this in mind before using.

**PRECAUTIONS FOR WIRING**

- Do not apply excessive tensile force to the cable.
- Ensure that the cable is not submerged in water during wiring work.
- Install the cable from power supply lines or power lines when wiring.
- Install the cable as far away as possible from any source of noise.
- Do not use a cable longer than 30m in length.

**PRECAUTIONS FOR INSTALLATION**

- Do not install the FD-Q Series in locations subject to vibrations.
- Use an insulated stabilizing power supply.
- Do not apply excessive tensile force to the cable.
- Be careful not to burn yourself.
- Do not modify the FD-Q Series.
- Do not use a sharply pointed object to press the setting keys.
- Do not drop the FD-Q Series, hit it against something, or apply excessive force.
- Do not install the FD-Q Series at a location where it may become submerged in a liquid.
- Do not install the FD-Q Series at a location where it may become exposed to intense light, such as direct sunlight, or radiation from a heat source.
- Do not install the FD-Q Series at a location where it may become subjected to an environment such as nuclear power generation, aircraft, railway, ship, vehicles, medical equipment, playground equipment, etc.
- Do not install the FD-Q Series at a location where it may become subjected to a hazardous location and/or potentially explosive atmosphere.

**PRECAUTIONS FOR DETECTABLE FLUID**

- When installing the FD-Q Series on a high-temperature pipe, the main unit will become hot. Be careful not to burn yourself.

**NOTICE**

- When installing the FD-Q Series on a high-temperature pipe, the main unit will become hot. Be careful not to burn yourself.
- Before wiring the FD-Q Series, check the colours of wires.
- Use the FD-Q Series within the rated range. The FD-Q Series is a product that uses a DC (direct current) power source. Do not apply AC (alternating current) or other power supplies. Do not use a lead that exceeds the allowable limit.
- If the temperature of the pipe exceeds 80°C, arrange the cable so it does not come in contact with the pipe.
- Do not apply excessive tensile force to the cable.
- Do not use excessive force to bend the cable.
- Do not use the FD-Q Series for facilities where death or serious property damage is possible, such as nuclear power, generation, aviation, ships, vehicles, medical equipment, playground equipment, etc.
- Do not install the FD-Q Series at a location where it may become submerged in a liquid.
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