Clamp-on Flow Sensor

FD-Q Series

Instruction Manual

Read this manual before using the product in order to achieve maximum performance. Keep this manual in a safe place after reading it so that it can be referenced at any time.

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Symbols

This instruction manual uses the following symbols that alert you to important messages. Be sure to read these messages carefully.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>Important messages. Be sure to read these messages carefully.</td>
</tr>
<tr>
<td>❗</td>
<td>Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>❗</td>
<td>Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>🔴</td>
<td>Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</td>
</tr>
<tr>
<td>🚧</td>
<td>Indicates a situation which, if not avoided, could result in product damage as well as property damage.</td>
</tr>
</tbody>
</table>

1. Before Operation

1-1 Safety Precautions

General cautions

1. Do not use the FD-Q Series out of the specification range. Comply with the contents described in this instruction manual when using the product.
2. Do not use the FD-Q Series for facilities where death or serious property damage is possible, such as nuclear power generation, aircraft, railway, ship, vehicles, medical equipment, playground equipment, etc.
3. Do not use this product for the purpose of protecting a human body or a part of human body.
4. This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.

1. Do not modify the FD-Q Series.

Precautions for handling

1. When installing the FD-Q Series on a high-temperature pipe, the main unit can become hot. Be careful not to burn yourself.
2. Do not drop the FD-Q Series, hit it against something, or apply excessive force.
3. Do not use a sharply pointed object to press the setting keys.

Precautions for detectable fluid

1. High-viscosity, high-turbidity, or sparkling fluid may cause unstable detection. Keep this in mind before using.
2. When the fluid temperature rises or pressure is reduced, air bubbles may form in the fluid within the pipe, resulting in unstable detection.

Precautions for wiring

1. Before wiring the FD-Q Series, check the colors of wires.
2. 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 load that exceeds the allowable limit.
3. If the temperature of the pipe exceeds 90°C, arrange the cable so that it does not come in contact with the pipe.

Precautions for installation

1. Do not install the FD-Q Series in locations used as footholds.
2. Install the FD-Q Series at a location where the inside of the measuring pipe is always filled with the fluid.
3. To prevent a situation where the FD-Q Series is affected by air bubbles or the pipe not being filled with fluid, it is recommended to secure it in a position where the display surface is perpendicular to the ground.
4. Arrange piping so that gas does not enter it. When the fluid contains bubbles, detection performance of the FD-Q Series may be affected.
5. When installing the FD-Q Series on a vertical pipe, choose the position where the fluid flows in the upward direction.
6. Install the sensor on the upstream side of a flow regulating valve or similar piece of equipment.
7. Install the FD-Q Series on a surface with no seams or rust.
8. Do not install the FD-Q Series in a location exposed to intense light, such as direct sunlight, or radiation from a heat source.
9. Do not install the FD-Q Series at a location where it may become submerged in a liquid.
10. When installing the FD-Q Series at a location where vibrations occur, fix the pipe with tubes or supports as close to the main unit as possible. Excessive vibration may cause unstable operation.
11. To avoid interference of detection signals, do not install multiple units closely in series.

Other precautions

1. 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.
2. Initial drift may occur after the power is turned on. To detect the fluid flow reliably, warm up for approx. 15 to 30 minutes before use.
3. If the temperature of the pipe exceeds 90°C, warm up for approx. 15 to 30 minutes before use.
4. Do not install the FD-Q Series in a location exposed to intense light, such as direct sunlight, or radiation from a heat source.

CE Marking

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable CE Directive(s), based on the following specifications. Be sure to consider the following specifications when using this product in the Member States of European Union.

- Applicable standard EMV EMI EN61326-1, Class A
- EMS: EN61326-1

These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of EMC Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive.

CSA certifications

This product complies with the following CSA and UL standards, and has obtained the CSA certifications.
- Applicable standard CAN/CSA C22.2 No.61010-1
- UL61010-1

Note the following requirements when using this product as a CSA certified product.
- Overvoltage category 1
- Pollution degree 3
- Install indoors.
- Install at a height of 2000 m or less.
- Use either of the power sources below.

CSA/UL Listing certified power sources that have Class 2 output specified in CEC (Canadian Electrical Code) and NEC (National Electrical Code), or CSA/UL Listing certified power sources that have been evaluated as Limited Power Source specified in CAN/CSA-C22.2 No.60950-1/UL60950-1.
2. Installation and Wiring

2-1 Part Names and Functions

Sensor main unit
- Output 1 indicator
- Output 2 indicator
- Current value display
- Set value display
- Large status indicator
- Setting button (Δ)
- Setting button (Y)
- M12-4pin connector
- MODE button (Q)
- Stability indicator
  - Detection stability
  - 1 to 4 lighting indications
  - Stability level display
  - 1 blinking indication
  - Detection not possible

Sensor bracket
- Upper bracket
- Base bracket

2-2 Piping and Installation

Installation method

**STEP1** Adjust the base bracket direction according to the size of the bore diameter.
- By inverting the base bracket 180 degrees, supported diameters will change.
- Align the bore diameter of the pipe to be used with the corresponding diameter printed on the sides of upper and base brackets.

(Example FD-Q10C)

<table>
<thead>
<tr>
<th>Available bore diameters for each model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>FD-Q10C</td>
</tr>
<tr>
<td>FD-Q20C</td>
</tr>
<tr>
<td>FD-Q32C</td>
</tr>
<tr>
<td>FD-Q50C</td>
</tr>
</tbody>
</table>

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

**STEP2** Fix the brackets to the pipe.

- **Point**
  - Secure the brackets together uniformly to prevent uneven mounting.

- **FD-Q10C/Q20C**
  - Attach the brackets with the slide cover slid to one end.
  - Recommended torque: M4 1.5N•m

<table>
<thead>
<tr>
<th>Model</th>
<th>Recommended torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD-Q10C</td>
<td>1.5N•m</td>
</tr>
<tr>
<td>FD-Q20C</td>
<td>2.5N•m</td>
</tr>
<tr>
<td>FD-Q32C</td>
<td>3.5N•m</td>
</tr>
<tr>
<td>FD-Q50C</td>
<td>5.0N•m</td>
</tr>
</tbody>
</table>

- **Point**
  - After the brackets are fixed, shift the slide cover to the center.

- **Reference**
  - "Simulation mode" (P7) can simulate different fluid-passing statuses to check the output operation of the sensors.
3. Initial Settings

3-1 Setting when the power is turned on for the first time (at initialization)

This section describes settings that must be configured prior to using the device.

To provide better flow readings:
- Press and hold \( \text{P-n} \), \( \text{nPn} \)

- Selecting pipe schedule
  - Selecting the pipe thickness (schedule) correctly will improve flow rate readings. (Press \( \Delta \) or \( \nabla \) to select.)
  - \( \text{SCP} \) : SGP
  - \( \text{PD} \) : Sch20
  - \( \text{QD} \) : Sch40
  - \( \text{BD} \) : Sch80

- Adjusting flow rate span
  - The flow rate values can be adjusted by 0.1x to 2.5x the initial values, of the instantaneous flow rate value detected by the FD-O Series. (Press \( \Delta \) or \( \nabla \) to select.)
  - Setting range: 0.10 to 2.50

- Selecting the flow units
  - \( \text{A} \) : Press and hold
  - \( \text{Un t} \) : \( \text{l} \)
  - \( \text{G} \) : \text{gal}

- Correcting the flow rate value
  - Selecting pipe schedule
    - Setting flow rate magnification
      - (Span adjustment)
      - For details, see P7.

- To provide better flow readings
  - Press and hold \( \text{ch2} \), \( \text{off} \)

- Display Settings

4-1 Switching the Display and Configuring Settings

- Instantaneous flow rate display
  - The Peak and Bottom instantaneous flow rate values from the time power is supplied are displayed.
  - If none of the above conditions is satisfied, the instantaneous flow rate screen shows the current value (---).

- Set value display conditions
  - Output 1 set value display conditions
    - Press \( \text{P1} \) or \( \text{P1-L} \) to change the set value.
  - Output 2 set value display conditions
    - Press \( \text{P2} \) or \( \text{P2-L} \) to change the set value.

- Integrated flow display
  - The integrated flow value is stored in the internal memory every 10 seconds.
  - When output 1 is in an integrated flow mode, pressing \( \Delta \) or \( \nabla \) can change the set value.

- Condition monitoring display
  - The relative value, compared to the 100% value registered using the Condition monitoring function, is displayed.
  - See P4 to use this function.
  - Since this is to be used for monitoring, set values cannot be changed from this screen.
5. Useful Functions

5-1 Origin Adjustment
This function adjusts the instantaneous flow rate value to “Zero” when performed. This helps to provide better readings when detecting in a low flow rate area, etc.

- Perform this function when the pipe is filled with fluid and the fluid is not moving. (Err) is displayed when the function fails due to the pipe not being completely filled, liquid isn’t stationary, etc.

5-2 Key lock
This function prevents operation mistakes by locking/disabling key operations. This is effective when you do not want the setting to be easily changed.

- Enabling/Disabling key lock
- Enabling/Disabling password-protected key lock

5-3 Condition Monitoring Function
This function registers the current instantaneous flow rate value as 100% and displays the current status on the screen. This function registers the current instantaneous flow rate value as 100% and displays the current status on the screen. This helps to provide better readings when detecting in a low flow rate area, etc.

- When failed (Err)
- Performing origin adjustment
- Canceling origin adjustment

5-4 Quick setting code
This function restores multiple setting parameters instantaneously by entering an 8-digit setting code recorded on the FD-Q Series main unit. This is convenient when applying the same settings to multiple FD-Q Series products.

- Entering the code restores the settings for the control output and external input. If a wrong code is entered, an unexpected operation may occur. Note if a wrong code is entered and an external device connected to the sensor, the sensor may be damaged.

5-5 Initializing
This restores each setting to factory default. This is effective when you are not sure of the status of the setting.

- After this function is performed, you can check the display by pressing 
  (P3 “Switching the Display and Configuring Settings”)
- The Condition monitoring function is effective only for the instantaneous flow rate value and its set value.
- If the reference point is registered at a low flow rate, the value may become unstable.
6. Detailed Settings

6-1 Menu Structure

- For the definition of detailed settings, see "Advanced Setting Descriptions" (P6)
- To return to the previous screen, press [MODE] + δ

1. Output 1 detection mode
   (Press δ or γ to select.)
   Set: Instantaneous flow rate mode
   R:ER Area mode
   PUL:5 Pulse output mode
   IN:7 Integrated flow mode

2. Output 1 output logic
   (Press δ or γ to select.)
   NO: Normally Open
   NC: Normally Closed

3. Response time
   (Press δ or γ to select.)
   Setting range (Unit: seconds)
   0.1/ 1.0/ 2.5/ 5.0/ 10.0/ 30.0/ 60.0

4. Integrated flow unit
   (Press δ or γ to select.)
   Setting range
   FD-Q10C: 0.1/1/10/100/1000
   FD-Q32C: 0.01/0.1/1/10/100/1000

5. Extended functions menu
   (Press δ or γ to select.)
   F:UL Extended Functions Menu

6. Output 2 detection mode
   (Press δ or γ to select.)
   Set: Instantaneous flow rate mode
   R:ER Area mode
   E:rr Error output mode

7. Setting complete

More advanced settings (Extended function settings)

1. Display resolution
   (Press δ or γ to select.)
   Setting range
   Other than FD-Q10C 0.01/0.1/1

2. Display averaging
   Setting range (Unit: seconds) 0 to 10

3. Hysteresis
   (Press δ or γ to select.)
   Setting range
   Other than FD-Q10C 0.0 to 99.99

4. Zero-cut flow rate
   (Press δ or γ to select.)
   Setting range
   Other than FD-Q10C 0.0 to 99.99

5. Display indicator illuminating mode
   (Press δ or γ to select.)
   ON: Green lighting - light on mode
   OFF: Red lighting mode
   PMI: Predictive maintenance information mode (Green, Green blinking, Red)

6. Power-saving mode
   (Press δ or γ to select.)
   OFF: Normal/Power-saving mode

7. Simulation mode
   (Press δ or γ to select.)
   OFF: Off/Performed Simulation

8. Simulation flow rate
   (Press δ or γ to select.)
   Setting range
   Other than FD-Q10C 0.0 to 99.99

9. Key lock method
   (Press δ or γ to select.)
   Set: Normal (without password)
   P55: Password-protected key lock

10. Flow direction
    (Press δ or γ to select.)
    Normal: From left to right
    PMI: Predictive maintenance information (Green, Green blinking, Red)

11. Selecting bore diameter of pipe
     (Press δ or γ to select.)
     Setting range
     Other than FD-Q10C 0.00 to 99.99

12. Correcting flow rate value
     (Press δ or γ to select.)
     Setting range
     Off: No correction
     SEL: Selecting pipe schedule
     SPM: Setting flow rate magnification (Span adjustment)

13. Adjusting flow rate span
     The flow rate value can be adjusted by 0.1x to 2.5x the initial values of the instantaneous flow rate value detected by the FD-Q Series. (Press δ or γ to select.)
     Setting range 0.10 to 2.50

Reference
6-2 Advanced Setting Descriptions

**Output modes**

### Instantaneous flow rate mode [S₁不克]

For ch.1 and ch.2.

If the instantaneous flow rate exceeds the set value, the output turns ON/OFF. This is useful to indicate when the supply flow becomes too low or too high.

- Reference: N.O./N.C. operation of the output can be switched in the settings. (P5 2, 6)
- Hysteresis can be adjusted in the extended settings. (P5 13)

### Area mode [R₆-R₆]

For ch.1 and ch.2.

If the instantaneous flow rate is out of a certain range, the output turns ON/OFF. This is useful when monitoring the varying flow within a specific range.

- Reference: N.O./N.C. operation of the output can be switched in the settings. (P5 2, 6)
- Hysteresis can be adjusted for the extended settings. (P5 13)

### Pulse output mode [PUL5]

For ch.1 only.

This outputs 1 pulse per integrated flow unit. This is useful when controlling or displaying the amount of flow that has passed through the sensor on an external device.

- Reference: Even when the display becomes saturated (FFFF is displayed), the output will continue pulsing.
- The output pulse turns ON/OFF every half value of the integrated flow unit.

(Right fig.: 1 pulse is output every 1 L.)

### Integrated flow mode [クトL]

For ch.1 only.

The output signals when the integrated flow has reached the set value. This is useful for indicating when a certain amount of flow has passed through the sensor.

- Reference: If the value exceeds the display limit, FFFF appears.
- The current integrated flow value can be reset to zero by setting the function selection of ch.2 to external input and assigning it the integrated flow reset input.
- When the integrated flow reset input signal is sent, the integrated flow value is reset to 0.

### Error output mode [Err]

For ch.2 only.

The output signals when any of the following errors occur.

- E₁: Overcurrent error
- E₆: EEPROM error
- E₉: Counter flow error
- E₉: Cannot receive detection signals

- Reference: For details on each error, refer to P8. If an overcurrent error occurs, the output turns OFF regardless of N.O./N.C.

### Free range analog output

For ch.2 only.

Flow values corresponding to the analog output lower limit and upper limit can be set. The current output type can be selected from either 4-20mA or 0-20mA. (The following example shows the case when 4-20mA is selected.)

#### Initial state

![Initial state](image)

- Analog output (mA)
- Flow rate (L/min or G/min)
- Analog output upper limit (Hys)
- Analog output lower limit value

#### When the setting is changed

**Example 1**

![Example 1](image)

- Analog output (mA)
- Flow rate (L/min or G/min)

**Example 2**

![Example 2](image)

- Analog output (mA)
- Flow rate (L/min or G/min)

**Notes:**
- When a counterflow error occurs (E₅), the ultrasonic signals cannot be received (∗∗∗∗), the analog output value will be 2mA (When 4-20mA is set)/0mA (When 0-20mA is set)
- Update cycle of the analog output is 300 ms

### External input

For ch.2 only.

When “External Input” is chosen as the function for ch.2, the signal can be chosen to represent one of three options below.

- **Integrated flow**
- **Flow rate zero input**
- **Origin adjustment input**

**Integrated flow**

While the integrated flow reset is being sent, the integrated flow value is reset to 0.

**Flow rate zero input**

This forcibly sets the instantaneous flow rate to zero while the external input is being sent.

This is convenient to prevent the flow rate from displaying at an unnecessary time, such as when the pipe is not filled with fluid.

- While the flow rate zero input is being input, the sensor is in almost the same status as if the instantaneous flow rate 0L/min.
- The minimum input time is 20ms.

**Origin adjustment input**

The origin adjustment function (P4) can be performed through the external input.

- This input can only be used on the normal detection display.
- The minimum input time is 20ms.
- It takes approx. 20 seconds to complete the adjustment.

### Response time

The response time is the time required for the internal evaluation value to change and to analog output to register/display at least 63% of the change in the instantaneous flow rate.

This provides more stable readings.

**Example**

When the response time is 10 seconds.

If the actual flow rate increased from zero to 100L/min instantaneously, the instantaneous flow rate value will show 63L/min or more after 10 seconds. (63L/min is 63% of 100L/min.)
**D4 Integrated flow unit**

The Integrated Flow Unit is the amount of flow represented by every single digit increase of the Integrated Flow Value. (Integrated Flow Unit x Integrated Flow Value = Actual Accumulated Flow Amount)

The output pulse turns ON/OFF every half value of the integrated flow unit. (Right fig.: 1 pulse is output every 1 L.)

**D5 Display averaging**

This function averages the instantaneous flow rate value, and display it. As this setting becomes larger, the display becomes more stable.

This affects the instantaneous flow rate display only. This does not affect the integrated flow display value, analog output value and internal value for control output evaluation.

**D6 Zero cut flow rate**

If the instantaneous flow rate is less than a certain value, the sensor is forced to recognize the instantaneous flow rate as 0L/min or 0 G/min. This value is called the “Zero cut flow rate”.

(Example)
When the zero cut flow rate is 1.0L/min
If the instantaneous flow rate falls below 1.0L/min, the flow rate value is recognized as 0L/min.

When this occurs, not only is the instantaneous flow rate effected, but also the control output, analog output, and integrated flow rate treat the flow rate as 0L/min or 0G/min.

**D7 Display indicator illumination mode**

The illumination mode for the large status indicator can be changed. The illumination status is related to the ch.1 set value P1 (P1-L/P1-H).

- **In Instantaneous flow rate mode**

  - Green
  - Red
  - OFF

- **In Area mode**

  - Green
  - Red
  - OFF

- **Predictive Maintenance Indicator (PMI). (3-St)**

  If “3-St” is selected and any of the following conditions are fulfilled, the large status indicator can be used as a PMI.
  1. Both output 1 and output 2 are in the “Instantaneous flow rate mode”
  2. Both output 1 and output 2 are in the “Area mode”

When both output 1 and output 2 are in the “Instantaneous flow rate mode”

- OK (Green lighting)
- PMI (Green blinking)
- Large limit error (Red lighting)

If the flow rate value exceeds both P1 and P2, the status is green. If it is between P1 and P2, green blinking. If it falls below both P1 and P2, red.

When both output 1 and output 2 are in the “Area mode”

- Upper limit error (Red lighting)
- OK (Green lighting)
- PMI (Green blinking)
- Large limit error (Red lighting)

If the flow rate value is in both output 1 area and output 2 area, the status is green. If it is in either area, green blinking. If it is out of both areas, red.

**D8 Power-saving mode**

This mode reduces the energy consumption. Only the output indicator and stability indicator operate normally, and the other indicators turn off.

**D9 Simulation mode**

From the screen shown below, set an arbitrary simulation flow rate value. Simulating water passing through with this value, the sensor output and indicator operations can be checked.

This is convenient to check the sensor settings, wiring status, or operation of external devices (PLC, etc.) when the sensor is turned ON/OFF.

**Changeable items based on the simulation flow rate**

1. Output status of output 1 and 2
2. Output 1 and 2 indicators
3. Analog output value
4. Pulse output
5. Large status indicator

- The integrated flow rate display value is not counted up even if this function is used.
- External inputs are invalid during the simulation mode.

**D10 Key lock method**

If the type of Key lock is set to “Password-protected key lock”, a 4-digit password entry is required when setting or canceling the key lock. This is effective when allowing only a specific person to change the settings on the units.

(Setting method P4)

**D11 Correcting flow rate value**

This function corrects the instantaneous flow rate value to improve the sensor readings.

SEL is convenient when the fluid is water and the pipe information is known. When the actual instantaneous flow rate is known, 5PRn is more convenient.

**Selecting pipe schedule (5EL)**

Depending on the pipe schedule, the thickness or internal diameter of pipe can differ from one unit to the next. For pipe schedules other than SGP, select the correct pipe schedule. Then, the flow rate value is corrected according to the internal diameter.

- *"STD" and "XS" for ANSI pipe are "Sch40" and "Sch80" equivalent respectively.
- *"Light", "Medium" and "Heavy" for DIN pipe are "Sch20", "Sch40" and "Sch80" equivalent respectively.

**Adjusting flow rate span (5PRn)**

The flow rate value can be adjusted from 0.10x to 2.50x compared to the initial values. This is convenient when the actual flow rate value is known.

**Flow rate**

When the span is set to 1.50

<table>
<thead>
<tr>
<th>Flow rate</th>
<th>Internal detection value</th>
</tr>
</thead>
<tbody>
<tr>
<td>15L/min</td>
<td>15L/min</td>
</tr>
<tr>
<td>10L/min</td>
<td>10L/min</td>
</tr>
</tbody>
</table>

**Reference**

- • External inputs are invalid during the simulation mode.
- • “Light”, “Medium” and “Heavy” for DIN pipe are “Sch20”, “Sch40” and “Sch80” equivalent respectively.
- • “STD” and “XS” for ANSI pipe are “Sch40” and “Sch80” equivalent respectively.
- • The integrated flow rate display value is not counted up even if this function is used.
- • External inputs are invalid during the simulation mode.
- • Password-protected key lock, a 4-digit password entry is required when setting or canceling the key lock.
7. Troubleshooting

### 7-1 Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ErC$ is displayed.</td>
<td>Excessive current (overcurrent) is flowing through output 1 or output 2.</td>
<td>• Check if the output wires are connected correctly and are not in contact with other wires. • Check if the load is within the rated range for the output.</td>
</tr>
<tr>
<td>$ErE$ is displayed.</td>
<td>The memory has reached its end of life, or the sensor is malfunctioning.</td>
<td>Perform initialization. If the problem persists, contact KEYENCE.</td>
</tr>
<tr>
<td>$rEU$ is displayed.</td>
<td>The fluid flows in the opposite direction of the setting.</td>
<td>Set the flow direction according to the correct fluid flow direction.</td>
</tr>
<tr>
<td>$FFFF$ is displayed.</td>
<td>The integrated flow display has exceeded the display range.</td>
<td>• Perform the integrated flow reset. • Change the integrated flow unit to a more appropriate setting, or use an external counter.</td>
</tr>
<tr>
<td>$Loc$ is displayed.</td>
<td>Keylock function is active.</td>
<td>• Disable the Keylock function when you want to change the settings. (P4)</td>
</tr>
<tr>
<td>$---$ is displayed.</td>
<td>• The sensor is not properly fixed to the pipe and bracket. • The pipe is not filled with fluid. • The detection signal is unstable.</td>
<td>• Check the sensor for partial tightening and looseness or uneven mounting, and reinstall it. • Install the sensor so that the display is perpendicular to the ground, not parallel. • If there is rust or dirt on the pipe surface, clean or avoid this area when installing. • If there is a seam on the contact surface or the back side of the pipe, move the sensor away from the seam before installation. • If air bubbles or foreign matters are expected inside the pipe, change the installation location, or remove them through high-pressure washing. If the problem persists, then the fluid or the pipe may be causing detection issues, or the sensor may be damaged.</td>
</tr>
</tbody>
</table>

The sensor is affected by pulsation, air bubbles or non-ideal flow distribution.

Cavitation is occurring due to pressure changes.

The integrated flow display has been set.

When using the external input function, the flow rate zero input ($t\bullet\odot$) is selected, and the external input is being sent.

No flow.

The fluid is actually flowing, however, with the flow rate value less than the zero cut flow rate. | Increase the response time. | Install the sensor on a straight section of pipe. • Avoid installing just after a bore conversion section or a bulb. | Press the MODE button to switch the screen, and check if the integrated flow display is set. | • Check if the wiring arrangement is correct. • If the input line and output line are in contact, separate them. • If the flow rate zero input ($t\bullet\odot$) has been set accidentally, select a different option. | Check valves for open and close conditions, and also check the pipe and filter for clog. | Adjust the zero cut flow rate value. |

### 7-2 Output Status during Errors

<table>
<thead>
<tr>
<th>Display</th>
<th>Control output</th>
<th>Analog output</th>
<th>Large status indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ErE$</td>
<td>Normal operation</td>
<td>Normal operation</td>
<td>Blinks red</td>
</tr>
<tr>
<td>$ErC$</td>
<td>OFF normal operation</td>
<td>Normal operation</td>
<td>Blinks red</td>
</tr>
<tr>
<td>$rEU$</td>
<td>Operates as if the flow rate is zero.</td>
<td>When 4-20mA is set: 2mA When 0-20mA is set: 0mA</td>
<td>Operates as if the flow rate is zero.</td>
</tr>
<tr>
<td>$---$</td>
<td>Operates as if the flow rate is zero.</td>
<td>When 4-20mA is set: 2mA When 0-20mA is set: 0mA</td>
<td>Operates as if the flow rate is zero.</td>
</tr>
</tbody>
</table>

The fluid rate differs greatly from the actual flow rate value.

The origin adjustment has not been correctly performed.

The characteristic of the fluid largely differs from that of water.

The display turns on and off.

The unit is in the power-saving mode.

The detection signal (One stability indicator lights or blinks.)

The sensor may be damaged.

Cavitation is occurring due to pressure changes.

The integrated flow display is perpendicular to the ground.

The flow rate differs from that of water.

The origin adjustment has not been correctly performed.

Adjust the integrated flow display is the setting. (P4)
### 8-1 Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>FD-Q10C</th>
<th>FD-Q20C</th>
<th>FD-Q32C</th>
<th>FD-Q50C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported pipe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer diameter of pipe (mm)</td>
<td>Φ13 to Φ16</td>
<td>Φ16 to Φ18</td>
<td>Φ18 to Φ23</td>
<td>Φ23 to Φ28</td>
</tr>
<tr>
<td>NPS (Nominal Pipe Size)</td>
<td>1/4&quot;</td>
<td>3/8&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>DN (Diameter Nominal)</td>
<td>8A</td>
<td>10A</td>
<td>15A</td>
<td>20A</td>
</tr>
<tr>
<td>Supported pipe materials</td>
<td>Metal pipe/Resin pipe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supported fluid temperature</td>
<td>0°C to 85°C (No freezing on the pipe surface)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Pipe surface temperature)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum rated flow</td>
<td>20L/min</td>
<td>30L/min</td>
<td>60L/min</td>
<td>100L/min</td>
</tr>
<tr>
<td>Zero cut flow rate (Default)</td>
<td>1.0L/min</td>
<td>2.5L/min</td>
<td>5L/min</td>
<td>25L/min</td>
</tr>
<tr>
<td>Display method</td>
<td>Status indicator, output indicator, dual row display with 4-digit, 7 segment LED, stability level indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display resolution (L/min)</td>
<td>0.01/0.1/1 (Default: 0.1)</td>
<td>0.1/1 (Default: 0.1)</td>
<td>0.1/1 (Default: 1)</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>0.5s/1.0s/2.5s/5s/10s/30s/60s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability (% of F.S.)</td>
<td>0.5s±2.0%, 1s±1.5%, 2.5s±1.0%, 5s±0.5%, 10s±0.35%, 30s±0.2%, 60s±0.15%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Specific to selected response time.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>Variable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated flow unit display (L)</td>
<td>0.1/1/10/100/1000 (Default: 1)</td>
<td>1/10/100/1000/10000 (Default: 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated flow data storage cycle</td>
<td>Save to memory every 10 seconds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory backup</td>
<td>EEPROM (Data storage length: 10 years or longer, Data read/write frequency: 1 million times or more)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power I/O connector</td>
<td>M12 4-pin connector</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input/Output (Selectable)</td>
<td>Output (ch.1/ch.2)</td>
<td>Control output/ Pulse output/ Error output (Selectable, Default: ch.1 control output/ ch.2 not used), NPN/PNP setting switchable, open collector output 30V or less, max. 100mA/ch., residual voltage 2.5V or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analog output (ch.2)</td>
<td>4 to 20mA/0 to 20mA (Selectable, Default: not used), load resistance 500Ω or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>External input (ch.2)</td>
<td>Integrated flow reset input/ Flow rate zero input/ Origin adjustment input (Selectable, Default: not used), short-circuit current 1.5mA or less, input time 20ms or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power source</td>
<td>Power supply voltage</td>
<td>20 to 30V DC , ripple (P-P) 10% max, Class2/LPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current consumption</td>
<td>100mA or less (Load current excluded) *6</td>
<td>130mA or less (Load current excluded) *6</td>
<td></td>
</tr>
<tr>
<td>Protection circuit</td>
<td>Power supply reverse connection protection, power supply surge protection, each output short-circuit protection, each output surge protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Enclosure rating</td>
<td>IP65/IP67 (IEC60529)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambient temperature</td>
<td>-10 to 60°C (No freezing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambient humidity</td>
<td>30 to 85%RH (No condensation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibration resistance</td>
<td>10 to 55 Hz, compound amplitude 1.5 mm, XYZ axes 2 hours for each axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shock resistance</td>
<td>100m/s² 16ms pulse X,Y,Z 1000 times for each axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Sensor main unit</td>
<td>PPS/PES/PBT/SUS303/SUS304/SUSXM7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensor surface</td>
<td>Rubber</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mounting bracket</td>
<td>SUS304/PA/SUSXM7</td>
<td>SUS304/PA/POM/SUSXM7</td>
<td></td>
</tr>
<tr>
<td>Weight (including mounting bracket)</td>
<td>Approx. 340g</td>
<td>Approx. 400g</td>
<td>Approx. 530g</td>
<td>Approx. 640g</td>
</tr>
</tbody>
</table>

*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.

*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 (38.4kbauds) The setting file can be downloaded from the KEYENCE website (http://www.keyence.com). If using the unit in an environment where downloading the file is not accessible via internet, contact your nearest KEYENCE office. IO-Link is either registered trademarks or trademarks of PROFIBUS Nutzervereinigung e.V. (PNO)

*6 When including the load current, please add 200mA to this value.
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8-2 Default Settings/Values List

<table>
<thead>
<tr>
<th>Item</th>
<th>FD-Q10C</th>
<th>FD-Q20C</th>
<th>FD-Q32C</th>
<th>FD-Q55C</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Selecting NPN/PPN (✓)</td>
<td>nPn</td>
<td>nPn</td>
<td>nPn</td>
<td>nPn</td>
<td></td>
</tr>
<tr>
<td>B. Selecting ch.2 function (✓)</td>
<td>aFF</td>
<td>aFF</td>
<td>aFF</td>
<td>aFF</td>
<td></td>
</tr>
<tr>
<td>C. Flow direction (✓)</td>
<td>zr</td>
<td>zr</td>
<td>zr</td>
<td>zr</td>
<td></td>
</tr>
<tr>
<td>D. Selecting bore diameter of pipe (✓)</td>
<td>3/8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Correcting the flow rate value (✓)</td>
<td>aFF</td>
<td>aFF</td>
<td>aFF</td>
<td>aFF</td>
<td></td>
</tr>
<tr>
<td>F. Selecting unit (✓)</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>1. Output 1 detection mode (✓)</td>
<td>Std</td>
<td>Std</td>
<td>Std</td>
<td>Std</td>
<td></td>
</tr>
<tr>
<td>2. Output 1 output logic (✓)</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>3. Response time (✓)</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Integrated flow unit (✓)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5. Output 2 detection mode (✓)</td>
<td>Std</td>
<td>Std</td>
<td>Std</td>
<td>Std</td>
<td></td>
</tr>
<tr>
<td>6. Output 2 output logic (✓)</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>7. Selecting input function (✓)</td>
<td>rS2Et</td>
<td>rS2Et</td>
<td>rS2Et</td>
<td>rS2Et</td>
<td></td>
</tr>
<tr>
<td>8. Analog output current value (✓)</td>
<td>4-20</td>
<td>4-20</td>
<td>4-20</td>
<td>4-20</td>
<td></td>
</tr>
<tr>
<td>9. Analog output lower limit (✓)</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>10. Analog output upper limit (✓)</td>
<td>30.0</td>
<td>100.0</td>
<td>300</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>11. Display resolution (✓)</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Display averaging (✓)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>13. Hysteresis (✓)</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Zero cut flow rate (✓)</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Display indicator illumination mode (✓)</td>
<td>Grn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Power-saving mode (✓)</td>
<td>aFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Key lock method (✓)</td>
<td>Std</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set value P1/P1-L (✓)</td>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set value P1-H (✓)</td>
<td>18.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set value P2/P2-L (✓)</td>
<td>6.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set value P2-H (✓)</td>
<td>15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set value of integrated flow (✓)</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) Items with ✓ can be restored using the quick setting code function. (*) Values in the bracket ( ) are default values when gallon is selected as the display unit.

Quick setting code

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Quick setting code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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