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KEYENCE

96M13515

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.

■ Table of contents

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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.

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a situation which, if not avoided, could result in product damage as well as property damage.

Important — Provides precautions on operations that must be performed.

Point — Provides precautions on operations that can be easily mistaken.

Reference — Provides useful information that will aid in understanding content.

1. Before Operation

1-1 Safety Precautions

■ General cautions

DANGER	1. Do not use the FD-Q Series out of the specification ranges. 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.
WARNING	1. Do not modify the FD-Q Series.

■ Precautions for handling

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

■ Precautions for detectable fluid

NOTICE	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

CAUTION	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 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 80 °C, arrange the cable so it does not come in contact with the pipe.
NOTICE	1. Use an insulated stabilizing power supply. 2. Do not apply excessive tensile force to the cable. 3. Ensure that the cable tip is not submerged in water during wiring work. 4. Isolate the cable from power supply lines or power lines when wiring. 5. Isolate the cable as far away as possible from any source of noise. 6. Do not use a cable longer than 20m in length.

■ Precautions for installation

CAUTION	1. Do not install the FD-Q Series in locations used as footholds.
NOTICE	1. Install the FD-Q Series at a location where the inside the measuring pipe is always filled with the fluid. 2. 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. 3. Arrange piping so that gas does not enter it. When the fluid contains bubbles, detection performance of the FD-Q may be affected. 4. When installing the FD-Q Series on a vertical pipe, choose the position where the fluid flows in the upward direction. 5. 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 pipe`s inside diameter. 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

NOTICE	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 a subtle difference in the flow rate, let the FD-Q Series warm up for approx. 15 to 30 minutes before use. 3. Do not bring a strong magnet or magnetic field close to the main body of the FD-Q Series.

Important — The FD-Q Series cannot be used as a measuring instrument for measurement in business deals or certifications.

1-2 Precautions on Regulations and Standards

■ CE Marking

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EC 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.

EMC Directive (2004/108/EC)

- Applicable standard 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 I
- Pollution degree 3
- Install indoors.
- Install at a height of 2000 m or less.
- Use either of the power sources below.

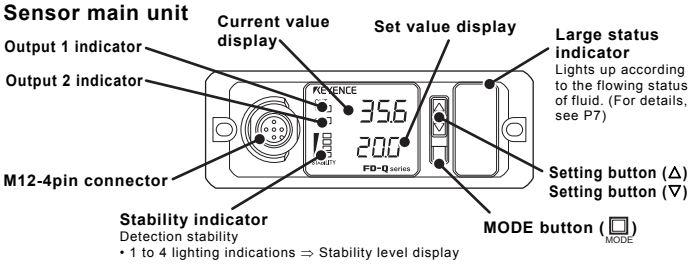
CSA/UL Listing certified power sources that have Class 2 output specified in CEC (Canadian Electrical Code) and NEC (National Electrical Code), or CSA/UL Listing certified power sources that have been evaluated as Limited Power Source specified in CAN/CSA-C22.2 No.60950-1/UL60950-1.

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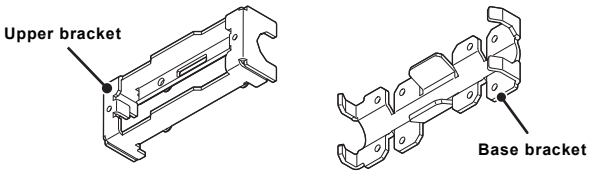
2. Installation and Wiring

2-1 Part Names and Functions

Sensor main unit



Sensor bracket



2-2 Piping and Installation

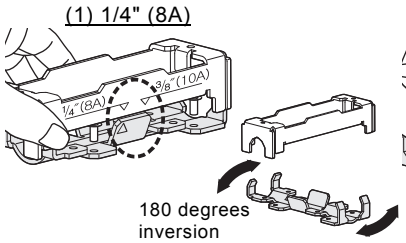
■ Installation method

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)

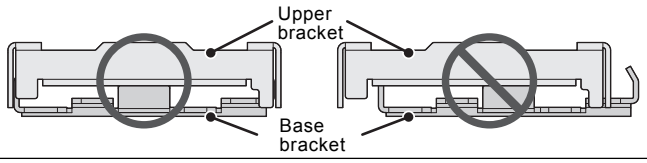
(1) 1/4" (8A) (2) 3/8" (10A)



Available bore diameters for each model

Model	(1)	(2)
FD-Q10C	1/4"(8A)(Φ13-Φ16)	3/8"(10A)(Φ16-Φ18)
FD-Q20C	1/2"(15A)(Φ18-Φ23)	3/4"(20A)(Φ23-Φ28)
FD-Q32C	1"(25A)(Φ28-Φ37)	1 1/4"(32A)(Φ37-Φ44)
FD-Q50C	1 1/2"(40A)(Φ44-Φ52)	2"(50A)(Φ52-Φ64)

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

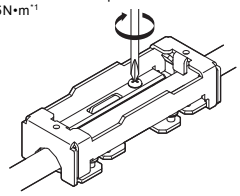


STEP2 Fix the brackets to the pipe.

Point — Secure the brackets together uniformly to prevent uneven mounting.

■FD-Q10C/Q20C

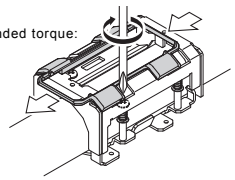
M4
Recommended torque: 1.5N•m*1



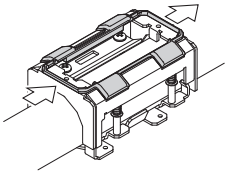
■FD-Q32C/Q50C

Attach the brackets with the slide cover slid to one end.

M5
Recommended torque: 1.5N•m*1



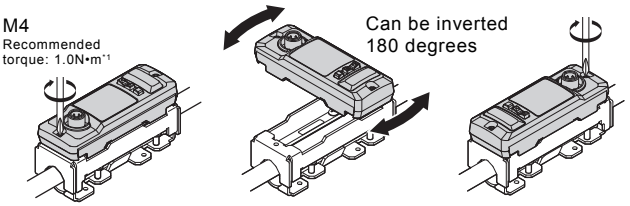
After the brackets are fixed, shift the slide cover to the center.



STEP3 Fix the sensor main unit to the brackets.

Point — Secure the main unit uniformly to prevent uneven mounting.

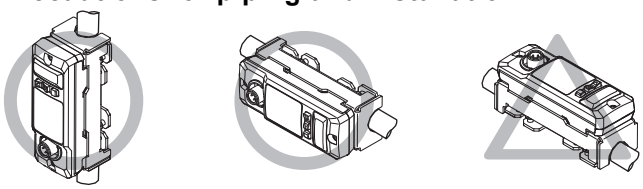
M4
Recommended torque: 1.0N•m*1



Reference — The flow direction relative to the sensor main unit can be changed in the settings.

*1 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 piping and installation



- Installing the sensor as above (△) is not recommended, because 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 characteristic.
- 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.

2-3 Wiring

Wiring arrangements vary depending on what function is assigned to input/output pin (2) (White). (Initial settings: P3)
Insulate the input/output lines independently that are not used.

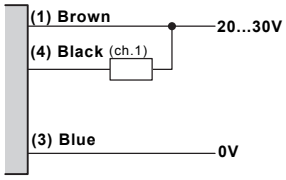
Load (Input device) (Analog current input device)

Pin layout on the sensor side

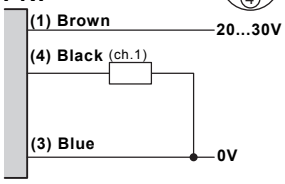


■ Out1 [1 output mode]

● NPN

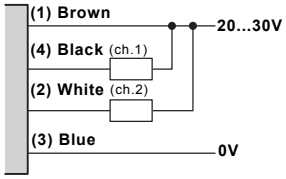


● PNP

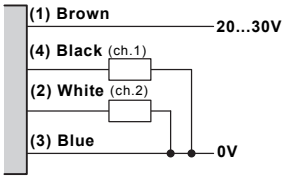


■ Out1+Out2 [2 output mode]

● NPN

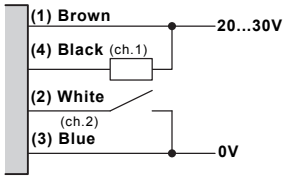


● PNP

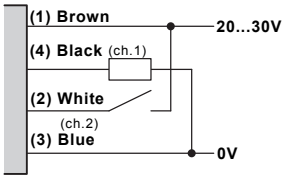


■ Out1+Input [External input mode]

● NPN

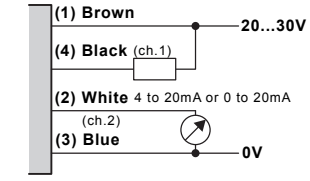


● PNP

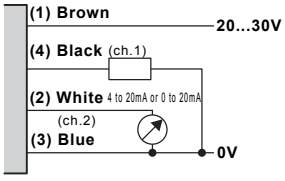


■ Out1+Analog [Analog output mode]

● NPN



● PNP



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

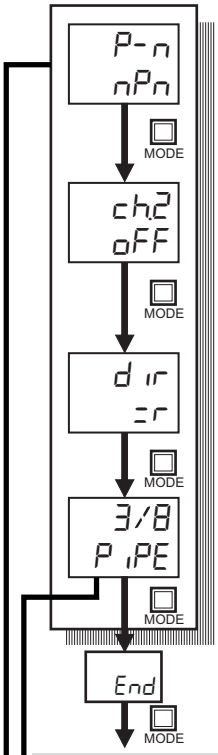
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3. Initial Settings

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. The following screens are displayed "**When the power is supplied to the unit for the first time**" or "**After the unit is initialized (P4)**".

Reference
- To return to a previous screen, press MODE +△.
- When MODE +△+▽ are pressed simultaneously in this menu, the quick setting code can be entered (P4).



A. Selecting NPN/PNP (Press △ or ▽ to select.)
- nPn NPN output
- PnP PNP output

B. Selecting ch.1 and ch.2 functions
(Press △ or ▽ to select.)

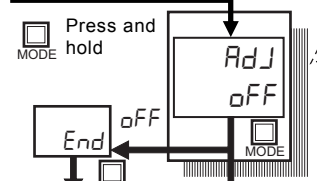
Selection	Mode	ch.1 (pin (4))	ch.2 (pin (2))
A oFF	1 Control Output Mode	Control output	–
B out	2 Control Output Mode	Control output	Control output
C in	Control Output + External Input Mode	Control output	External input
D AnLG	Control Output + Analog Output Mode	Control output	Analog output

C. Selecting flow direction (Press △ or ▽ to select.)
- →r Flow direction: From left to right
- L→ Flow direction: From right to left

D. Selecting bore diameter of pipe
(Press △ or ▽ to select.)

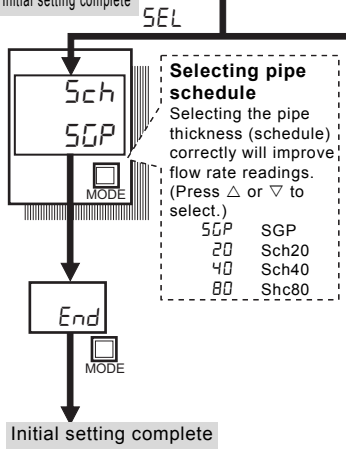
Model	Selection	NPS	DN
FD-Q10C	1/4	1/4"	8A
	3/8	3/8"	10A
FD-Q20C	1/2	1/2"	15A
	3/4	3/4"	20A
FD-Q32C	1	1"	25A
	1 1/4	1 1/4"	32A
FD-Q50C	1 1/2	1 1/2"	40A
	2	2"	50A

● To provide better flow readings



E. Correcting the flow rate value
(Press △ or ▽ to select.)
- oFF No correction
- SEL Selecting pipe schedule
- SPAn Setting flow rate magnification (Span adjustment)

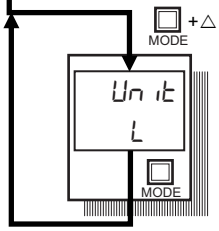
For details, see P7. D11



Selecting pipe schedule
Selecting the pipe thickness (schedule) correctly will improve flow rate readings. (Press △ or ▽ to select.)
- SGP SGP
- 20 Sch20
- 40 Sch40
- 80 Shc80

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-Q Series. (Press △ or ▽ to select.)
Setting range: 0.10 to 2.50

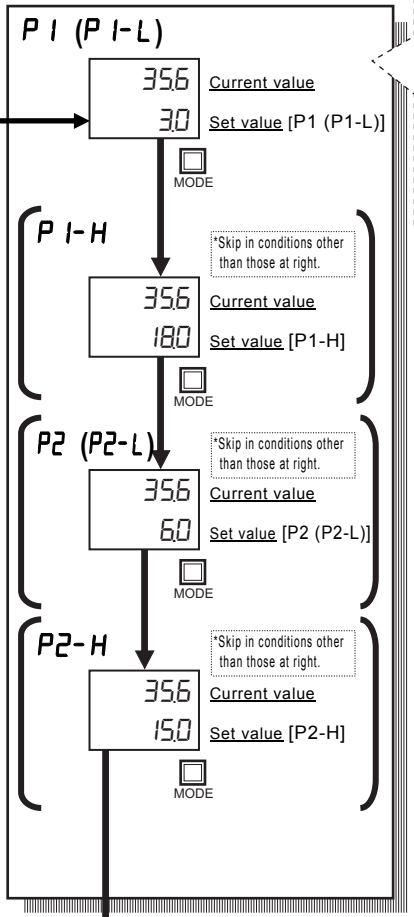
● Selecting the flow units



F. Selecting unit
- L liter
- G gallon

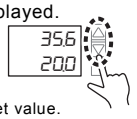
4. Display Settings

4-1 Switching the Display and Configuring Settings



Instantaneous flow rate display
The current instantaneous flow rate value is displayed.

Reference
Press △ or ▽ to change the set value.

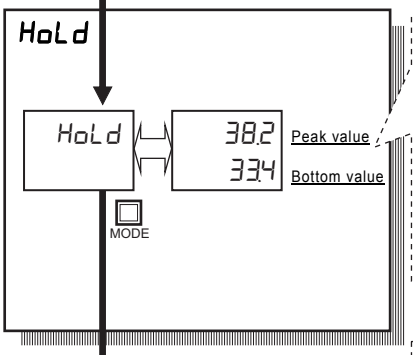


Set value display conditions

Set value	Meaning	Display condition
P1	Output 1 set value	When the output 1 is in the instantaneous flow rate mode
P1-L	Output 1 lower limit value	When the output 1 is in the area mode
P1-H	Output 1 upper limit value	When the output 1 is in the area mode
P2	Output 2 (*1) set value	When the output 2 is in the instantaneous flow rate mode
P2-L	Output 2 lower limit value	When the output 2 is in the area mode
P2-H	Output 2 (*1) upper limit value	When the output 2 is in the area mode

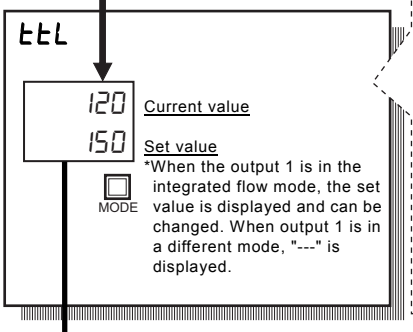
*1 only when the ch.2 function is used in the output 2 mode

* If none of the above conditions is satisfied, the instantaneous flow rate screen shows the current value/---.



Instantaneous flow rate hold values
The Peak and Bottom instantaneous flow rate values from the time power is supplied are displayed.

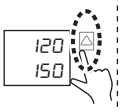
Reference
- Pressing and holding △+▽ can reset the hold values.
- The hold value is reset also when the power is OFF.



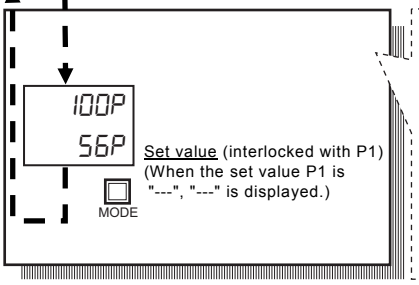
*When the output 1 is in the integrated flow mode, the set value is displayed and can be changed. When output 1 is in a different mode, "---" is displayed.

Integrated flow display
The integrated flow value is displayed.

Reference
- Pressing and holding △+▽ can reset the integrated flow value.
- The integrated flow value is stored in the internal memory every 10 seconds.
- When output 1 is in integrated flow mode, pressing △ or ▽ can change the set value.



Only when the Condition monitoring function (P4) is enabled



Condition monitoring display
The relative value, compared to the 100% value registered using the Condition monitoring function, is displayed.

Reference
- See P4 to use this function.
- Since this is to be used for monitoring, set values cannot be changed from this screen.

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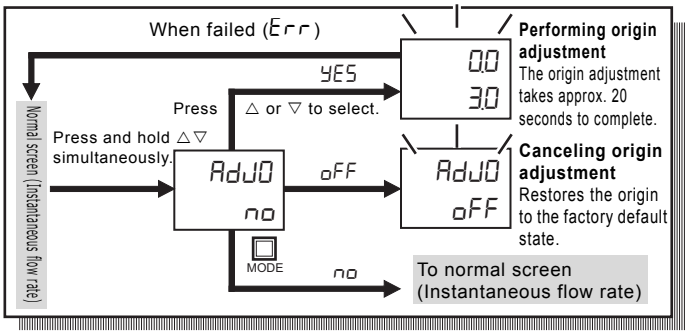
5. Useful Functions

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.

Point

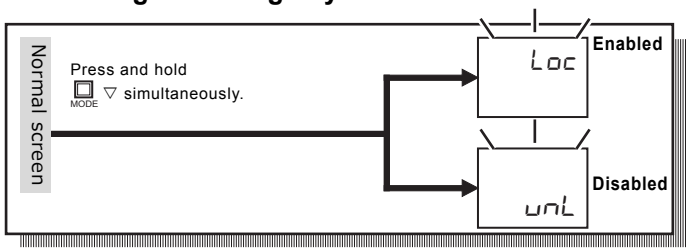
Perform this function when the pipe is filled with fluid and the fluid is not moving. (Err) is displayed when the function fails due to the pipe not being completely filled, liquid isn`t stationary, etc.



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.

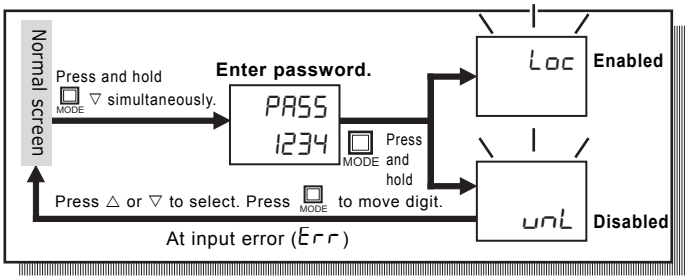
■ Enabling/Disabling key lock



■ Enabling/Disabling password-protected key lock

Reference

Set the key lock method to PASS in "Extended function setting (P5)"to use this function.

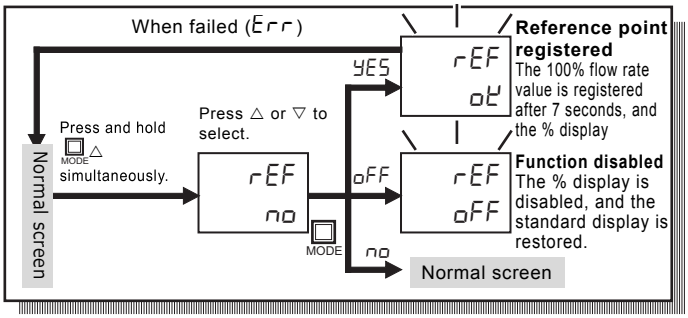


5-3 Condition Monitoring Function

This function registers the current instantaneous flow rate value as 100% and displays the current status on the screen.
This is an effective way to monitor the flow rate, relative to a base flow rate.

Point

- Perform the Condition monitoring function when the fluid is flowing at a nominal rate that you would like to be represented as 100%.(Err) is displayed if the fluid is not flowing the pipe, or the pipe is not completely filled with water.
- When performed at a low flow rate, the display may become unstable.



Reference

- After this function is performed, you can check the display by pressing MODE. (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.

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.

NOTICE

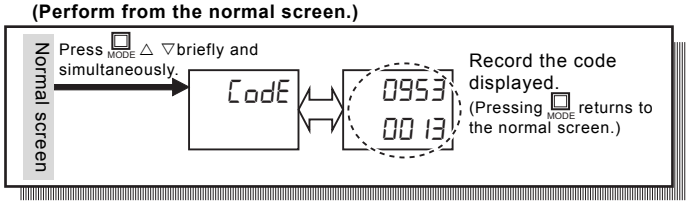
Entering the code restores the settings for the control output and external input.
If a wrong code is entered, an unexpected operation may occur. Note if a wrong code is entered and an external device connected to the sensor, the sensor may be damaged.

Point

- This function cannot restore set values. Separately record them as necessary. (P10 "Default Value List")
- (Err) is displayed when an invalid code is entered

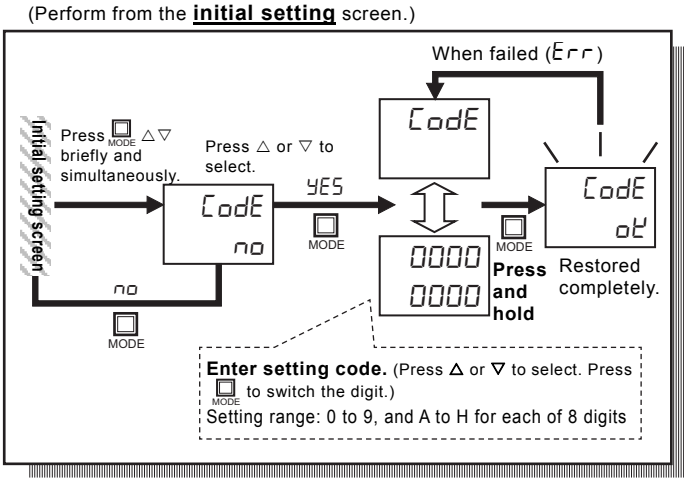
■ Checking the current quick setting code

(Perform from the normal screen.)



■ Restoring the settings by entering the code

(Perform from the **initial setting** screen.)

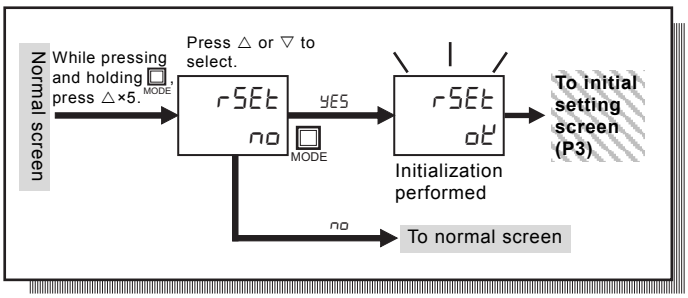


Reference

The initial setting screen is displayed when "5-5 Initializing" is performed, or when the power is turned on for the first time.

5-5 Initializing

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



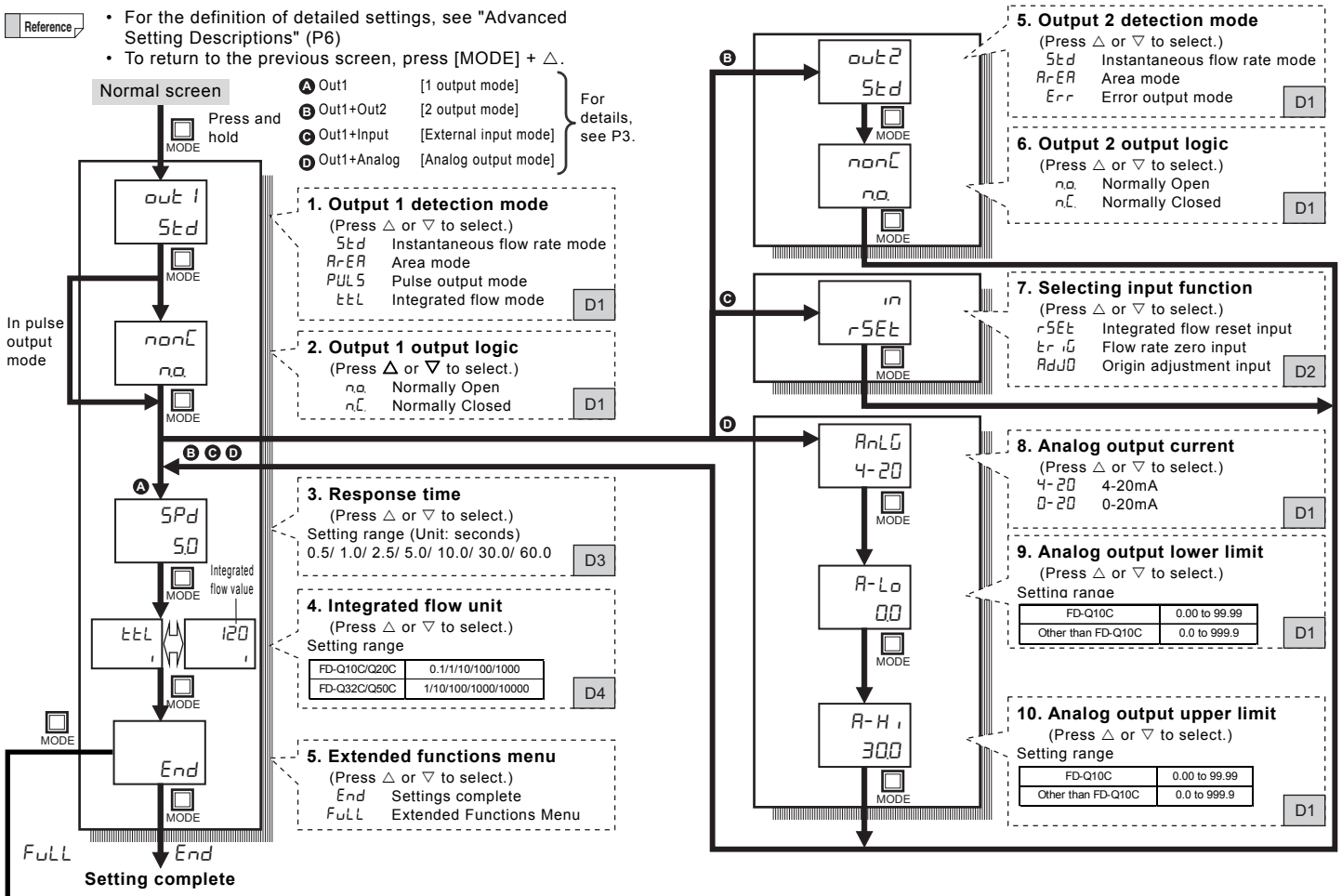
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6. Detailed Settings

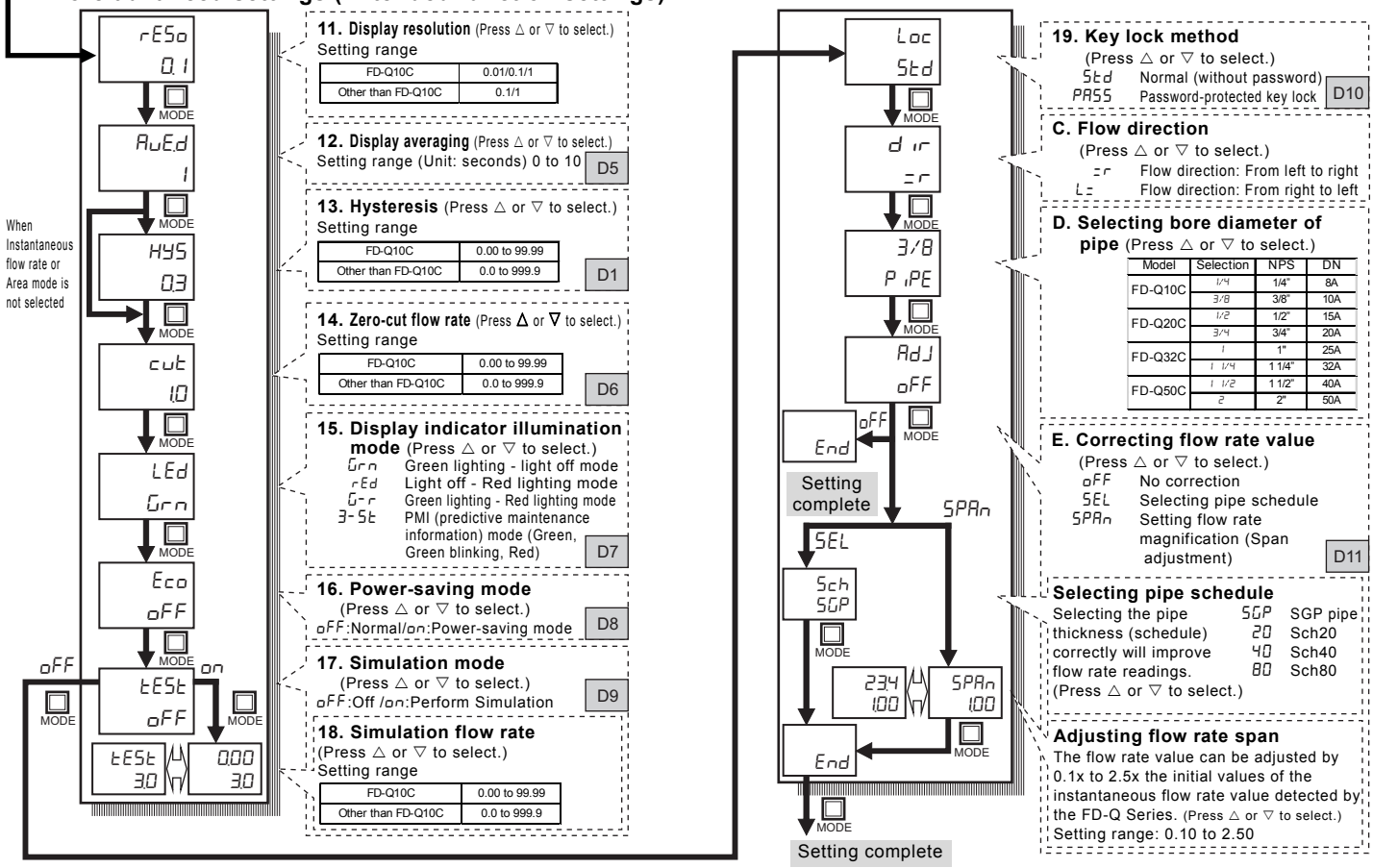
6-1 Menu Structure

Symbols D1 to D11 correspond to the detail description numbers on P6.

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



● More advanced settings (Extended function settings)



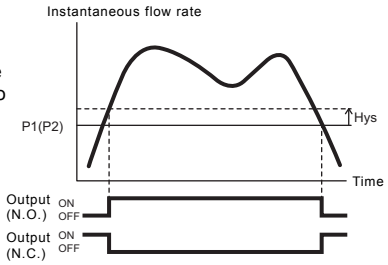
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6-2 Advanced Setting Descriptions

D1 Output modes

■ Instantaneous flow rate mode [Std] For ch.1 and ch.2

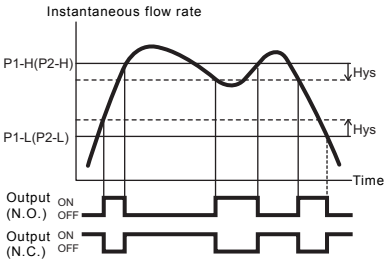
If the instantaneous flow rate exceeds the set value, the output turns ON/OFF.
This is useful to indicate when the supply flow becomes too low or too high.



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

■ Area mode [ArEA] For ch.1 and ch.2

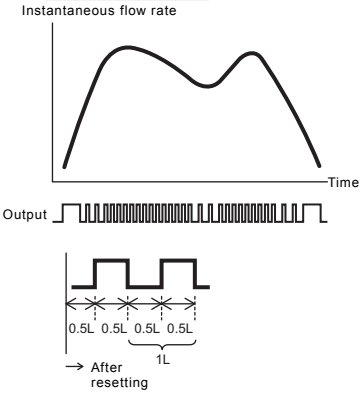
If the instantaneous flow rate is out of a certain range, the output turns ON/OFF.
This is useful when monitoring the a varying flow within a specific range.



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

■ Pulse output mode [PULS] 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.

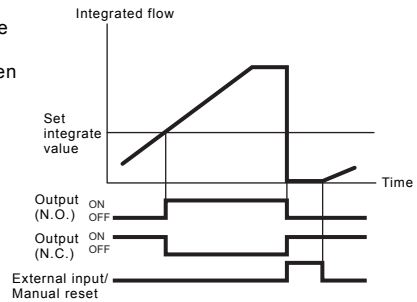


Reference
- Even when the display becomes saturated (FFFF is displayed), the output will continue pulsing.
- The output pulse turns ON/OFF every half value of the integrated flow unit.

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

■ Integrated flow mode [ttL] 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

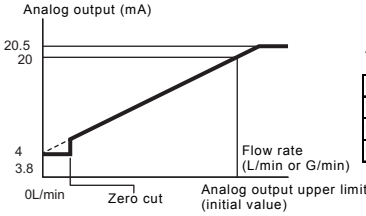
The output signals when any of the following errors occur.
- **ErC Overcurrent error**
- **ErE EEPROM error**
- **rEu Counter flow error**
- **--- Cannot receive detection signals.**

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**

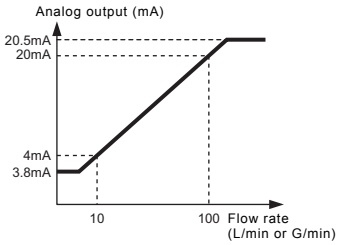


Analog output upper limit (Initial value)	
FD-Q10C	30.0 L/min
FD-Q20C	100.0 L/min
FD-Q32C	300 L/min
FD-Q50C	500 L/min

● **When the setting is changed**

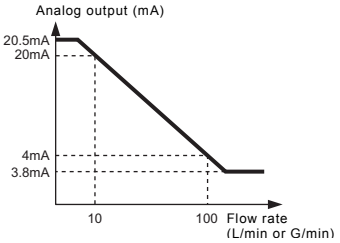
Example 1

Analog output upper limit	100 (L/min)
Analog output lower limit	10 (L/min)



Example 2

Analog output upper limit	10 (L/min)
Analog output lower limit	100 (L/min)



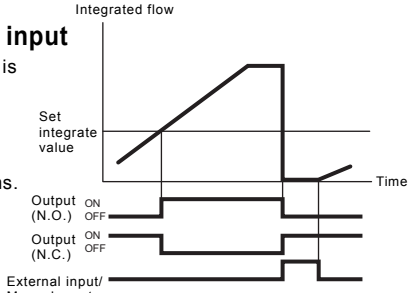
参考
- When a counterflow error occurs (rEu) or the ultrasonic signals cannot be received ("---"), the analog output value will be 2mA (When 4-20mA is set)/0mA (When 0-20mA is set)
- Update cycle of the analog output is 300 ms.

D2 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 reset input

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

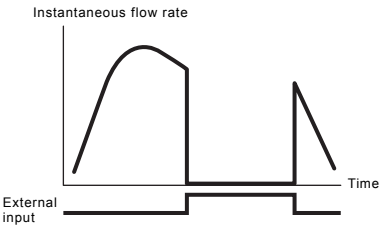


Reference
The minimum input time is 20ms.

■ 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.



Reference
- 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.

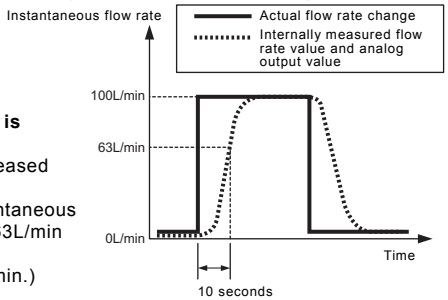
■ Origin adjustment input

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

Reference
- 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.

D3 Response time

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



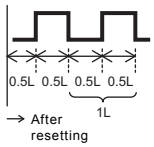
(Example)
When the response time is 10 seconds
If the actual flow rate increased from zero to 100L/min instantaneously, the instantaneous flow rate value will show 63L/min or more after 10 seconds.
(63L/min is 63% of 100L/min.)

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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.)



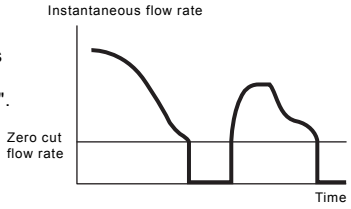
D5 Display averaging

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

Reference 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".



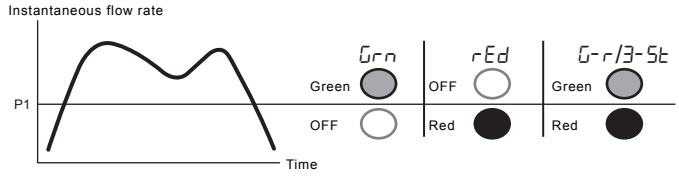
(Example)
When the zero cut flow rate is 1.0L/min
If the instantaneous flow rate falls below 1.0L/min, the flow rate value is recognized as 0L/min.

Reference 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.

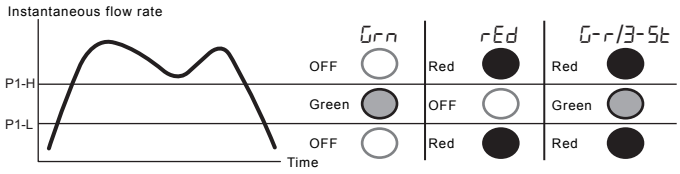
D7 Display indicator illumination mode

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



● In Area mode

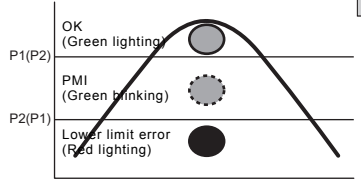


Reference
- The large status indicator is independent of the output logic N.O./N.C.
- When ch.1 is in the pulse output mode/integrated flow mode, the illumination status is related to the zero cut flow rate (not with P1).

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

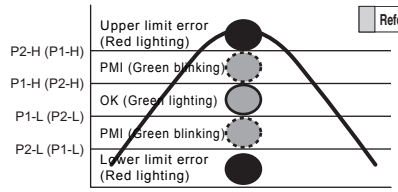
If "3-St" is selected and any of the following conditions are fulfilled, the large status indicator can be used as a PMI.
1) Both output 1 and output 2 are in the "**Instantaneous flow rate mode**"
2) Both output 1 and output 2 are in the "**Area mode**"

When both output 1 and output 2 are in the "**Instantaneous flow rate mode**"



Reference 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**"
Set the output 1 area inside the output 2 area.



Reference 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.

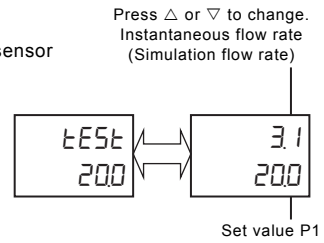
D8 Power-saving mode

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

Reference
- 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, SPAn is more convenient.

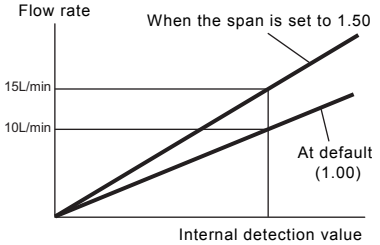
■ Selecting pipe schedule (SEL)

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.

Reference
- "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 (SPAn)

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.



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7. Troubleshooting

7-1 Troubleshooting

Problem	Cause	Solution
ErC is displayed.	Excessive current (overcurrent) is flowing through output 1 or output 2.	• 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.
ErE is displayed.	The memory has reached its end of life, or the sensor is malfunctioning.	Perform initialization. If the problem persists, contact KEYENCE.
rEu is displayed.	The fluid flows in the opposite direction of the setting.	Set the flow direction according to the correct fluid flow direction.
FFFF is displayed.	The integrated flow display has exceeded the display range.	• Perform the integrated flow reset. • Change the integrated flow unit to a more appropriate setting, or use an external counter.
Loc is displayed.	Keylock function is active.	• Disable the Keylock function when you want to change the settings.(P4)
--- is displayed.	• The sensor is not properly fixed to the pipe and bracket. • The pipe is not filled with fluid. • The detection signal is unstable.	• 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 persist, then the fluid or the pipe may be causing detection issues, or the sensor may be damaged.
• The instantaneous flow rate experience large fluctuations. • Occasionally "0" L/min(G/min) is displayed. (One stability indicator lights or blinks.)	The sensor is affected by pulsation, air bubbles or non-ideal flow distribution..	Increase the response time.
	Cavitation is occuring due to pressure changes.	• Install the sensor on a straight section of pipe. • Avoid installing just after a bore conversion section or a bulb.
The instantaneous flow rate does not change from "0".	The integrated flow display has been set.	Press the MODE button to switch the screen, and check if the integrated flow display is set.
	When using the external input function, the flow rate zero input (tr iG) is selected, and the external input is being sent.	• 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 (tr iG) has been set accidentally, select a different option.
	No flow.	Check valves for open and close conditions, and also check the pipe and filter for clog.
	The fluid is actually flowing, however, with the flow rate value less than the zero cut flow rate.	Adjust the zero cut flow rate value.
The flow rate differs greatly from the actual flow rate value.	The bore diameter of pipe or the pipe schedule selected by setting differs from those of the actual pipe.	Set the bore diameter and the pipe schedule correctly. Adjust the flow rate span according to the actual flow rate value.
	The origin adjustment has not been correctly performed.	Perform the origin adjustment again when the pipe is filled with fluid and the fluid is still.
	The characteristic of the fluid largely differs from that of water.	Adjust the flow rate span according to the actual flow rate value.
The display turns on and off.	• The power is not turned on. • The connector cable is damaged. • The unit is in the power-saving mode.	• Check the power capacity. • Check the wiring for crossed wires or loose connections. • Replace the connector cable with a spare. • Check if the sensor is in the power-saving mode.

7-2 Output Status during Errors

Display	Control output	Analog output	Large status indicator
ErE	Normal operation	Normal operation	Blinks red
ErC	OFF	Normal operation	Blinks red
rEu	Operates as if the flow rate is zero.	When 4-20mA is set: 2mA When 0-20mA is set: 0mA	Operates as if the flow rate is zero.
---	Operates as if the flow rate is zero.	When 4-20mA is set: 2mA When 0-20mA is set: 0mA	Operates as if the flow rate is zero.

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8. Specifications

8-1 Specifications

Model		FD-Q10C		FD-Q20C		FD-Q32C		FD-Q50C	
Supported pipe diameter	Outer diameter of pipe (mm)	Φ13 to Φ16	Φ16 to Φ18	Φ18 to Φ23	Φ23 to Φ28	Φ28 to Φ37	Φ37 to Φ44	Φ44 to Φ52	Φ52 to Φ64
	NPS (Nominal Pipe Size)	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
	DN (Diameter Nominal)	8A	10A	15A	20A	25A	32A	40A	50A
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 surface temperature)		0°C to 85°C (No freezing on the pipe surface) *2							
Maximum rated flow		20L/min	30L/min	60L/min	100L/min	200L/min	300L/min	400L/min	500L/min
Zero cut flow rate (Default) *3		1.0L/min		2.5L/min		5L/min		25L/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		0.5s/ 1.0s/ 2.5s/ 5s/ 10s/ 30s/ 60s							
Repeatability (% of F.S.) *4 (Specific to selected response time.)		0.5s:±2.0%, 1s:±1.5%, 2.5s:±1.0%, 5s:±0.5%, 10s:±0.35%, 30s:±0.2%, 60s:±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 30V or less, max. 100mA/ch., residual voltage 2.5V or less							
	Analog output (ch.2)	4 to 20mA/0 to 20mA (Selectable, Default: not used), load resistance 500Ω or less							
	External input (ch.2)	Integrated flow reset input/ Flow rate zero input/ Origin adjustment input (Selectable, Default: not used), short-circuit current 1.5mA or less, input time 20ms or more							
Power source	Power supply voltage	20 to 30 V DC , ripple (P-P) 10% max, Class2/LPS							
	Current consumption	100mA or less (Load current excluded) *6				130mA 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 (No freezing)							
	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	100m/s^2 16ms 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. 340g		Approx. 400g		Approx. 530g		Approx. 640g	

*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℃.

*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 (38.4kbps) 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 Nutzerorganisation 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

Item	FD-Q10C	FD-Q20C	FD-Q32C	FD-Q50C	Notes
A. Selecting NPN/PNP (✔)	nPn	nPn	nPn	nPn	
B. Selecting ch.2 function (✔)	oFF	oFF	oFF	oFF	
C. Flow direction (✔)	→r	→r	→r	→r	
D. Selecting bore diameter of pipe (✔)	3/8	3/4	1 1/4	2	
E. Correcting the flow rate value (✔)	oFF	oFF	oFF	oFF	
F. Selecting unit (✔)	L	L	L	L	
1. Output 1 detection mode (✔)	Std	Std	Std	Std	
2. Output 1 output logic (✔)	no.	no.	no.	no.	
3. Response time (✔)	5.0	5.0	5.0	5.0	
4. Integrated flow unit (✔)	1	1	1	1	
5. Output 2 detection mode (✔)	Std	Std	Std	Std	
6. Output 2 output logic (✔)	no.	no.	no.	no.	
7. Selecting input function (✔)	rSEt	rSEt	rSEt	rSEt	
8. Analog output current (✔)	4-20	4-20	4-20	4-20	
9. Analog output lower limit	0.0	0.0	0	0	
10. Analog output upper limit	30.0 (8.0)	100.0 (26.0)	300 (80)	500 (130)	
11. Display resolution (✔)	0.1	0.1	1	1	
12. Display averaging	1	1	1	1	
13. Hysteresis	0.3 (0.1)	1.0 (0.3)	3 (1)	5 (2)	
14. Zero cut flow rate	1.0 (0.3)	2.5 (0.7)	5 (2)	25 (6)	
15. Display indicator illumination mode (✔)	Grn	Grn	Grn	Grn	
16. Power-saving mode (✔)	oFF	oFF	oFF	oFF	
19. Key lock method (✔)	Std	Std	Std	Std	
Set value P1/P1-L	3.0 (1.0)	10.0 (3.0)	30 (8)	50 (13)	
Set value P1-H	18.0 (6.0)	60.0 (18.0)	180 (48)	300 (78)	
Set value P2/P2-L	6.0	20.0	60	100	
Set value P2-H	15.0 (5.0)	50.0 (15.0)	150 (40)	250 (65)	
Set value of integrated flow	150 (150)	150 (150)	150 (150)	150 (150)	

(*) 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

Serial No.	Quick setting code

8-3 WARRANTIES AND DISCLAIMERS

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