



Clamp-On Flow Sensor

NEW FD-H Series



The Next
Evolution in
Clamp-On
Technology

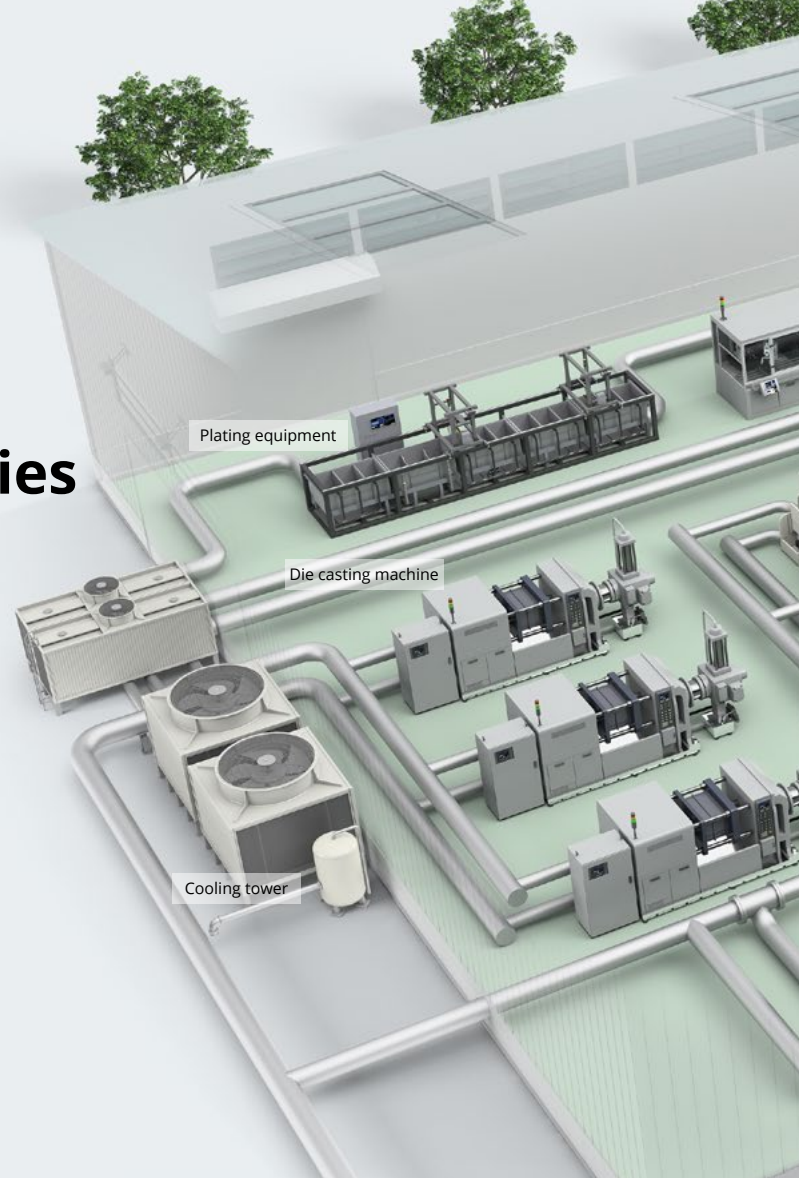


Scan for More

FD-H Series

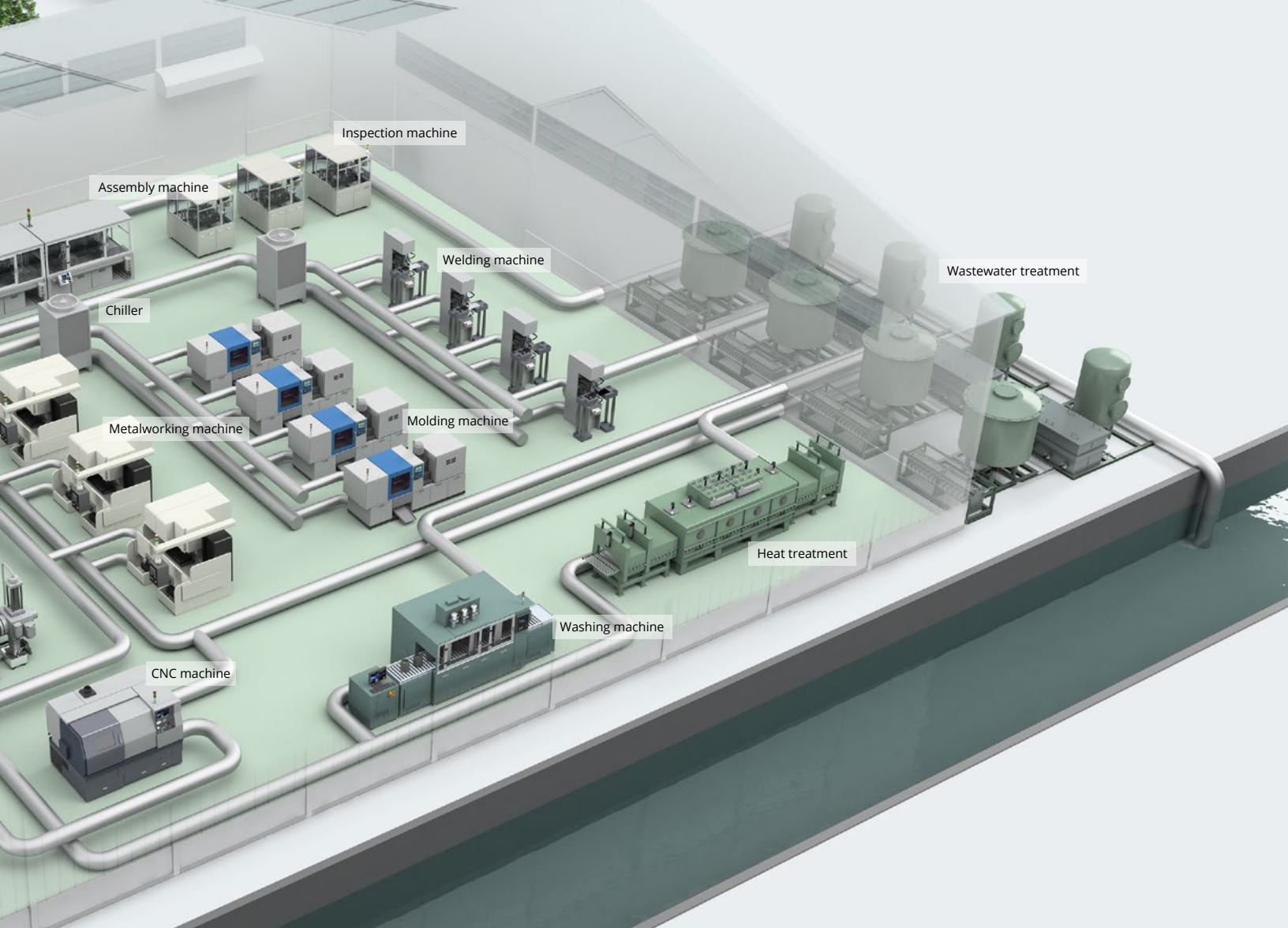
Countless Opportunities for Process/Machine Improvement

Consider the questions below to help identify different areas where the FD-H Series can be a benefit to a machine or process!



Which processes or machines in your facility utilize liquids?

| Liquid Examples | | Process & Machine Examples | |
|-----------------|-----------|----------------------------|---------------|
| Water | Oils | Molding/Casting | Parts Washing |
| Chemicals | Coolants | Welding | CNC/Grinding |
| Grease | Adhesives | Induction Heating | Assembly |
| DI Water | Product | Wastewater Treatment | Mixing |



What are the risks if the liquid does not flow properly?

Many risks and problems can arise if liquids are not flowing properly. Consider the potential negative impacts to your machines or processes if the liquid is not flowing correctly.

Damaged Equipment

Downtime

Scrapped Parts

Wasted Resources

How are you currently monitoring liquid flow?

To prevent problems, it is necessary to continuously monitor flow and recognize potential issues quickly. Consider if your current monitoring techniques are adequate.

Nothing

Visual Checks

Mechanical Sensors

High Accuracy Meters

All you need to do is
CLAMP-ON



Benefits of Clamp-On:

KEYENCE is the world leader in Clamp-On flow monitoring. This revolutionary technology has made flow monitoring possible in more places than ever before by making implementation easier and less cumbersome than conventional flow sensors.

No Pipe Modifications

No Pressure Loss

No Downtime

No Contamination

Fast Installation

No Leakage

No Clogging

No Maintenance

FD-H Series

Clamp-On Liquid Flow Sensor



Utilize Anywhere

Any Pipe

Any Liquid

Any Condition



Unmatched Features

Intuitive Display

Universal Connectivity

Impressive Accuracy



Complete Process Monitoring

Concentration Sensing

Temperature Sensing

Level Sensing

Utilize Anywhere



Scan for More

Iron/Copper/Stainless Steel
[¼" to 1 ¼"]



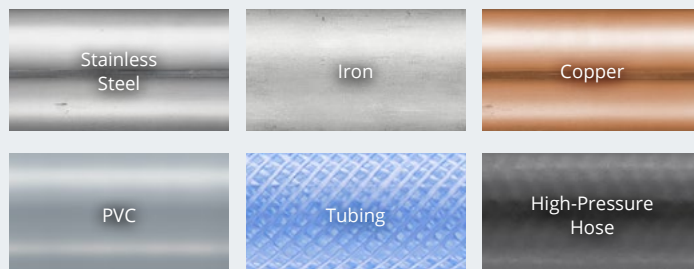
Rigid Plastic/PVC
[¼" to 1 ¼"]



Hose/Tube [ø13 to ø63 0.51" to 2.48"]
Hose Type



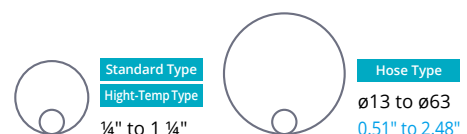
High-Pressure Hose [ø13 to ø63 0.51" to 2.48"]
Hose Type

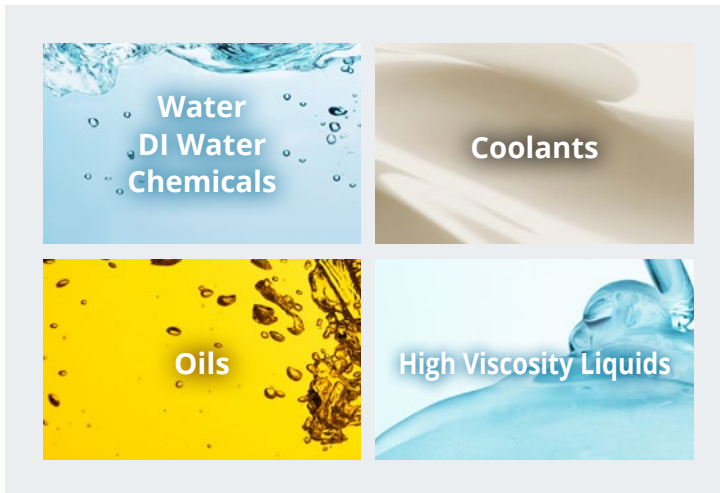


Any Pipe

Including Flexible Hoses

Monitor flow on more pipes than ever before, including braided hoses. Clamp-on flow monitoring has never been more versatile.

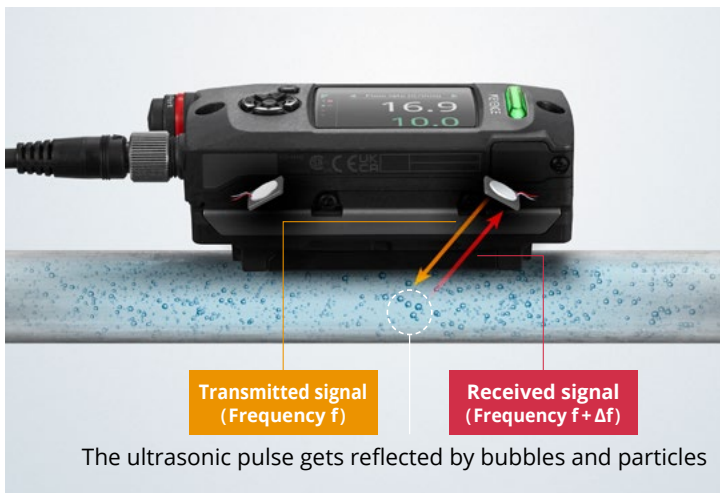




Any Liquid

Stable and Reliable Detection

Improvements in the sensing technology in the FD-H Series make it possible to detect the majority of liquids. From DI water to high viscosity liquids, the FD-H Series can provide consistently stable detection from outside of the pipe or hose.



Any Condition

Standard Type High-Temp Type

Bubbles in the liquid flow have long been a problem for clamp-on flow sensors, but not anymore. The new hybrid detection method, utilized by the FD-H Series, makes it possible to continue detecting in the presence of bubbles or particulates to provide unmatched stability.



Nearly Any Temperature

High-Temp Type

Even under extreme circumstances where the pipe temperature is exceedingly hot, the FD-H Series can still provide a solution. The High Temperature models offer excellent heat resistance and can be exposed to pipe temperatures of up to 180°C (357°F).

Unmatched Features

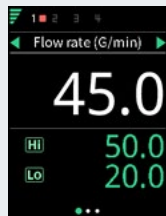
Detachable Display

View all the pertinent data and make adjustments with ease by separating the display from the sensing head. Accessibility is no longer limited by sensor placement.

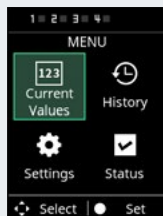


Rotatable Display

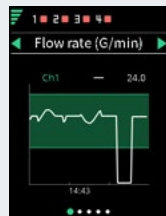
Highly Visible Indicators



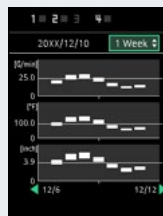
Current values



Clear menus



Real-time graphing



Historical data

All-In-One Display

Everything at Your Fingertips

No manuals necessary with clear menus and even clearer displays. From easy to read graphs to historical data, the FD-H provides display options for any user.

One year of data is stored and can be output via USB

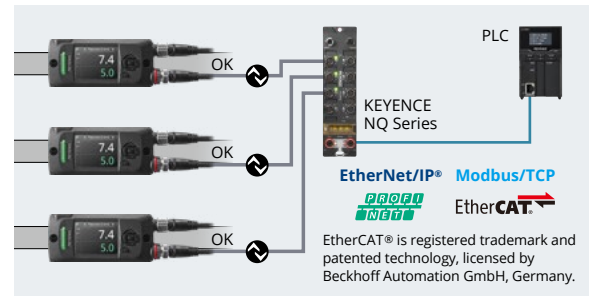




Built-In Temperature Sensor

Standard Type

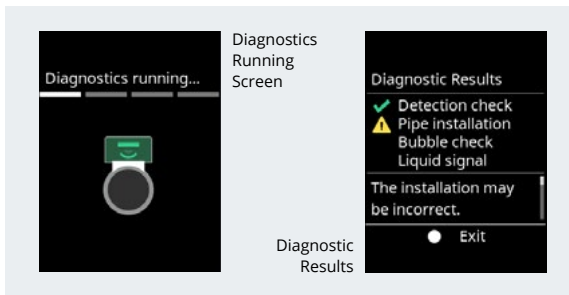
Monitor flow and temperature with one unit, eliminating the need for additional equipment, installation, and setup. Combining flow and temperature data will allow you to understand your system better than ever.



Universal Connectivity

Control Outputs, Analog Outputs, & IO-Link

The FD-H Series allows users to mix and match control outputs, analog outputs, and inputs to fit any setup. The FD-H Series also offers IO-Link communication to provide limitless data over a network.



Diagnostic Function

Built-In Troubleshooting Ensures Stability

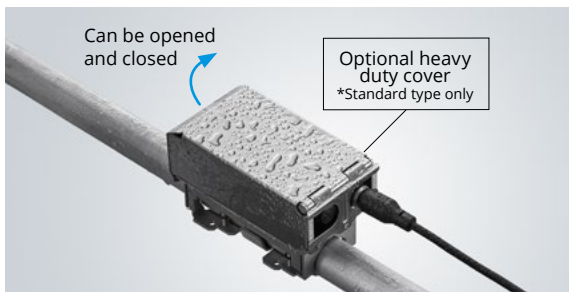
No more guessing why the stability is low. The FD-H Series offers a built-in diagnostics function that will check multiple factors and then make appropriate recommendations to improve stability.



Impressive Accuracy

Standard Type High-Temp Type

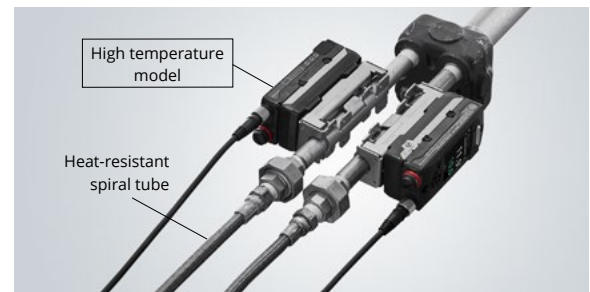
The FD-H Series provides an impressive absolute accuracy specification of $\pm 3\%$ of the reading value. This makes the FD-H Series capable of general detection, as well as more precise detection when needed.



Environmentally Resistant

Waterproof, Dustproof, & Impact Resistant

The FD-H is designed for the factory environment and boasts enclosure ratings of IP65 and IP67. Along with this, an optional heavy duty cover is available to prevent impact damage if necessary.



Mounts in Tight Spaces

No More Bulky Flow Sensors

Space is always at a premium on machines, and this is extremely apparent when it comes to piping. The small size and detachable display make the FD-H Series the perfect size to fit nearly anywhere.

COMPLETE PROCESS MONITORING

Extend Beyond Flow Sensing to Understand the Full System



Concentration

NEW Digital Refractometer

FI-C Series

➔ Pg.12



Temperature

NEW Temperature Sensor

FI-T Series

➔ Pg.14



Level

Sensing Guide Pulse
Level Sensor

FL Series

➔ Pg.16



Consolidate your
monitoring into
one display



Scan for More

Look at more than just flow!

Concentration

Temperature

Level

Introducing Complete Process Solutions

Monitor and manage multiple variables all through one centralized device.

The FD-H Series does not stop at simply monitoring flow, it can also integrate with up to two other devices to provide a complete picture of your machine's performance. Along with flow rate, other variables like concentration, level, and temperature can be centralized into the FD-H to help optimize your equipment usage and prevent costly downtime.

Avoid Costly Manufacturing Issues

Downtime

Scrapped Parts

Equipment
Damage

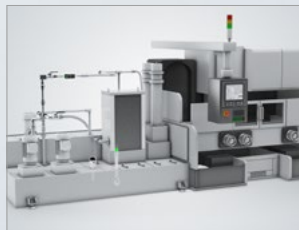
Examples of Complete Process Monitoring

Heat transfer control for molds [Flow Rate + Temperature]

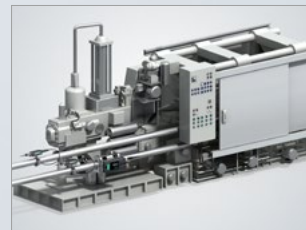
Monitoring of mold release agent [Flow Rate + Level]

Quality control during quenching [Flow Rate + Concentration]

Coolant reservoir monitoring/filling [Flow Rate + Concentration + Level]



Coolant management for grinding or CNC machines



Cooling water management for die casting machines



Multi-Port



Digital Refractometer

Probe type

Digital Refractometer
Probe Type

FI-C20D NEW



Tool-Free
Maintenance

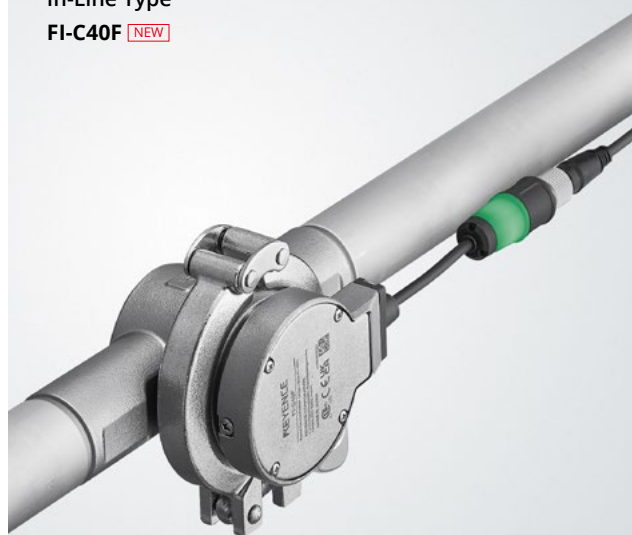


Built-in
temperature
sensor

In-Line type

Digital Refractometer
In-Line Type

FI-C40F NEW

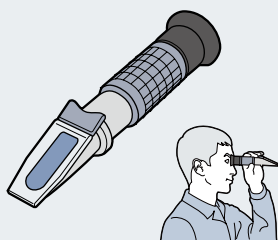


Built-in
temperature
sensor

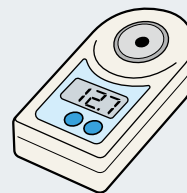
Replace Frustrating Conventional Refractometers

Handheld refractometers represent a costly and labor intensive way of monitoring the concentration of specific liquids. Since they depend on an operator to regularly check the Brix% of the liquid, they are prone to inconsistent readings, missed readings, and delays in detecting problems that could damage machinery or parts. By continuously monitoring concentration with a digital refractometer, operator interaction is eliminated and problems are detected immediately.

Conventional Refractometers



Handheld Type

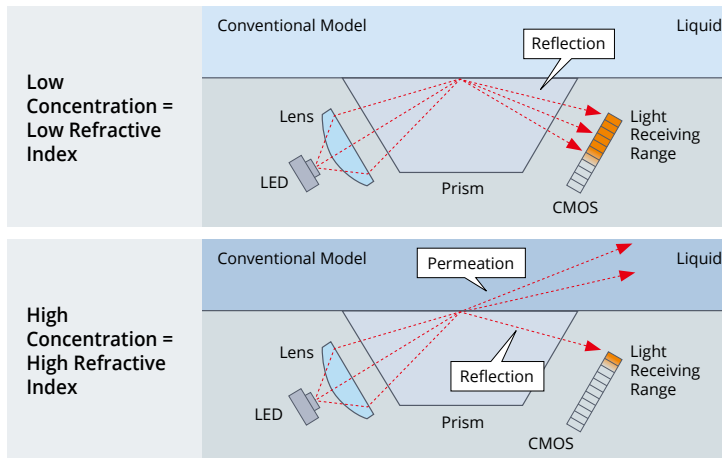


Digital Handheld Type

Flow Rate + Concentration



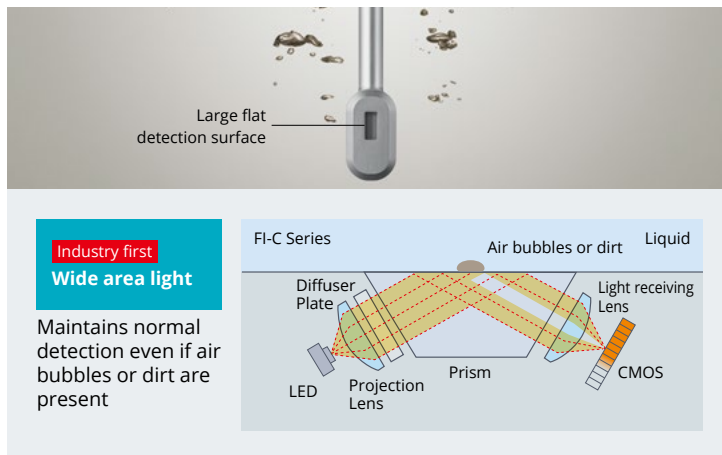
FD-H Series



Measuring Refractivity

Using Light Reflection to Indicate Concentration

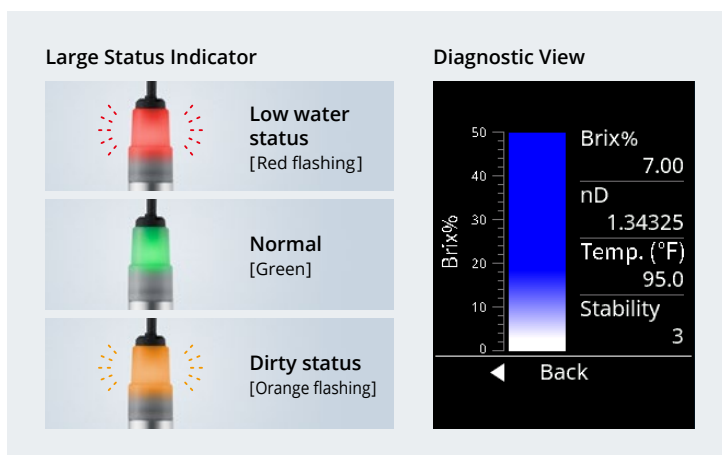
The FI-C Series operates by measuring the refractive index of the liquid and converting this value to a Brix%. This is done by monitoring how much light is reflected off of the inner surface, as opposed to being absorbed by the liquid. As concentration changes, so does the refractive index. This is especially useful for water-based coolants.



Stable and Reliable Detection

Not Impacted by Bubbles or Debris

By utilizing an innovative wide area light method, the FI-C Series is able to provide consistent and stable detection in harsh conditions. The wide area light ensures that bubbles and dirt on the lens do not affect detection. The surface is also rugged and resistant to scratching from particulates that may be in the liquid.



Understanding at a Glance

Large Status Indicator & Detailed Display

Both the in-line and probe type models feature a large three-color indicator light. This indicator can display the concentration status, as well as alert operators to unseen issues in the tank or pipe. By looking at the display on the FD-H or FI-1000, it is even easier to understand the current situation with all the necessary information on one screen.

Clamp-On Temperature Sensor

Small pipes
1/8" to 1/4"

**Clamp-On
Temperature Sensor**
FI-T8/T15 **NEW**

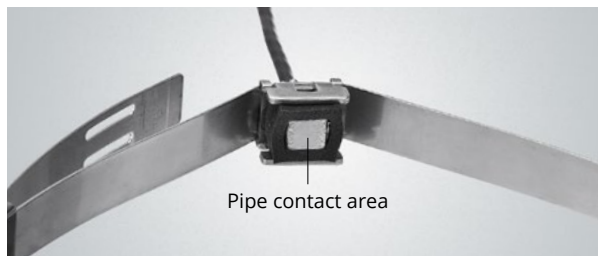
Attach to the pipe
with two screws

**Medium/large
pipes**
3/4" to 8"

**Clamp-On
Temperature Sensor**
FI-T25/T50/T100/T200 **NEW**

Attach to the pipe
with metallic bands

Innovative Design Ensures Stable Temperature Monitoring



The FI-T Series utilizes several innovative techniques to provide the most reliable temperature measurement from outside the pipe. The contact point between the FI-T Series and the pipe is made of a soft metal that conforms to the shape of the pipe easily to ensure minimal air gaps. Along with this, special insulation is utilized to greatly minimize the effects of the ambient temperature. Lastly, a platinum RTD is used to ensure a dependable readings.

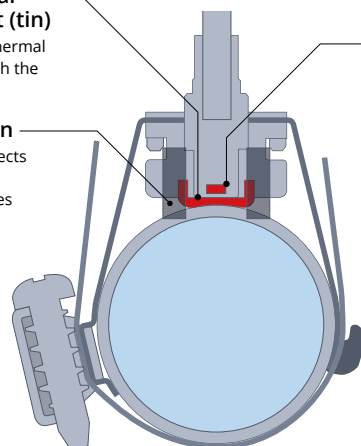
**Soft Metal
Couplant (tin)**

Increased thermal
coupling with the
pipe

Insulation

Reduces effects
of ambient
temperatures

**Platinum
RTD
(Pt100)**



Flow Rate + Temperature



FD-H Series



Easy Installation

No Pipe Modification Necessary

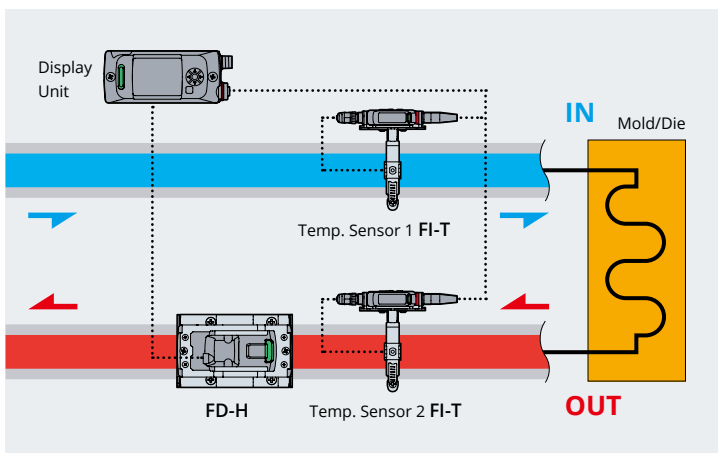
Eliminate downtime and installation time by simply clamping the FI-T Series temperature sensor on the outside of the pipe. The FI-T Series offers several different models that are compatible with a range of pipes from 1/8" to 8" in size. All of these models can be mounted in seconds to start monitoring temperature immediately.



Dedicated Display Amplifier

Easy to Read OLED Display

The FI-T Series can be connected to the FD-H, FI-1000, or even used by itself. In all situations, the FI-T offers a dedicated display that can be mounted near the unit for monitoring with a quick glance. The OLED display can be easily read and also allows for quick adjustments on the fly.



Heat Transfer Monitoring

No Calculations Needed

When you combine two FI-T Temperature Sensors with the FD-H Series, it is possible to calculate the amount of heat that is being transferred into or out of a system. By monitoring the heat transfer rate, it is easier to recognize potential issues before they arise. This is ideal for molding or casting applications where heat transfer is key.

Sensing Guide Pulse Level Sensor

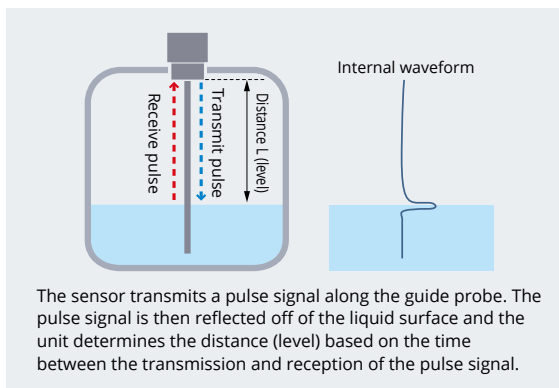
Sensing Guide Pulse Level Sensor FL Series

Truly trouble-free
level sensing



Sensing Guide Pulse Method = Guide Pulse Method + TriSense Technology

Guide Pulse Method



TriSense Technology

Sensing of Any Liquid

The sensor automatically adjusts to properly detect any liquid. Along with water, other liquids such as oils and chemicals can now be detected with ease.

Sensing of the Installation Environment

The environment around the probe is recognized and ignored. Even when the space is limited or there is an obstacle nearby, the sensor learns its installation environment and eliminates the risk of false detection.

Sensing of the Probe Condition

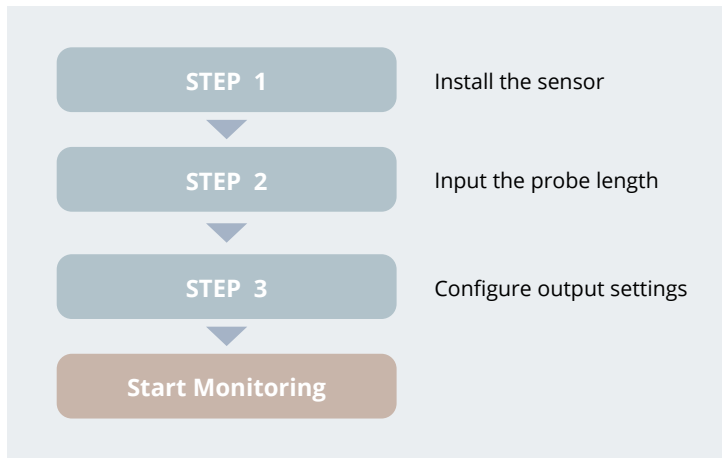
The probe, which guides the pulse signals, is continuously monitored for build-up. Based on this data, the FL Series is able to appropriately adjust its sensitivity to ignore build-up and ensure stable detection.



Flow Rate + Level



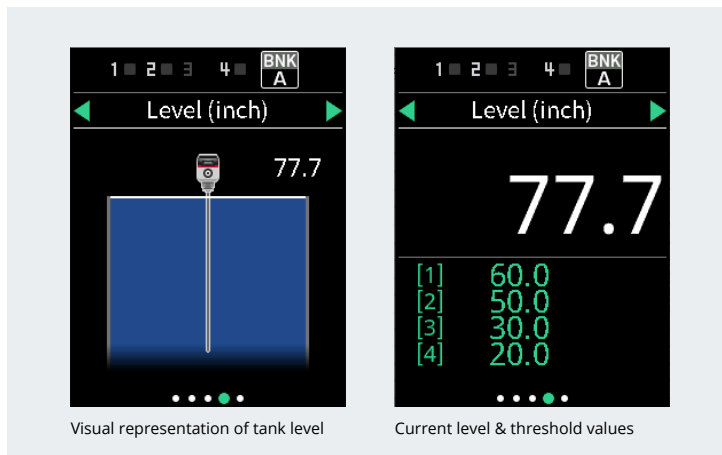
FD-H Series



Simple and Easy Installation

Ready in Just 3 Steps

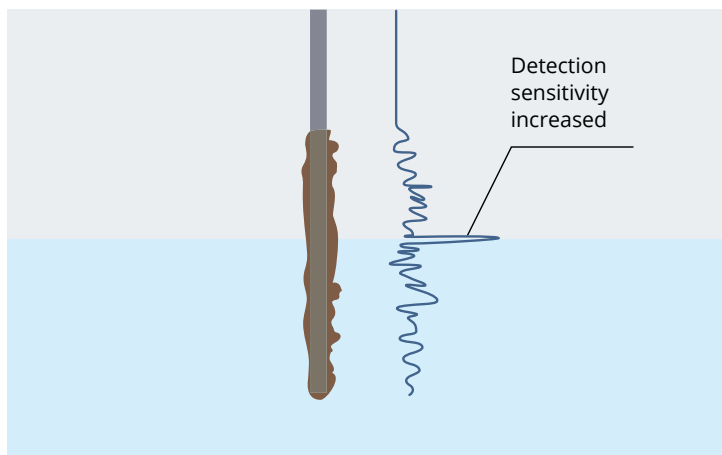
Startup is almost immediate after installation of the FL Series unit. Simply input the probe length and necessary output thresholds to start stably detecting liquid level. This eliminates the need for empty tank adjustments and other time consuming tasks associated with conventional level sensors.



Remote Monitoring

Understand Level at a Glance

It is not always easy to see the display on the top of a large tank. By connecting the FL Series to the FD-H Series or the FI-1000, you now have a remote display that can be mounted in a convenient location with ease. The different display options make it a breeze to understand the current tank level situation.



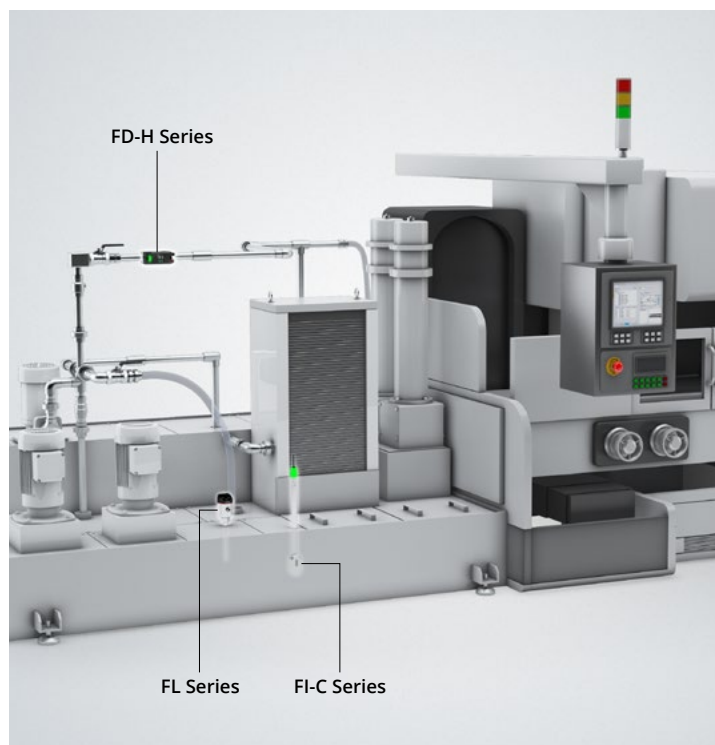
Build-Up Resistance

Only Clean When Absolutely Necessary

The sensor automatically optimizes liquid level detection by differentiating between the liquid level and build-up on the probe. This ensures stable detection for long periods of time. If there is too much accumulation or build-up to conduct stable detection, a warning signal can be sent before problems occur.

APPLICATIONS

Complete process monitoring applications

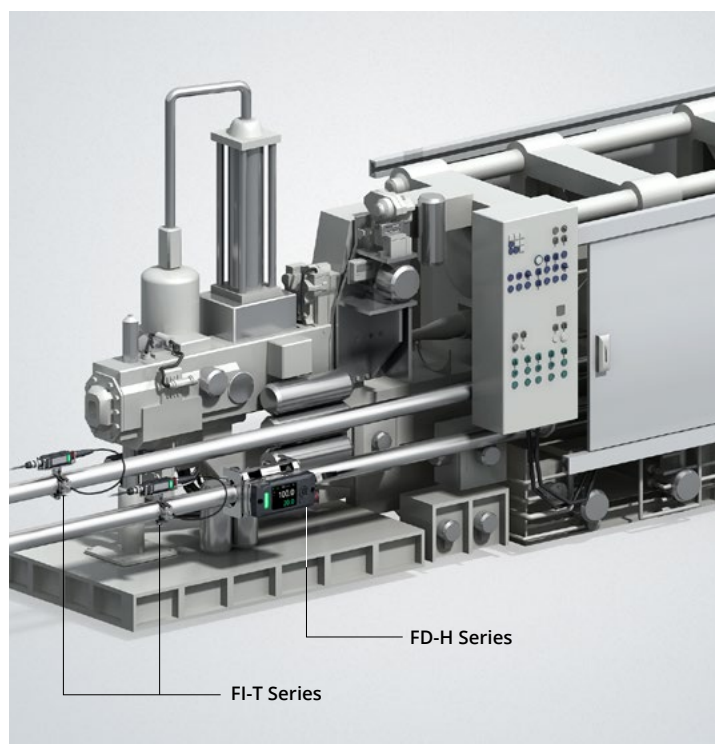


Metalworking Machines

(CNC Machines/Grinders)

| | |
|---------------|-----------------------|
| Liquid | Water-soluble coolant |
| Flow Rate | FD-H Series |
| Concentration | FI-C Series |
| Temperature | FI-C/FI-T Series |
| Level | FL Series |

Simultaneous monitoring of the flow rate, concentration, and temperature of water-soluble coolant ensures the quality of parts is maintained and potential issues are detected immediately. Everything from proper coolant concentration & tank level to potential flow obstructions can be monitored in one system.



Die Casting Machines

| | |
|---------------|----------------------------------|
| Liquid | Cooling water for dies |
| Flow Rate | FD-H Series |
| Temperature | FI-T Series |
| Liquid | Water-soluble mold-release agent |
| Concentration | FI-C Series |

In addition to monitoring the flow rate of the mold cooling water, two temperature sensors are installed on the inlet and outlet sides to measure the heat transfer. By monitoring the heat transfer, it is easy to recognize that proper heating and cooling of the dies is occurring. In addition, monitoring the concentration of the water-soluble mold-release agent ensures the product releases properly each time.



Molding Machines

(Engineering plastics and glass-reinforced resins)

| | |
|-------------|----------------------------------|
| Liquid | Oil for mold temperature control |
| Flow Rate | FD-H Series |
| Temperature | FI-T Series |

High-temperature oil is used when molding engineering plastics or glass-reinforced resins, and it is important for quality control to maintain mold temperatures properly. In addition to monitoring the oil flow to detect mold clogs, a temperature sensor can check the temperature of the oil leaving the thermolator to ensure that it is within the correct range.



Induction Hardening Machines

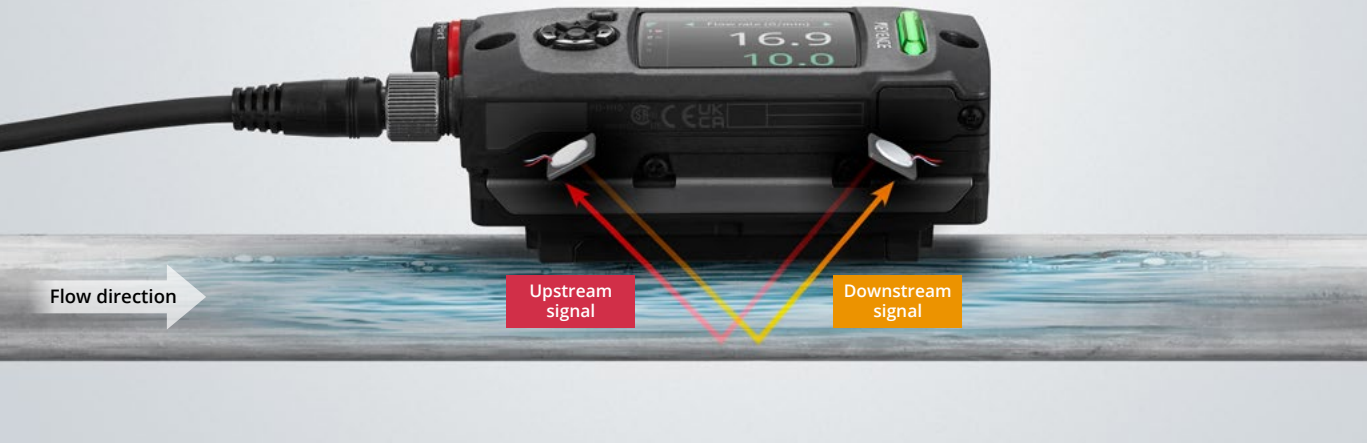
| | |
|---------------|------------------|
| Liquid | Quenching water |
| Flow Rate | FD-H Series |
| Concentration | FI-C Series |
| Temperature | FI-C/FI-T Series |

Proper tempering is key when it comes to induction hardening. Not only is the flow rate of the liquid important but also the temperature and concentration of the liquid. All of these variables can be monitored simultaneously to ensure the proper quality and strength of these parts.

FD-H Series Detection Principles

In the absence of air bubbles

Delta TOF [Time of Flight Method]

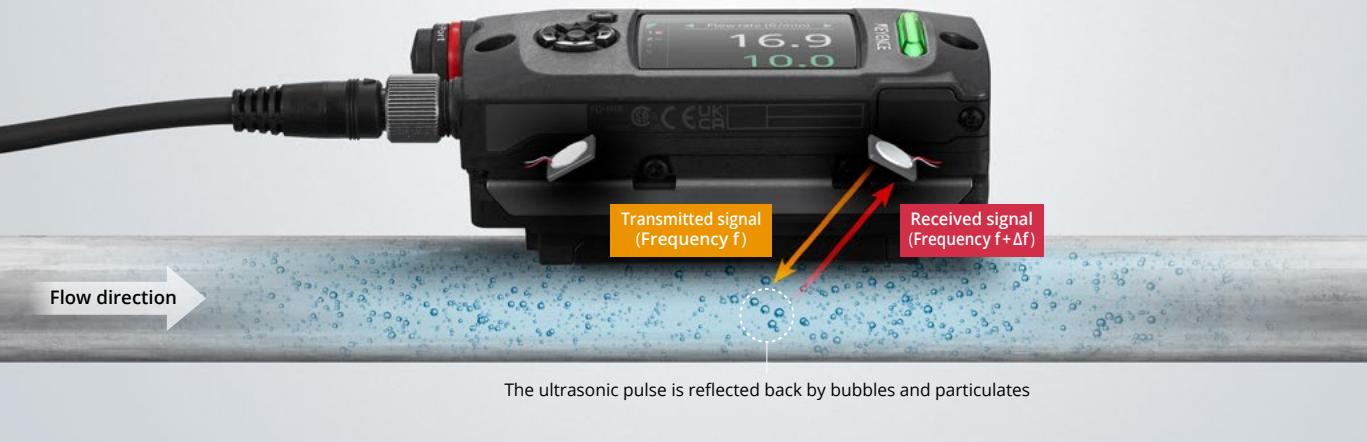


When many bubbles are present

Pulse Doppler

Standard model

High temperature model



Standard model

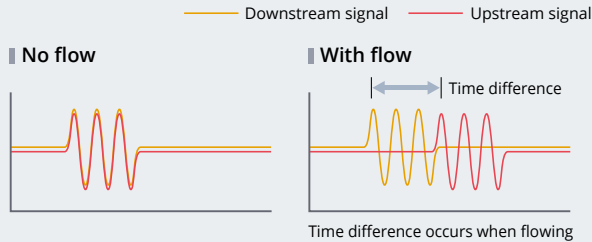
High temperature model

Measurement accuracy

±3.0% of RD

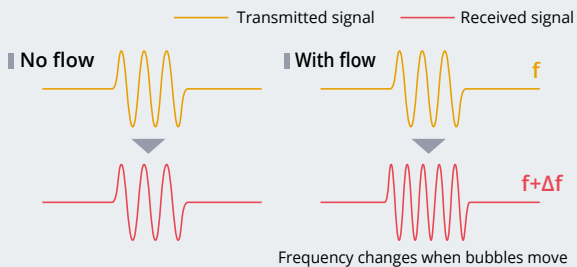
The FD-H Series is equipped with a proprietary algorithm that allows it to achieve a measuring accuracy of ±3.0% of RD (reading value). It is also resistant to environmental changes, like ambient temperature fluctuations, and can provide stable detection for a long period of time.

Delta TOF [Time of Flight Method]



Delta TOF determines the flow rate by monitoring two ultrasonic signals (one moving in the direction of flow and one moving against the direction of flow) and measuring the difference in time to move through the liquid. This time difference correlates to the flow rate. By using two signals, the readings remain consistent and stable regardless of external factors such as temperature changes.

Pulse Doppler



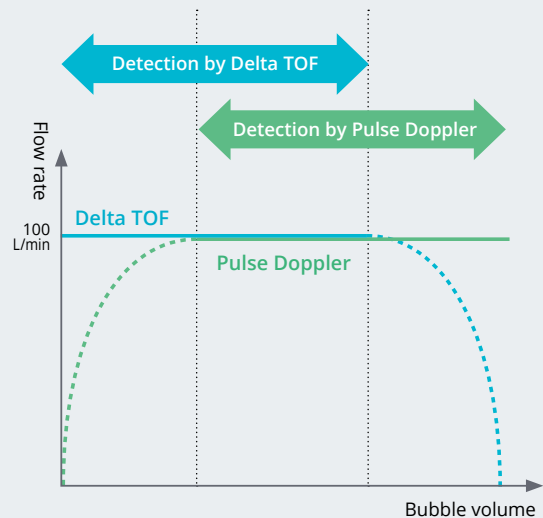
The Pulse Doppler method works when there are bubbles or particulates in the liquid by transmitting and receiving a pulse on the same element. The element transmits a pulse that is reflected back by a bubble or particulate in the liquid. Based on the speed of the liquid, the pulse returns back at a different frequency. This difference in frequency correlates to the flow rate.

Hybrid Detection Principle

Delta TOF without bubbles

Pulse Doppler with bubbles

Automatically switches the detection method based on the amount of bubbles present



Both detection methods are continuously being monitored. The unit will switch accordingly as the amount of bubbles in the liquid changes. This ensures a seamless transition and no delays in detection.

Standard model

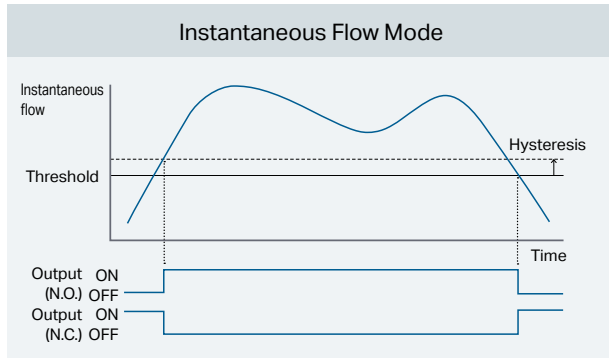
High temperature model

Span adjustment not required
Automatic correction of liquid sound velocity

Conventional ultrasonic flow meters typically require a span adjustment to provide accurate monitoring due to the differences in properties from one liquid to another. The FD-H Series calculates the liquid sound velocity automatically and uses this information to set the appropriate span adjustment and ensure precise detection.

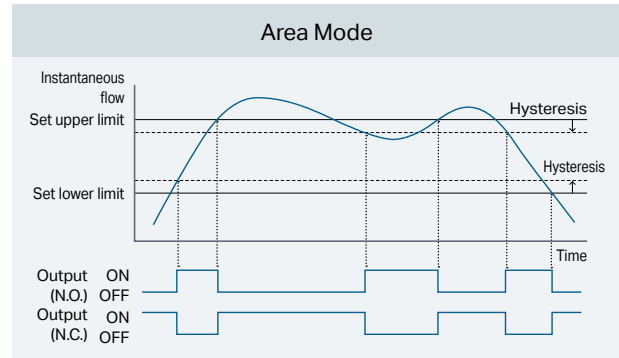
Various Detection Modes to Suit Any Application

Find out if the instantaneous flow has decreased



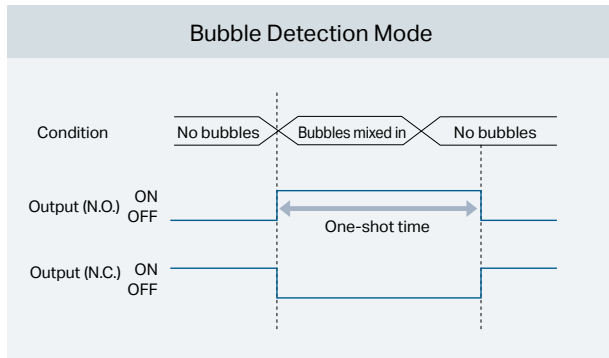
Output switches depending on the threshold value set for instantaneous flow.

Find out if the instantaneous flow is outside an acceptable range



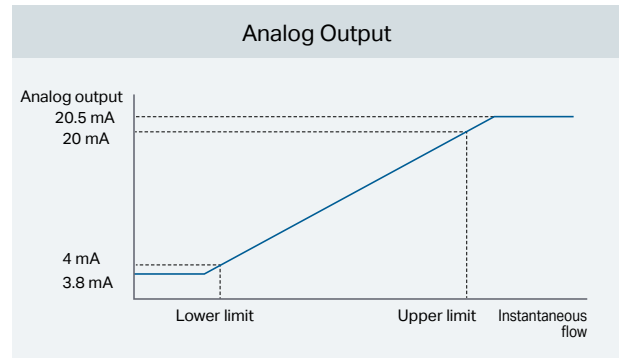
Output switches when the instantaneous flow falls outside the acceptable range.

Find out if bubbles have gotten into the fluid



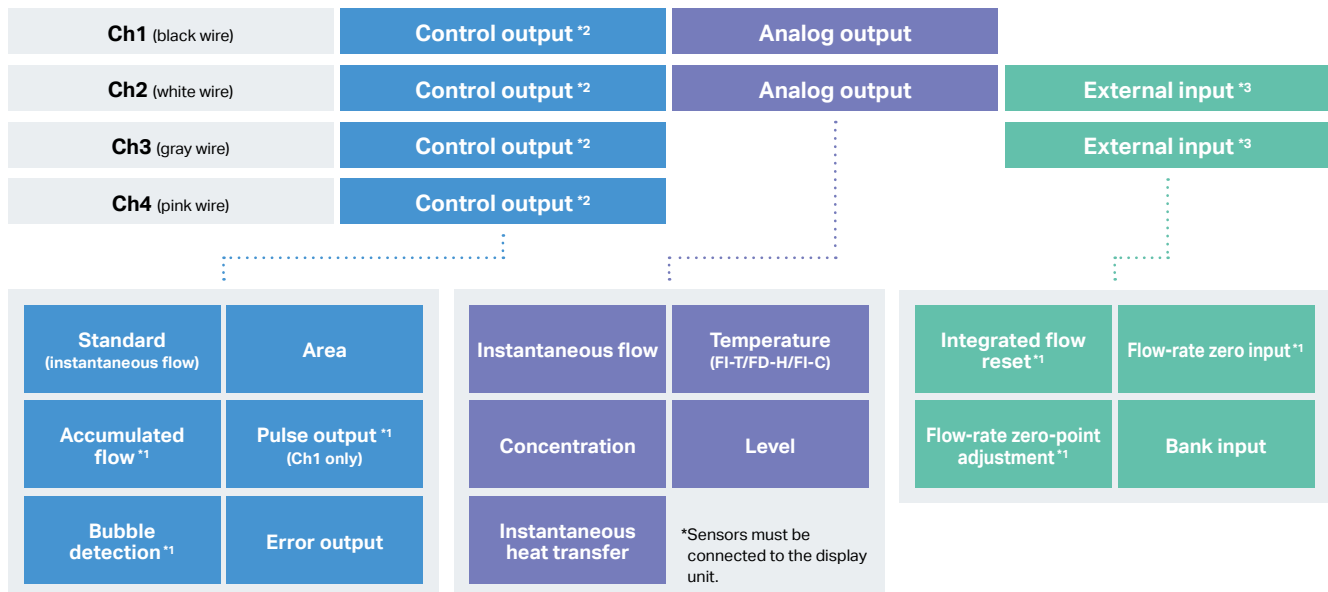
This mode detects bubbles within the pipe and provides a one-shot output.

Monitor variations in the flow rate






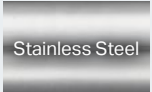






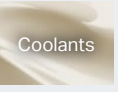




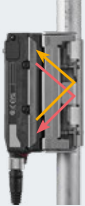

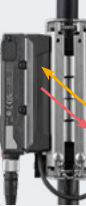



The signal is output from 4–20 mA or 0–20 mA depending on the specified lower and upper limits. (Above image depicts 4–20 mA.)

Mix and Match IO to Fit Your Needs



*1 Flow sensor only *2 Concentration sensor: low liquid output; Level sensor: stability alert output; Temperature sensor (when two units are connected): Accumulated heat pulse output (Ch1 only), accumulated heat output can be assigned separately.

*3 Concentration sensor: concentration hold; Temperature sensor (when two units are connected): Accumulated heat reset can be assigned separately.

| Three Unique Types | | | |
|---------------------|---|--|---|
| Model | Standard Type | High-Temperature Type | Hose Type |
| |  IO-Link IP65/67 |  IO-Link IP65/67 |  IO-Link IP65/67 |
| Pipe O.D. | ø13 to ø44 ø0.51" to 1.73" | ø13 to ø44 ø0.51" to 1.73" | ø13 to ø63 ø0.51" to 2.48" |
| Compatible pipes |  Stainless Steel |  Iron |  Copper |
| |  PVC |  Rigid Plastics |  Rigid Plastics |
| Compatible liquids |  Water DI Water Chemicals |  Coolants |  Oils |
| |  Bubbles |  Bubbles |  High Temp. Liquids |
| Detection principle | Hybrid Detection Principle Delta TOF + Pulse Doppler | Hybrid Detection Principle Delta TOF + Pulse Doppler | Delta TOF |
| Additional points | Compatible fluid temperature up to 85°C 185°F | Compatible fluid temperature up to 180°C 356°F | Compatible fluid temperature up to 100°C 212°F |
| | Built-in temperature sensor | - | - |
| | Measuring accuracy ±3.0% of RD | Measuring accuracy ±3.0% of RD | - |
| | Repeatability ±0.3% of F.S.* | Repeatability ±0.3% of F.S.* | Repeatability ±0.3% of F.S.* |
| | Automatic correction of liquid sound velocity | Automatic correction of liquid sound velocity | - |
| Unique Features |  Reflective type |  Reflective type |  Transmission type |
| | Built-in temperature sensor The built-in thermistor enables simultaneous measurement of flow rate and temperature.  | High temperature 180°C 356°F compatible Use with temperatures up to 180°C 356°F with a couplant (sold separately). (Up to 140°C 284°F when not used)  | Hose mounting The bracket design maintains uniform pressure on six sides of the hose. Stable long-term detection is possible even with hoses that are easily deformed.  |

*When response time is 5.0 s

Clamp-on Flow Sensor FD-H Series

Standard Type

| Model | Rated flow | Supported pipe sizes | Pipe outer diameter |
|--------|------------------------|----------------------|---------------------|
| FD-H10 | 20 L/min 5.3 gal/min | 1/4" (8 A) | ø13-16 ø0.51"-0.63" |
| | 30 L/min 7.9 gal/min | 3/8" (10 A) | ø16-18 ø0.63"-0.71" |
| FD-H20 | 60 L/min 15.9 gal/min | 1/2" (15 A) | ø18-23 ø0.71"-0.91" |
| | 100 L/min 26.4 gal/min | 3/4" (20 A) | ø23-28 ø0.91"-1.10" |
| FD-H32 | 200 L/min 52.8 gal/min | 1" (25 A) | ø28-37 ø1.10"-1.46" |
| | 300 L/min 79.3 gal/min | 1 1/4" (32 A) | ø37-44 ø1.46"-1.73" |

Rigid piping



Built-in temperature sensor

Compatible with fluids with bubbles



140°C 284°F or lower

Between
140-180°C 284-356°FUltra-high-temperature couplant **Required**

If the fluid temperature exceeds 140°C 284°F, it is necessary to change the couplant and separate the display unit from the sensor.

FD-HK1: for FD-H10K

FD-HK2: for FD-H20K

FD-HK3: for FD-H32K

Power supply cables **Required**

Dedicated power supply cable

| Appearance | Model | Overview |
|------------|----------|---|
| | FD-HCB2 | M12 power supply cable 6-core cable PVC 2 m 6.6' |
| | FD-HCB10 | M12 power supply cable 6-core cable PVC 10 m 32.8' |

High-Temperature Type

| Model | Rated flow | Supported pipe sizes | Pipe outer diameter |
|---------|------------------------|----------------------|---------------------|
| FD-H10K | 20 L/min 5.3 gal/min | 1/4" (8 A) | ø13-16 ø0.51"-0.63" |
| | 30 L/min 7.9 gal/min | 3/8" (10 A) | ø16-18 ø0.63"-0.71" |
| FD-H20K | 60 L/min 15.9 gal/min | 1/2" (15 A) | ø18-23 ø0.71"-0.91" |
| | 100 L/min 26.4 gal/min | 3/4" (20 A) | ø23-28 ø0.91"-1.10" |
| FD-H32K | 200 L/min 52.8 gal/min | 1" (25 A) | ø28-37 ø1.10"-1.46" |
| | 300 L/min 79.3 gal/min | 1 1/4" (32 A) | ø37-44 ø1.46"-1.73" |

Rigid piping



Compatible with fluids with bubbles



Hose Type

| Model | Rated flow | Pipe outer diameter |
|---------|-------------------------|-------------------------|
| FD-H22F | 60 L/min 15.9 gal/min | ø13-22.9 ø0.51"-0.90" |
| FD-H32F | 200 L/min 52.8 gal/min | ø23-32.9 ø0.91"-1.295" |
| FD-H47F | 300 L/min 79.3 gal/min | ø33-47.9 ø1.299"-1.886" |
| FD-H63F | 500 L/min 132.1 gal/min | ø48-63 ø1.89"-2.48" |

Hoses/Tubes



High-viscosity liquid compatible



Stabilization bracket

Optional

Can be used to secure hose models to walls, etc. Can be used with any of the four different hose models.

FD-HFB1



For IO-Link communication

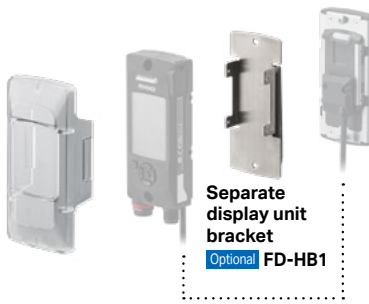
Can be converted to 4 pins using the below.

| Appearance | Model | Overview |
|------------|----------|---|
| | FD-HCC2 | M12 power supply cable 8-pin female to 4-pin male PVC 2 m 6.6' |
| | FD-HCC10 | M12 power supply cable 8-pin female to 4-pin male PVC 10 m 32.8' |
| | FD-HCC0 | 8-pin female to 4-pin male adapter |

Accessories (Display Unit Related)

Heavy Duty Protection Cover

Standard models only

Heavy duty protection cover
FD-HP2Heavy duty power supply cable
FD-HCB10G
M12 6-core cable
PVC 10 m 32.8'Display unit protection cover
Optional
FD-HP1Separate display unit bracket
Optional FD-HB1

*Can also be used with the FI-1000.

Connection cable when separating the display **Optional**

A dedicated cable for when using the display unit separated from the sensor.

| Appearance | Model | Overview |
|------------|----------|--|
| | FD-HCS2 | Display unit separation connection cable PVC 2 m 6.6' |
| | OP-85503 | 2 m 6.6' PVC |
| | OP-85504 | 5 m 16.4' PVC |
| | OP-88075 | 2 m 6.6' PUR |
| | OP-88076 | 5 m 16.4' PUR |

Can be extended an additional 18 m 59.1' (for a total of 20 m 65.6') using these M12-M12 connector cables.

- To output historical data to a PC: USB cable OP-51580 (2 m 6.6') or OP-86941 (5 m 16.4') can be used. Historical data that can be output includes: 1) Instantaneous data and stability for every 10 seconds over the past 7 days, 2) Instantaneous data and stability for every 10 minutes over the past year, 3) Accumulated flow data for every hour over the past year, 4) Accumulated heat transfer data for every hour over the past year, and 5) Up to 100 events.

FD-H Series



M8 4-pin to M12 4-pin cable

Maximum extension of 20 m **65.6'** from the display unit to the temperature sensor display amplifier

| Model | Overview |
|----------|----------------------|
| OP-88456 | 2 m 6.6' PVC |
| OP-88457 | 5 m 16.4' PVC |
| OP-88071 | 2 m 6.6' PUR |
| OP-88072 | 5 m 16.4' PUR |



M12 Multi-Port

The Y-shaped connector below is required when connecting more than one device

FD-HY1



Multi-Port Configurations

Using the Y-shaped connector, you can connect a mix of concentration, level, and temperature sensors. (Up to one each of the concentration and level sensors, and up to two temperature sensors.)

Display Unit (Standalone)

If not using an FD-H flow sensor, please use the following display model.

FI-1000

When extending the cable length beyond 2 m **6.6'**



M12 4-pin to M12 4-pin cable

Maximum extension of 20 m **65.6'** from display unit to concentration sensor (with FI-C40F cable length considered to be 0 m **0'**)

| Model | Overview |
|----------|----------------------|
| OP-85503 | 2 m 6.6' PVC |
| OP-85504 | 5 m 16.4' PVC |
| OP-88075 | 2 m 6.6' PUR |
| OP-88076 | 5 m 16.4' PUR |



M12 8-pin-M12 4-pin cable for FL Series

Maximum extension of 20 m **65.6'** from the display unit to the level sensor

| Model | Overview |
|----------|-----------------------|
| OP-88444 | 2 m 6.6' PVC |
| OP-88445 | 5 m 16.4' PVC |
| OP-88446 | 10 m 32.8' PVC |

*When extending the cable, please use one of OP-88444/88445/88446, and an M12 4-pin to M12 4-pin junction cable (OP-85504 5 m **16.4'** PVC, etc.).

Clamp-on Temperature Sensor FI-T Series



Head



Cable length: Approx. 250 mm **9.84"**

Display amplifier



M8-M8 extension cable

Optional

Maximum extension of 20 m **65.6'** from display amplifier to head

OP-88673 PVC 2 m **6.6'**
OP-88672 PVC 10 m **32.8'**

| Model | Supported pipe sizes | Pipe outer diameter |
|---------|---|------------------------------|
| FI-T8 | 1/8", 1/4" (6 A/8 A) | ø8-14 ø0.31"-0.55" |
| FI-T15 | 3/8", 1/2" (10 A/15 A) | ø14-22 ø0.55"-0.87" |
| FI-T25 | 3/4", 1" (20 A/25 A) | ø22-38 ø0.87"-1.50" |
| FI-T50 | 1 1/4", 1 1/2", 2" (32 A/40 A/50 A) | ø38-70 ø1.50"-2.76" |
| FI-T100 | 2 1/2", 3", 3 1/2", 4" (65 A/80 A/90 A/100 A) | ø70-126 ø2.76"-4.96" |
| FI-T200 | 5", 6", 8" (125 A/150 A/200 A) | ø126-220 ø4.96"-8.66" |

*If using the FI-T temperature sensor on its own, use a 4-pin M8 connector cable. (Examples: OP-87625 (PVC, 2 m **6.6'**), OP-87626 (PVC, 10 m **32.8'**), OP-87628 (PUR, 2 m **6.6'**), OP-87629 (PUR, 10 m **32.8'**))

Digital Refractometer FI-C Series

Probe Type



Cable length 2 m **6.6'**

Probe Length (bottom of indicator to center of detection element): 331.5 mm **13.05"**

Temperature sensor built-in

| Model | Installation |
|---------|--------------|
| FI-C20D | Probe type |

Options

| Appearance | Model | Overview |
|------------|---------|-----------------------------------|
| | FI-CDB1 | Dedicated bracket for probe type |
| | FI-CD1 | Extension pipe* 0.4 m 1.3' |
| | FI-CD2 | Extension pipe* 0.8 m 2.6' |

*Only one extension pipe can be used per setup

In-Line Type



Cable length 50 mm **1.97"**

Temperature sensor built-in

| Model | Installation |
|---------|--|
| FI-C40F | 2S ferrule attached to dedicated pipe attachment |

Options

| Appearance | Model | Overview |
|------------|--------|--------------------------|
| | FI-CF1 | Pipe attachment Rc3/4 |
| | FI-CF3 | Pipe attachment NPT3/4 |
| | FI-CF2 | Pipe attachment Rc1-1/2 |
| | FI-CF4 | Pipe attachment NPT1-1/2 |

Sensing Guide Pulse Level Sensor FL Series

Standard type FL-001



Sanitary type FL-S001

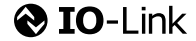


Chemical type FL-C001



+ probe and accessories For details, see the FL Series catalog.

Flow Sensors (FD-H)



| Type | | Standard model / High-temperature model (K) | | | | | | Hose model | | | |
|--|-------------------------------|--|--|--|---------------------------|--|---------------------------|---|---------------------------|---|----------------------------|
| Model | | FD-H10 FD-H10K | | FD-H20 FD-H20K | | FD-H32 FD-H32K | | FD-H22F | FD-H32F | FD-H47F | FD-H63F |
| Supported pipe diameter | Pipe outer diameter | ø13-16 ø0.51"-0.63" | ø16-18 ø0.63"-0.71" | ø18-23 ø0.71"-0.91" | ø23-28 ø0.91"-1.10" | ø28-37 ø1.10"-1.46" | ø37-44 ø1.46"-1.73" | ø13-22.9 ø0.51"-0.90" | ø23-32.9 ø0.91"-1.295" | ø33-47.9 ø1.299"-1.886" | ø48-63 ø1.89"-2.48" |
| | A nominal | 8 A | 10 A | 15 A | 20 A | 25 A | 32 A | — | | | |
| | B nominal | 1/4" | 3/8" | 1/2" | 3/4" | 1" | 1 1/4" | — | | | |
| Supported pipe materials | | Metal piping, hard plastic piping*1 | | | | | | Soft plastic piping, all hoses (braided hoses, pressure-resistant rubber hoses, etc.)*1 | | | |
| Supported fluids | | All fluids (water, oil, chemicals, etc.)*1 | | | | | | | | | |
| Supported fluid temperatures | | Standard model: 0–85°C 32–185°F (no freezing on pipe surface)*2 High-temperature model: 0–180°C 32–356°F (no freezing on pipe surface)*2,3 | | | | | | 0–100°C 32–212°F (no freezing on pipe surface)*2 | | | |
| Rated flow | | 20 L/min 5.3 gal/min | 30 L/min 7.9 gal/min | 60 L/min 15.9 gal/min | 100 L/min 26.4 gal/min | 200 L/min 52.8 gal/min | 300 L/min 79.3 gal/min | 60 L/min 15.9 gal/min | 200 L/min 52.8 gal/min | 300 L/min 79.3 gal/min | 500 L/min 132.1 gal/min |
| Zero cut flow (variable, initial value) | | 0.3 L/min 0.08 gal/min | | 0.5 L/min 0.13 gal/min | | 1.0 L/min 0.3 gal/min | | 0.5 L/min 0.13 gal/min | 1.0 L/min 0.3 gal/min | 2.0 L/min 0.5 gal/min | 5.0 L/min 1.3 gal/min |
| Detection principle | | Delta TOF + Pulse Doppler | | | | | | Delta TOF | | | |
| Function for automatic correction for speed of sound in liquid | | Yes | | | | | | — | | | |
| Display | | QVGA 2.0 model: color LCD, status indicator light | | | | | | | | | |
| Display update cycle | | Approx. 10 times/second | | | | | | | | | |
| Display resolution | Instantaneous flow (L/min) | 0.01/0.1/1 (default value: 0.1) | | | | 0.01/0.1/1 (default value: 1) | | 0.01/0.1/1 (default value 0.1) | | 0.01/0.1/1 (default value: 1) | |
| | Integrated flow (L) | 0.01/0.1/1 (default value: 0.1; up to 8 digits) | | | | 0.01/0.1/1 (default value 1; up to 8 digits) | | 0.01/0.1/1 (default value: 0.1; up to 8 digits) | | 0.01/0.1/1 (default value: 1; up to 8 digits) | |
| Response time | | 0.5 s / 1.0 s / 2.5 s / 5.0 s / 10.0 s / 30.0 s / 60.0 s / 120.0 s / 200.0 s | | | | | | | | | |
| Measurement accuracy | Between 10 and 100% of F.S. | ±3.0% of RD*4,5 | | | | | | — | | | |
| | Between 0 and 10% of F.S. | ±0.3% of F.S.*4,5 | | | | | | | | | |
| Repeatability*4,6 | | 0.5 s: ±1.0%, 1 s: ±0.7%, 2.5 s: ±0.45%, 5 s: ±0.3%, 10 s: ±0.2%, 30 s: ±0.15%, 60 s: ±0.1% of F.S. | | | | | | | | | |
| Hysteresis | | Variable | | | | | | | | | |
| Flow rate unit | | L/min m³/h G/min | | | | | | | | | |
| Pulse output increments (L) | | 0.02–999.99 | | | | | | | | | |
| Pipe temperature measurement accuracy (ambient temperature of 25°C 77°F)*4 | | Standard model: ±2.0°C ±3.5°F (pipe temperature 0–50°C 32–122°F), ±3.0°C ±5.4°F (pipe temperature 50–85°C 122–185°F) High-temperature model: — | | | | | | — | | | |
| Heat calculation function*7 | Unit | MJ/h kW kBTU/h | | | | | | | | | |
| | Display resolution | Instantaneous value (MJ/h): 0.01/0.1/1 (default value 0.1); Integrated value (MJ): 0.01/0.1/1 (default value 0.1) | | | | | | | | | |
| | Pulse output increments (MJ) | 0.02–999.99 | | | | | | | | | |
| Data accumulation | Accumulation period | Approx. 1 year | | | | | | | | | |
| | Data reading | USB2.0 | | | | | | | | | |
| Power supply I/O connector | | M12 8-pin connector (male) | | | | | | | | | |
| I/O (switchable) | Output (Ch1/2/3/4) | Instantaneous flow mode / area mode / pulse output mode / integrated flow mode / bubble detection mode / error output NPN/PNP setting switching, open collector output 30 VDC or less, max. 100 mA/Ch or less, residual voltage 2.5 V or less | | | | | | | | | |
| | Analog output (Ch1/2) | 4–20 mA/0–20 mA (switchable), load resistance 500 Ω or less | | | | | | | | | |
| | External input (Ch2/3) | Integrated reset input / flow-rate zero input / zero-point adjustment input / bank input Short circuit current: 1.5 mA or less; input time: 20 ms or more | | | | | | | | | |
| Power supply | Power voltage | 20–30 VDC, ripple (P-P) 10% included, Class 2/LPS | | | | | | | | | |
| | Current consumption | 240 mA or less (when using flow sensor standalone; with analog output; excluding load current)*8 | | | | | | | | | |
| Protection circuit | | Protection against reverse power connection, power supply surges, output short circuits, and output surges | | | | | | | | | |
| Network compatibility | | IO-Link*9 | | | | | | | | | |
| Environmental resistance | Enclosure rating | IP65/67 (IEC 60529)*10 | | | | | | | | | |
| | Operating ambient temperature | Sensor head: –20 to +60°C –4 to +140°F (no freezing); Display unit: –20 to +50°C –4 to +122°F (no freezing)*2 | | | | | | | | | |
| | Operating ambient humidity | 35–85% RH (no condensation) | | | | | | | | | |
| | Vibration resistance | 10–500 Hz; Power spectral density: 0.816 G²/Hz; X, Y and Z directions | | | | | | | | | |
| | Shock resistance | 100 m/s² (approx. 10 G), 16 ms pulses, 1000 times each for X, Y and Z axes | | | | | | | | | |
| Material | Display unit | Body: PPS/PET/POM; Display window: PAR | | | | | | | | | |
| | Sensor head | Body: Standard model: PPS/PET/PAR/SUS304; High-temperature model: PEEK/PPS/PET/PAR/SUS304 Sensor element: special rubber; Mounting bracket: SUS304/SUSXM7 | | | | | | Body: PPS/PET/PAR/SUS304; Cable: PVC Sensor element: special rubber; Mounting bracket: PPS/PBT/POM/SUS304/SUSXM7 | | | |
| Weight | | Standard model: approx. 440 g 15.52 oz High-temperature model: approx. 490 g 17.28 oz | Standard model: approx. 480 g 16.93 oz High-temperature model: approx. 540 g 19.05 oz | Standard model: approx. 620 g 21.87 oz High-temperature model: approx. 680 g 23.99 oz | Approx. 770 g 27.16 oz | | Approx. 880 g 31.04 oz | Approx. 1130 g 39.86 oz | Approx. 1360 g 47.97 oz | | |

*1 For fluids through which ultrasonic waves propagate, and which do not contain a large quantity of bubbles. Detection may be unstable depending on the type and condition of the pipe.

*2 When the display unit is mounted directly on the sensor head, there is a de-rating according to the ambient temperature and fluid temperature.

*3 When using with fluids at temperatures of 140°C 284°F or greater, equip with the separately sold ultra-high-temperature couplant FD-HK1/HK2/HK3. Furthermore, the display unit must be separated from the sensor based on the de-rating.

*4 This is the guaranteed value from verification performed at KEYENCE inspection facilities. Measurement error may occur depending on the type and condition of the customer's pipes, the type of fluid, the fluid temperature and other factors. *5 This is the value for when the zero point is adjusted, for a constant 25°C 77°F environment, taking into account the linearity and span error.

*6 In a state where flow velocity distribution is stable. Does not include pulsation and fluctuations in flow velocity distribution due to equipment factors. Please also convert the given F.S. (full scale) using the rated flow range.

*7 Can be used when two temperature sensors (sold separately) are connected.

*8 640 mA or less including load. When connecting devices such as temperature sensors, please add on the current consumption of each sensor (up to a maximum of 830 mA or less).

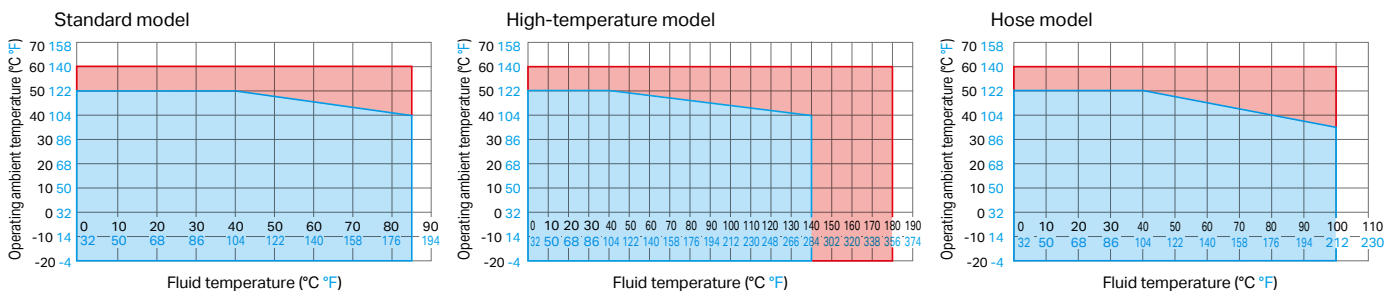
*9 Supports IO-Link specification v.1.1/COM2 (38.4 kbps). Setting files can be downloaded from the KEYENCE website (www.keyence.com). IO-Link is a trademark or registered trademark of PROFIBUS Nutzerorganisation e.V. (PNO).

*10 When a USB connection is in use, IP65/67 compliance is impaired.

Derating Charts

Display unit integration OK

Display unit separation required



Temperature Sensors (FI-T)



| Model | | FI-T8 | FI-T15 | FI-T25 | FI-T50 | FI-T100 | FI-T200 |
|---|------------------------------------|--|-----------------------------|-----------------------------|-----------------------------|------------------------------|------------------------------|
| Supported pipe diameter | Pipe outer diameter | ø8–14 ø0.31"–0.55" | ø14–22 ø0.55"–0.87" | ø22–38 ø0.87"–1.50" | ø38–70 ø1.50"–2.76" | ø70–126 ø2.76"–4.96" | ø126–220 ø4.96"–8.66" |
| | A nominal | 6 A, 8 A | 10 A, 15 A | 20 A, 25 A | 32 A, 40 A, 50 A | 65 A, 80 A 90 A, 100 A | 125 A, 150 A 200 A |
| | B nominal | 1/8", 1/4" | 3/8", 1/2" | 3/4", 1" | 1 1/4", 1 1/2", 2" | 2 1/2", 3" 3 1/2", 4" | 5", 6", 8" |
| Supported pipe materials | | Metal piping | | | | | |
| Supported temperature range | | –20 to +180°C –4 to +356°F *1 | | | | | |
| Display resolution | | 0.1°C 32.18°F | | | | | |
| Response time | | 5 s (50% response), 15 s (90% response)*2 | | | | | |
| Display amplifier averaging time | | 0.1 s / 10.0 s / 20.0 s / 30.0 s / 60.0 s / 120.0 s / 300.0 s | | | | | |
| Measurement accuracy (ambient temperature of 25°C 77°F) | | ±0.5°C ±0.9°F (pipe temperature –20 to +80°C –4 to 176°F)*2,3 ±1.0°C ±1.8°F (pipe temperature 80–180°C 176–356°F)*2,3 | | | | | |
| Hysteresis | | Variable | | | | | |
| Measurement principle | | Pt100 4-wire type | | | | | |
| Display method | | Organic EL, status indicator light | | | | | |
| Power supply I/O connector | | M8 4-pin connector | | | | | |
| Current consumption | | 20 mA or less (excluding load current)*4 | | | | | |
| When used standalone* | I/O (switchable) | Control output: switching NPN/PNP setting Open collector output: 30 VDC or less, maximum 100 mA/ch or less, residual voltage 2.5 V or less | | | | | |
| | Output (Ch1/Ch2) | 4–20 mA / 0–20 mA (switchable), load resistance 260 Ω or less | | | | | |
| | Analog output (Ch2) | 20–30 VDC, ripple (P-P) 10% included; Class2/LPS | | | | | |
| | Power voltage | Protection against reverse power connection, power supply surges, output short circuits, and output surges | | | | | |
| | Protection circuit | IO-Link*6 | | | | | |
| Environmental resistance | Enclosure rating | IP65/IP67 (IEC60529) | | | | | |
| | Operating ambient temperature | –10 to +60°C –14 to +140°F (no freezing) | | | | | |
| | Operating ambient humidity | 35–85% RH (no condensation) | | | | | |
| | Vibration resistance | 10–500 Hz; power spectral density: 0.816 G ² /Hz; X, Y and Z directions | | | | | |
| | Shock resistance | 100 m/s ² (approx. 10 G), 16 ms pulses, 1000 times each for X, Y and Z directions | | | | | |
| Material | Display amplifier | PBT / PAR / POM / SUS303 | | | | | |
| | Sensor head | Head: PPS / SUS303 / Sn; Pipe clamp unit: SUS304; Cable: fluororesin | | | | | |
| | Display amplifier mounting bracket | SUS304 | | | | | |
| Weight | | Approx. 70 g 2.47 oz | Approx. 80 g 2.82 oz | Approx. 65 g 2.29 oz | Approx. 70 g 2.47 oz | Approx. 100 g 3.53 oz | Approx. 120 g 4.23 oz |

*1 When pipe temperature is 100°C **212°F** or more, the display amplifier cannot be mounted on the pipe clamp unit. Install the amplifier so it is insulated from the heat from the pipe.

*2 This is the guaranteed value from verification performed at KEYENCE inspection facilities. Measurement error may occur depending on the type and condition of the customer's pipes and fluid, the ambient temperature and other factors.

*3 This is the value for a constant 25°C **77°F** environment, taking into account absolute error and repeatability.

*4 During standalone use, 220 mA or less including load. *5 When connecting to a FD-H Series/FI-1000 model, please follow the specifications of the display unit.

*6 Supports IO-Link specification v.1.1/COM2 (38.4 kbps). Setting files can be downloaded from the KEYENCE website (www.keyence.com).

IO-Link is a trademark or registered trademark of PROFIBUS Nutzerorganisation e.V. (PNO).

Concentration Sensors (FI-C)

| Type | | Probe type | | Pipe type | |
|----------------------------------|-----------------------------------|--|--|--|--|
| Model | Main unit | FI-C20D | | FI-C40F | |
| | Attachment | — | | FI-CF1/CF3 | FI-CF2/4 |
| Detection principle | | Refractive index (surface light source) | | | |
| Rated concentration range | | Brix: 0–20% (nD: 1.32500–1.37000) | | Brix: 0–40% (nD: 1.32500–1.41000) | |
| Display range | | Brix: 0–25% | | Brix: 0–50% | |
| Supported fluids | | Non-corrosive aqueous solutions (such as water-soluble coolants, mold release agents, etc.)* ¹ | | | |
| Supported fluid temperature | | 0–70°C 32–158°F (no freezing) | | | |
| Connection diameter | | — | | FI-CF1: Rc3/4 (20 A); FI-CF3: NPT3/4 | FI-CF2: Rc1 1/2 (40 A); FI-CF4: NPT1 1/2 |
| Rated pressure range | | — | | 1.0 MPa or less | |
| Pressure resistance | | — | | 2.0 MPa | |
| Display resolution | | Brix: 0.01/0.1% (default value: 0.1) (nD: 0.00001) | | | |
| Response time | | 1.0 s / 2.5 s / 5.0 s / 10.0 s / 30.0 s / 60.0 s / 120.0 s / 200.0 s | | | |
| Measurement accuracy | | Brix: ±0.2%* ^{2,3} (nD: ±0.0003) | | | |
| Concentration unit | | Brix nD* ⁴ | | | |
| Temperature measurement accuracy | | ±1.0°C 1.8°F * ² | | | |
| Display method | | Status indicator light | | | |
| Current consumption | | 25 mA or less | | | |
| Environmental resistance | Enclosure rating | IP65/IP67 (IEC60529) | | | |
| | Operating ambient temperature | –10 to +60°C 14 to +140°F (no freezing) | | | |
| | Operating ambient humidity | 35–85% RH (no condensation) | | | |
| | Vibration resistance | 10–500 Hz; Power spectral density: 0.816 G ² /Hz; X, Y and Z directions | | | |
| | Shock resistance | 100 m/s ² (approx. 10 G), 16 ms pulses, 1000 times each for X, Y and Z directions | | | |
| Material | Liquid end materials (main body) | Sensor element: synthetic quartz Body: aluminum die-cast (nickel chrome plating) / SUS304 Pipe: aluminum alloy (anodized); Gasket: FKM | | Sensor element: sapphire Body: SCS16A; Gasket: FFKM | |
| | Liquid end materials (attachment) | — | | Body: SCS16A; Gasket: FKM | |
| | Other materials | Indicator light: PPSU / TPU / PBT Cable: PUR | | Body: SUS304; PPS indicator light: PPSU / TPU / PBT Cable: PVC | |
| Weight | | Approx. 480 g 16.93 oz | | Main body: approx. 410 g 14.46 oz ; FI-CF1/CF3: approx. 790 g 27.87 oz ; FI-CF2/CF4: approx. 1360 g 47.97 oz | |

*1 Use water as the solvent, and use materials that are soluble in water. If the particles are not water soluble, such as with slurry, the refractive index may not change.

*2 This is the guaranteed value from verification performed at KEYENCE inspection facilities. Measurement error may occur depending on the type, condition and temperature of the fluid used by the customer, as well as other factors. *3 This is the value obtained when sucrose solution is used in a constant 20°C **68°F** environment, and absolute error and repeatability is taken into account.

*4 When using solutions other than sucrose solutions, concentration can be adjusted via span adjustment.

Level Sensors (FL)



| Model | | Standard | Sanitary type | Chemical type |
|--|-------------------------------|--|---|--|
| | | FL-001 | FL-S001 | FL-C001 |
| Measurement range | | 100–2000 mm 3.94" – 78.74" *1 | 200–2000 mm 7.87" – 78.74" | |
| Measurable relative permittivity of medium*2 | | 2 or higher | | 3 or higher |
| Resolution*3 | | 1 mm 0.04" | | |
| Linearity*3 | | ±3 mm 0.12" | | |
| Temperature characteristic | | 0.1 mm/°C | | |
| Undetectable area | Upper side*4 | 25 mm 0.98" | 25 mm 0.98" | 25 mm 0.98" |
| | Lower side*4,5 | 10 mm 0.39" | 45 mm 1.77" max. | 33 mm 1.30" max. |
| Judgment output response time | | Minimum 0.4 s | | |
| Lateral torque of probe | | 6 N·m | | |
| Tank pressure | | –0.1 to +0.5 MPa | –0.1 to +1 MPa | –0.1 to +0.1 MPa |
| Material | Liquid end materials | Probe: SUS304 Housing bottom seal: PTFE Gasket: FKM (interior of seal) | Sheath: PFA Probe: SUS304 (does not come into direct contact with liquid) | Sheath: PFA Probe: SUS304 (does not come into direct contact with liquid) |
| | Housing | Metal portion of case: SUS304, SUS303 Resin portion of case: PBT, PAR, NBR, HNBR, PET | Metal portion of case: SUS304 Resin portion of case: PBT, PAR, HNBR, EPDM, PTFE, PPSU, PET | Resin portion of case: PPS, PPSU, FKM, PVC Cable connector: brass with nickel plating |
| Connection diameter | | G3/4 | 2S ferrule | G3/4 on dedicated probe side |
| Output | Judgment output/alarm output | NPN/PNP open collector (switching type) 30 VDC or less, max 50 mA for each Residual voltage NPN 2 V or less, PNP 2.5 V or less, N.O./N.C. switchable | | |
| | Analog output | 4–20 mA maximum load resistance 350 Ω (Response time: 0.1 s after output result [90% response]) Ripple (P-P) when work is stopped: 2% F.S. or less | | |
| Network compatibility | | IO-Link*6 | | |
| Analog output accuracy | Resolution | 1 mm 0.04" | | |
| | Zero accuracy | ±0.1 mA (zero point = 4 mA) | | |
| | Full-scale accuracy | ±0.2 mA (full-scale = 20 mA) | | |
| Environmental resistance | Operating ambient temperature | –20 to +60°C –4 to +140°F | –20 to +60°C –4 to +140°F | –10 to +60°C 14 to +140°F |
| | Operating ambient humidity | 35–85% RH (no condensation) | | |
| | Temperature of medium used | –20 to +100°C –4 to +212°F | –20 to +150°C –4 to +302°F | –10 to +110°C 14 to +230°F |
| | Vibration resistance | 10–55 Hz, double amplitude 0.75 mm 0.03" ; 2 hours each in X, Y and Z directions | | |
| Shock resistance | | 300 m/s ² 3 times in each of 6 directions | | |
| Enclosure rating | | IP67 | | |
| Power voltage | | 10–30 VDC, ripple (P-P) 10% included, Class 2 or LPS | | |
| Current consumption | | 300 mA (at 10 V) / 120 mA or less (at 30 V) (excluding load) | | |
| Applicable cable | | M12 connector 8-pin | | |
| Weight | | 400 g 14.11 oz | 670 g 23.63 oz | 380 g 13.40 oz |

*1 For types with even longer measurement ranges, please contact KEYENCE. *2 Value within 100 mm **3.94"** from the walls of the metal tank. If using a resin tank, please contact KEYENCE.

*3 Measured under the following conditions.

| | |
|-----------------|---|
| Medium | Water |
| Tank material | Metal |
| Linearity range | Within 6 cm 2.36" on the upper side to 1 cm 0.39" on the lower side |
| Response time | 4 s |

*4 For water. For oil, see the following table.

| | FL-001 | FL-S001 | FL-C001 |
|------------|--------------------|-----------------------------------|-----------------------------------|
| Upper side | 50 mm 1.97" | 50 mm 1.97" | 25 mm 0.98" |
| Lower side | 30 mm 1.18" | Maximum length 65 mm 2.56" | Maximum length 53 mm 2.09" |

*5 Sanitary/chemical-type lower-side undetectable areas will differ based on probe length.

*6 Supports IO-Link specification v.1.1/COM2 (38.4kbps).IO-Link is a registered trademark or trademark of PROFIBUS Nutzerorganisation e.V. (PNO).

Standalone Display Unit (FI-1000)

| | | |
|-----------------------------|-------------------------------|---|
| Model | | FI-1000 |
| Display | | QVGA 2.0 model: color LCD, status indicator light |
| Display update cycle | | Approx. 10 times/second |
| Heat calculation function*1 | Unit | MJ/h, kW, kBTU/h, GJ/h, MW, MBTU/h |
| | Display resolution | Instantaneous value (MJ/h): 0.01/0.1/1 (default value 0.1); Integrated value (MJ): 0.01/0.1/1 (default value 0.1) |
| | Pulse output increments (MJ) | 0.02–999.99 |
| Data accumulation | Accumulation period | Approx. 1 year |
| | Data reading | USB2.0 |
| Power supply I/O connector | | M12 8-pin connector (male) |
| I/O (switchable) | Output (Ch1/2/3/4) | NPN/PNP setting switching, open collector output 30 VDC or less, max. 100 mA/ch or less, residual voltage 2.5 V or less |
| | Analog output (Ch1/2) | 4–20 mA/0–20 mA (switchable), load resistance 500 Ω or less |
| | External input (Ch2/3) | Short circuit current: 1.5 mA or less; input time: 20 ms or more |
| Power supply | Power voltage | 20–30 VDC, ripple (P-P) 10% included, Class 2/LPS |
| | Current consumption | 55 mA or less (display unit standalone, excluding load current)*2 |
| Protection circuit | | Protection against reverse power connection, power supply surges, output short circuits, and output surges |
| Network compatibility | | IO-Link*3 |
| Environmental resistance | Enclosure rating | IP65/IP67 (IEC60529)*4 |
| | Operating ambient temperature | –20°C to +50°C –4°F to +122°F (no freezing) |
| | Operating ambient humidity | 35–85% RH (no condensation) |
| | Vibration resistance | 10–500 Hz; Power spectral density: 0.816 G ² /Hz; X, Y and Z directions |
| Shock resistance | | 100 m/s ² (approx. 10 G), 16 ms pulses, 1000 times each for X, Y and Z directions |
| Material | | Body: PPS / PET / POM; Display window: PAR |
| Weight | | Approx. 120 g 4.23 oz |

*1 Available when the separately sold flow meter FD-R Series and two temperature sensors are connected.

*2 455 mA or less including load. When connecting devices such as temperature sensors, please add on the current consumption of each sensor (to a maximum of 830 mA or less).

*3 Supports IO-Link specification v.1.1/COM2 (38.4 kbps). Setting files can be downloaded from the KEYENCE website (www.keyence.com). IO-Link is a trademark or registered trademark of PROFIBUS Nutzerorganisation e.V. (PNO). *4 When a USB connection is in use, IP65/67 compliance is impaired.

Flow Sensors (FD-H)

The FD-H Series allows users to allocate control outputs, external inputs, and analog outputs to 4 different I/O channels (Ch1 through Ch4) according to the user's settings.

| Wire color | Role |
|---------------|--|
| Brown | Power supply + 20–30 V |
| Blue | GND |
| Black (Ch1)*1 | Choose from control output or analog output |
| White (Ch2) | Choose from control output, analog output, or external input*2 |
| Gray (Ch3) | Choose from control output or external input*2 |
| Pink (Ch4) | Control output (Fixed) |

*1 IO-Link compatible wire when connected to an IO-Link module. Also note that only Ch1 supports pulse output.

*2 When using the bank input function, two external input wires are necessary. Set both Ch2 and Ch3 to external input.

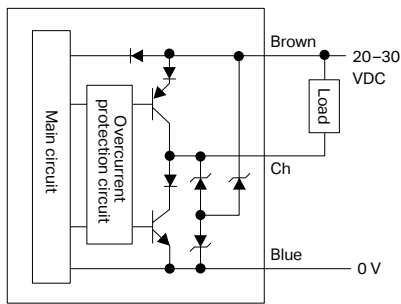
*3 When using a M12 8-pin-4-pin conversion cable or adapter, the four wires—brown, blue, black for Ch1, and white for Ch2—can be used as follows.



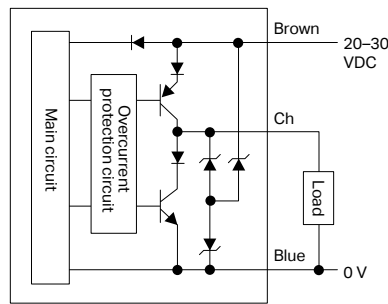
- ① Brown ③ Blue
② White (Ch2) ④ Black (Ch1)

(1) Wiring of channel to which control output has been selected

When NPN is selected

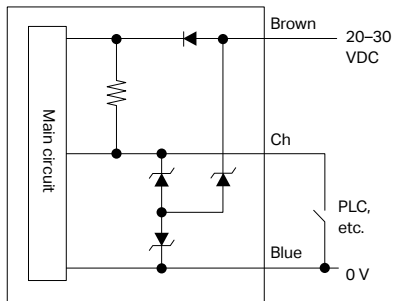


When PNP is selected

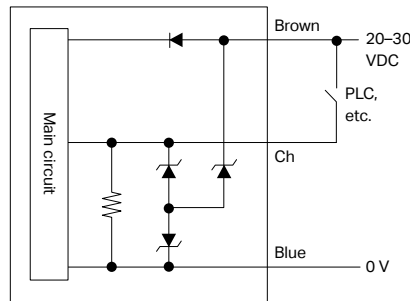


(2) Wiring of channel to which external input has been selected

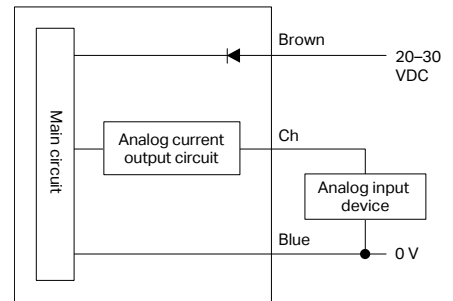
When NPN is selected



When PNP is selected



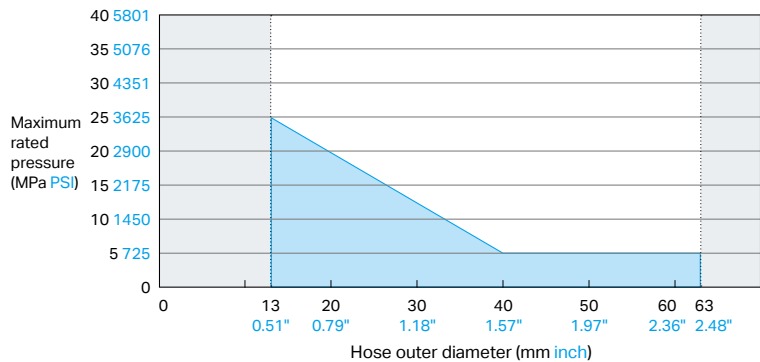
(3) Wiring of channel to which analog output has been selected



*Can be switched to 4–20 mA or 0–20 mA using the settings

Recommended High-Pressure Hose Characteristics

When utilizing the FD-H Series with a high-pressure hose, please check the maximum rated pressure and the outer diameter to estimate the level of reinforcement (number of resin/metal layers). If the hose is highly reinforced it may affect the stability of detection. Utilize the chart on the right to determine if the hose characteristics fall in the acceptable blue range. Testing may be required if the characteristics do not fall within the blue range.

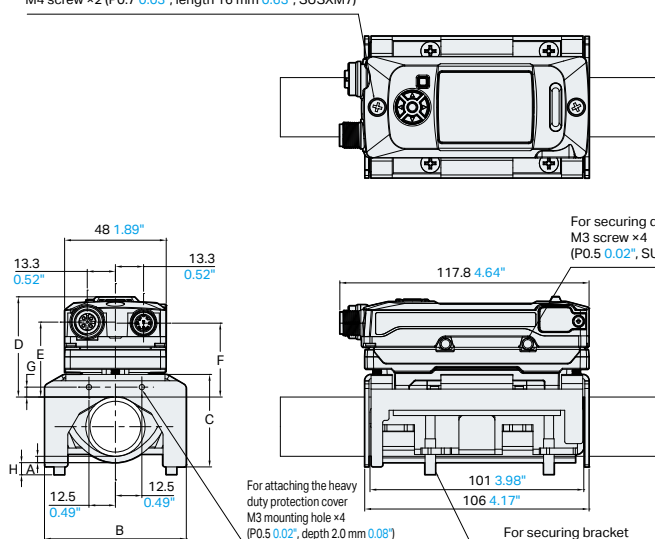


Flow Sensors (FD-H)

Standard models / High-temperature models

| Model | A | B | C | D | E | F | G | H |
|---------|---------------|----------|------------|------------|------------|------------|-----------|---------------|
| FD-H10 | 2 0.08" | 38 1.50" | 25.3 1.00" | 47.4 1.87" | 35.4 1.39" | 34.9 1.37" | 5.2 0.20" | Max 1.6 0.06" |
| FD-H20 | Max 2.5 0.10" | 48 1.89" | 30 1.18" | 47.4 1.87" | 35.4 1.39" | 34.9 1.37" | 4.1 0.16" | Max 3.4 0.13" |
| FD-H32 | Max 4.2 0.17" | 67 2.64" | 43.7 1.72" | 47.4 1.87" | 35.4 1.39" | 34.9 1.37" | 4.7 0.19" | Max 5.7 0.22" |
| FD-H10K | 2 0.08" | 38 1.50" | 25.3 1.00" | 56.4 2.22" | 44.4 1.75" | 43.9 1.73" | 5.2 0.20" | Max 1.6 0.06" |
| FD-H20K | Max 2.5 0.10" | 48 1.89" | 30 1.18" | 56.4 2.22" | 44.4 1.75" | 43.9 1.73" | 4.1 0.16" | Max 3.4 0.13" |
| FD-H32K | Max 4.2 0.17" | 67 2.64" | 43.7 1.72" | 56.4 2.22" | 44.4 1.75" | 43.9 1.73" | 4.7 0.19" | Max 5.7 0.22" |

For securing main unit
M4 screw ×2 (P0.7 0.03", length 16 mm 0.63", SUSXM7)

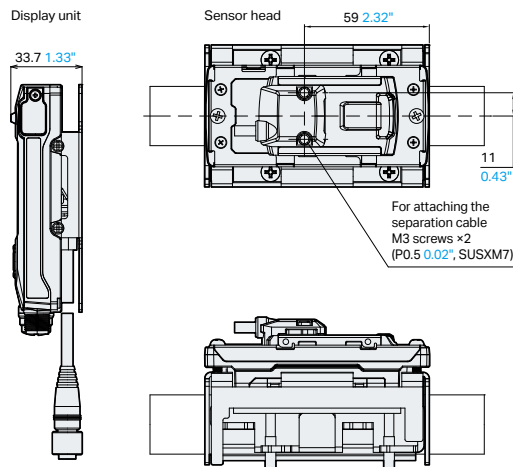


For securing display unit
M3 screw ×4 (P0.5 0.02", SUSXM7)

For attaching the heavy duty protection cover
M3 mounting hole ×4 (P0.5 0.02", depth 2.0 mm 0.08")

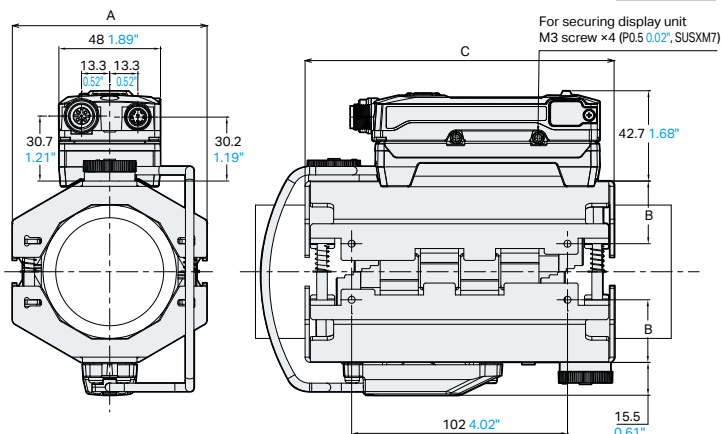
For securing bracket
FD-H10(K): M4 screw ×4 (P0.7 0.028", length 13 mm 0.51", SUSXM7)
FD-H20(K): M4 screw ×4 (P0.7 0.028", length 19 mm 0.75", SUSXM7)
FD-H32(K): M5 screw ×4 (P0.8 0.031", length 30 mm 1.18", SUSXM7)

When display unit is separated from sensor



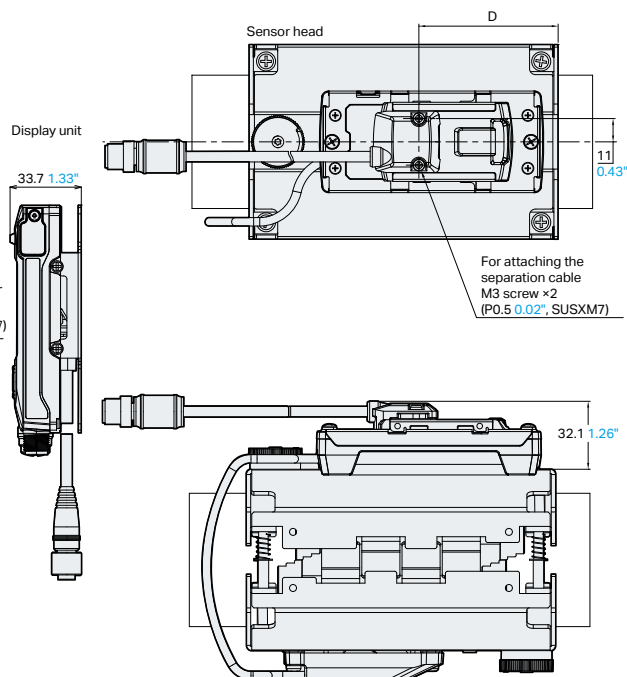
Hose models

| Model | A | B | C | D |
|---------|----------|------------|-----------|------------|
| FD-H22F | 48 1.89" | 10.6 0.42" | 140 5.51" | 70.9 2.79" |
| FD-H32F | 57 2.24" | 15.5 0.61" | 140 5.51" | 69 2.72" |
| FD-H47F | 75 2.95" | 21.6 0.85" | 146 5.75" | 69.2 2.72" |
| FD-H63F | 92 3.62" | 29.6 1.17" | 146 5.75" | 65.8 2.59" |



For securing display unit
M3 screw ×4 (P0.5 0.02", SUSXM7)

When display unit is separated from sensor

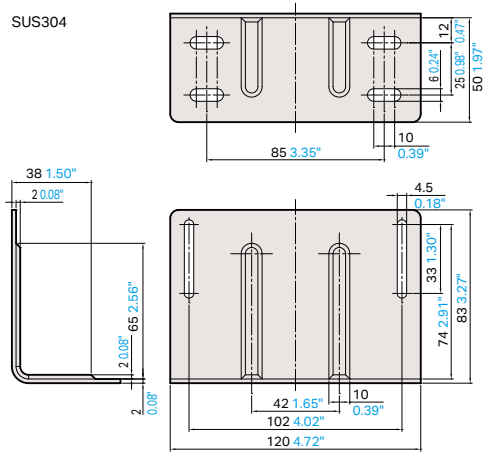


Flow Sensors (FD-H)

Stabilization bracket

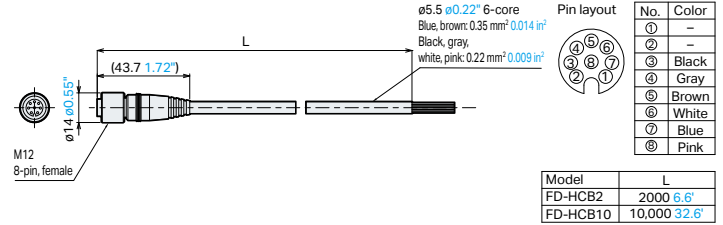
FD-HFB1

SUS304

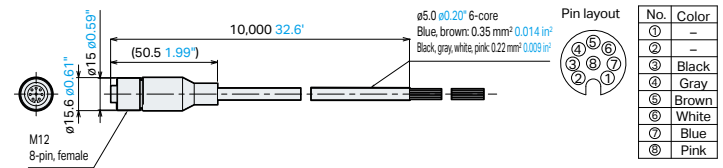


FD-H power supply cables

M12 power supply cable 8-core FD-HCB2/HCB10



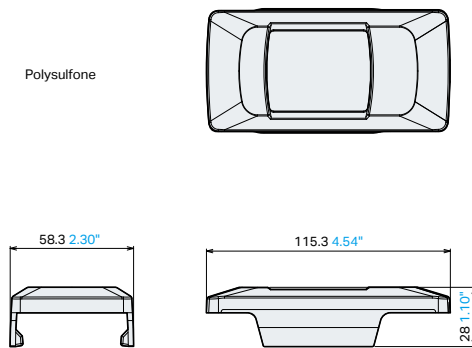
M12 power supply cable (for heavy duty use) 8-core FD-HCB10G



FD-H display unit protection cover

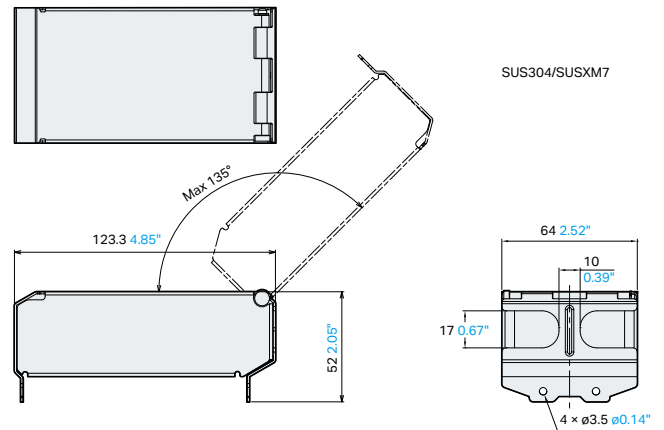
FD-HP1

Polysulfone



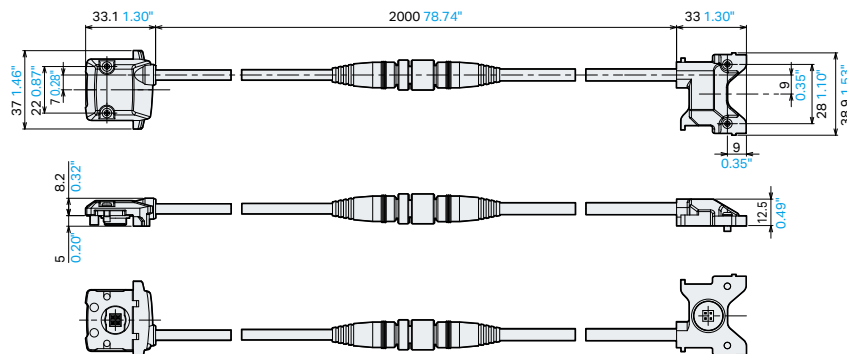
FD-H display unit heavy duty protection cover

FD-HP2



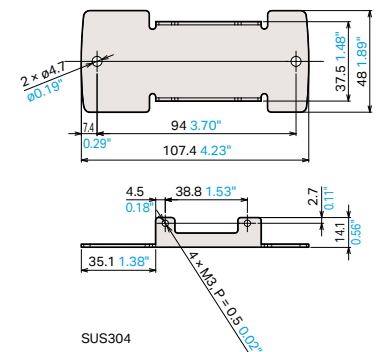
Display unit separation cable

FD-HCS2

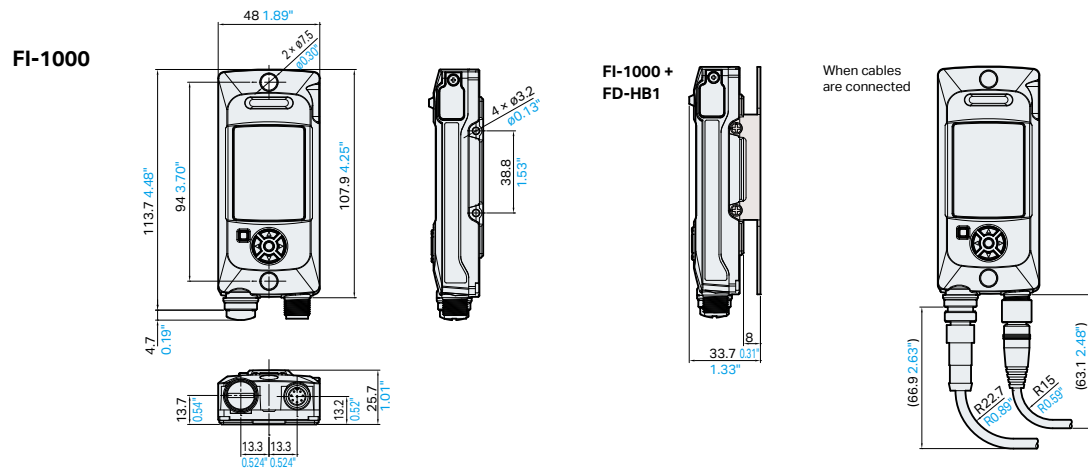


Display unit separation bracket

FD-HB1

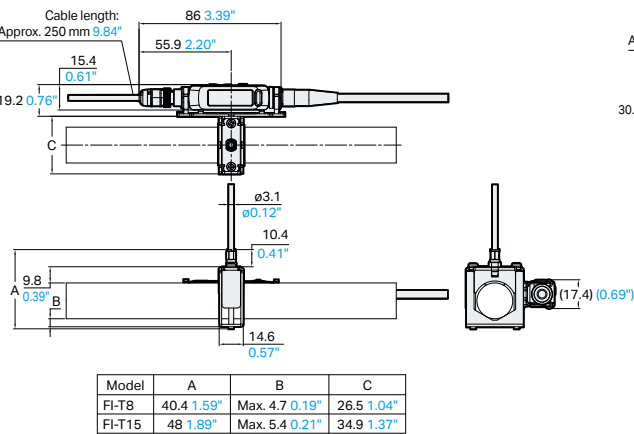


Display Unit (FI-1000)

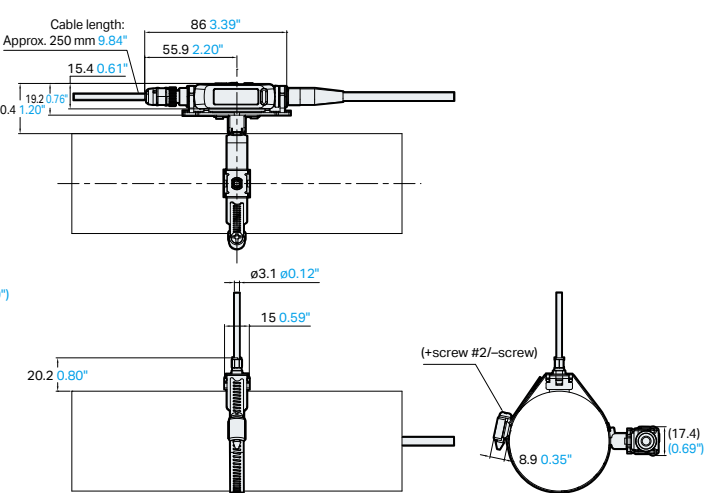


Temperature Sensors (FI-T)

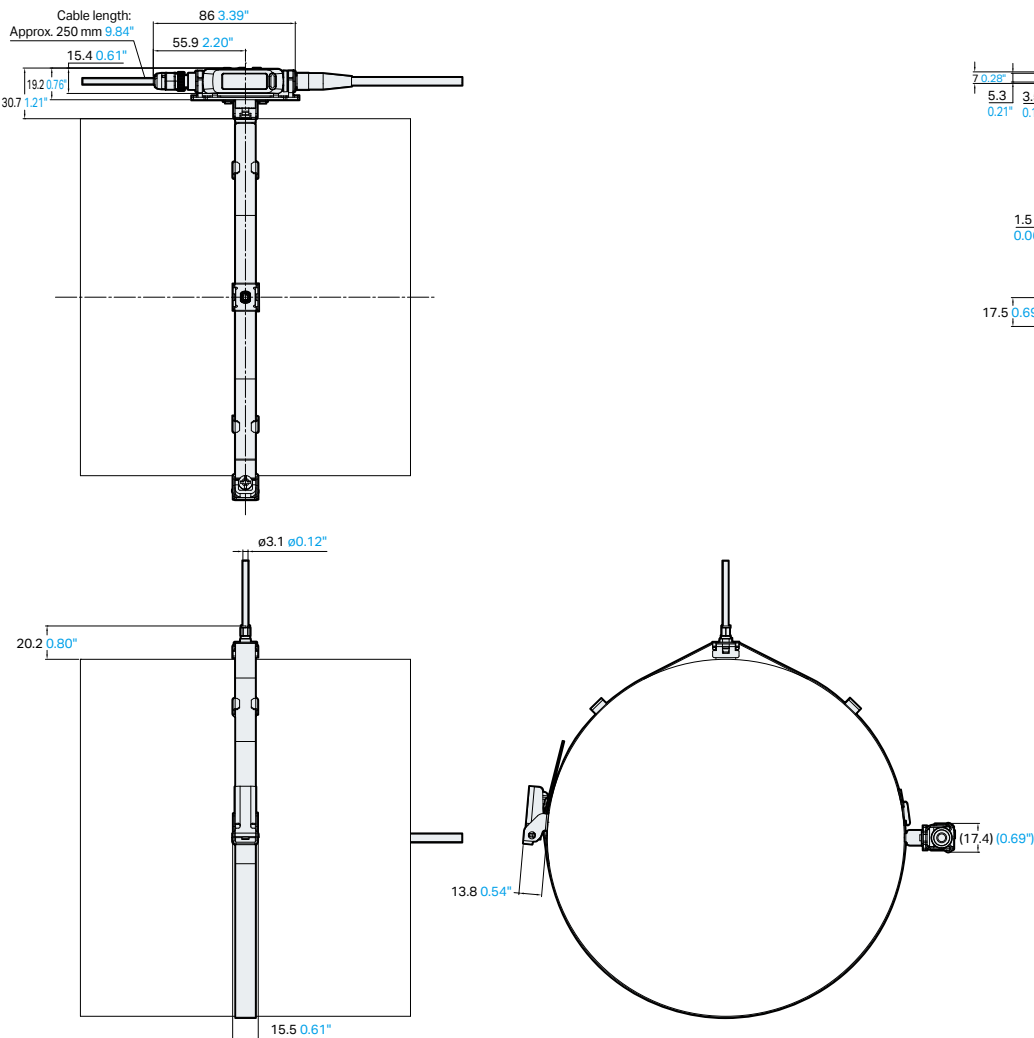
FI-T8/T15



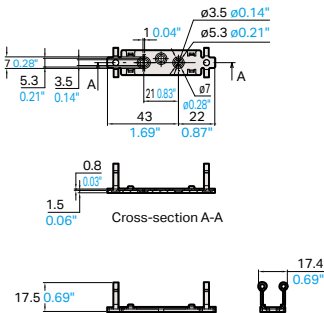
FI-T25/T50



FI-T100/T200



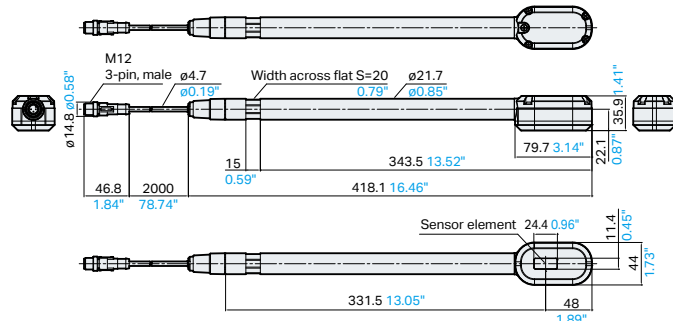
Amplifier stabilization bracket



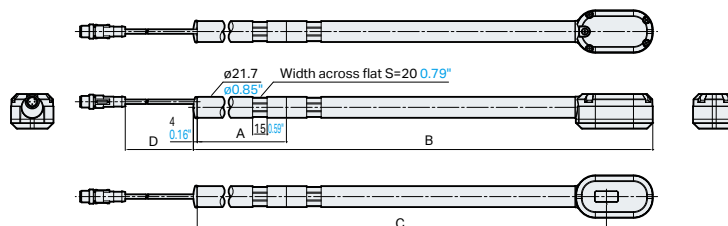
Concentration Sensors (FI-C)

Probe type

FI-C20D standalone

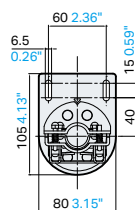


FI-C20D + FI-CD1/CD2



| Model | A | B | C | D |
|--------|------------|---------------|---------------|---------------|
| FI-CD1 | 400 15.75" | 783.5 30.85" | 731.5 28.80" | 1634.6 64.35" |
| FI-CD2 | 800 31.50" | 1183.5 46.59" | 1131.5 44.55" | 1234.6 48.61" |

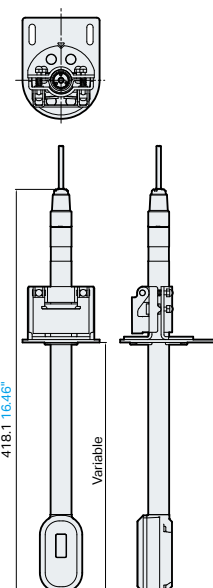
FI-CDB1



For securing bracket
M4 screw x2
(Iron nickel plating)

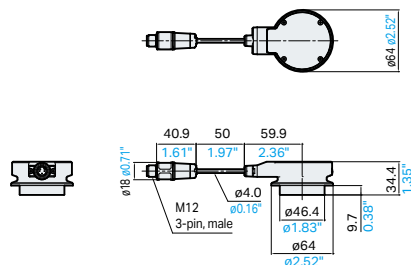
For securing sensor
M4 screw x2
(Iron nickel
plating)

FI-C20D + FI-CDB1

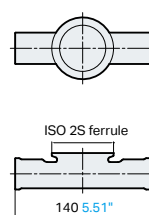


In-Line type

FI-C40F

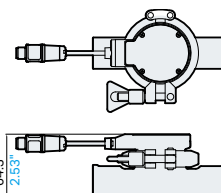


FI-CF1/CF3

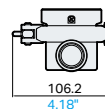


SCS16A

FI-C40F + FI-CF1/CF3

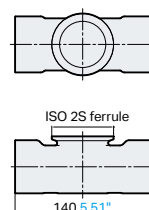


Clamp: SCS13
Gasket: FKM



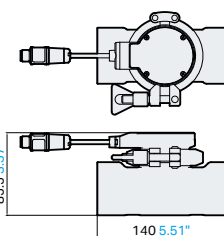
| | |
|--------|--------|
| Model | d |
| FI-CF1 | Rc3/4 |
| FI-CF3 | NPT3/4 |

FI-CF2/CF4

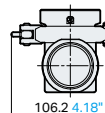


SCS16A

FI-C40F + FI-CF2/CF4



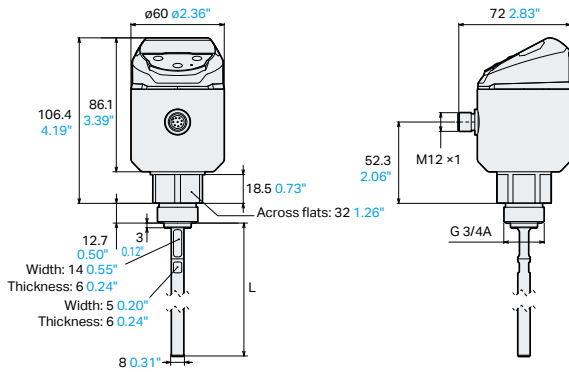
Clamp: SCS13
Gasket: FKM



| Model | d |
|--------|----------|
| FI-CF2 | Rc1 1/2 |
| FI-CF4 | NPT1 1/2 |

Level Sensors (FL)

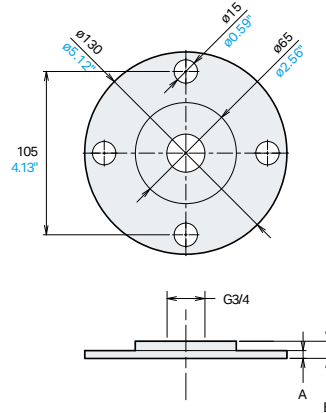
FL-001 when FL-P is attached



| | Min | Max |
|-----------------|-----------|---------------|
| L: probe length | 100 3.94" | 2000 78.74" * |

*For types with even longer measurement ranges, please contact KEYENCE.

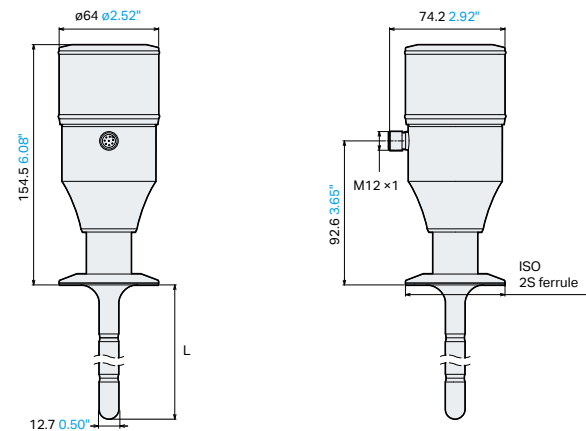
OP-87573/87577



• JIS 5K 50A equivalent
(Listed as "equivalent" as thickness differs from that stipulated in JIS 5K 50A)

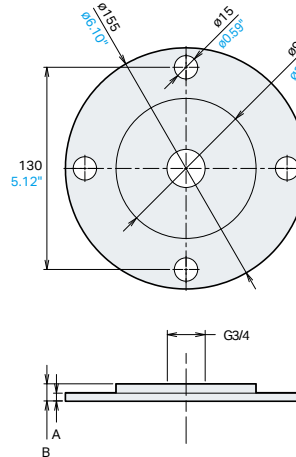
| | A | B |
|----------|----------|------------|
| OP-87573 | 5 0.20" | 11 0.43" |
| OP-87577 | 14 0.55" | 21.5 0.85" |

FL-S001 when FL-SP is attached



| | Min | Max |
|-----------------|-----------|-------------|
| L: total length | 217 8.54" | 2034 80.08" |

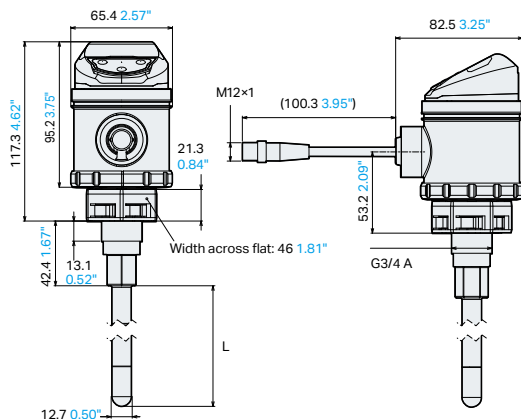
OP-87574/87578



• JIS 5K 65A equivalent
(Listed as "equivalent" as thickness differs from that stipulated in JIS 5K 65A)

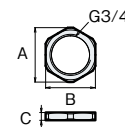
| | A | B |
|----------|----------|------------|
| OP-87574 | 5 0.20" | 11 0.43" |
| OP-87578 | 14 0.55" | 21.5 0.85" |

FL-C001 when FL-CP is attached



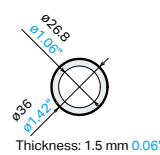
| | Min | Max |
|-----------------|-----------|-------------|
| L: total length | 203 7.99" | 2015 79.33" |

**OP-87642/
87645**

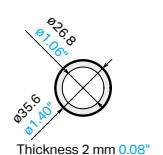


| | A | B | C |
|----------|------------|------------|----------|
| OP-87642 | 35 1.38" | 32 1.26" | 5 0.20" |
| OP-87645 | 39.8 1.57" | 35.7 1.41" | 15 0.59" |

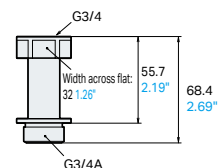
OP-87548



**OP-87561/
87562**



OP-87551



Clamp-On Flow Meter FD-R Series

KEY FEATURES:

- Clamps on to 1 1/2" to 8" pipes with as little as four screws
- Superior environmental resistance with IP-65/67/69K and Nema 4X ratings
- High powered signals and automatic build-up resistance ensure lasting detection



Chilling Tower Monitoring















Wastewater Monitoring




Large Scale Mixing

Flow Meters

| Supported pipe size (Outer diameter) | Appearance | Rated flow velocity range | Flow rate range (Typical) | Weight | Model |
|--|---|------------------------------|--|------------------------------|---------|
| 1 1/2" (40A) (ø44 to ø55 ø1.73" to ø2.17") |  | 0.3 m/s to 5 m/s | 36 to 400 L/min 9 to 100 gal/min 2.4 to 24 m³/h  | Approx. 2.5 kg 5.51 lb | FD-R50 |
| 2" (50A) (ø55 to ø64 ø2.17" to ø2.52") | | | 36 to 600 L/min 9 to 150 gal/min 2.4 to 36 m³/h  | | |
| 2 1/2" (65A) (ø64 to ø83 ø2.52" to ø3.27") |  | | 90 to 1000 L/min 24 to 260 gal/min 5.4 to 60 m³/h  | Approx. 3.0 kg 6.61 lb | FD-R80 |
| 3" (80A) (ø83 to ø100 ø3.27" to ø3.94") | | | 90 to 1500 L/min 24 to 390 gal/min 5.4 to 90 m³/h  | | |
| 4" (100A) (ø100 to ø127 ø3.94" to ø5.00") |  | | 220 to 2500 L/min 60 to 660 gal/min 12 to 150 m³/h  | Approx. 3.3 kg 7.28 lb | FD-R125 |
| 5" (125A) (ø127 to ø152 ø5.00" to ø5.98") | | | 220 to 3700 L/min 60 to 990 gal/min 12 to 220 m³/h  | | |
| 6" (150A) (ø152 to ø191 ø5.98" to ø7.52") |  | | 570 to 5500 L/min 150 to 1400 gal/min 36 to 330 m³/h  | Approx. 3.5 kg 7.72 lb | FD-R200 |
| 8" (200A) (ø191 to ø220 ø7.52" to ø8.66") | | | 570 to 9500 L/min 150 to 2500 gal/min 36 to 570 m³/h  | | |

*The minimum flow rates (zero cut flow rates) can be changed in the settings.

Cables

| Specifications | Appearance | Length | Material | Weight | Model |
|----------------------------|---|-------------------|----------------------|-------------------------------|-----------------|
| Indoor use (standard) |  | 2 m 6.6' | PVC | Approx. 55 g 1.94 oz | OP-75721 |
| | | 10 m 32.8' | Brass nickel plating | Approx. 220 g 7.76 oz | OP-85502 |
| Indoor use (oil resistant) | | 2 m 6.6' | PUR | Approx. 75 g 2.65 oz | OP-87636 |
| | | 10 m 32.8' | Zinc nickel plating | Approx. 260 g 9.17 oz | OP-87637 |
| Outdoor use | | 10 m 32.8' | PUR SUS316L | Approx. 310 g 10.93 oz | OP-88196 |

Clamp-On Micro-Flow Sensor FD-X Series

KEY FEATURES:

- Monitor micro-flow in tubes or pipes from $\varnothing 3$ mm to $\varnothing 13.8$ mm $\varnothing 0.11"$ to $0.55"$
- Compatible with any liquid, even highly viscous liquids like grease, FIPG, and adhesives
- Small shot amounts can be monitored precisely with built-in calibration tools



Dispensing



Filling



Spraying

| Supported pipes | Supported pipe diameters | | Clamp set | | Sensor head | | Rated flow range |
|---------------------------|--|--|------------|-----------|-------------|---------|--------------------------------------|
| | Pipe outer diameter* | Installable range | Appearance | Model | Appearance | Model | |
| Plastic piping/ tubing | $\varnothing 3$ $0.12"$ $1/8"$ (3.18 mm $0.13"$) | $\varnothing 2.7$ to 3.7 $\varnothing 0.11"$ to $0.15"$ | | FD-XC1R1 | | FD-XS1 | 0 to 1000 mL/min |
| | $\varnothing 4$ $0.16"$ | $\varnothing 3.5$ to 4.5 $\varnothing 0.14"$ to $0.18"$ | | FD-XC1R2 | | | |
| | $\varnothing 6$ $0.24"$ | $\varnothing 5.5$ to 6.5 $\varnothing 0.22"$ to $0.26"$ | | FD-XC8R1 | | FD-XS8 | 0 to 3000 mL/min |
| | $1/4"$ (6.35 mm $0.25"$) | $\varnothing 5.9$ to 6.9 $\varnothing 0.23"$ to $0.27"$ | | FD-XC8R2 | | | |
| | $\varnothing 8$ $0.31"$ | $\varnothing 7.5$ to 8.5 $\varnothing 0.30"$ to $0.33"$ | | FD-XC8R3 | | | |
| | $3/8"$ (9.53 mm $0.38"$) | $\varnothing 9.0$ to 10.0 $\varnothing 0.35"$ to $0.39"$ | | FD-XC20R1 | | FD-XS20 | 0 to 15 L/min |
| | $\varnothing 10$ $0.39"$ | $\varnothing 9.5$ to 10.5 $\varnothing 0.37"$ to $0.41"$ | | FD-XC20R2 | | | |
| | $\varnothing 12$ $0.47"$ | $\varnothing 11.5$ to 12.5 $\varnothing 0.45"$ to $0.49"$ | | FD-XC20R3 | | | 0 to 20 L/min |
| | $1/2"$ (12.7 mm $0.50"$) | $\varnothing 12.2$ to 13.2 $\varnothing 0.48"$ to $0.52"$ | | FD-XC20R4 | | | |
| Metal piping | $\varnothing 3$ $0.12"$ $1/8"$ (3.18 mm $0.13"$) | $\varnothing 2.8$ to 5.5 mm $\varnothing 0.11"$ to $0.22"$ | | FD-XC1M | | FD-XS1 | 0 to 1000 mL/min |
| | $\varnothing 4$ $0.16"$ | | | | | | |
| | $\varnothing 6$ $0.24"$ | $\varnothing 5.5$ to 8.3 mm $\varnothing 0.22"$ to $0.33"$ | | FD-XC8M | | FD-XS8 | 0 to 3000 mL/min 0 to 8000 mL/min |
| | $1/4"$ (6.35 mm $0.25"$) | | | | | | |
| | $\varnothing 8$ $0.31"$ | | | | | FD-XS20 | 0 to 15 L/min 0 to 20 L/min |
| | $3/8"$ (9.53 mm $0.38"$) | $\varnothing 8.3$ to 10.8 mm $\varnothing 0.33"$ to $0.43"$ | | FD-XC20M1 | | | |
| | $\varnothing 10$ $0.39"$ | | | | | | |
| | $\varnothing 10.5$ $0.41"$ | | | | | | |
| | $\varnothing 12$ $0.47"$ | $\varnothing 10.8$ to 14 mm $\varnothing 0.43"$ to $0.55"$ | | FD-XC20M2 | | | |
| | $1/2"$ (12.7 mm $0.50"$) | | | | | | |
| | $\varnothing 13.8$ $0.54"$ | | | | | | |

*Inch notation does not refer to the B-nominal in the JIS or ANSI standards, but to the standard whereby 1 inch = 25.4 mm.

*For a complete FD-X Series setup, please reference the FD-X Series brochure or contact your local KEYENCE office.

Network Communication Module NQ Series

INTRODUCING THE KEYENCE NQ SERIES

Network Communication Modules
for IO-Link Integration



ON/OFF Status
Various Settings



Network
Communication
Module
NEW NQ Series



Simplified Integration

Any System
Any Device
Any Location



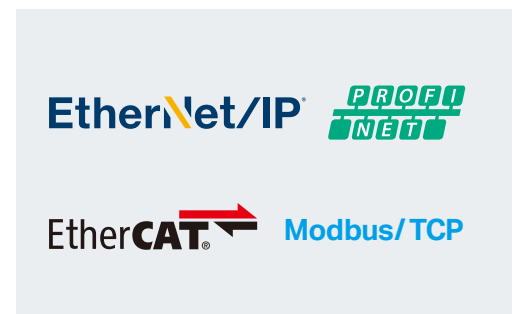
Intuitive Software

Direct or Remote Connection
Automatic Device Recognition
Easy Real-Time Configuration



Unmatched Monitoring

Fully Customizable Displays
Reduced Downtime
Improved Preventive Maintenance

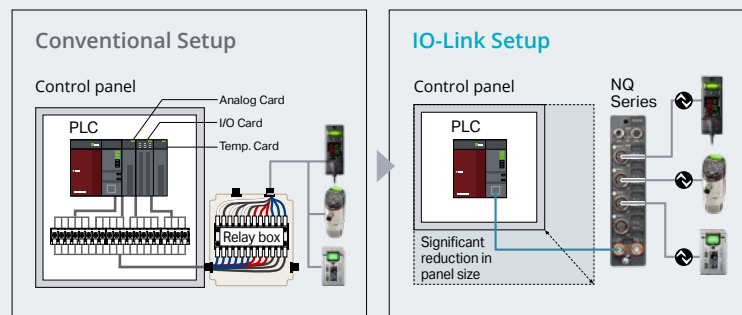


Various Network Protocols

EtherNet/IP®
PROFINET
Modbus/TCP and more

What is IO-Link?

IO-Link communication allows sensors to share large amounts of information with an IO-Link Master Unit via a single connection point. The master unit then converts this information to a common network protocol to communicate with a PLC, greatly reducing wiring.



Complete Process LineUp

KEYENCE offers a full lineup of process devices beyond the FD-H and FI Series

Do you have larger ($>1 \frac{1}{4}$ ") or smaller ($< \frac{1}{4}$ ") pipes or tubes ?

FD-R Series

Clamp-On Flow Meter

The FD-R Series can clamp-on to pipes as large as 8" with ease.

➔ Pg.36



FD-X Series

Clamp-On Flow Sensor

The FD-X Series is ideal for micro-flow monitoring in small tubes or pipes.

➔ Pg.37



Do you monitor pressure?

GP-M Series

Heavy Duty Digital Pressure Sensors

The GP-M Series can monitor both gas and liquid pressure.

➔ See KEYENCE GP-M Catalog



Do you understand your facility compressed air usage?

FD-G Series

Clamp-On Gas Flow Meter

The FD-G Series offers a clamp-on solution for compressed air monitoring.

➔ See KEYENCE FD-G Catalog



Do you network your sensors to access more data and control?

NQ Series

Network Communication Module

The NQ Series IO-Link communication modules allow users to gather data from sensors and devices around a machine and convert it to a common network communication format. This device simplifies wiring, while providing a level of detail and control that has not been seen before.

➔ Pg.38



CALL
TOLL
FREE

TO CONTACT YOUR LOCAL OFFICE
1-888-KEYENCE
1 - 8 8 8 - 5 3 9 - 3 6 2 3

www.keyence.com



SAFETY INFORMATION

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

CONTACT YOUR NEAREST OFFICE FOR RELEASE STATUS

KEYENCE CORPORATION OF AMERICA

Head Office 500 Park Boulevard, Suite 200, Itasca, IL 60143, U.S.A.

PHONE: +1-201-930-0100 **FAX:** +1-855-539-0123

E-mail: keyence@keyence.com

AL Birmingham
AR Little Rock
AZ Phoenix
CA San Francisco

CA San Jose
CA Cupertino
CA Los Angeles
CA Irvine

CO Denver
FL Tampa
GA Atlanta
IA Iowa

IL Chicago
IN Indianapolis
KY Louisville
MA Boston

MI Detroit
MI Grand Rapids
MN Minneapolis
MO Kansas City

MO St. Louis
NJ Elmwood Park
NY Rochester
NC Charlotte

NC Raleigh
OH Cincinnati
OH Cleveland
OR Portland

PA Philadelphia
PA Pittsburgh
SC Greenville
TN Knoxville

TN Nashville
TX Austin
TX Dallas
UT Salt Lake City

WA Seattle
WI Milwaukee

KEYENCE CANADA INC.

Head Office **PHONE:** +1-905-366-7655 **FAX:** +1-905-366-1122 **E-mail:** keyencecanada@keyence.com

Montreal **PHONE:** +1-514-694-4740 **FAX:** +1-514-694-3206 **Windsor** **PHONE:** +1-905-366-7655 **FAX:** +1-905-366-1122

KEYENCE MEXICO S.A. DE C.V.

PHONE: +52-55-8850-0100 **FAX:** +52-81-8220-9097

E-mail: keyencemexico@keyence.com

The information in this publication is based on KEYENCE's internal research/evaluation at the time of release and is subject to change without notice.
Company and product names mentioned in this catalog are either trademarks or registered trademarks of their respective companies.
The specifications are expressed in metric units. The English units have been converted from the original metric units. Unauthorized reproduction of this catalog is strictly prohibited.
Copyright © 2022 KEYENCE CORPORATION. All rights reserved.

KA1-1099

FDH-KA-C-US 2032-3 611S39