



Radar Level Sensor

NEW FR Series



Stable Level Detection with **RADAR**
for Any Target and Environment

Water

Chemical

Oil

Powder

FR Series

NEW Standard Level Sensing with RADAR



Benefits of RADAR

Measurement Range

~15 m ~49.2'

Resolution

1 mm 0.04"

Accuracy

±1 mm ±0.04"

It varies depending on the measurement distance.

Continuous Level Detection

Analog Output

0-20 mA/4-20 mA

Digital Output



Factors eliminated by RADAR

Build-Up

Vapor

Ripples

Condensation

Foam

Rust/Coating

Liquid Quality Change

Obstacles

Point Level Detection

5 (Overflow)

1

2

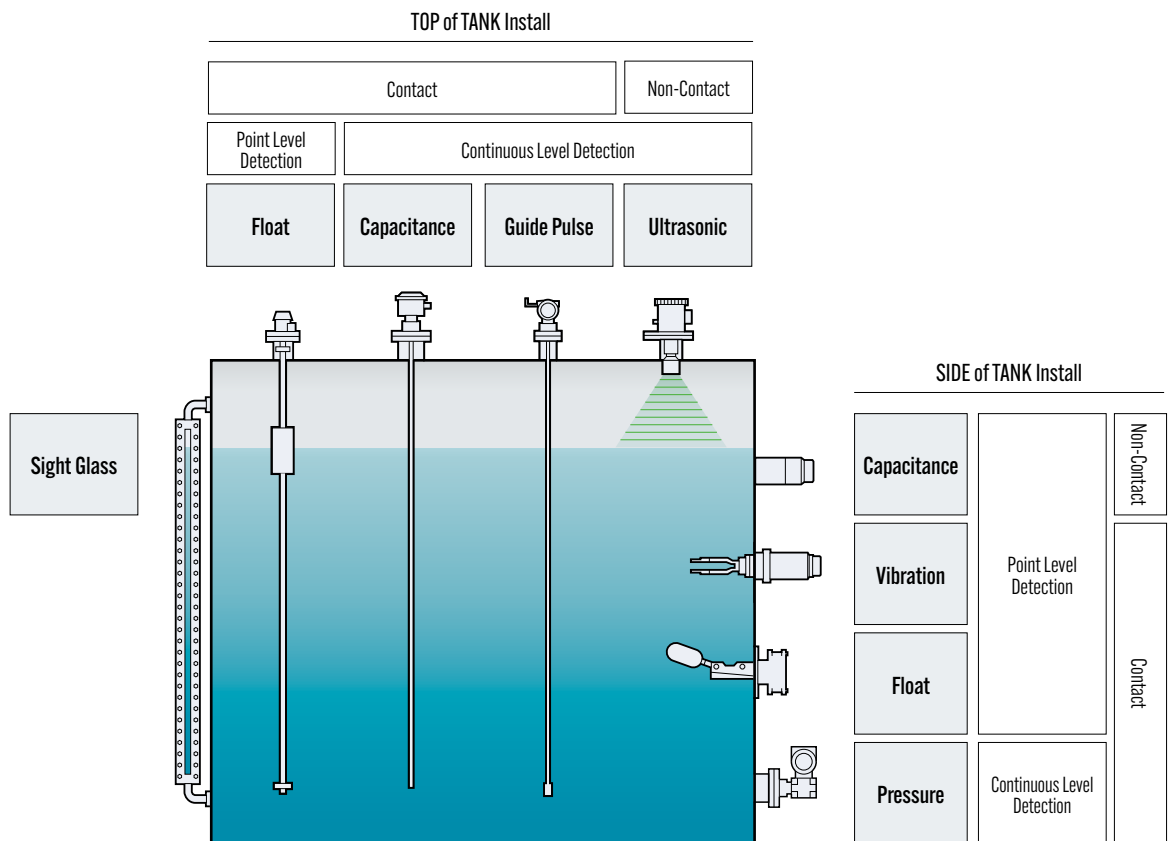
Control Output

3

4

Conventional Level Sensing is Application Specific

There are many types of conventional level sensing technologies on the market, each with their own limitations. Conventional devices are susceptible to issues caused when liquids, environments, or application needs change.



Point Level Detection

This detection style alerts when a singular level is reached. Typically, only providing a single point of detection.

Continuous Level Detection

This detection style allows for understanding of the full range of level, continuous monitoring, and measurement.

VERSATILE LINE UP

FR-S Series Short range model

Up to 1.5 m
4.9'



Standard model
FR-S01



Compact / Chemical model
FR-SH01 + FR-SA1

FR-L Series Long range model

Up to 15 m
49.2'



Standard model
FR-LM20L



Chemical model
FR-LP20L

RADAR LEVEL SENSOR FR Series

Non-Contact with Stable Detection



- RADAR Technology
- Innovative Functionality

Radar technology finally meets innovation! The FR Series boasts features that allow for accurate detection in any environment to achieve various applications.

Intuitive Design and Structure



- Big 360° Indicator Light
- LCD Display

The FR Series is designed to ensure easy set up and monitoring. The indicator lights can be seen from any angle and the LCD screen makes programming easy.

Unmatched Ease of Use

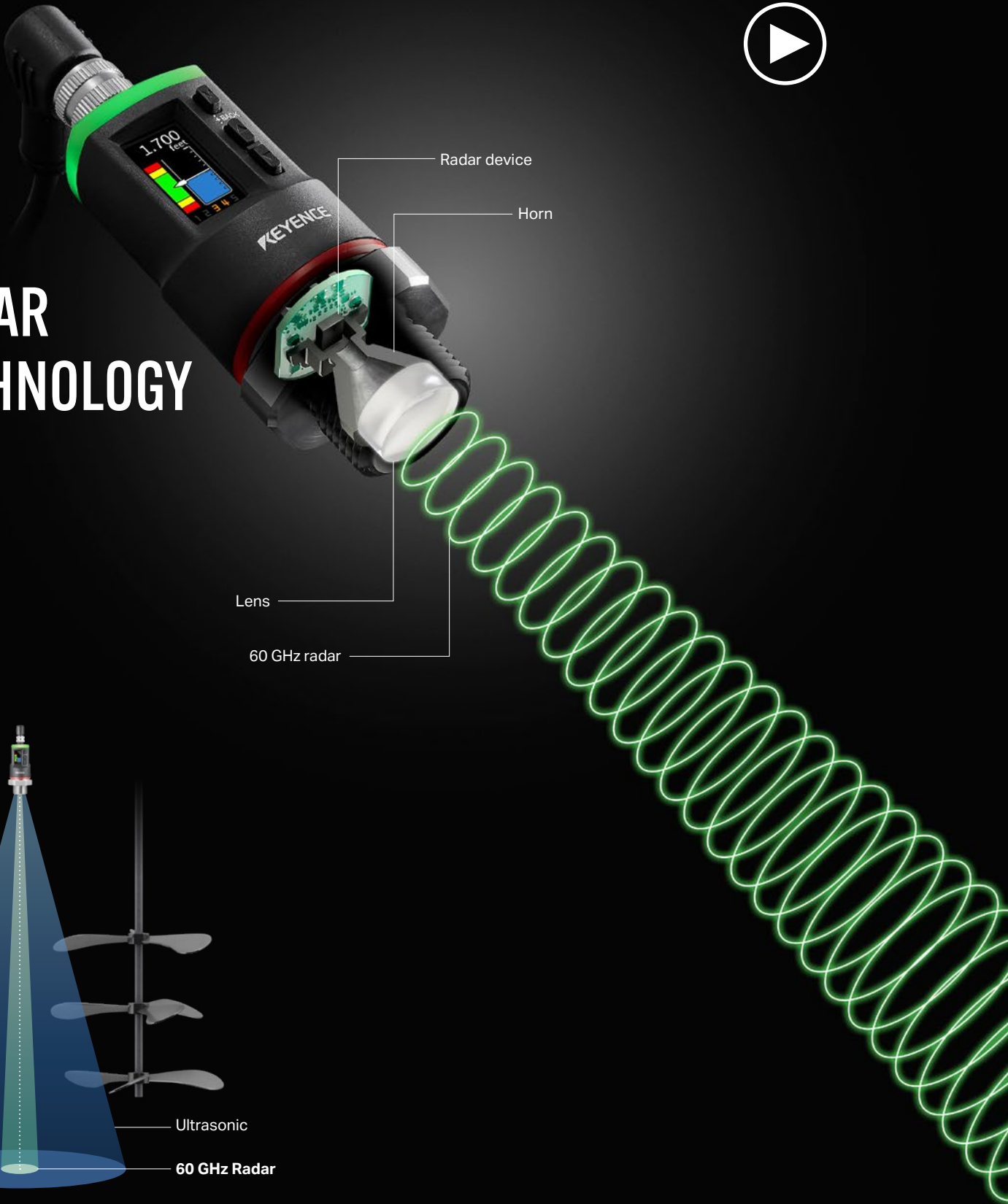


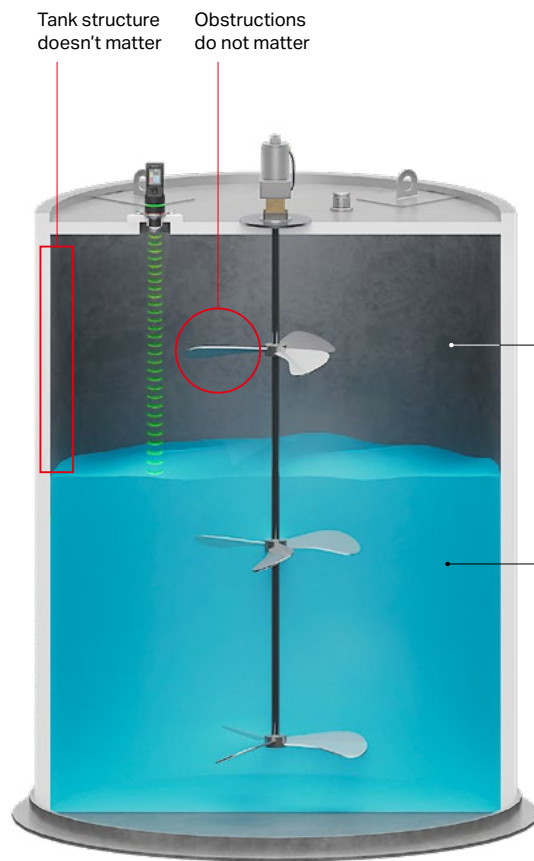
- Various Dedicated Brackets
- Customizable I/O

The FR Series has over a dozen different bracket options which will help with any mounting requirements along with custom I/O to fit any project need.



RADAR TECHNOLOGY



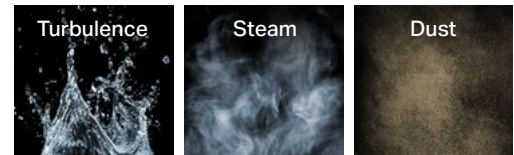


Mount Anywhere

The FR Series can be mounted anywhere without any limitations. Unlike typical level sensors that have rigid mounting requirements, the FR Series offers versatile mounting to meet the needs of any application. No more false detections caused by incorrect mounting.

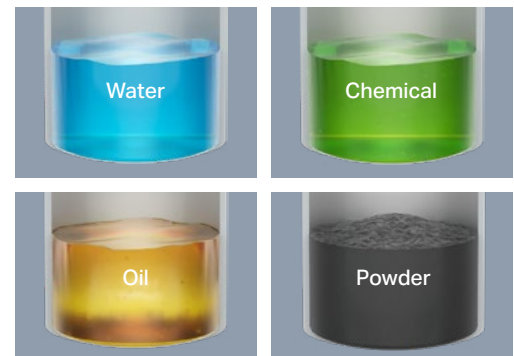
Install in Any Environment

Many level sensor technologies have significant issues with the environment. The FR Series can handle a variety of harsh environmental conditions, such as steam, smoke, dust, etc.

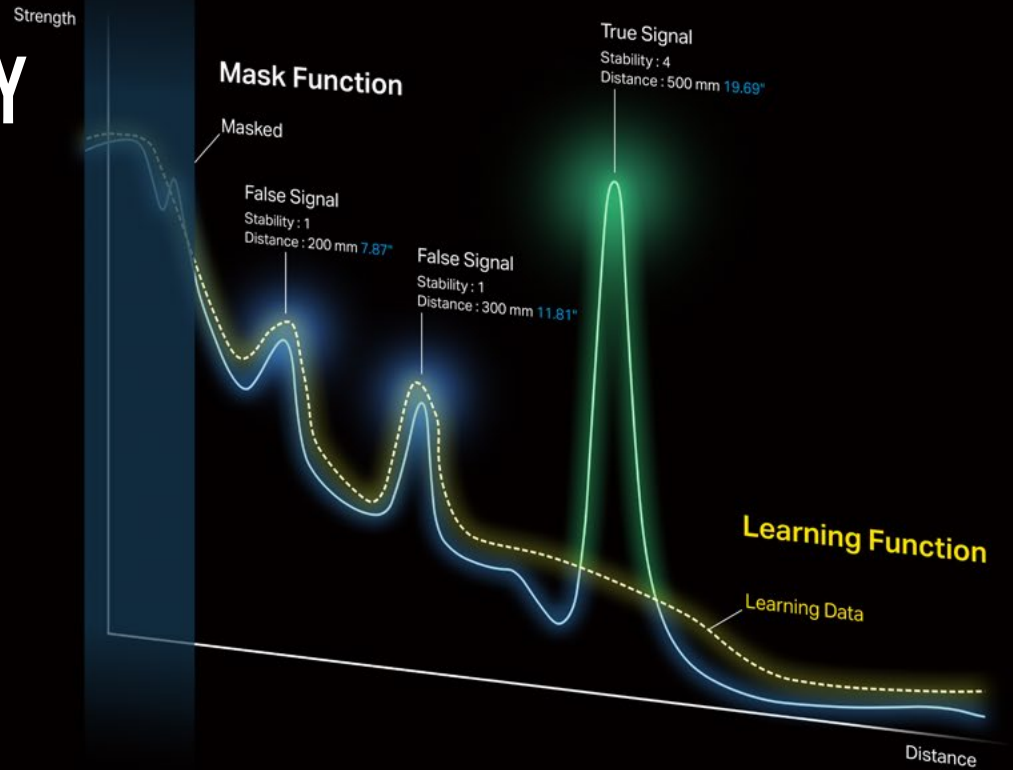


Detect Any Target

The FR Series has the benefit of using RADAR so different targets do not play a factor in detection. The FR Series can detect a wide range of mediums such as water, chemicals, oils, and even powders.

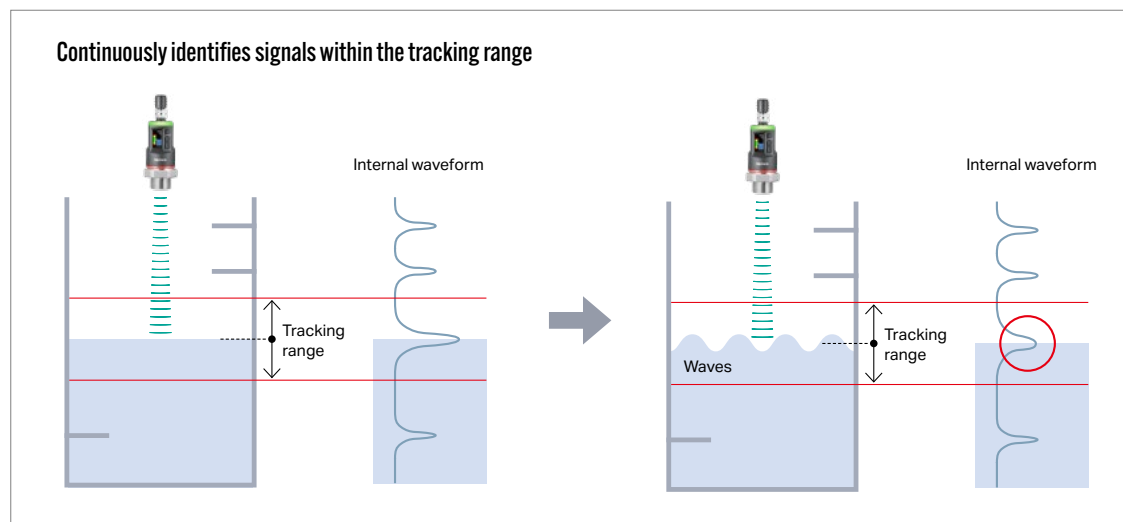


INNOVATIVE FUNCTIONALITY



Tracking Function

The Tracking Function is one of the main features leading to extremely stable detection. Once the level is detected, a custom range can be set ensuring a stable read out. This is beneficial when agitation, turbulence, or splashing occurs.



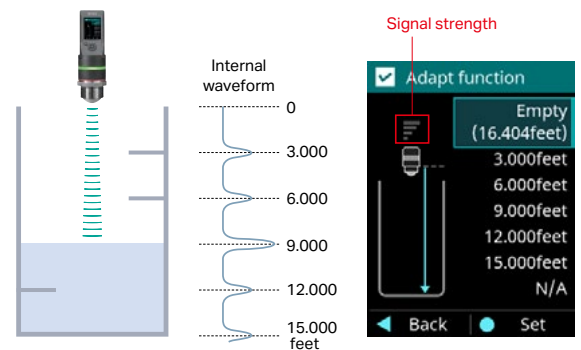
Adapt Function

No more manually adjusting echo curves! The Adapt Function makes set up easy and quick. The sensor will detect all level points it currently sees then select which one is the correct level height of the medium.

Adapt Function Flow

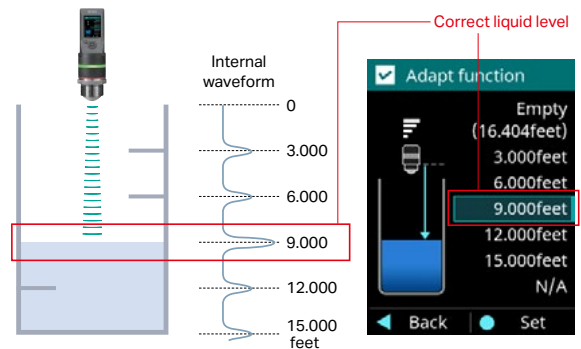
1 Automatically sense all signals

The FR Series makes it easy to understand what the RADAR sensor is detecting. It will automatically run and list out all possible detection points.



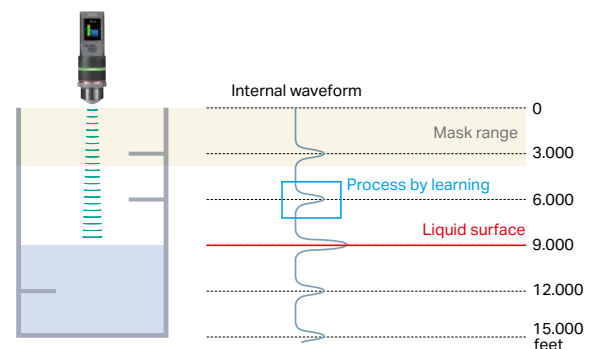
2 Easily select the correct level height

Once the FR Series shows the list of all detection points, now all that is needed to do is select the correct height of the actual level.



3 Automatically optimize internal settings

Once the correct level height is selected, the FR Series will automatically change other settings to optimize detection and increase stability by automatically masking out unwanted signals.



Big and bright
indicator lights

Can see from
any angle

BIG 360°
INDICATOR

IMPRESSIVE
LCD DISPLAY





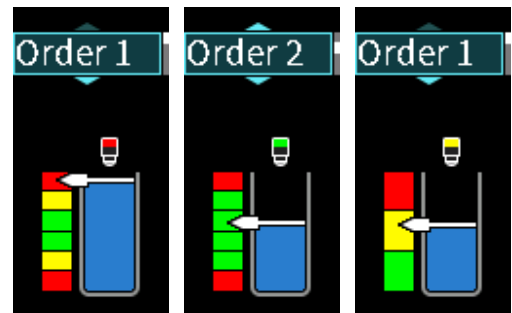
Understanding at a Glance

Easily be able to tell where level is by glancing at the bright indicator lights. No more having to access the HMI or program code to be able to remotely see where level is.



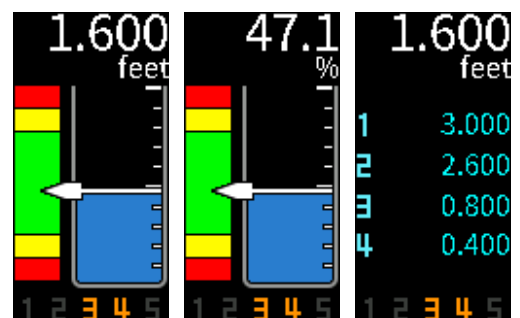
Customize the Lights

The set up can be customized to fit the application. There are multiple options to choose from to make the most sense for maintenance and others involved.



Valuable On-Screen Display

Quick understanding of level data is easily seen on the sensor screen vs needing to dig into HMI/PLCs. This ensures easy install and operation.



Unmatched Ease of Use

VARIOUS DEDICATED BRACKETS

Ferrule
mounting
bracket



Side
mounting
bracket



Clamp
mounting
bracket



Flange
mounting
bracket



Offset
mounting
bracket



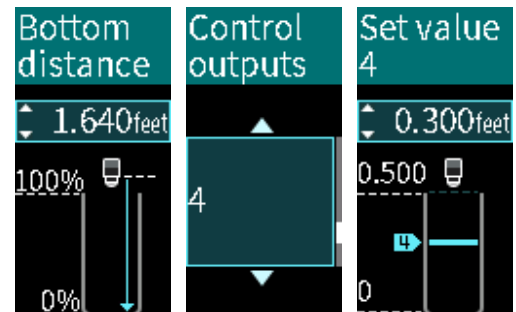


Easy Installation for Any Tank Application

Regardless of which style tank may be used, there are plenty of pre-made bracket options to choose from. These brackets are strong, easy to install, and inexpensive.

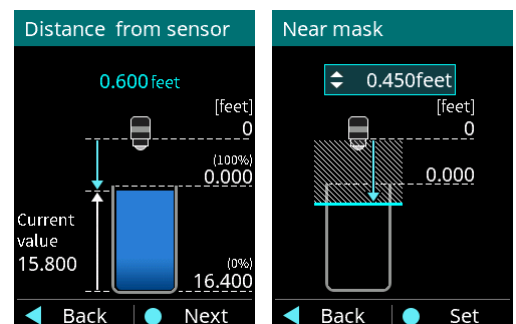
Easy Setup and Configuration

Initial set up will take minutes to complete. The screen makes selecting options easy, no need for extra software or devices, ensuring effortless navigation without complexity.

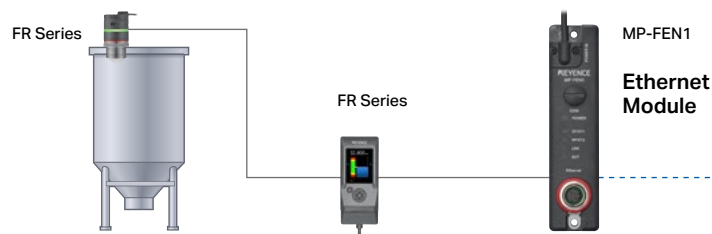


Easily Make Adjustments After Mounting

There are different features that can be utilized in order to dial in the sensor and ignore any unexpected changes in the tank. Easily adjust the settings directly on the device.

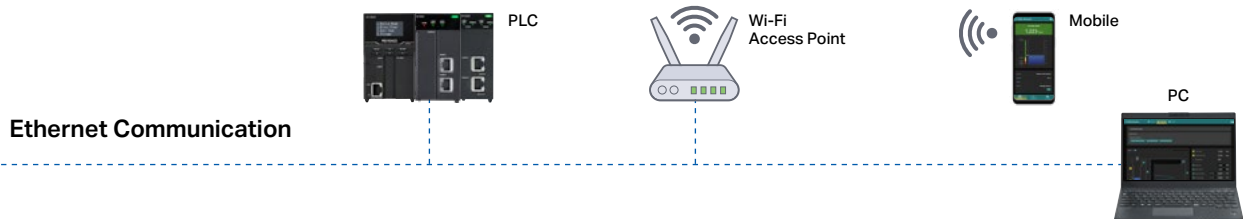


Programless Monitoring, Settings, And Diagnostics With Web Server Function



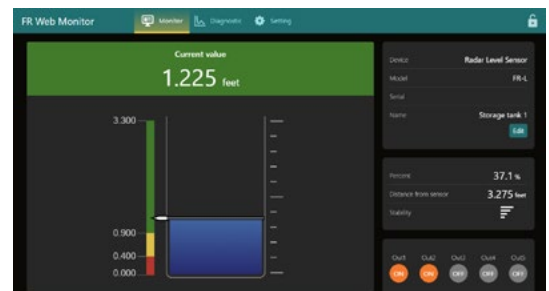
**Remote Monitoring
over Wi-Fi with Laptop or Mobile**





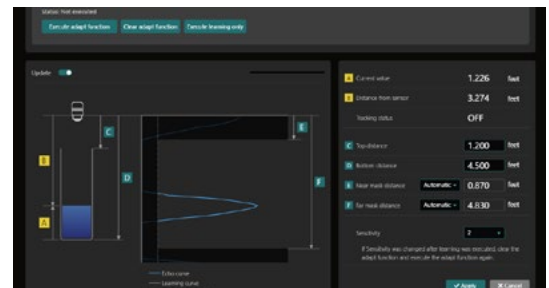
Status Monitoring

Easily monitor the level and sensor status remotely without having to be standing near the FR Series.



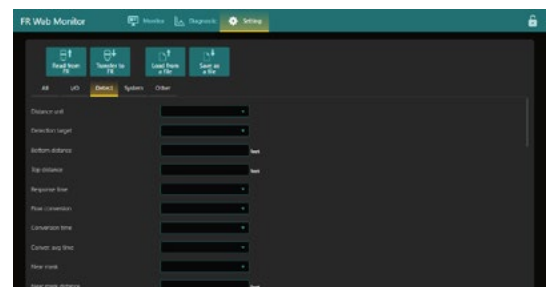
Visual Feedback

Without relying on traditional echo curves, the FR Series will graph out your data in the click of a button.



Remotely Program

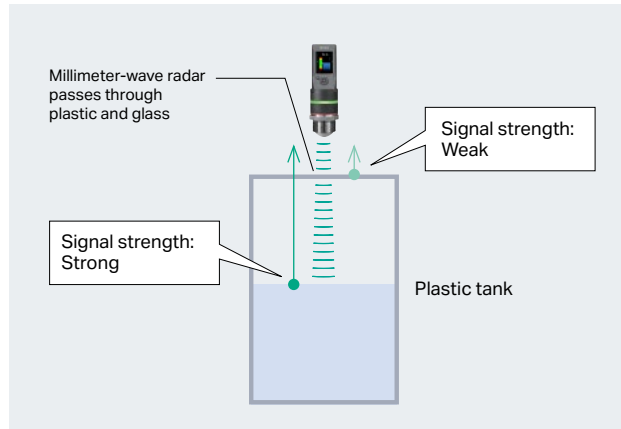
Easily program the FR Series remotely without having to rely on Bluetooth connectivity or hands-on set up.



Other Features

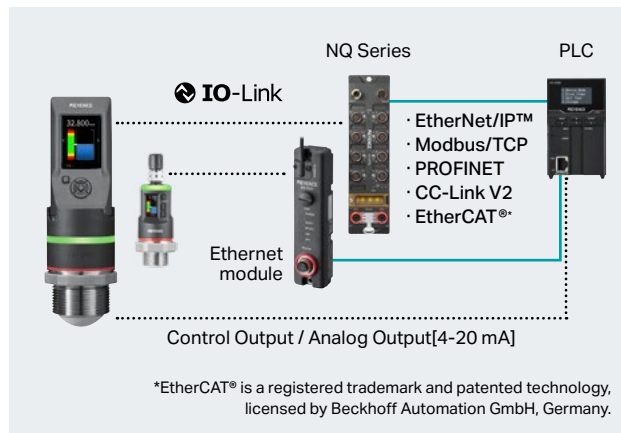
Detect Through Resin

Easily detect any liquid/medium inside of a plastic tank. The FR Series utilizes RADAR technology, which provides stable detection through plastic and enables flexible integration.



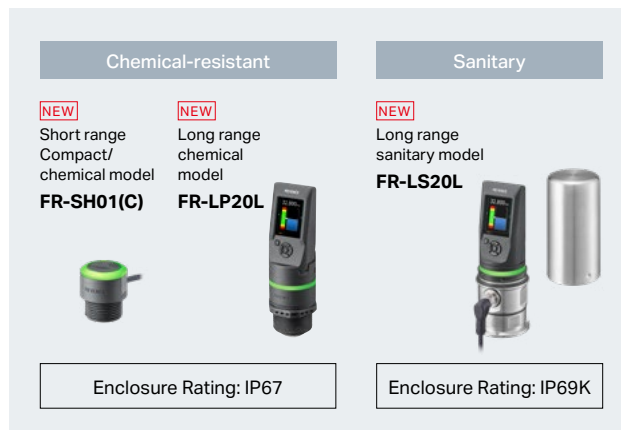
Customizable I/O

The FR Series offers many ways to integrate back to controls. With 5 digital outputs, 4-20 mA analog, and IO Link, this sensor can communicate in various ways with controls systems.



Chemical / Sanitary Models Are Available

Level sensing applications are commonly in harsh, dirty, or sanitary rated environments. The FR Series contains a variety of models that can withstand any condition.



Maintenance Free

Traditional level sensors are susceptible to build-up and dirt. The FR Series is designed to withstand any environment, making routine maintenance unnecessary.



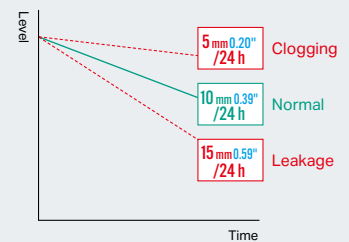
Accumulated Level Mode

[Short-range type only]

Easily see a percentage of level inside of the tank instead of relying on the actual level measurement. Making it easy to read for anyone involved.



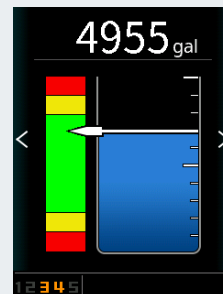
Detects abnormalities by capturing the rate of change



Flow Conversion Mode

[Long-range type only]

The FR Series can detect gradual changes in level measurement and calculate a flow rate change over time, as long as certain parameters of the application are input.

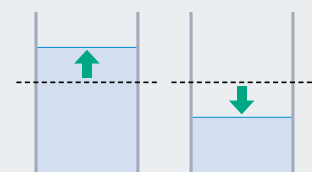


When increasing

5 L/min
1.32 gal/min

When decreasing

-5 L/min
-1.32 gal/min



HAZARDOUS ENVIRONMENT RATED

The FR Series is rated for Explosion-Proof or Intrinsically Safe environments without sacrificing sensor capabilities.



Long-Range Radar Level Sensor
2-Wire Explosion-Proof Model

NEW

FR-LEX20L

FR-LW20L (Standard model) without explosion-proof specifications are also available

LCD
DISPLAY



INDICATOR
LIGHT

Outdoor
Protection
Cover



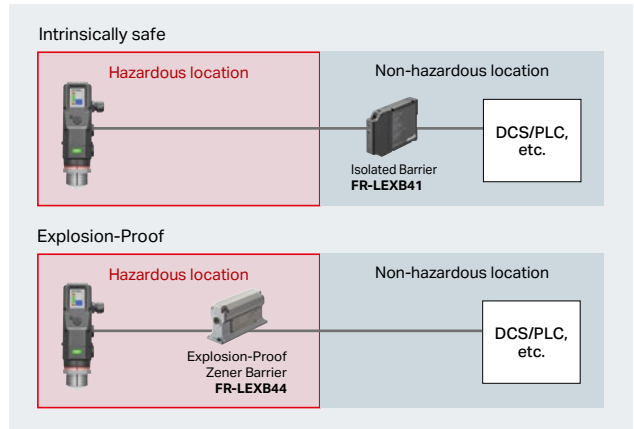
STABLE
DETECTION



HART® is a registered trademark of FieldComm Group

Compatible Explosion-Proof and Intrinsically Safe Needs

The FR Series covers any needs for hazardous location requirements. The same sensor has options to fit in either location while maintaining the rating needed for any application.



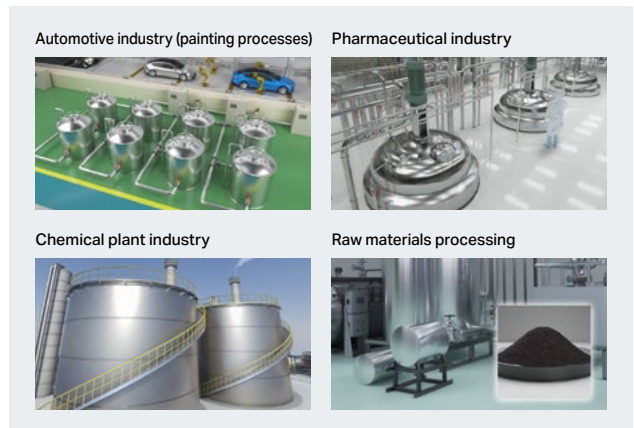
Compatible HART Communication

Remotely program and easily troubleshoot with HART communication. HART communication makes it possible to create and change settings without needing to enter hazardous locations.



For Any Hazardous Process

There are many different processes that require Hazardous ratings. The FR Series can stably detect various liquids and powders while maintaining the rating needed for any location.



Find a Solution for Any Tank Within the Facility



Dispensers

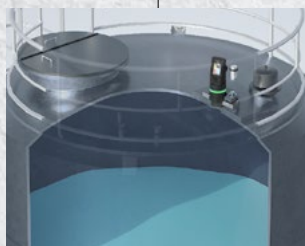
Liquids

FR-S01

Can be installed in pressurized tanks. The amount remaining in the tank can be checked in real time, letting users know when to refill.



Ingredient tank



Ingredient tank

Liquids

FR-LP20L

Corrosive liquids such as chemicals, powders, solids and other substances can be detected without contact, making it possible to detect a wide range of materials.

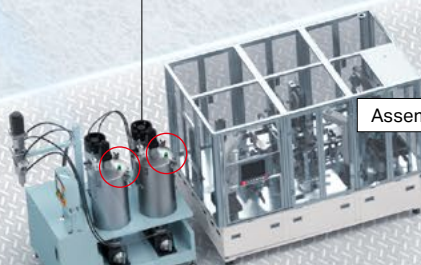


Release agent tank

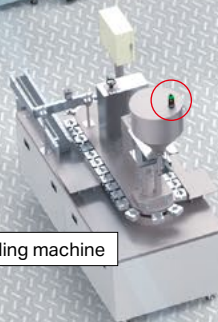
Liquids

FR-S01

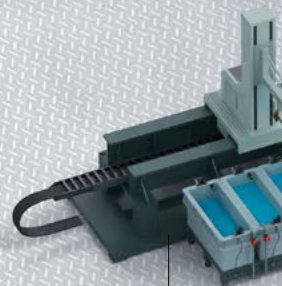
Accurate measurements of usage volumes can reduce the man-hours required for daily inspections. Oil-based liquids can also be detected.



Assembly machine



Filling machine



Casting machine



Plating tank

Liquids

FR-SH01

Can be installed even where space is limited. The plastic type is highly resistant to chemicals, making it ideal for use even in chemical environments.

Painting machine



Painting booths

Liquids

FR-LEX20L

Can be installed in environments demanding explosion protection. The status can be checked from outside the booth by separating the display unit.

Thermal treatment

Wastewater treatment

Plating

Molding machine

Processing machine



Wastewater treatment

Liquids

FR-LM20L

Can be mounted outdoors and perform reliable detection without being impacted by wind or rain. Of course, no maintenance is required for dealing with material build-up.

Coolant tank

Liquids

FR-S01

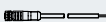
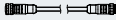
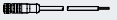
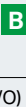
Stable detection is possible without being impacted by waves. No maintenance is required to deal with the build-up of dirt or chips.

Plastic pellet tank

Plastic

FR-S01

Detects a variety of pellets without being impacted by color. Scaling is possible even if the bottom of the tank is not flat.

STEP 1		STEP 2	STEP 3	STEP 4	Select detecting distance and model	
Range		Model		Cable Configuration		
Short up to 1.5 m (4.9')	Standard model (metal)	FR-S01 		Use as built-in display A M12 8-pin Power Cable  OR B M12 8-pin to M12 4-pin cable (for IO-Link) 		
	Compact/ Chemical model	5 m 16.4' Dedicated Connector Cable type FR-SH01 	Use as separated display B M12 8-pin to M12 4-pin cable  D Display Unit FI-1000  C M12 8-pin Power Cable 			
		3 m 9.8' M12 Connector Cable type FR-SH01C 	Use as separated display  D Display Unit FI-1000  C M12 8-pin Power Cable  OP-88907 M12 4-pin to M12 4-pin [Optional] When over 3 m 9.8' is necessary			
	Long up to 15 m (49.2')	Standard model (metal)	FR-LM20L 		Use as built-in display  A M12 8-pin Power Cable  OR B M12 8-pin to M12 4-pin cable (for IO-Link)  PLC(I/O) IO-Link Master, etc.	
Chemical model		FR-LP20L 		Use as separated display *only for FR-LM20L/FR-LP20L  F Dedicated connection cable  A M12 8-pin Power Cable  OR B M12 8-pin to M12 4-pin cable (for IO-Link)  PLC(I/O) IO-Link Master, etc.		
Sanitary model		FR-LS20L 		*The main unit can be separated into the sensor head section and the display unit. 		
2-wire model		Explosion-proof type FR-LEX20L Standard type FR-LW20L 		➔ Page27, for more detail of Sanitary Model ➔ Page28, for more detail of 2-wire Model		

STEP 1	STEP 2	STEP 3	STEP 4	Select Cables and display unit
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A M12 8-pin Power Cable	Standard		Model	Connector		Material		Length
				Female	Male	cable	connector	
		Straight	OP-88893	M12 8-pin	Strand wire	PVC	SUS316L	2 m 6.6'
			OP-88894	8-pin				5 m 16.4'
			OP-88895	Straight				10 m 32.8'
		L-shape	OP-88896	M12 8pin	Strand wire	PVC	SUS316L	2 m 6.6'
			OP-88897	8pin				5 m 16.4'
			OP-88898	L-shape				10 m 32.8'
	Oil resistant		OP-87582	M12 8pin	Strand wire	PUR	Zinc nickel plating	2 m 6.6'
			OP-87583	Straight				5 m 16.4'
			OP-87584	M12 8pin	Strand wire	PUR	Zinc nickel plating	10 m 32.8'
			OP-87586	Straight				2 m 6.6'
Chemical resistant		Straight	OP-88899	M12 8pin	Strand wire	Chemical-resistant PVC	PBT	10 m 32.8'
			OP-88900	8pin				2 m 6.6'
		L-shape	OP-88901	M12 8pin	Strand wire	Chemical-resistant PVC	PBT	5 m 16.4'
			OP-88902	L-shape				10 m 32.8'

When extending

Type	Appearance	Model	Connector		Material		Length
			Female	Male	cable	connector	
Standard		OP-88903	M12 8-pin L-shape	M12 8-pin straight	PVC	SUS316L	10 m 32.8'
		OP-88904	M12 8-pin straight	M12 8-pin straight	PVC	SUS316L	10 m 32.8'
Chemical resistant		OP-88905	M12 8-pin L-shape	M12 8-pin straight	Chemical-resistant PVC	PBT	10 m 32.8'

B M12 8-pin to M12 4-pin cable	Standard for IO-Link		Model	Connector		Material		Length
				Female	Male	cable	connector	
			OP-88444	M12 8-pin straight	M12 4-pin straight	PVC	Nickel-plated brass	
			OP-88445					
			OP-88446					10 m 32.8'

C M12 8-pin Power Cable	Standard		Model	Connector		Material		Length
				Female	Male	cable	connector	
			FD-HCB2	M12 8-pin straight	Strand wire, 6-core	PVC	Nickel-plated brass	
			FD-HCB10					

D Display Unit	Type	Appearance	Model	Input/output	Cable	Adding an expansion unit
	Cable Type Main Unit		FR-SA1	4 outputs 1 analog output 1 output / 1 external input* *Selectable	PVC 2 m 6.6' Strand wire, 8-core	With FR-SA1 as the main unit, up to 12 FR-SA2 units can be connected With NU Series as the main unit, up to 16 FR-SA2 units can be connected
	Cable Type Expansion Unit		FR-SA2	4 outputs 1 output / 1 external input* *Selectable	PVC 2 m 6.6' Strand wire, 5-core	
	M8 Connector Type Main Unit		FR-SA1C	1 output / IO-Link 1 output / 1 external input / 1 analog output* *Selectable	None (M8 4pin male connector)	Adding expansion unit not possible
	Zero Line Type Expansion Unit		FR-SA0	*via NU series	None	Up to 16 units can be added to NU series. Network Communication Unit NU Series
	Standalone Display Unit		FI-1000	4 outputs / 2 analog outputs / 2 inputs *Selectable	None (M12 8-pin male connector)	None

E M8 4-pin Power Cable *Only for FR-SA1C	Appearance	Model	Connector		Material		Length
			Female	Male	cable	connector	
		OP-88714	M8 4-pin	Strand wire	PVC	Nickel-plated brass	
			Straight				
When extending		OP-88673	M8 4-pin Straight	M8 4-pin Straight	PVC	Nickel-plated brass	2 m 6.6'
		OP-88672					10 m 32.8'

F Dedicated connection cable	Standard		Model	Connector	Material		Length
					cable	connector	
	Chemical resistant		FR-LMS5	Dedicated connector	PVC	SUS316L	5 m 16.4'
					Chemical-resistant PVC	PBT	

When extending

Appearance	Model	Connector		Material		Length
		Female	Male	Female	Male	
	OP-88906	M12 4-pin straight	M12 4-pin straight	PVC	SUS316L	5 m 16.4'
	OP-88907			Chemical-resistant PVC	PBT	

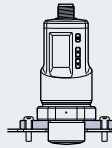
STEP 1	STEP 2	STEP 3	STEP 4	Select the mounting method
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Mounting hardware required for mounting on a top plate

▶

Attaching a general mounting bracket

No nuts required, no concern of falling / Through-hole and screw hole machining on the top plate



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

General mounting bracket

OP-88872 SUS304

OP-88874 PPS



Long range
(up to 15 m (49.2'))

Standard Liquid chemicals 2 Wire Standard 2 Wire EX

General mounting bracket

OP-88881 SUS304

OP-88919 PPS

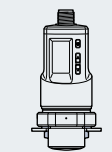


*The customer must provide mounting screws for the top plate.

▶

Nut mounting

Through-hole machining on the top plate



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Nut

OP-87642 SUS304

OP-88876 PPS



Gasket

OP-87548 Inorganic fiber and oil-resistant rubber

OP-87562 FKM

*Not needed if sealing is not required



Long range
(up to 15 m (49.2'))

Standard Liquid chemicals 2 Wire Standard 2 Wire EX

Nut

OP-88883 SUS304

OP-88887 PPS



Gasket

OP-88890 Inorganic fiber and oil-resistant rubber

OP-88891 FKM

OP-88892 FFKM

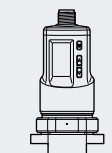


*Not needed if sealing is not required

▶

Screw mounting

G screw hole machining on the top plate



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Gasket

OP-87548 Inorganic fiber and oil-resistant rubber

OP-87562 FKM

*Not needed if sealing is not required



Long range
(up to 15 m (49.2'))

Standard Liquid chemicals 2 Wire Standard 2 Wire EX

Gasket

OP-88890 Inorganic fiber and oil-resistant rubber

OP-88891 FKM

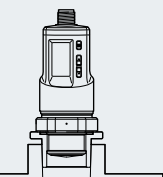
OP-88892 FFKM



▶

NPT mounting

NPT screw hole machining on the top plate



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

NPT mounting bracket

OP-88879 SUS304



Gasket

OP-87548 Inorganic fiber and oil-resistant rubber

OP-87562 FKM

*Not needed if sealing is not required



Long range
(up to 15 m (49.2'))

Standard Liquid chemicals 2 Wire Standard 2 Wire EX

NPT mounting bracket

OP-88884 SUS304



Gasket

OP-88890 Inorganic fiber and oil-resistant rubber

OP-88891 FKM

OP-88892 FFKM



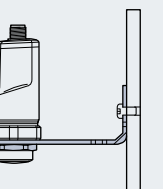
*Not needed if sealing is not required

Mounting hardware required for mounting on an inner wall

▶

Attaching a side mounting bracket

M6 screw hole machining on the side face



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Side mounting bracket

OP-88873 SUS304

*One SUS304 nut (OP-87642) is included

OP-88875 PPS

*One PPS nut (OP-88876) is included



Long range
(up to 15 m (49.2'))

Standard Liquid chemicals 2 Wire Standard 2 Wire EX

Side mounting bracket

OP-88882 SUS304

*One SUS304 nut (OP-88883) is included

OP-88886 PPS

*One PPS nut (OP-88887) is included

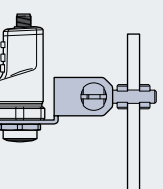


*The customer must provide mounting screws for the side.

▶

Adjustable mounting bracket

ø11 ø0.43" hole machining on the side face / Can be adjusted to the desired angle



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Adjustable mounting bracket

FR-SB33

SUS304/Zinc Die Cast Nickel Plating/Iron Nickel Plating

*One SUS304 nut (OP-87642) is included

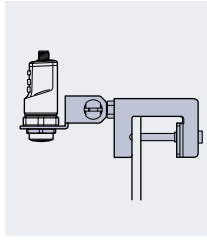


Mounting hardware required if attaching with a clamp



Clamp mounting

No machining is required on the tank



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Clamp mounting bracket

FR-SB32
SUS304/Zinc Die Cast Nickel Plating/Iron Nickel Plating

*One SUS303 nut (OP-87642) is included

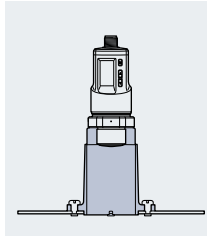


Mounting hardware required if mounting at a distance



Attaching an offset mounting bracket

ø50 ø1.97" through-hole and M6 screw hole machining on the top plate



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Offset mounting bracket

FR-SB31A
Aluminum die casting



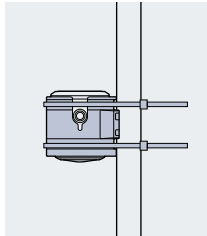
*The customer must provide mounting screws for the top plate.

Mounting hardware required when mounting where space is not available



Attaching a compact mounting bracket

Only applicable to FR-SH01 / M3 screw hole machining on the side face or cable tie-mounted



Short range
(up to 1.5 m (4.9'))

Compact liquid chemical

Compact mounting bracket

FR-SB34

PPS

*Two cable ties are included



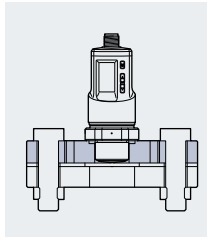
*If mounting with screws, the customer must provide the screws.

Mounting hardware required for mounting on flanges/ferrules



Flange mounting

If a tank has a flange



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Flange mounting bracket

OP-88877
SUS304 JIS10K 20-32A equivalent

*One FKM gasket (OP-87562) is included



Long range
(up to 15 m (49.2'))

Standard Liquid chemicals 2 Wire Standard 2 Wire EX

Flange mounting bracket

OP-88880

SUS304 JIS5K 50A/10K 50A equivalent

*One FKM gasket (OP-88891) is included



OP-88885

PVC JIS5K 50A/10K 50A equivalent

*One FKM gasket (OP-88891) is included

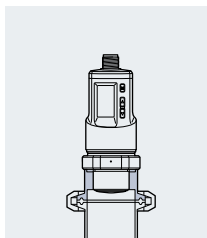


*Flange gaskets, bolts and nuts must be provided by the customer.



Ferrule mounting

If the tank is equipped with a ferrule



Short range
(up to 1.5 m (4.9'))

Standard Compact liquid chemical

Ferrule mounting bracket

OP-88878
1.5S Ferrule SUS316L

*One FKM gasket (OP-87562) is included.



Long range
(up to 15 m (49.2'))

Standard Liquid chemicals Sanitary 2 Wire Standard 2 Wire EX

Ferrule mounting bracket

Gasket

OP-88888 2S Ferrule
OP-88889 2S Ferrule (with leakage port)
OP-89245 2.5S Ferrule (with leakage port)
OP-88920 EPDM

*One EPDM gasket (not sold separately) is included

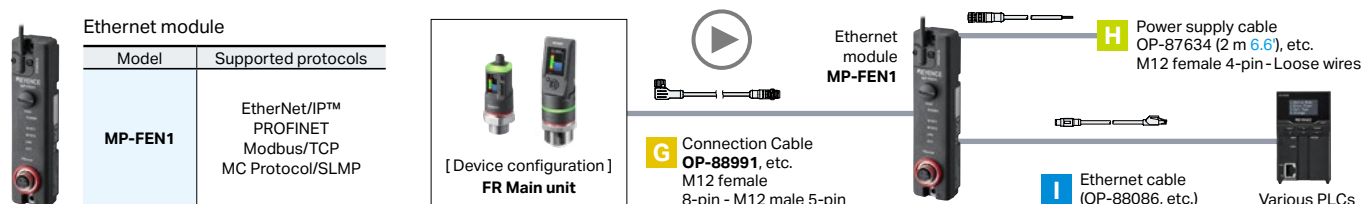


*The customer must provide ferrule gaskets and clamps.



STEP 1	STEP 2	STEP 3	STEP 4	Select options as needed
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Industrial Ethernet communications [optional]



	Type	Appearance	Model	Connector		Material		Length
				Female	Male	cable	connector	
G M12 8-pin to M12 5-pin Cable	Standard connection cable		OP-88991	M12 8-pin L-shape	M12 5-pin Straight	PVC	SUS316L	2 m 6.6'
			OP-88992					5 m 16.4'
			OP-88993					10 m 32.8'
	Chemical resistant connection cable		OP-88994			Chemical-resistant PVC	PBT	2 m 6.6'
			OP-88995					5 m 16.4'
			OP-88996					10 m 32.8'
H M12 4-pin Power Cable	Power supply cable		OP-87634	M12 4-pin straight	Strand wire	PVC	Nickel-plated brass	2 m 6.6'
			OP-87272					5 m 16.4'
			OP-87635					10 m 32.8'
I M12 4-pin to RJ45 Network Cable	Ethernet cable		OP-88086	RJ45	M12 4-pin straight	PUR	Zinc nickel plating	2 m 6.6'
			OP-88087					5 m 16.4'
			OP-88088					10 m 32.8'

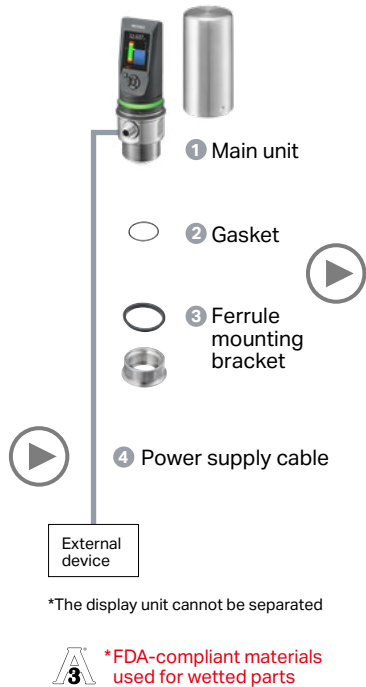
Other Options [optional]

Name	Appearance	Model	Material	Compatible Model	Name	Appearance	Model	Material	Compatible model
Protective cover		FR-SP1	SUS304	[Short Model] FR-S01	Display Unit Bracket		FD-HB1	SUS304	FI-1000
		FR-LMP1	SUS304 Screw: SUS	[Long Model] FR-LM20L FR-LP20L	Display Unit Protection Cover		FD-HP1	PSF	
		FR-LB1	PBT/ POM Screw: SUS	[Long Model] FR-LM20L FR-LP20L	Amplifier Securing Bracket		OP-88245	PC	FR-SA1 (C)
Panel Mounting Bracket		FR-LB1	PBT/ POM Screw: SUS	[Long Model] FR-LM20L FR-LP20L	End Unit for amplifier		OP-26751	PC, stainless steel, screw: iron (nickel plating)	FR-SA1(C) FR-SA2 FR-SA0 FR-LEXB41 FR-LEXB42
Rear Mounting Bracket		FR-LB2	SUS304 Screw: SUS	[Long Model] FR-LM20L FR-LP20L	Sensor Head Connector		OP-88921	PA	FR-SH01

*Use the protection cover when installing outdoors.

For Sanitary Use

Option1 Sanitary Model + Gasket + Ferrule mounting bracket



1 Select the main unit

External Appearance	Model	
  IO-Link	FR-LS20L	Sanitary model

2 Select a gasket

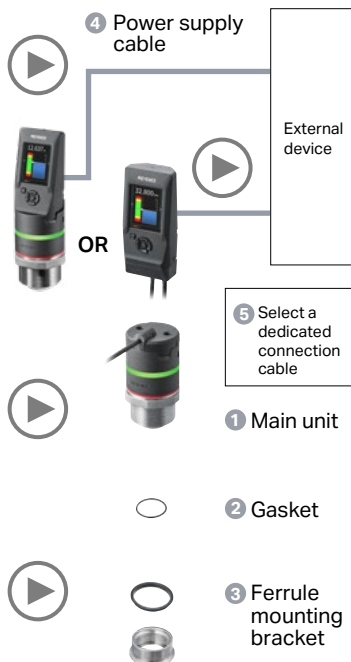
External Appearance	Model	Applications and materials
	OP-88920	Internal gasket for ferrule mounting bracket (OP-88888/88889/89245). Material: EPDM

3 Select a ferrule mounting bracket

External Appearance	Model	Applications and materials
 3	OP-88889	This is a 2S ferrule mounting bracket with a leakage port on the side. Vapour leaks can be noticed when there is a fault with the internal gasket. Use this when performing Sterilization in Place (SIP), etc. Ferrule mounting bracket: SUS316L Gasket: EPDM
 3	OP-89245	This is a 2.5S ferrule mounting bracket with a leakage port on the side. Vapour leaks can be noticed when there is a fault with the internal gasket. Use this when performing Sterilization in Place (SIP), etc. Ferrule mounting bracket: SUS316L Gasket: EPDM

4 Select a power supply cable Select from **A** or **B** in pg.23

Option2 Standard Model + Gasket + Ferrule mounting bracket *can be separated



1 Select the main unit

External Appearance	Model	
  IO-Link	FR-LM20L	Standard model

2 Select a gasket

External Appearance	Model	Applications and materials
	OP-88920	Internal gasket for ferrule mounting bracket (OP-88888/88889/89245). Material: EPDM

3 Select a ferrule mounting bracket

External Appearance	Model	Applications and materials
	OP-88888	This is a standard 2S ferrule mounting bracket. Ferrule mounting bracket: SUS316L Gasket: EPDM
	OP-88889	This is a 2S ferrule mounting bracket with a leakage port on the side. Vapour leaks can be noticed when there is a fault with the internal gasket. Use this when performing Sterilization in Place (SIP), etc. Ferrule mounting bracket: SUS316L Gasket: EPDM
	OP-89245	This is a 2.5S ferrule mounting bracket with a leakage port on the side. Vapour leaks can be noticed when there is a fault with the internal gasket. Use this when performing Sterilization in Place (SIP), etc. Ferrule mounting bracket: SUS316L Gasket: EPDM

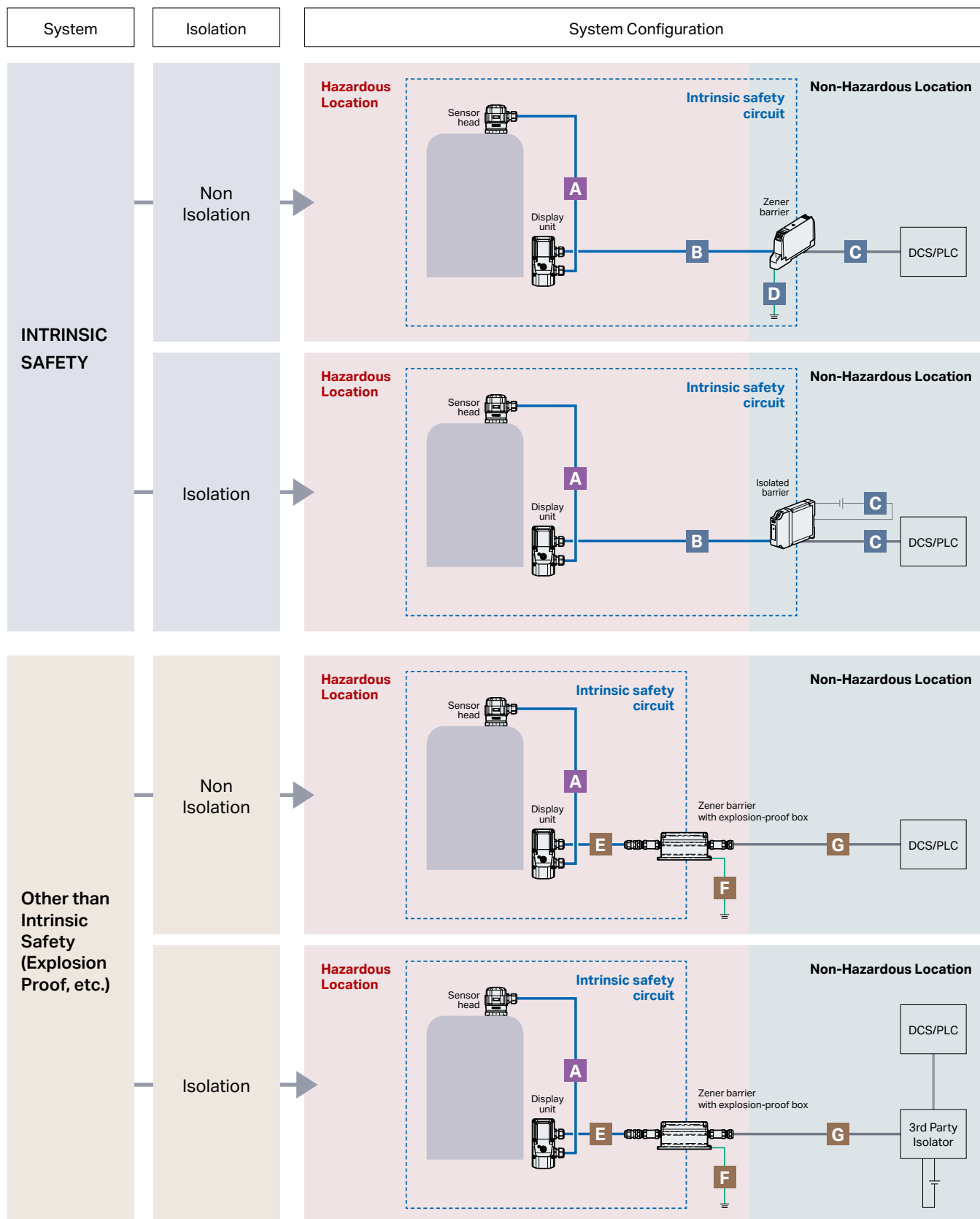
4 Select a power supply cable
Select from **A** or **B** on pg.23

When Using as separated display

5 Select a dedicated connection cable
Select from **F** on pg.23

For Intrinsic Safety / Explosion-Proof Use

① Select System Configuration



② Select Main Unit

External Appearance	Model Number	Model Type	Input/Output	Explosion-Proof Specifications ^{*1}
	FR-LEX20L	Explosion-proof model	2-wire system	Intrinsically safe ^{*2} Class I, Zone 0, AEx ia IIC T4 Ga / Class I, Division 1, Groups A, B, C, D, T4 or Class I, Zone 0, AEx ia IIB T4 Ga / Class I, Division 1, Groups C, D, T4 ^{*3}

*1 Refer to "Explosion-Proof Specifications" (pg.34).

*2 Always use with a barrier.

*3 Varies depending on the barrier used.

*Select cable from **B** for built-in type



③ Select Barrier^{*1}

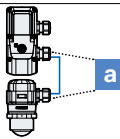
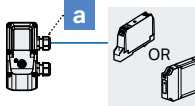
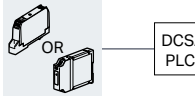
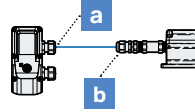
External Appearance	Model	Type	Input/Output	Explosion-Proof Specifications ^{*2}
	FR-LEXB41	Isolated barrier	2-wire input supply + analog output	[AEx ia Ga] IIC or [AEx ia Ga] IIB [AEx ia Da] IIC
	FR-LEXB42	Zener barrier	2-wire system	[AEx ia Ga] IIB [AEx ia Da] IIC
	FR-LEXB44^{*3}	Zener barrier with explosion-proof box	2-wire system	AEx db [ia Ga] IIB T4 Gb AEx tb [ia Da] IIC T135°C Db

*1 When using a self-provided barrier, customers should select it according to the electrical rating in "Explosion-Proof Specifications" (pg. 34).

*2 Refer to "Explosion-Proof Specifications" (pg.34).

*3 Use FR-LEXB43 in Japan. Please contact KEYENCE for details.

④ Select Cables / Cable Gland

				a Cable Gland		b Cable Gland		Cable		
				Thread Size	Max Width Across Corners	Thread Size	Max Width Across Corners	O.D.	No. of Conductors	AWG
For separated display	A Display and Sensor head connection 	using cable gland comes with FR-LEX20L	(Accessory of FR-LEX20L)		—		6 to 12 mm 0.24" to 0.47"	6	16 to 26	
		using cable gland provide from 3rd party	M20	Max. 31 mm 1.22"	—		(Depending on the gland)	6	16 to 26	
Wiring details for Intrinsic safety unit	B Sensor to barrier connection 	using cable gland comes with FR-LEX20L	(Accessory of FR-LEX20L)		—		6 to 12 mm 0.24" to 0.47"	2	12 to 26 for FR-LEXB41 12 to 24 for FR-LEXB42	
		using cable gland provide from 3rd party	M20	Max. 33 mm 1.30"	—		(Depending on the gland)	2	12 to 24 for FR-LEXB42	
	C Barrier to PLC/ DCS connection 	—	—	—	—	—	4 for FR-LEXB41 2 for FR-LEXB42	12 to 26 for FR-LEXB41 12 to 24 for FR-LEXB42		
	D Ground connection 	—	—	—	—	—	1	Use thicker cable than B		
Wiring details for Explosion-proof unit	E Sensor to barrier connection 	using cable gland comes with FR-LEX20L	(Accessory of FR-LEX20L)		NPT 1/2	No limitation for Max Width Across Corners	6 to 12 mm 0.24" to 0.47"	2	12 to 24	
		using cable gland provided from 3rd party	M20	Max. 33 mm 1.30"		(Depending on the gland)	2	12 to 24		
	G Barrier to PLC/ DCS connection 	—	NPT 1/2	No limitation for Nut Width Across Corners	—	—	(Depending on the gland)	2	12 to 24	
	F Ground connection 	—	—	—	—	—	1	Min. 11		

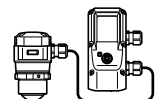
⑤ Other Options

Name	Appearance	Model	Material	Compatible model
Protective cover		FR-LEXP1[*]	SUS304 Screws: SUS	[Long model] FR-LEX20L / FR-LW20L
Exchange cable gland		OP-88908	PA/EPDM	FR-LEX20L / FR-LW20L (2 included with main unit)
Rear Mounting Bracket		FR-LB2	SUS304 Screw: SUS	[Long Model] FR-LEX20L FR-LW20L

*Use the protection cover when installing outdoors.

2 wire standard model

External Appearance	Model Number	Model Type	Input/Output
	FR-LW20L	Standard type	2 wire



*The sensor head and display unit can be separated.

⑥ Select Bracket from pg.24-25

*Select cable from **B** for built-in type

*Select cable from **A** for separated type

For Outdoor Use

The FR Series can be confidently utilized outdoors by using the protection cover and separating the unit for easier programming.

Outdoor protection cover

Use as
built-in
display



Use as
separated
display



Compatible
Model Long
Range
FR-LM20(L)
FR-LP20(L)
FR-LW20(L)
FR-LEX20(L)

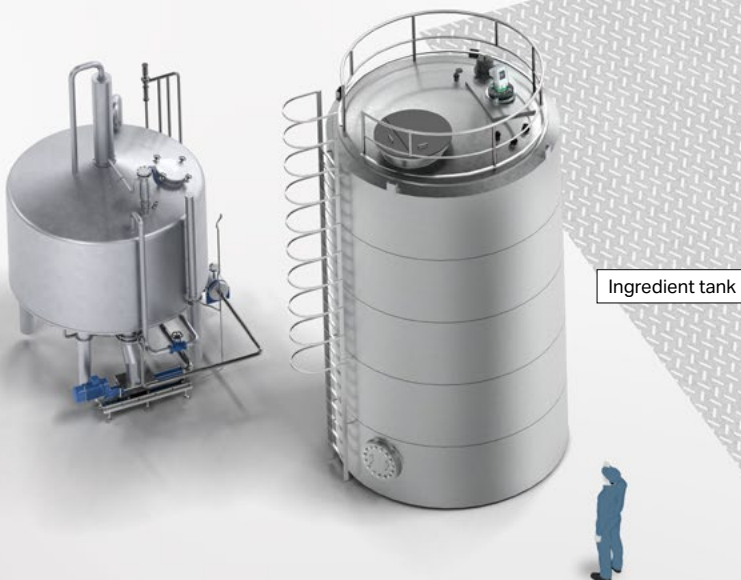


Protection Cover
FR-LMP1/FR-LEXP1



Long Range Detection up to 65.6' If Outdoors

For outdoor use and enclosed tanks only. The FR Series boasts a long-range to help with any liquid or powder detection in outdoor tanks and silos. Utilizing the outdoor rated protection cover and web server function can help with set up and reliability long term.



Difference by models

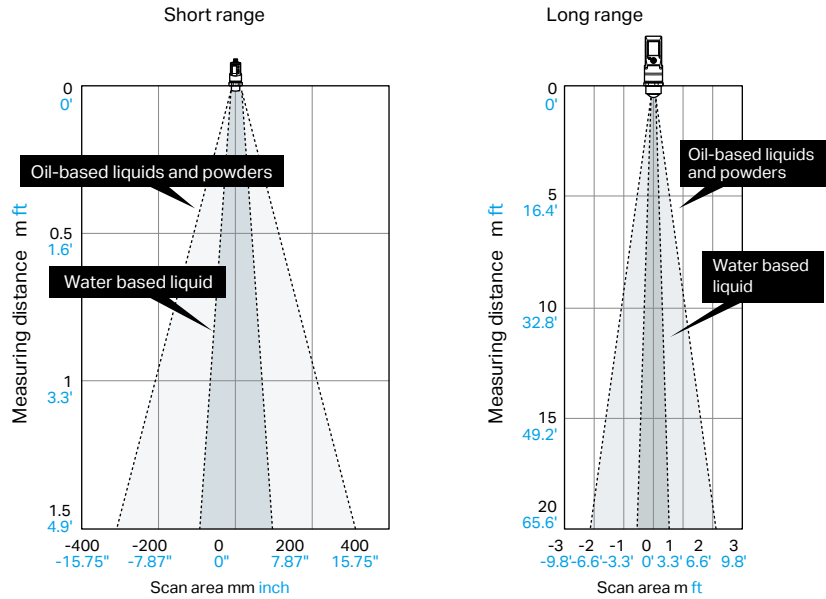
	Appearance	Radar Power	Place to install	Model	Range
Standard model (metal)		High	Only Outdoor	FR-LM20	Up to 20 m 65.6'
		Low	Indoor / Outdoor	FR-LM20L	Up to 15 m 49.2'
Chemical model		High	Only Outdoor	FR-LP20	Up to 20 m 65.6'
		Low	Indoor / Outdoor	FR-LP20L	Up to 15 m 49.2'
2-wire explosion-proof model		High	Only Outdoor	FR-LEX20	Up to 20 m 65.6'
		Low	Indoor / Outdoor	FR-LEX20L	Up to 15 m 49.2'
2-wire standard model		High	Only Outdoor	FR-LW20	Up to 20 m 65.6'
		Low	Indoor / Outdoor	FR-LW20L	Up to 15 m 49.2'

Characteristics

The FR Series has scan area characteristics as shown in the figure to the right, and the area to be considered depends on the target.

It is possible to detect more stably by positioning the device so that there are no metal obstructions within the area shown to the right.

If that cannot be done, diagnostic functions can be carried out to ensure stable detection.



Typical values (short range)

Measuring Distance	Scan area	
	Water based liquid	Oil-based liquids and powders
0.5 m 1.6'	Approx. ø80 ø3.15"	Approx. ø220 ø8.66"
1 m 3.3'	Approx. ø130 ø5.12"	Approx. ø415 ø16.34"
1.5 m 4.9'	Approx. ø185 ø7.28"	Approx. ø610 ø24.02"

Typical values (long range)

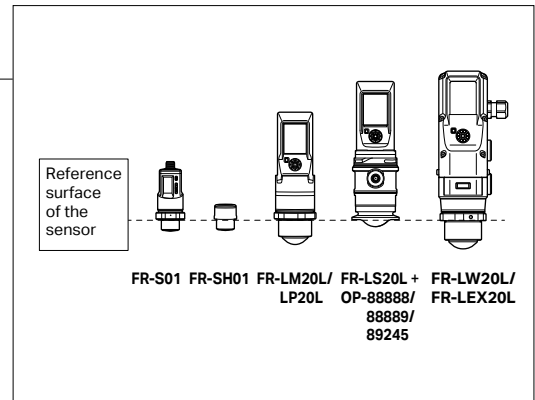
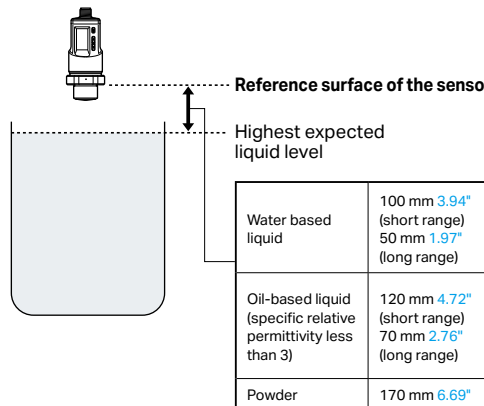
Measuring Distance	Scan area	
	Water based liquid	Oil-based liquids and powders
1 m 3.3'	Approx. ø100 ø3.94"	Approx. ø260 ø10.24"
3 m 9.8'	Approx. ø200 ø7.87"	Approx. ø680 ø26.77"
5 m 16.4'	Approx. ø310 ø12.20"	Approx. ø1100 ø43.31"
10 m 32.8'	Approx. ø570 ø22.44"	Approx. ø2150 ø84.65"
15 m 49.2'	Approx. ø830 ø32.68"	Approx. ø3200 ø125.98"
20 m 65.6'	Approx. ø1100 ø43.31"	Approx. ø4250 ø167.32"

*In the case of a metal wall that has only a slightly uneven surface, there is no problem even if the wall is inside the scan area.



Detection can be unstable at short distances. It is recommended that the reference plane of the sensor's main unit be installed at least the distance indicated on the right from the highest position of expected liquid level.

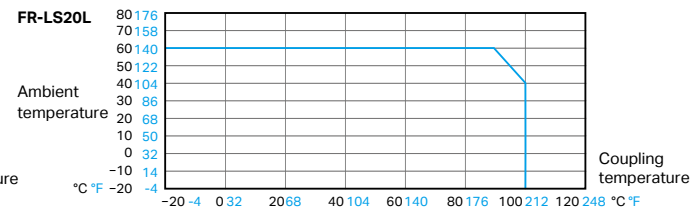
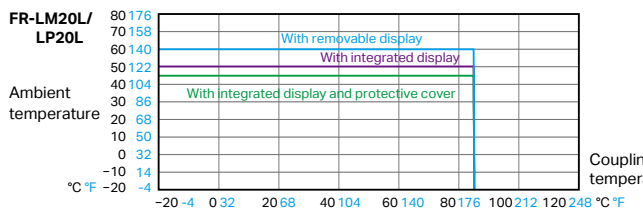
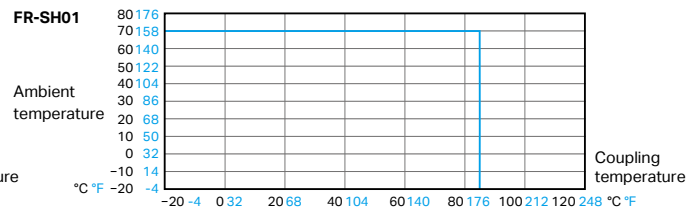
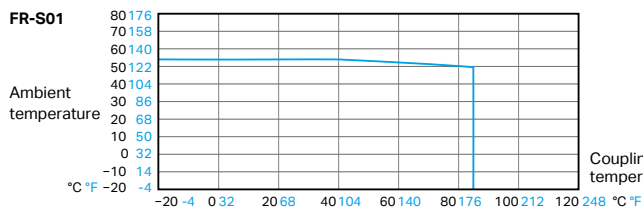
However, if the environment is free of foam or adhesive material, it may be possible to use the product with a lesser distance.



Sensor Unit

Model		Short range		Long range		
		Standard model	Compact chemical model	Standard model	Chemical model	Sanitary model
		FR-S01	FR-SH01(C)	FR-LM20L	FR-LP20L	FR-LS20L
Measuring range ^{*1}		Up to 1.5 m 4.9'		Up to 15 m 49.2'		
Display range ^{*1}		Up to 2 m 6.6'		Up to 25 m 82.0'		
Relative Permittivity ^{*2}		2 or higher		2 or higher		
Resolution		1 mm 0.04"		1 mm 0.04"		
Accuracy ^{*3}		Up to 0.1 m 0.3' ; ±20 mm 0.79" ; 0.1 to 0.3 m 0.3' to 1.0' : ±5 mm 0.20" ; 0.3 to 1.5 m 1.0' to 4.9' : ±1 mm 0.04"		Up to 0.1 m 0.3' ; ±10 mm 0.39" ; 0.1 to 10 m 0.3' to 32.8' : ±1 mm 0.04" ; 10 to 15 m 32.8' to 49.2' : ±2 mm 0.08"		
Response time		0.4 s, 1.5 s, 4 s (default value), 10 s		0.4 s, 1.5 s, 4 s (default value), 10 s		
Tank pressure		-0.1 to +1 MPa		-0.1 to +1 MPa	-0.1 to +0.1 MPa	-0.1 to +1 MPa
Material	Tank interior	Lens: PTFE Internal packing: FKM Joint: SUS304	Lens: PTFE Internal packing: FKM Joint: PPS	Lens: PTFE Internal packing: FKM Joint: SUS304	Lens: PTFE Internal packing: FKM Joint: PPS	Lens: PTFE Ferrule Internal Packing: EPDM (when using OP-88920) Ferrule: SUS316L (when using OP-88888/88889/89245)
	Housing	PBT PAR	PPS PPSU	PPS PET PAR	PPS PPSU	SUS304
Connection diameter		G3/4 (20 A)	G3/4 (20 A)	G1-1/2 (40 A)	G1-1/2 (40 A)	2S/2.5S ferrule
Output	No. of control outputs	Maximum 5	—	Maximum 5		
	Control output/ auxiliary output	NPN/PNP open collector (switching type) 30 VDC or less, max 50 mA for each Residual voltage of 1.4 V or less (50 mA or less) N.O./N.C. Switching type IO2 is switchable to IO-Link IO5 is switchable to external input	—	NPN/PNP open collector (switching type) 30 VDC or less, max 50 mA for each Residual voltage of 1.4 V or less (50 mA or less) N.O./N.C. Switching type IO2 is switchable to IO-Link		
	Analog output	0–20 mA/4–20 mA maximum load resistance 260 Ω (Response time: 0.2 s after judgment output is confirmed [90% response])	—	0–20 mA/4–20 mA maximum load resistance 260 Ω (Response time: 0.2 s after judgment output is confirmed [90% response])		
External input		Short-circuit current: 1.5 mA or less Input time 500 ms or more	—	—		
Network compatibility		IO-Link v1.1/COM2	—	IO-Link v1.1/COM2		
Analog output accuracy ^{*4}	Resolution	1 mm 0.04"	—	1 mm 0.04"		
	Zero accuracy	±0.1 mA (zero point = 4 mA)	—	±0.1 mA (zero point = 4 mA)		
	F.S. accuracy	±0.2 mA (full-scale = 20 mA)	—	±0.2 mA (full-scale = 20 mA)		
Environmental resistance	Operating ambient temperature	-20°C to +55°C ^{*,*5} -4°F to +131°F (no freezing)	-10 to +70°C ^{*,*5} 14°F to 158°F (No freezing)	Display part when combined and separated: -20 to +50°C -4°F to +122°F (no freezing) ^{*,*5} Head when separated: -20 to +60°C -4°F to +140°F (no freezing) ^{*,*5}	Display part when combined and separated: -10 to +50°C 14°F to 122°F (no freezing) ^{*,*5} Head when separated: -10 to +60°C 14°F to 140°F (no freezing) ^{*,*5}	-20°C to +60°C ^{*,*5} -4°F to +140°F (no freezing)
	Operating ambient humidity	Up to 85% RH (no condensation)				
	Temperature of coupling used	-20 to +85°C -4°F to +185°F (no freezing) ^{*,*5}	-10 to +85°C 14°F to 185°F (no freezing) ^{*,*5}	-20 to +85°C -4°F to +185°F (no freezing) ^{*,*5}	-10 to +85°C 14°F to 185°F (no freezing) ^{*,*5}	-20 to +100°C -4°F to +212°F (no freezing) ^{*,*5}
	Vibration resistance	10–500 Hz Power spectral density: 0.816 G ² ; X, Y and Z directions				
	Shock resistance	100 m/s ² (10 G), 16 ms pulses, 1000 times each for X, Y and Z directions				
Enclosure rating		IP67 (IEC60529)		IP67 (IEC60529), Enclosure Type 4X (NEMA250)		IP67 (IEC60529), IP69K (ISO20653)
Protection circuit		Protection against reverse power connection, power supply surges, output overcurrent protection, and output surges				
Power voltage		24 VDC + 25%/–20% Including ripple Class 2 or LPS		24 VDC + 25%/–20% Including ripple Class 2 or LPS		
Power Consumption (Excluding Load Current)		80 mA or less		106 mA or less	98 mA or less	106 mA or less
Weight		Approx. 170 g 6.00 oz	FR-SH01: Approx. 140 g 4.94 oz FR-SH01C: Approx. 120 g 4.23 oz	Approx. 600 g 21.16 oz	Approx. 400 g 14.11 oz	Approx. 900 g 31.75 oz

*1 Guaranteed value in water with the recommended installation. Static water can be measured up to the edge of the lens. An undetectable area on the short-range side is created due to the environment and measurement medium. The maximum measuring distance is also shortened. *2 Measurement may not be possible depending on the shape and environment of the target. *3: This is the guaranteed value from verification performed at KEYENCE inspection facilities. Measurement errors may occur depending on the customer's environment. *4: This is the guaranteed value from verification performed at KEYENCE inspection facilities with a load resistance of 250 Ω. Measurement errors may occur depending on the customer's environment. *5 Details of the operating temperature range of each model are shown below. The FR-S01 and FR-LM20L/LP20L can be used up to an ambient temperature setpoint of 10°C 50°F by selecting "Off when not in Operation" under "Screen Brightness."



*6 When performing SIP with the FR-LS20L, do so for 1 hour or less with an ambient temperature of 40°C 104°F or less and an internal system temperature of 130°C 266°F. When performing SIP with the FR-S01/LM20L/LP20L, turn the power supply off, and then perform this operation for 1 hour or less with an ambient temperature of 40°C 104°F or less and an internal system temperature of 130°C 266°F. In addition, always install the KEYENCE optional ferrule mounting bracket and internal gasket.

* The FR Series uses 60 GHz wireless. Always follow the rules, conventions, regulations, and laws of the country or region in which you use the device.

Sensor Unit (Only for outdoor)

Model		Long range	
		Standard model	Chemical model
		FR-LM20	FR-LP20
Measuring range ^{*1}		Up to 20 m 65.6'	
Display range ^{*1}		Up to 25 m 82.0'	
Relative Permittivity ^{*2}		2 or higher	
Resolution		1 mm 0.04"	
Accuracy ^{*3}		Up to 0.1 m 0.3' ; ±10 mm 0.39" ; 0.1 to 10 m 0.3' to 32.8' : ±1 mm 0.04" ; 10 to 20 m 32.8' to 65.6' : ±2 mm 0.08"	
Response time		0.4 s, 1.5 s, 4 s (default value), 10 s	
Tank pressure		-0.1 to +1 MPa	-0.1 to +0.1 MPa
Material	Tank interior	Lens: PTFE Internal packing: FKM Joint: SUS304	Lens: PTFE Internal packing: FKM Joint: PPS
	Housing	PPS PET PAR	PPS PPSU
Connection diameter		G1-1/2 (40 A)	G1-1/2 (40 A)
Output	No. of control outputs	Maximum 5	
	Control output/ auxiliary output	NPN/PNP open collector (switching type) 30 VDC or less, max 50 mA for each Residual voltage of 1.4 V or less (50 mA or less) N.O./N.C. Switching type IO2 is switchable to IO-Link	
	Analog output	0–20 mA/4–20 mA maximum load resistance 260 Ω (Response time: 0.2 s after judgment output is confirmed [90% response])	
External input		—	
Network compatibility		IO-Link v1.1/COM2	
Analog output accuracy ^{*4}	Resolution	1 mm 0.04"	
	Zero accuracy	±0.1 mA (zero point = 4 mA)	
	F.S. accuracy	±0.2 mA (full-scale = 20 mA)	
Environmental resistance	Operating ambient temperature	Display part when combined and separated: -20 to +50°C -4°F to +122°F (no freezing) ^{*5, *6} Head when separated: -20 to +60°C -4°F to +140°F (no freezing) ^{*5, *6}	Display part when combined and separated: -10 to +50°C 14°F to 122°F (no freezing) ^{*5, *6} Head when separated: -10 to +60°C 14°F to 140°F (no freezing) ^{*5, *6}
	Operating ambient humidity	Up to 85% RH (no condensation)	
	Temperature of coupling used	-20 to +85°C -4°F to +185°F (no freezing) ^{*5, *6}	-10 to +85°C 14°F to 185°F (no freezing) ^{*5, *6}
	Vibration resistance	10–500 Hz Power spectral density: 0.816 G ² ; X, Y and Z directions	
	Shock resistance	100 m/s ² (10 G), 16 ms pulses, 1000 times each for X, Y and Z directions	
Enclosure rating		IP67 (IEC60529), Enclosure Type 4X (NEMA250)	
Protection circuit		Protection against reverse power connection, power supply surges, output overcurrent protection, and output surges	
Power voltage		24 VDC + 25%/–20% Including ripple Class 2 or LPS	
Power Consumption (Excluding Load Current)		106 mA or less	98 mA or less
Weight		Approx. 600 g 21.16 oz	Approx. 400 g 14.11 oz

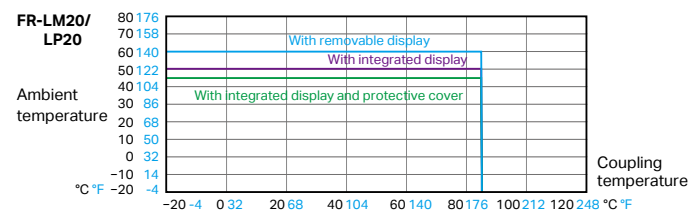
*1 Guaranteed value in water with the recommended installation. Static water can be measured up to the edge of the lens. An undetectable area on the short-range side is created due to the environment and measurement medium. The maximum measuring distance is also shortened.

*2 Measurement may not be possible depending on the shape and environment of the target.

*3: This is the guaranteed value from verification performed at KEYENCE inspection facilities. Measurement errors may occur depending on the customer's environment.

*4: This is the guaranteed value from verification performed at KEYENCE inspection facilities with a load resistance of 250 Ω. Measurement errors may occur depending on the customer's environment.

*5 Details of the operating temperature range of each model are shown below. The FR-LM20/LP20 can be used up to an ambient temperature setpoint of 10°C **50°F** by selecting "Off when not in Operation" under "Screen Brightness."



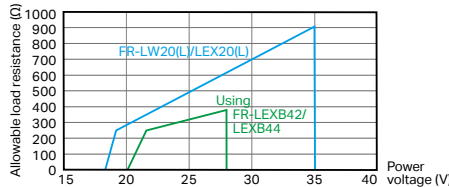
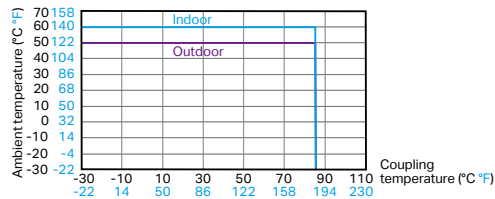
*6 When performing SIP with FR-LM20/LP20, be sure to turn off the power and perform at an ambient temperature of 40°C **104°F** or less and an internal temperature of 130°C **266°F** or less for up to one hour. In addition, always install the KEYENCE optional ferrule mounting bracket and internal gasket.

* The FR Series uses 60 GHz wireless. Always follow the rules, conventions, regulations, and laws of the country or region in which you use the device.

Specifications

Sensor Unit						
Model	2-wire standard model		2-wire explosion-proof model	2-wire explosion-proof model (when using an Isolated barrier)	2-wire explosion-proof model (when using a Zener barrier)	2-wire explosion-proof model (when using a Zener barrier with a flameproof enclosure)
	FR-LW20(L)		FR-LEX20(L)	FR-LEXB41	FR-LEXB42	FR-LEXB44
Measurement range ^{*1}	Up to 20 m 65.6' (Up to 15 m 49.2' for FR-LW20L, FR-LEX20L)					
Display range ^{*1}	Up to 25 m 82.0'					
Relative Permittivity ^{*2}	2 or more					
Resolution	1 mm 0.04"					
Accuracy ^{*3}	Up to 0.1 m 0.3' ; ±10 mm 0.39" ; 0.1 to 10 m 0.3' to 32.8' ; ±1 mm 0.04" ; 10 to 20 m 32.8' to 65.6' ; ±2 mm 0.08"					
Response time	1 s, 4 s (default value), 10 s, 25 s					
Tank pressure	-0.1 to +1 MPa (-0.1 to +0.1 MPa below -20°C -4°F)					
Materials	Tank interior	Lens: PTFE; Internal seal: FKM; Fastener: SUS304		Lens: PTFE; Internal seal: FFKM; Fastener: SUS304		
	Housing	PPS PC PA	PPS PC PA Internal potting agent: Epoxy resin	Barrier: PC	Barrier: PC	Explosion-proof enclosure: Aluminium die casting, NBR Cable glands: Nickel-plated brass, chloroprene
Connection diameter		G1-1/2 (40A)				
Outputs	No. of control outputs	1		—		
	Control output/ auxiliary output	Transistor output (NPN open collector) Common independent type 35 VDC or less, 50 mA max. Residual voltage of 4.0 V or less (50 mA or less) N.O./N.C. switching		—		
	Analog output	See separately for 4 to 20 mA maximum load resistance ^{*5} (Response time: 3 s after internal value is confirmed [90% response])				
Analog output precision ^{*4}	Resolution	1 mm 0.04"				
	Zeroing accuracy	±0.1 mA (zero point = 4 mA)				
	F.S. accuracy	±0.2 mA (full scale = 20 mA)				
Network compatibility		HART				
Environmental resistance	Operating ambient temperature	-30 to +60°C -22 to 140°F^{*5} (no freezing)	-30 to +60°C -22 to 140°F^{*5} (no freezing)	Barrier: -30 to +60°C -22 to 140°F (no freezing)		
	Temperature of coupling used	-30 to +85°C -22 to 185°F (no freezing)				
	Operating ambient humidity	Up to 85% RH (no condensation)				
	Vibration resistance	10 to 500 Hz; Power spectral density: 0.816 G ² X, Y and Z directions				
	Shock resistance	100 m/s ² (10 G), 16 ms pulses, 1000 times each in X, Y and Z directions				
Enclosure rating		IP67 (IEC60529), Enclosure Type 4X (NEMA250)	IP67 (IEC60529), Enclosure Type 4X (NEMA250)	Barrier: Not specified	Barrier: Not specified	Explosion-proof enclosure : IP67 (IEC60529) Enclosure Type 4X (NEMA250)
Protection circuit		Reverse power connection protection, power supply surge protection, output short-circuit protection, output surge protection	Reverse power connection protection, power supply surge protection	Reverse power connection protection, power supply surge protection		
Power voltage		18.3 to 35 VDC. See separately for allowable load resistance based on the power voltage ^{*6}	18.3 to 35 VDC. See separately for allowable load resistance based on the power voltage ^{*6}	24 VDC +25%/-10%	20.1 to 28 VDC ^{*6}	
Power consumption (including analog output; excluding load current)		752.5 mW or less	752.5 mW or less	3 W or less	602 mW or less	602 mW or less
Weight		Approx. 920 g 32.45 oz	Approx. 920 g 32.45 oz	Barrier: Approx. 320 g 11.28 oz	Barrier: Approx. 100 g 3.52 oz	Flameproof enclosure + barrier (without cable glands): Approx. 1300 g 45.85 oz

^{*1} Guaranteed value in water with the recommended installation. In still water, measurement is possible with water up to the edge of the lens. An undetectable area is present at short range due to the environment and measurement medium. The maximum measuring range is also reduced. ^{*2} Measurement may not be possible depending on the environment and shape of the target. ^{*3} Guaranteed value from verification performed at KEYENCE inspection facilities. Measurement errors may occur depending on the customer's environment. ^{*4} Guaranteed value from verification performed at KEYENCE inspection facilities with a load resistance of 250 Ω. Measurement errors may occur depending on the customer's environment. ^{*5} Details of the operating temperature range are shown below. ^{*6} The allowable load resistance based on the power voltage of each model is as below.



^{*7}The FR Series uses 60 GHz wireless. Always follow the rules, conventions, regulations and laws of the country or region in which the device is used.

Explosion-Proof Specifications

IECEX

Model	2-wire explosion-proof model	2-wire explosion-proof model (when using an isolated barrier)	2-wire explosion-proof model (when using a Zener barrier)	2-wire explosion-proof model (when using a Zener barrier with a flameproof enclosure)
	FR-LEX20(L)	FR-LEXB41	FR-LEXB42	FR-LEXB43*/LEXB44
Explosion-proof performance	Ex ia IIC T4 Ga or Ex ia IIB T4 Ga Ex ia IIIC T135°C Da	[Ex ia Ga] IIC or [Ex ia Ga] IIB [Ex ia Da] IIIC	[Ex ia Ga] IIB [Ex ia Da] IIIC	Ex db [ia Ga] IIB T4 Gb Ex tb [ia Da] IIIC T135°C Db
Zone	Zone 0/20	Do not install in a hazardous location (associated apparatus ^{*2})		Zone 1/21
Electrical ratings	Ui: 35 VDC Ii: 142.4 mA Pi: 1000 mW Li: 26.2 nH Ct: 79 nF	Um: 250 VRMS Uo: 26.78 VDC Io: 115.307 mA Po: 772 mW Lo (IIC): 0.2 mH Co (IIC): 0.092 μF Lo (IIB): 0.2 mH Co (IIB): 0.72 μF	Um: 250 VRMS Uo: 34.33 VDC Io: 112.007 mA Po: 961.3 mW Lo: 1.0 mH Co: 0.37 μF	Explosion-proof enclosure: -30°C -22°F ≤ Ta ≤ 60°C 140°F -30°C -22°F ≤ T ≤ 85°C 185°F

^{*1} FR-LEXB43 is Japan model. Contact your local KEYENCE representative for more details.

^{*2} Associated apparatus are devices that comprise both intrinsically safe and non-intrinsically safe circuits. The FR-LEX20(L) meets the requirements for intrinsically safe construction when used in conjunction with associated apparatus.

ATEX and UKEX

Model	2-wire explosion-proof model	2-wire explosion-proof model (when using an isolated barrier)	2-wire explosion-proof model (when using a Zener barrier)	2-wire explosion-proof model (when using a Zener barrier with a flameproof enclosure)
	FR-LEX20 (L)	FR-LEXB41	FR-LEXB42	FR-LEXB44
Explosion-proof performance	II 1 G Ex ia IIC T4 Ga or II 1 G Ex ia IIB T4 Ga II 1 D Ex ia IIIC T135°C Da	II (1) G [Ex ia Ga] IIC or II (1) G [Ex ia Ga] IIB II (1) D [Ex ia Da] IIIC	II (1) G [Ex ia Ga] IIB II (1) D [Ex ia Da] IIIC	II 2 (1) G Ex db [ia Ga] IIB T4 Gb II 2 (1) D Ex tb [ia Da] IIIC T135°C Db
Zone	Zone 0/20	Do not install in a hazardous location (associated apparatus ^{*2})		Zone 1/21
Electrical ratings	Ui: 35 VDC Ii: 142.4 mA Pi: 1000 mW Li: 26.2 nH Ct: 79 nF	Um: 250 VRMS Uo: 26.78 VDC Io: 115.307 mA Po: 772 mW Lo (IIC): 0.2 mH Co (IIC): 0.092 μF Lo (IIB): 0.2 mH Co (IIB): 0.72 μF	Um: 250 VRMS Uo: 34.33 VDC Io: 112.007 mA Po: 961.3 mW Lo: 1.0 mH Co: 0.37 μF	Explosion-proof enclosure: -30°C -22°F ≤ Ta ≤ 60°C 140°F -30°C -22°F ≤ T ≤ 85°C 185°F

Type Approval of Electrical Equipment for Use in Explosive Atmospheres

Model	2-wire explosion-proof model	2-wire explosion-proof model (when using an isolated barrier)	2-wire explosion-proof model (when using a Zener barrier)	2-wire explosion-proof model (when using a Zener barrier with a flameproof enclosure)
	FR-LEX20(L)	FR-LEXB41	FR-LEXB42	FR-LEXB43 ^{*1}
Explosion-proof performance	Ex ia IIC T4 Ga or Ex ia IIB T4 Ga Ex ia IIIC T135°C Da	[Ex ia Ga] IIC or [Ex ia Ga] IIB [Ex ia Da] IIIC	[Ex ia Ga] IIB [Ex ia Da] IIIC	Ex db [ia Ga] IIB T4 Gb Ex tb [ia Da] IIIC T135°C Db
Zone	Zone 0/20	Do not install in a hazardous location (associated apparatus ^{*2})		Zone 1/21
Electrical ratings	Ui: 35 VDC Ii: 142.4 mA Pi: 1000 mW Li: 26.2 nH Ci: 79 nF	Um: 250 VRMS Uo: 26.78 VDC Io: 115.307 mA Po: 772 mW Lo (IIC): 0.2 mH Co (IIC): 0.092 µF Lo (IIB): 0.2 mH Co (IIB): 0.72 µF	Um: 250 VRMS Uo: 34.33 VDC Io: 112.007 mA Po: 961.3 mW Lo: 1.0 mH Co: 0.37 µF	
Temperature	-30°C -22°F ≤ Ta ≤ 60°C 140°F -30°C -22°F ≤ Tp ≤ 85°C 185°F	—	—	Explosion-proof enclosure: -30°C -22°F ≤ Ta ≤ 60°C 140°F

NRTL/ACO

Model	2-wire explosion-proof model	2-wire explosion-proof model (when using an isolated barrier)	2-wire explosion-proof model (when using a Zener barrier)	2-wire explosion-proof model (when using a Zener barrier with a flameproof enclosure)
	FR-LEX20(L)	FR-LEXB41	FR-LEXB42	FR-LEXB44
Explosion-proof performance	Class I, Zone 0, AEx ia IIC T4 Ga/Zone 20, AEx ia IIIC T135°C Da/Class I, Division 1, Groups A, B, C, D, T4/Class II, Division 1, Groups E, F, G, T135°C/Class III, Division 1 or Class I, Zone 0, AEx ia IIB T4 Ga/Zone 20, AEx ia IIIC T135°C Da/Class I, Division 1, Groups C, D, T4/Class II, Division 1, Groups E, F, G, T135°C/Class III, Division 1	[AEx ia Ga] IIC or [AEx ia Ga] IIB/[AEx ia Da] IIIC Intrinsically safe circuit for Class I, Division 1, Groups A, B, C, D or Class I, Division 1, Groups C, D/Class II, Division 1, Groups E, F, G/Class III, Division 1	[AEx ia Ga] IIB/[AEx ia Da] IIIC Intrinsically safe circuit for Class I, Division 1, Groups C, D/Class II, Division 1, Groups E, F, G/Class III, Division 1	Class I, Zone 1, AEx db [ia Ga] IIB T4 Gb/Zone 21, AEx tb [ia Da] IIIC T135°C Db/Class I, Division 1, Groups C, D, T4/Class II, Division 1, Groups E, F, G, T135°C/Class III, Division 1
Zone/Division	Zone 0/20 Division 1	Do not install in a hazardous location (associated apparatus ^{*2})		Zone 1/21 Division 1
Electrical ratings	Ui: 35 VDC Ii: 142.4 mA Pi: 1000 mW Li: 26.2 nH Ci: 79 nF	Um: 250 VRMS Uo: 26.78 VDC Io: 115.307 mA Po: 772 mW Lo (IIC): 0.2 mH Co (IIC): 0.092 µF Lo (IIB): 0.2 mH Co (IIB): 0.72 µF	Um: 250 VRMS Uo: 34.33 VDC Io: 112.007 mA Po: 961.3 mW Lo: 1.0 mH Co: 0.37 µF	
Temperature	-30°C -22°F ≤ Ta ≤ 60°C 140°F -30°C -22°F ≤ Tp ≤ 85°C 185°F	—	—	Explosion-proof enclosure: -30°C -22°F ≤ Ta ≤ 60°C 140°F

*1 FR-LEXB43 is Japan model. Contact your local KEYENCE representative for more details. *2 Associated apparatus are devices that comprise both intrinsically safe and non-intrinsically safe circuits. The FR-LEX20(L) meets the requirements for intrinsically safe construction when used in conjunction with associated apparatus.

Amplifier unit

Model		Short Separated Amplifier Unit			
		FR-SA1	FR-SA2	FR-SA1C	FR-SA0
Cable/connector		Cable	Cable	M8 connector	Zero line
Main Unit/Expansion Unit		Main Unit	Expansion Unit	Main Unit	Expansion unit
Response time		0.4 s, 1.5 s, 4 s (default value), 10 s			
Output	No. of control outputs	Maximum 5		Maximum 2	0
	Control output/auxiliary output	NPN/PNP open collector (switchable) up to 30 VDC or less, max 50 mA for each Total 750 mA or less for the entire amplifier when adding five or more expansion units Residual voltage 1.4 V or less (50 mA or less) N.O./N.C. switchable IO5 is switchable to external input		NPN/PNP open collector (switchable) Up to 30 VDC or less, max 50 mA for each Residual voltage of 1.4 V or less (50 mA or less) N.O./N.C. Switching type IO1 is switchable to IO-Link IO2 is switchable to analog output/external input	—
	Analog output	0–20 mA/4–20 mA Maximum load resistance 260 Ω (Response time: 0.2 s (90% response) after control output is confirmed)	—	0–20 mA/4–20 mA Maximum load resistance 260 Ω (Response time: 0.2 s (90% response) after control output is confirmed)	—
External input		Short circuit current: 1.5 mA or less Input time: 500 ms or more			
External communication		—	NU Series compatibility	IO-Link v1.1/COM2	NU Series compatibility
Analog output Precision ^{*1}	Resolution	1 mm 0.04"	—	1 mm 0.04"	—
	Zero accuracy	±0.1 mA (zero point = 4 mA)	—	±0.1 mA (zero point = 4 mA)	—
	Full-scale accuracy	±0.2 mA (full-scale = 20 mA)	—	±0.2 mA (full-scale = 20 mA)	—
Expansion		Connected to FR-SA1 (with FR-S01 connected): up to 8 units (9 units total including main unit) ^{*2} Connected to FR-SA1 (with FR-SH01(C) connected): up to 12 units (13 units total including main unit) ^{*2} FR-SA2 is connected to NU series: up to 16 units ^{*5}			With NU series connected: up to 16 units ^{*7} (17 units total including main unit)
Protection circuit		Protection against reverse power connection, power supply surges, output overcurrent protection, and output surges			
Power voltage		24 VDC +25%/-20% ^{*3,4} including ripple, Class2 or LPS			
Power Consumption (Excluding Load Current)		When FR-S01 is connected: up to 1940 mW or less (72 mA or less at 24 V) When FR-SH01(C) is connected: up to 1560 mW or less (56 mA or less at 24 V)	When FR-S01 is connected: up to 1690 mW or less (60 mA or less at 24 V) When FR-SH01(C) is connected: up to 1310 mW or less (48 mA or less at 24 V)	1880 mW or less (63 mA or less at 24 V)	1620 mW max. (53 mA max. at 24 V)
Environmental resistance	Operating ambient temperature	-20°C to +55°C -4°F to +131°F (no freezing) ^{*5}			
	Operating ambient humidity	Up to 85% RH (no condensation)			
Material		PC			
Weight		Approx. 100 g 3.53 oz	Approx. 90 g 3.17 oz	Approx. 20 g 0.71 oz	Approx. 20 g 0.71 oz

*1 With a load resistance of 250 Ω, this value is guaranteed by KEYENCE inspection facilities. Errors may occur due to your environment.

*2 You can increase the number of expansion units possible in the system by lowering the total analog output current below 750 mA. For details, contact your nearest KEYENCE office.

*3 When expanding the system by one or more FR-SA2 units with the FR-S01 connected or by eight or more FR-SA2 units with the FR-SH01 connected, use a power voltage of 21.6 V or higher.

*4 When expanding the system by four or more FR-SA0 units with the FR-S01 connected or by ten or more FR-SA0 units with the FR-SH01 connected, use a power voltage of 21.6 V or higher.

*5 When expanding the system by 1 expansion unit, ensure the ambient temperature is 50°C 122°F or less. When expanding the system by 2 or more expansion units, ensure the ambient temperature is 45°C 113°F or less.

*6 When expanding the system by six or more units with the FR-S01 connected or by eight or more units with the FR-SH01 connected, contact your nearest KEYENCE office.

*7 When expanding the system by 13 or more units with the FR-SH01 connected, contact your nearest KEYENCE office.

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 GJ/h MW
	Display resolution	Instantaneous value (MJ/h): 0.01/0.1/1/1 (default value 0.1); Integrated value (MJ): 0.01/0.1/1/1 (default value 0.1)
	Pulse output units (MJ)	0.02 to 999.99
Data accumulation	Accumulation period	Approx. 1 year
	Data reading	USB2.0
Power supply I/O connector	M12 8-pin connector (male)	
Input/output (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} Usable 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 v1.1/COM2 (38.4kbps). Setting files can be downloaded from the KEYENCE website (www.keyence.com).

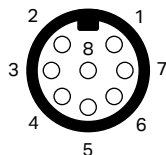
IO-Link is a trademark or registered trademark of PROFIBUS Nutzerorganisation e.V. (PNO).

^{*4} When a USB connection is in use, IP65/67 compliance is impaired.

Pin layout/Cable wire color

Short range standard model,
long range standard model/liquid chemical model/sanitary model

Connector pin layout for power cable



Pin No.	Wire color	Description
1	White	Analog output
2	Brown	24 VDC power supply
3	Green	Control output 3
4	Yellow	Control output 4
5	Grey	Control output 1
6	Pink	Control output 2 ^{*1}
7	Blue	0 V
8	Red	Control output 5/ External Input ^{*2}

^{*1} IO-Link compatible wire when connected to IO-Link devices

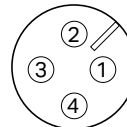
^{*2} Short range only

Short range
amplifier unit

Cable type (FR-SA1/SA2)

Wiring colors	Description
White [*]	Analog output
Brown [*]	24 VDC power supply
Green	Control output 3
Yellow	Control output 4
Grey	Control output 1
Pink	Control output 2
Blue [*]	0 V
Red	Control output 5/ External Input

^{*} FR-SA1 only

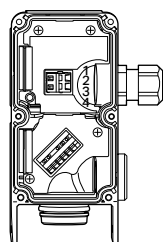
M8 Connector
Type
(FR-SA1C)

Pin No.	Wire color	Description
1	Brown	24 VDC power supply
2	White	Control output 2/ external input/ analog output
3	Blue	0 V
4	Black	Control output 1 [*]

^{*} IO-Link compatible wire when connected to IO-Link devices

Long-range 2-wire standard model/2-wire explosion-proof model

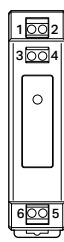
Sensor Unit



Terminal number	Function
1	4–20 mA (+)
2	4–20 mA (–)
3*	OUT (+)
4*	OUT (–)

^{*2}-wire standard model only

Isolated Barrier



Terminal number	Function
1	POWER (+)
2	POWER (–)
3	4–20 mA (+)
4	4–20 mA (–)

Terminal number	Function
5	SENSOR (–)
6	SENSOR (+)

Zener Barrier



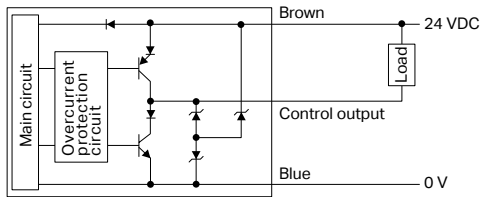
Terminal number	Function
1	4–20 mA (+)
2	4–20 mA (–)

Terminal number	Function
3	SENSOR (+)
4	SENSOR (–)

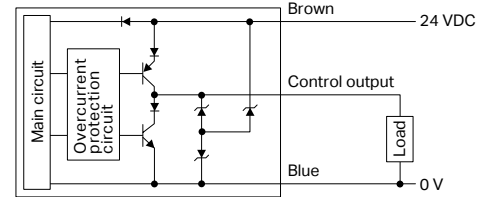
Short-range standard model/Compact liquid chemical model/Long-range standard model/Liquid chemical model/Sanitary model

Control output

When NPN is selected

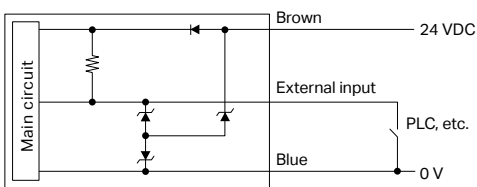


When PNP is selected

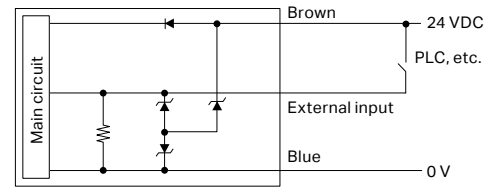


External input

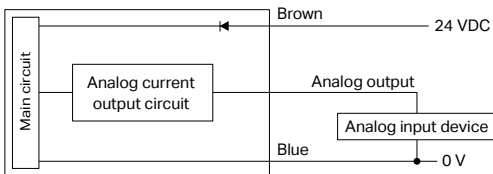
When NPN is selected



When PNP is selected

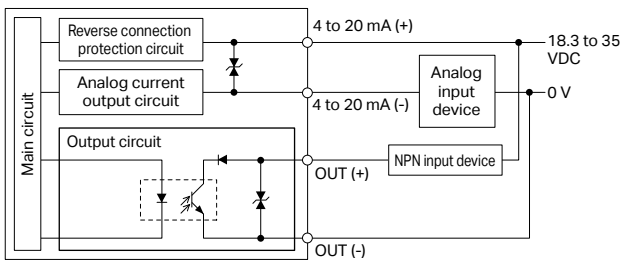


Analog output

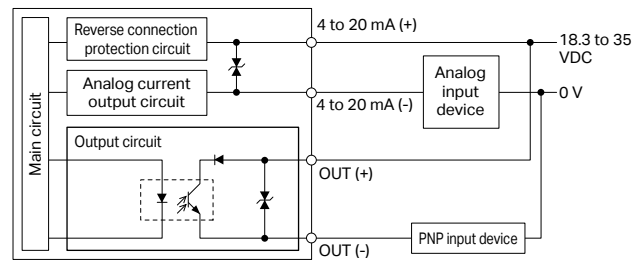


Long-range 2-wire standard model

With NPN input device connected

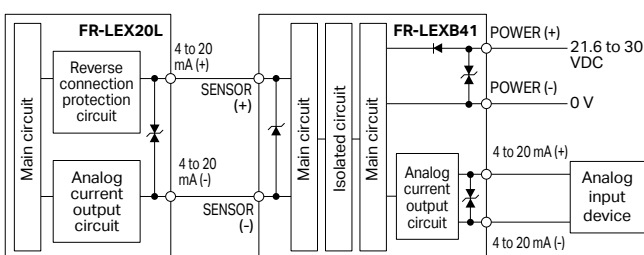


With PNP input device connected

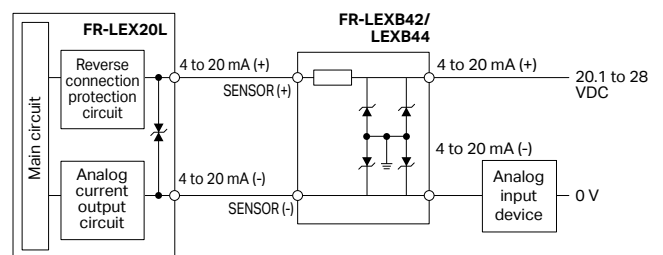


Long-range 2-wire explosion-proof model

When using FR-LEXB41

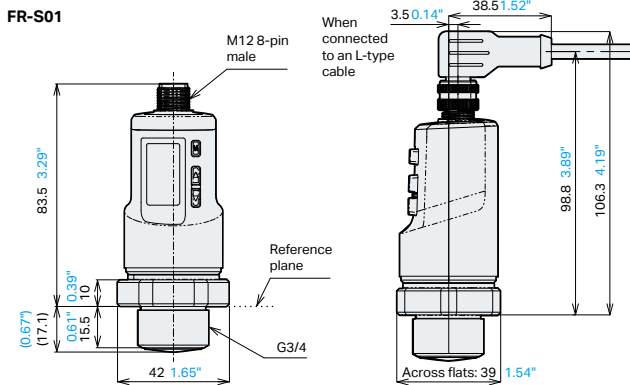


When using FR-LEXB42/LEXB44

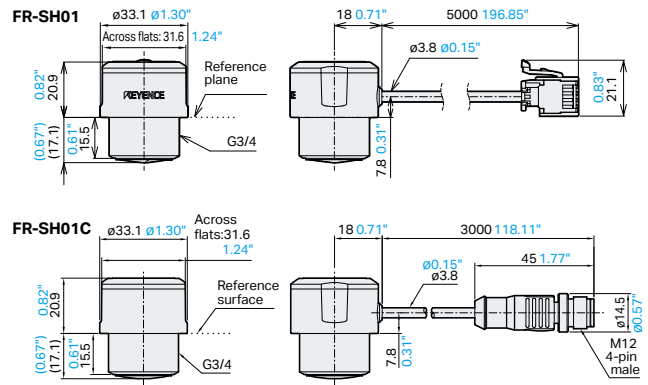


Short range

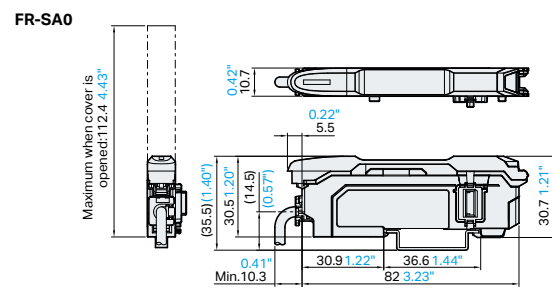
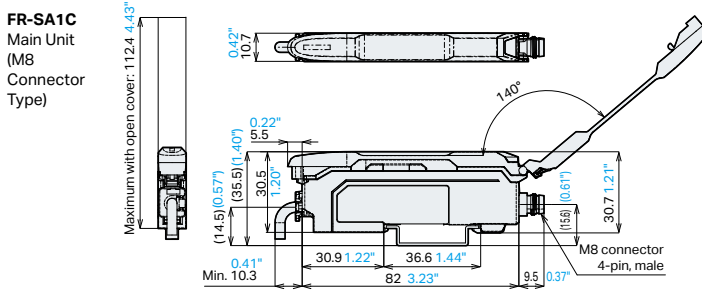
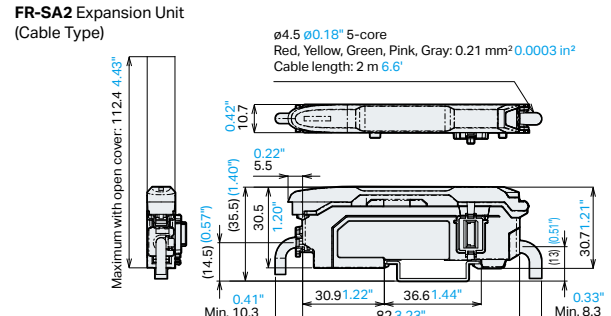
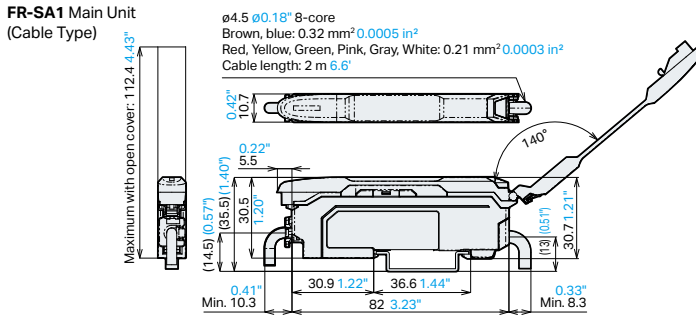
Short range sensor main unit with integrated display **Standard**



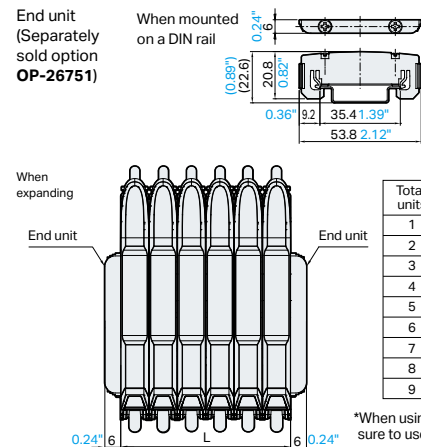
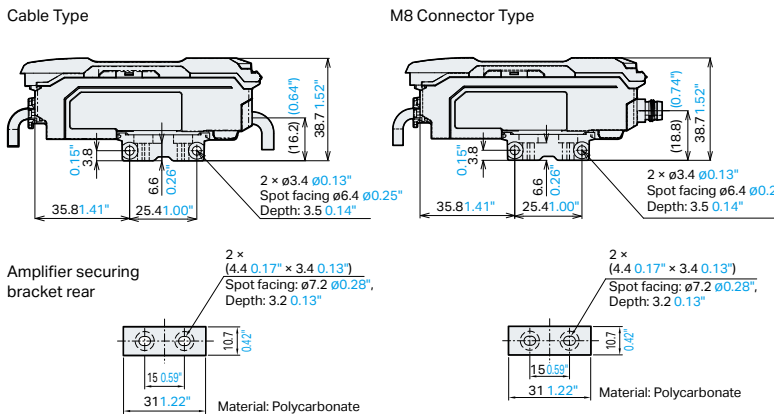
Short range sensor head with separate display **Compact liquid chemical**



Short range amplifier unit with separate display **Standard** **Compact liquid chemical**

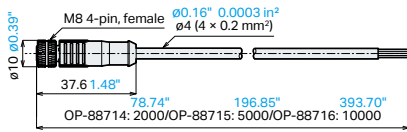


With removable display amplifier securing bracket mounted (when using separately sold option OP-88245) **Standard** **Compact liquid chemical**



Power supply cable for removable display amplifier **Standard** **Compact liquid chemical**

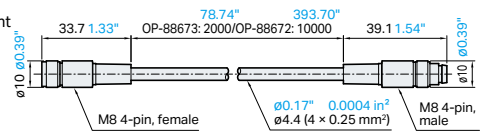
M8-4-pin cable
straight loose wire
**OP-88714/
88715/
88716**



Connector
pin layout

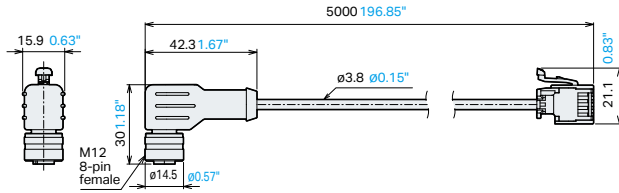
No.	Colour
①	Brown
②	White
③	Blue
④	Black

M8-4-pin cable
straight to straight
**OP-88673/
88672**

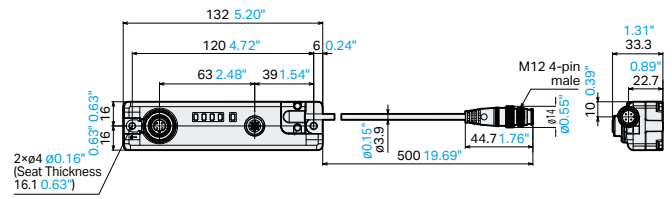


Short range cable for removable display (head to amplifier) **Standard**

FR-SS5

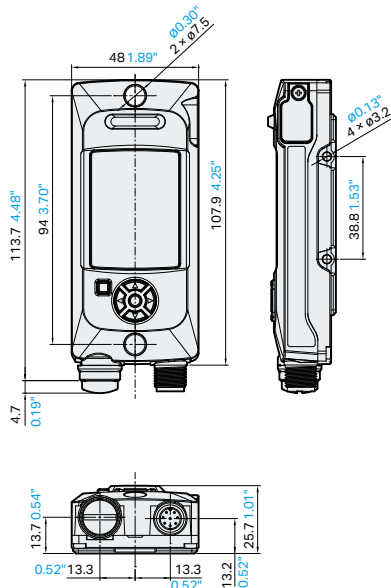


Ethernet Module

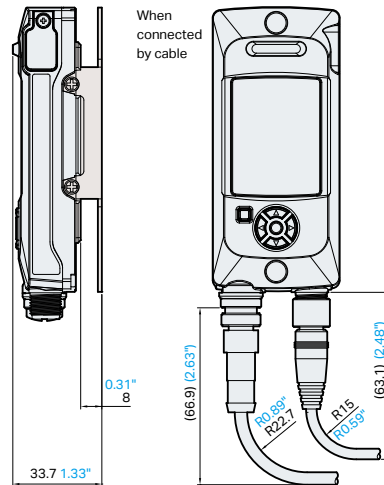


Display unit

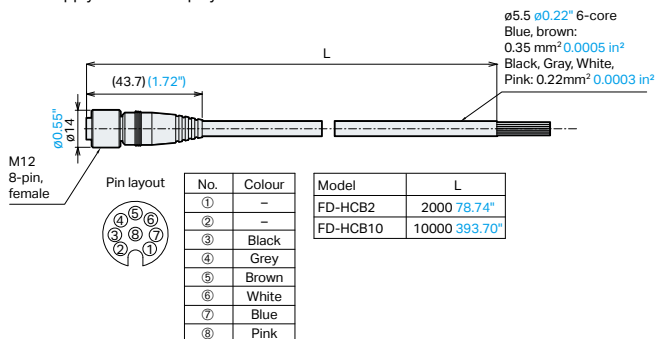
FI-1000



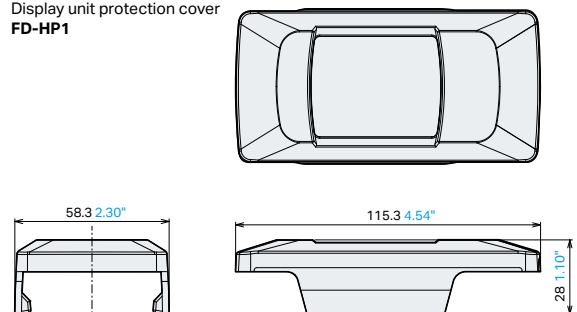
**FI-1000+
FD-HB1**



Power supply cable for display unit **FD-HCB2/HCB10**



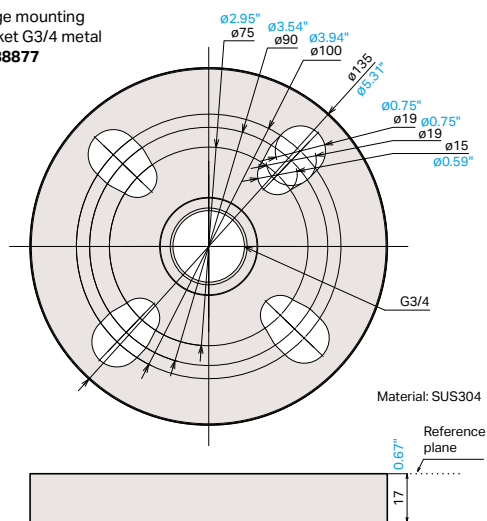
Display unit protection cover
FD-HP1



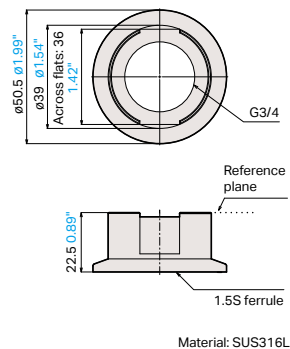
Short range

Short-range mounting brackets **Standard** **Compact liquid chemical**

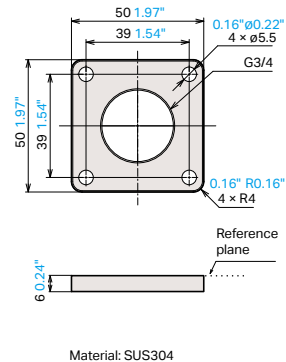
Flange mounting bracket G3/4 metal
OP-88877



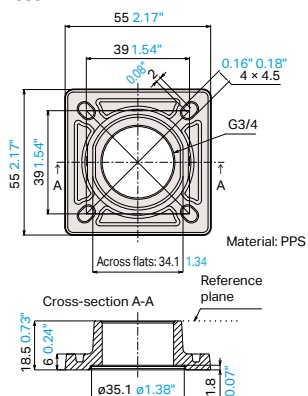
1.5S ferrule mounting bracket
OP-88878



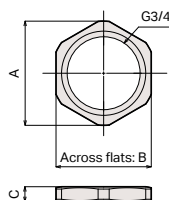
General-purpose mounting bracket G3/4 Metal
OP-88872



General-purpose mounting bracket G3/4 Plastic
OP-88874

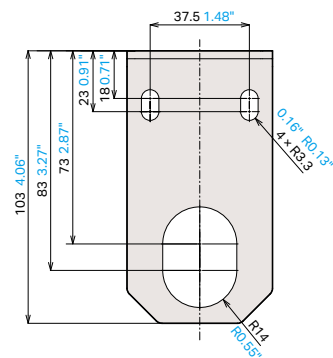


Nut G3/4 metal **OP-87642**
Nut G3/4 plastic **OP-88876**

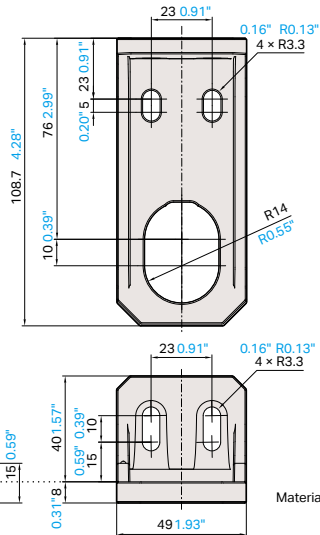


Model	OP-87642	OP-88876
A	35 1.38"	36 1.42"
B	32 1.26"	33 1.30"
C	5 0.20"	7 0.28"
Material	SUS303	PPS

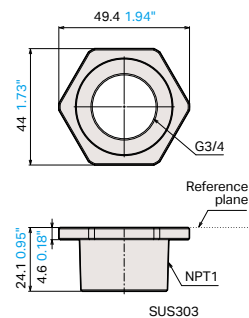
Side mounting bracket G3/4 metal
OP-88873

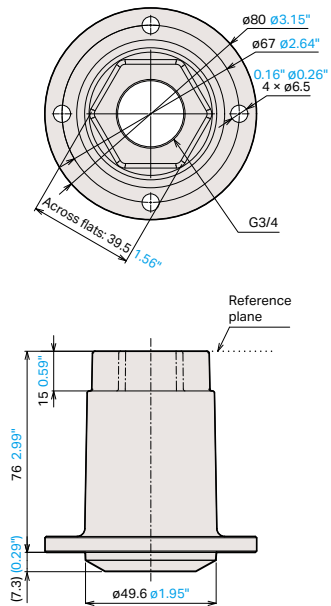


Side mounting bracket G3/4 plastic
OP-88875

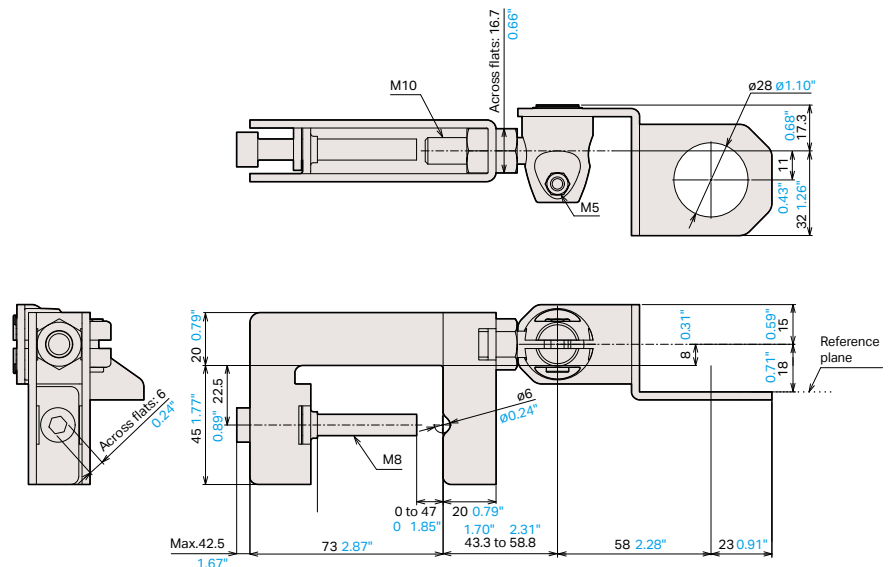


NPT mounting bracket
OP-88879

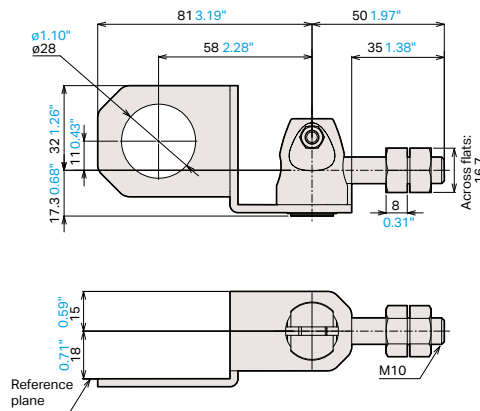


Offset mounting bracket **FR-SB31A**

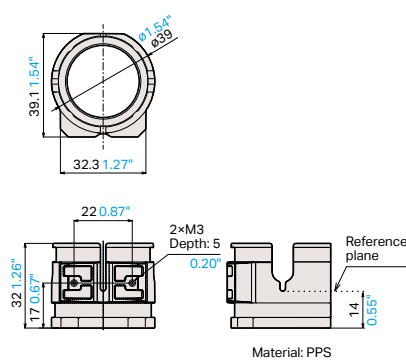
Material: Aluminium die-casting

Clamp mounting bracket **FR-SB32**

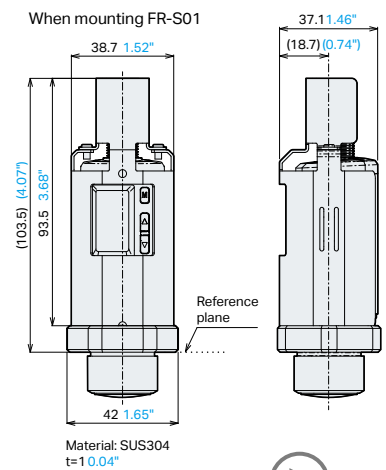
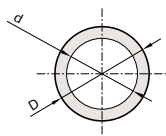
Material: SUS304 (t=3 0.12"), zinc die-cast nickel plating and iron nickel plating

Adjustable mounting bracket **FR-SB33**

Material: SUS304 (t=3 0.12"), zinc die-cast nickel plating and iron nickel plating

Space-saving mounting bracket **FR-SB34**

Material: PPS

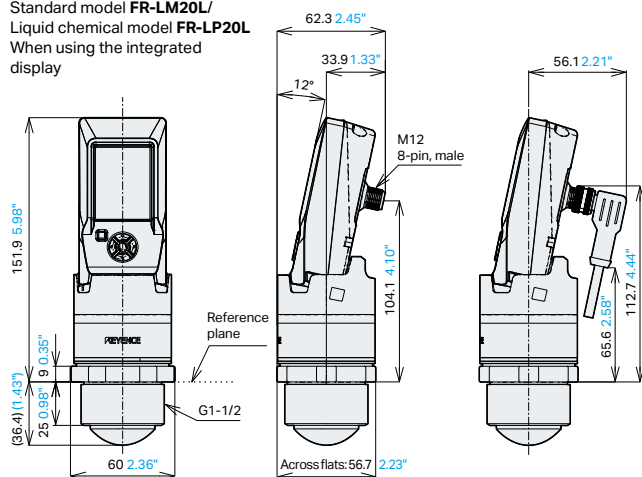
Protective cover **Standard**Protective cover for short range sensor main unit with integrated display
FR-SP1Material: SUS304
t=1 0.04"Gasket **Standard** Compact liquid chemicalGasket G3/4
Inorganic fiber + oil-resistant rubber: **OP-87548**
FKM: **OP-87562**

Model	D	d	t
OP-87548	$\phi 36$ $\phi 1.42$	$\phi 26.8$ $\phi 1.06$	t = 1.5 0.06"
OP-87562	$\phi 35.6$ $\phi 1.40$	$\phi 26.8$ $\phi 1.06$	t = 2 0.08"

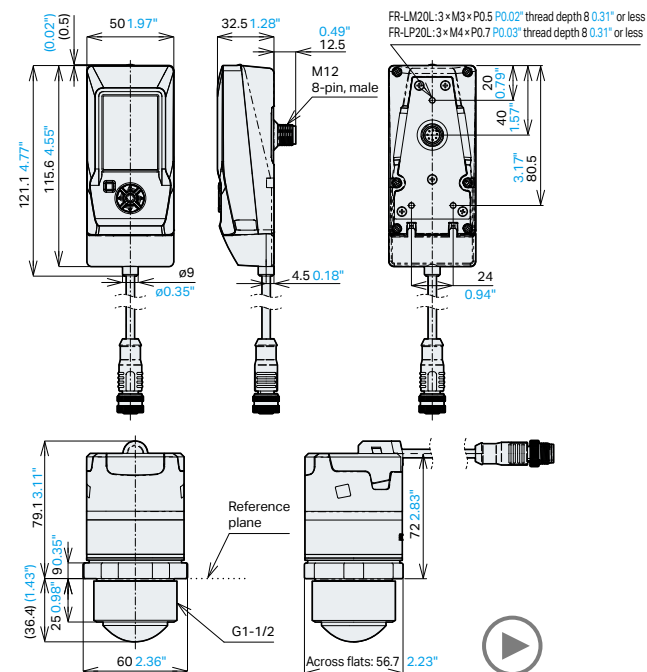
Long range

Long range Sensor main unit **Standard** **Liquid chemicals**

Standard model **FR-LM20L**/
Liquid chemical model **FR-LP20L**
When using the integrated display

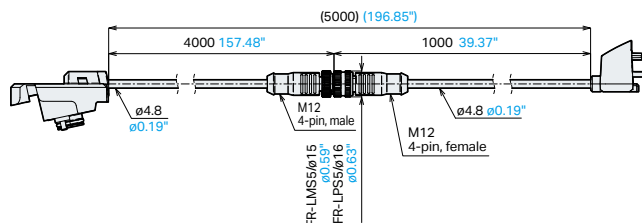


Using removable display
with cable attached



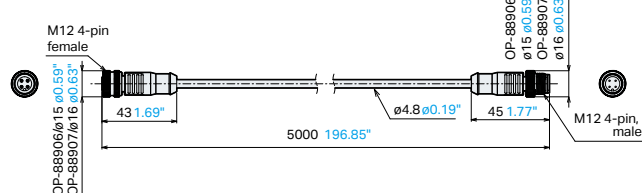
Long range Display isolated cable (head to amplifier) **Standard** **Liquid chemicals**

Metal type **FR-LMS5**/Plastic type **FR-LPS5**



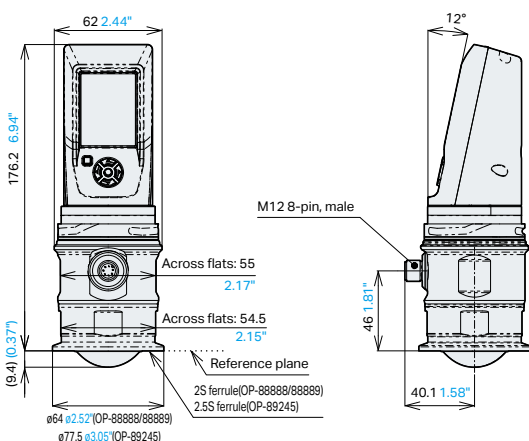
Long range Display isolated extension cable **Standard** **Liquid chemicals**

Metal type **OP-88906**/Plastic type **OP-88907**

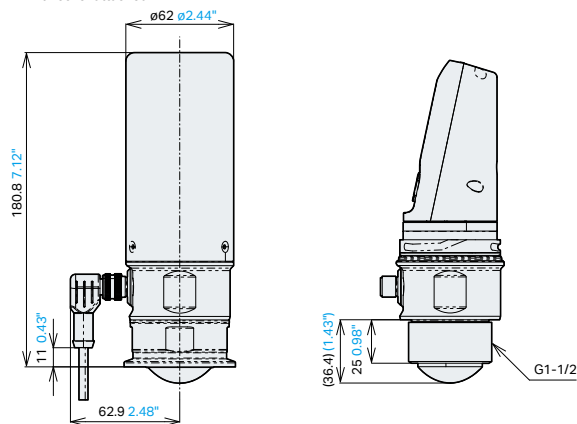


Long range Sensor main unit Sanitary model **Sanitary**

FR-LS20L With OP-88888/88889/89245 attached



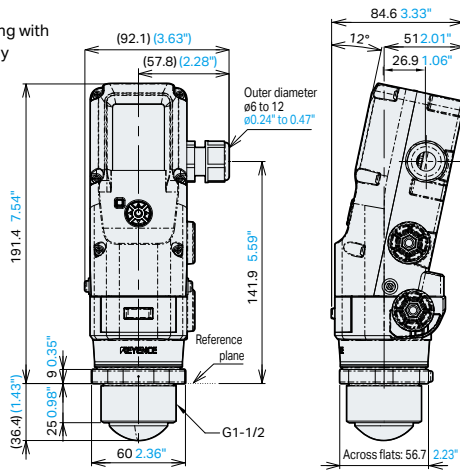
With cover attached



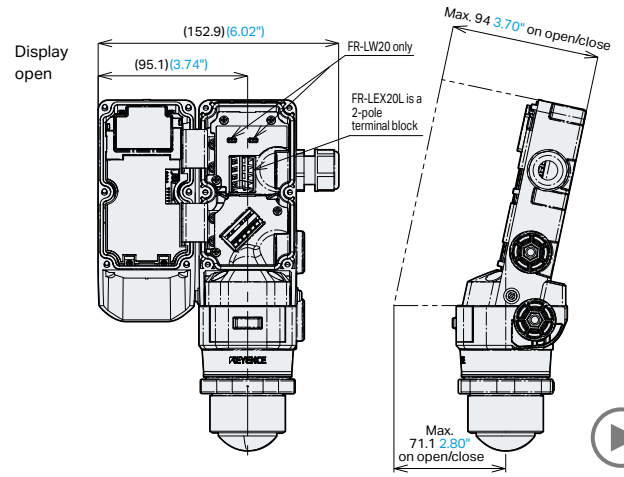
Long-range sensor main unit 2-wire type **2-wire standard model** **2-wire explosion-proof model**

2-wire standard model **FR-LW20L** / 2-wire explosion-proof model **FR-LEX20L**

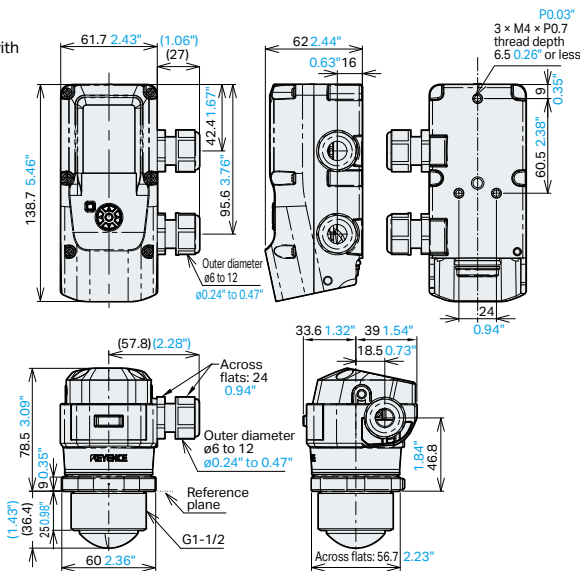
When using with
the display
attached



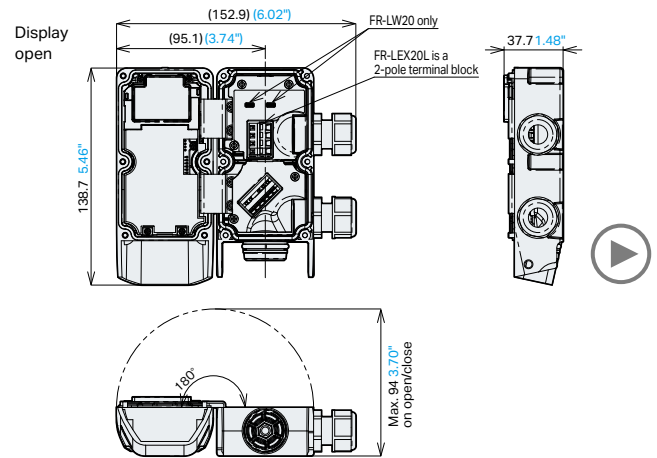
Display
open



When using with
the display
detached

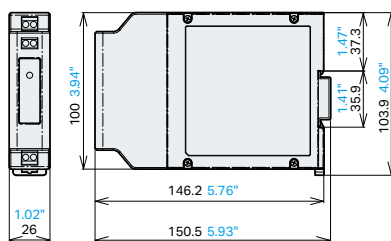


Display
open

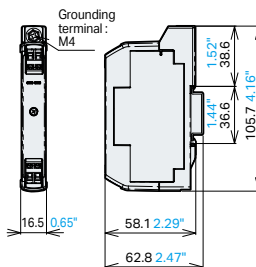


Long-range 2-wire explosion-proof model **2-wire explosion-proof model**

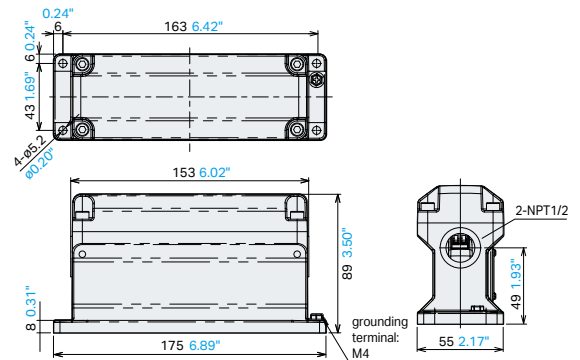
Isolated barrier **FR-LEXB41**



Zener Barrier **FR-LEXB42**

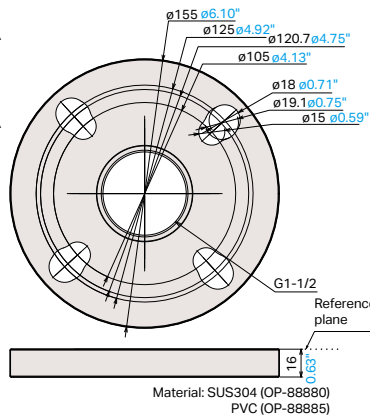


Flameproof Enclosure-Equipped Zener Barrier **FR-LEXB44**



Flange mounting
bracket JIS5K/10K 50A
equivalent, metal
OP-88880

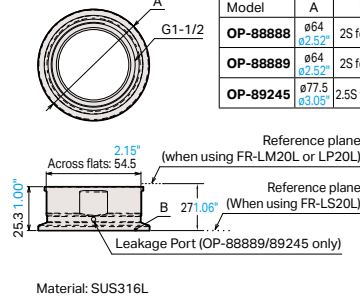
Flange mounting
bracket JIS5K/10K 50A
equivalent, plastic
OP-88885



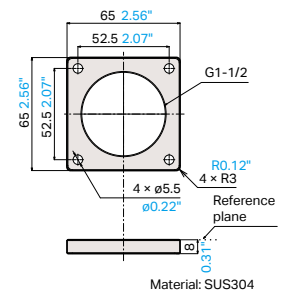
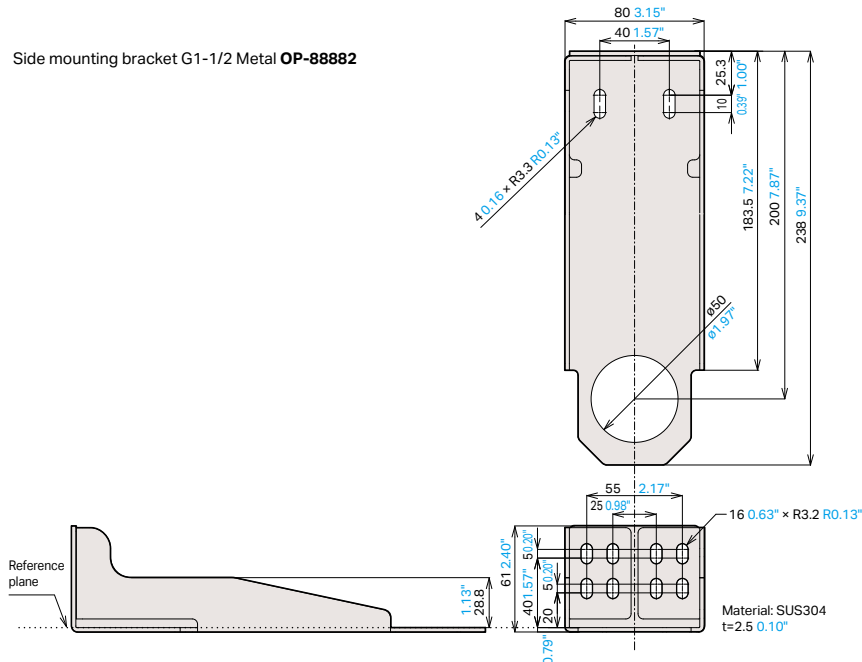
Standard	Liquid chemicals	Sanitary
2-wire standard model	2-wire explosion-proof model	

OP-88888/88889/89245

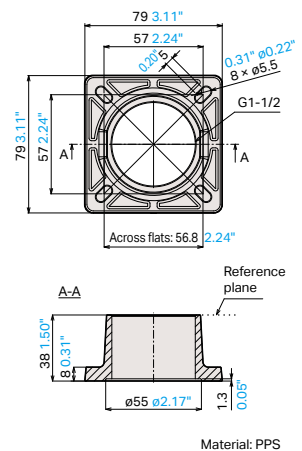
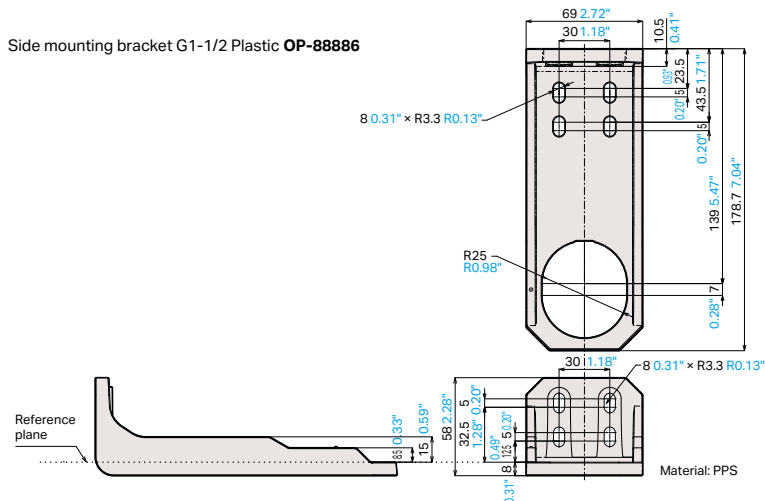
Model	A	B
OP-88888	ø64 ø2.52 ⁱⁿ	2S ferrule
OP-88889	ø64 ø2.52 ⁱⁿ	2S ferrule
OP-89245	ø77.5 ø3.05 ⁱⁿ	2.5S ferrule



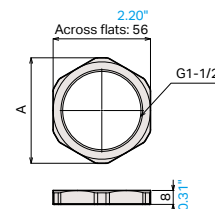
General-purpose mounting
bracket G1-1/2 Metal
OP-88881

Side mounting bracket G1-1/2 Metal **OP-88882**

General-purpose mounting
bracket G1-1/2 Plastic
OP-88919

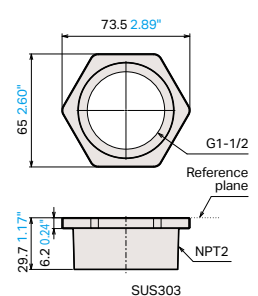
Side mounting bracket G1-1/2 Plastic **OP-88886**

Nut G1-1/2 Metal **OP-88883**
Nut G1-1/2 Plastic **OP-88887**



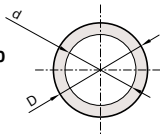
Model	OP-88883	OP-88887
A	60.7 2.390"	60.6 2.386"
Material	SUS304	PPS

NPT mounting bracket
OP-88884



Gasket **Standard** **Liquid chemicals** **2-wire standard model** **2-wire explosion-proof model**

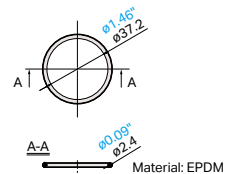
Gasket G1-1/2
Inorganic fiber +
oil-resistant rubber: **OP-88890**
FKM: **OP-88891**
FFKM: **OP-88892**



Model	D	d	t
OP-88890	ø54.5 ø2.15"	ø48.3 ø1.90"	t = 1.5 0.06"
OP-88891	ø54.1 ø2.13"	ø48.3 ø1.90"	t = 1.5 0.06"
OP-88892	ø54.1 ø2.13"	ø48.3 ø1.90"	t = 1.5 0.06"

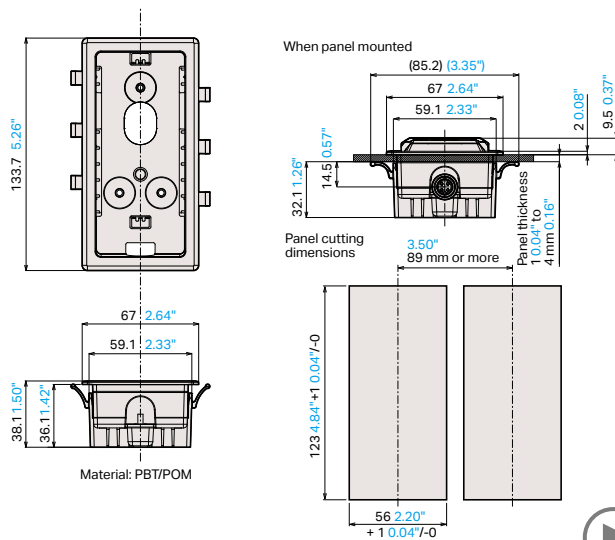
Gasket **Standard** **Liquid chemicals** **Sanitary** **2-wire standard model** **2-wire explosion-proof model**

Long-range sanitary gasket
OP-88920



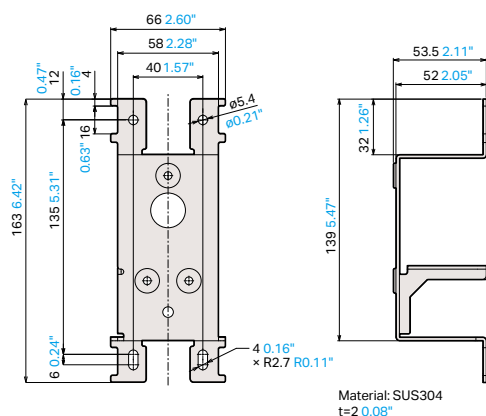
Display unit mounting bracket when using separate long-range display

Display unit panel mounting bracket **FR-LB1** **Standard** **Liquid chemicals**



Display unit rear mounting bracket **FR-LB2**

Standard **Liquid chemicals** **2-wire standard model** **2-wire explosion-proof model**

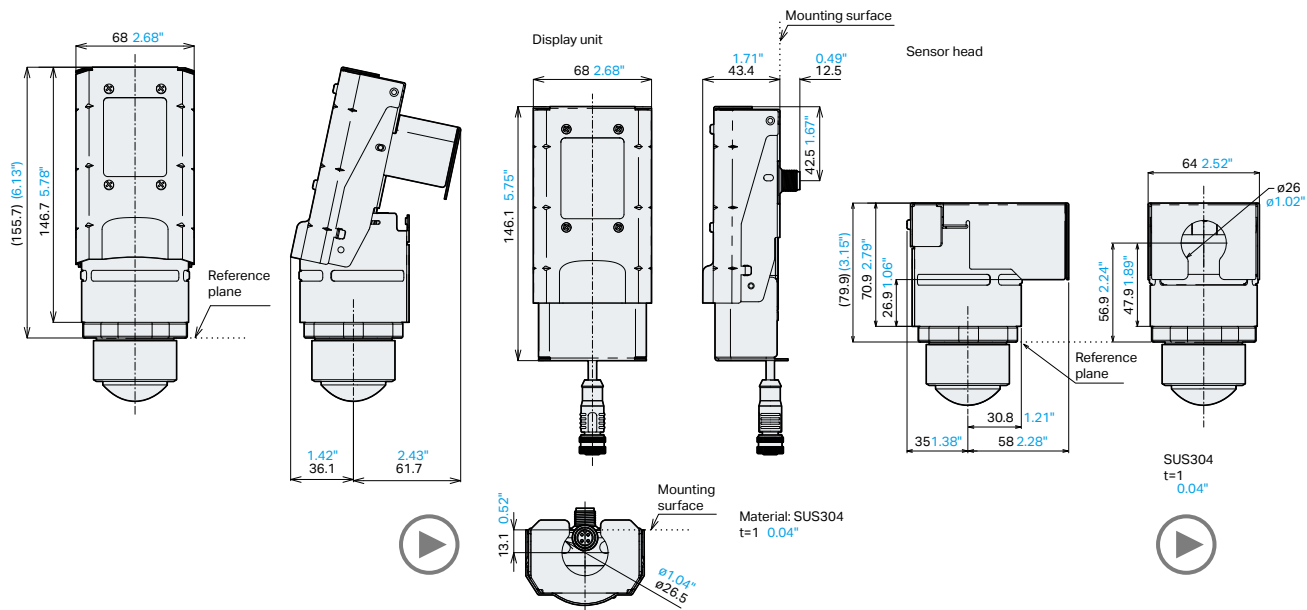


Long-range protection cover **Standard** **Liquid chemicals**

Protection cover **FR-LMP1**

With protective cover attached when using integral display unit

With protective cover attached when using separate display

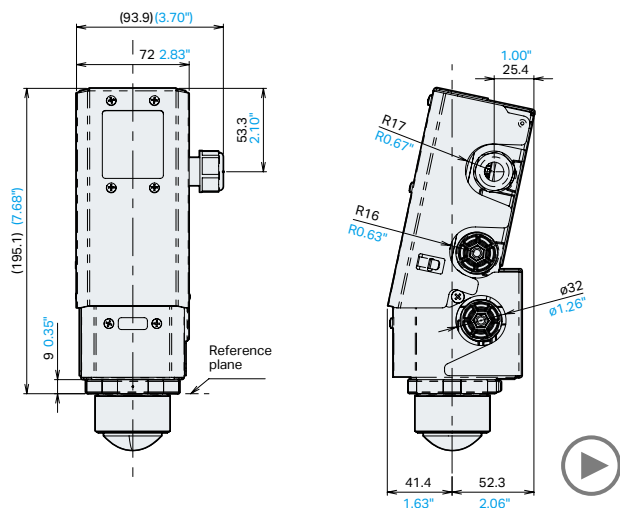


Long range

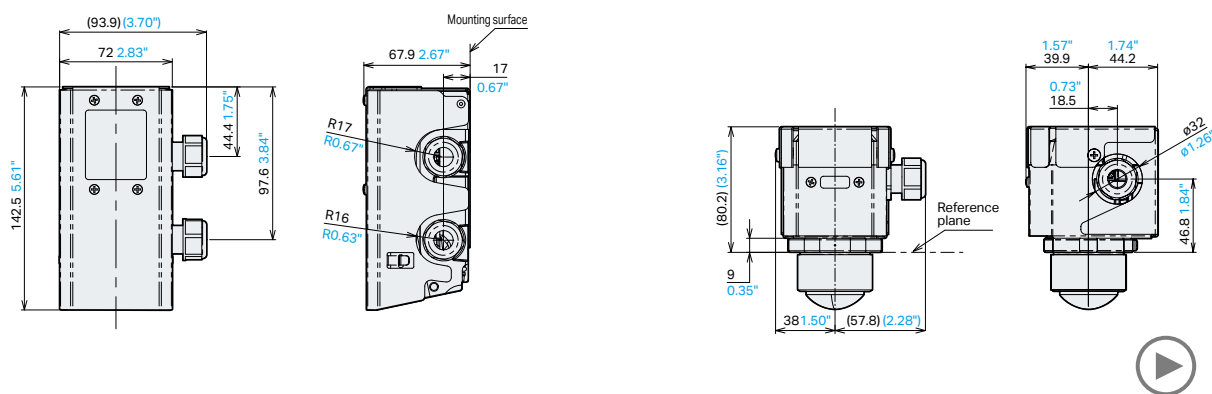
Long-range protection cover **2-wire standard model** **2-wire explosion-proof model**

Protection cover **FR-LEXP1**

With protective cover installed when using with display attached



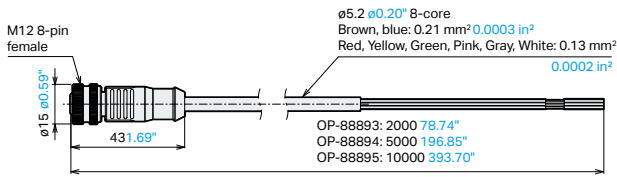
With protective cover installed when using with display detached



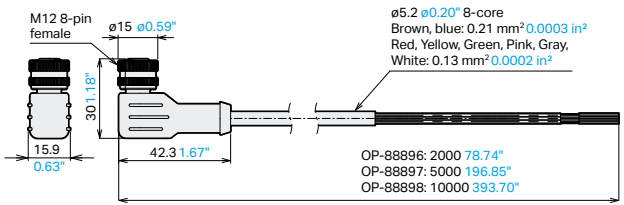
Short range/long range

Power supply cable (standard) **Standard** **Liquid chemicals** **Sanitary**

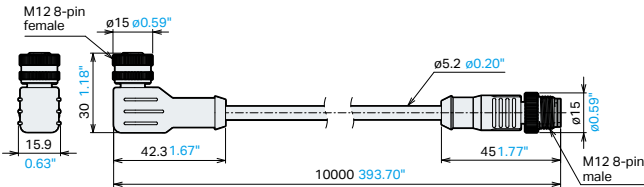
M12-8pin standard loose wire cable Straight **OP-88893/88894/88895**



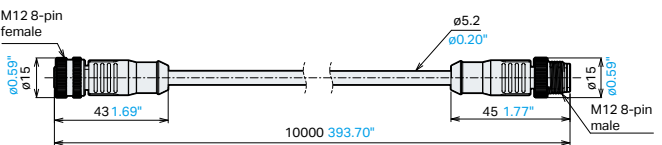
M12-8pin standard loose wire cable L-Shape **OP-88896/88897/88898**



M12-8pin extension cable L-Shape - Straight **OP-88903**

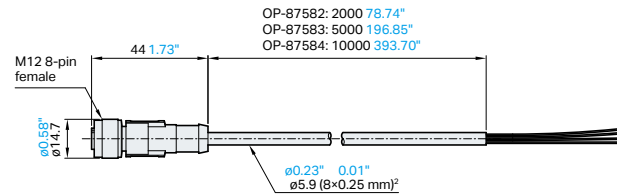


M12-8pin extension cable Straight to Straight **OP-88904**

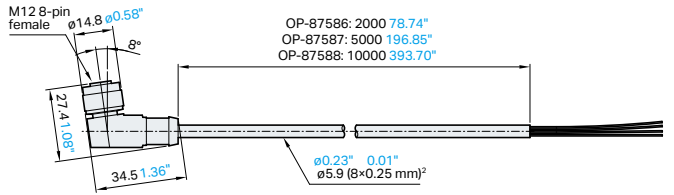


Power supply cable (oil resistant) **Standard** **Liquid chemicals** **Sanitary**

M12-8pin Oil-resistant loose wire cable Straight **OP-87582/87583/87584**

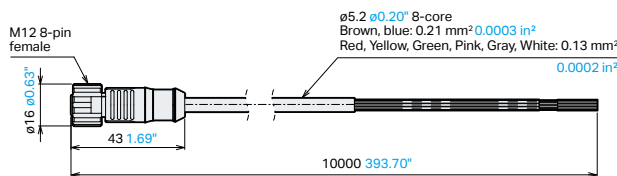


M12-8pin Oil-resistant loose wire cable L-Shape **OP-87586/87587/87588**

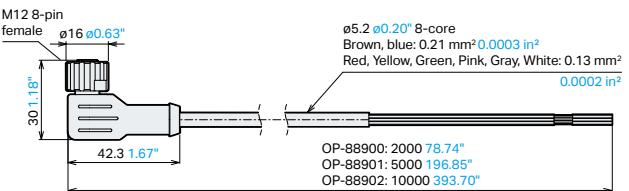


Power supply cable (chemical resistant) **Standard** **Liquid chemicals** **Sanitary**

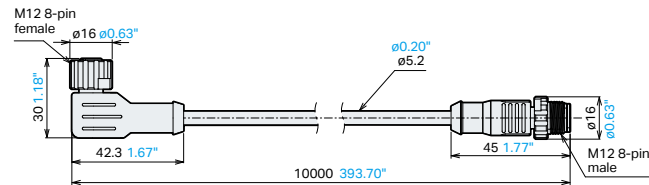
M12-8pin Chemical-resistant loose wire cable Straight **OP-88899**



M12-8pin Chemical-resistant loose wire cable L-Shape **OP-88900/88901/88902**



M12-8pin extension cable L-Shape - Straight **OP-88905**



Pin layout for
M12 8-pin
female connector



Pin No.	Colour
1	White
2	Brown
3	Green
4	Yellow
5	Grey
6	Pink
7	Blue
8	Red

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