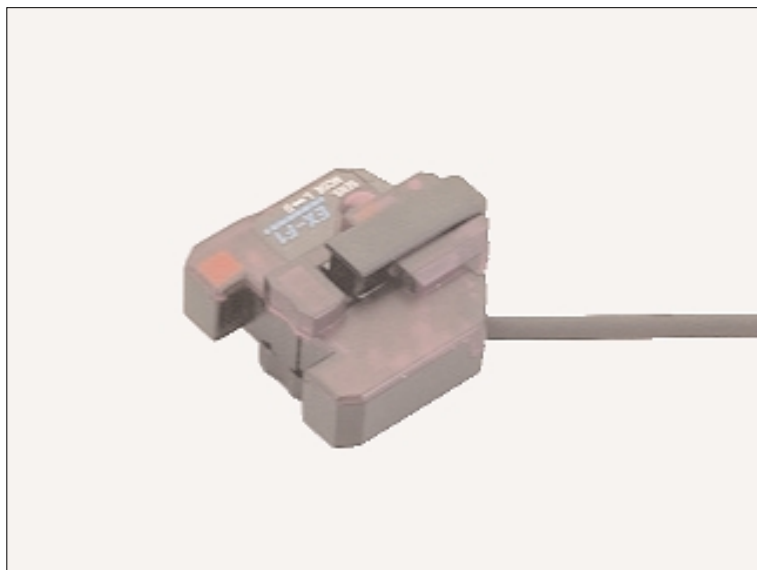


# EX-F1 SERIES

Pipe-mountable Liquid Level Detection Sensor **Amplifier Built-in**



Reliable liquid level detection with amplifier built-in low-priced sensor



### Space-saving amplifier built-in type

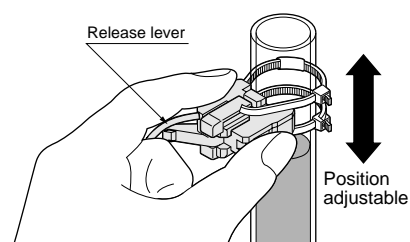
EX-F1 amplifier built-in sensor saves space as there is no need to install a separate amplifier.

### Low price

EX-F1 is very cost-effective.

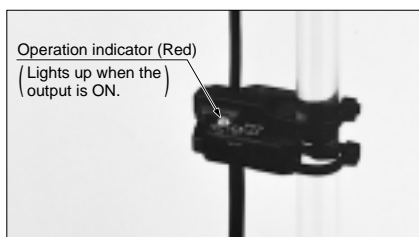
### Easily mountable and adjustable

Just attach it on a pipe with the tying bands. The position can be easily changed with the release lever even after mounting, so that there is no need to cut the tying bands.



### Easy to check operation Indicator

The operation can be checked at a glance from different directions.

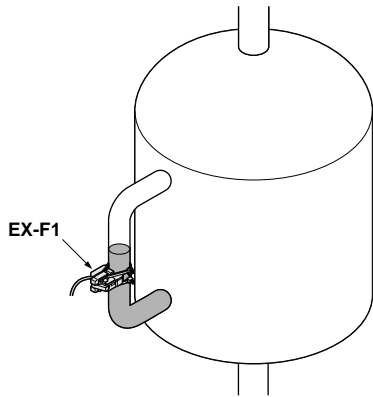


### Operation mode switch

Either Light-ON or Dark-ON can be selected by a switch. This is useful to check the operation during installation because it forces the output to be turned ON or OFF even without the liquid being inside the pipe.

## APPLICATIONS

### Detecting liquid level in a tank

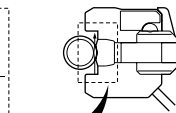
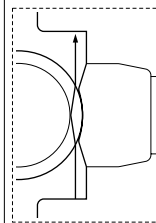


### Principle of Detection

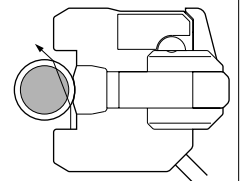
When the pipe is empty, the beam is reflected from the inner surface of the pipe wall and returns to the beam-receiving part, since the difference in the refractive indexes of the pipe and air is large.

When there is liquid in the pipe, the beam enters the liquid through the wall and does not return to the beam-receiving part, since the difference in the refractive indexes of the pipe and the liquid is small.

<Empty pipe>



<Filled pipe>



The beam reflected from the inner surface of the pipe wall returns to the beam-receiving part.

The beam passes through the wall into the liquid.

## ORDER GUIDE

Type	Appearance	Sensing object	Applicable pipe diameter	Model No.
Amplifier Built-in Pipe-mountable 5 m / 16.404 ft cable length type		Liquid (Note 1)	Outer dia. $\phi 6$ to $\phi 13$ mm $\phi 0.236$ to $\phi 0.512$ in PFA (Fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in (Note 2)	EX-F1
				EX-F1-C5

Notes: 1) Unclear or highly viscous liquid may not be detected stably.  
 2) Do not use the sensor with pipes other than the above specified.

# EX-F1

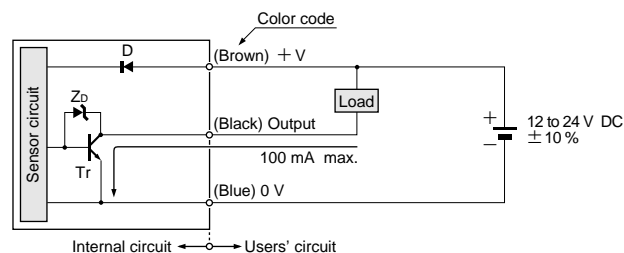
## SPECIFICATIONS

Type	Amplifier built-in • Pipe-mountable	
Item	Model No.	<b>EX-F1</b>
Sensing object	Liquid (Note 1)	
Applicable pipe diameter	Outer dia. $\phi 6$ to $\phi 13$ mm $\phi 0.236$ to $\phi 0.512$ in transparent pipe [PFA (Fluorine resin) or equivalently transparent pipe, wall thickness 1 mm 0.039 in ] (Note 2)	
Repeatability	0.5 mm 0.020 in or less	
Supply voltage	12 to 24 V DC $\pm 10\%$ Ripple P-P 10% or less	
Current consumption	30 mA or less	
Output	NPN open-collector transistor	
	<ul style="list-style-type: none"> <li>• Maximum sink current: 100 mA</li> <li>• Applied voltage: 30 V DC or less (between output and 0 V)</li> <li>• Residual voltage: 1 V or less (at 100 mA sink current) 0.4 V or less (at 16 mA sink current)</li> </ul>	
	Utilization category	DC-12 or DC-13
	Output operation	Switchable either Light-ON (Liquid-absent-ON) or Dark-ON (Liquid-present-ON)
Short-circuit protection	Incorporated	
Response time	2 ms or less	
Operation indicator	Red LED (lights up when the output is ON)	
Environmental resistance	Pollution degree	3 (Industrial environment)
	Ambient temperature (Note 3)	$-10$ to $+55$ °C $+14$ to $+131$ °F (No dew condensation or icing allowed), Storage: $-20$ to $+70$ °C $-4$ to $+158$ °F
	Ambient humidity	35 to 85 % RH, Storage: 35 to 85 % RH
	Ambient illuminance	Sunlight: 10,000 lx at the light-receiving face, Incandescent light: 3,000 lx at the light-receiving face
	EMC	EN 50081-2, EN 50082-2, EN 60947-5-2
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure
	Insulation resistance	20 M $\Omega$ , or more, with 250 V DC megger between all supply terminals connected together and enclosure
	Vibration resistance	10 to 150 Hz frequency, 0.75 mm 0.030 in amplitude in X, Y and Z directions for two hours each
	Shock resistance	100 m/s <sup>2</sup> acceleration (10 G approx.) in X, Y and Z directions for five times each
	Emitting element	Infrared LED (modulated)
Material	Enclosure: Polycarbonate, Tying band: Nylon, Anti-slip tube: Silicone	
Cable	0.1 mm <sup>2</sup> 3-core cabtyre cable, 1 m 3.281 ft long	
Cable extension	Extension up to total 50 m 164.042 ft is possible with 0.3 mm <sup>2</sup> , or more, cable.	
Weight	15 g approx.	
Accessories	Tying band: 2 pcs., Anti-slip tube: 2 pcs.	

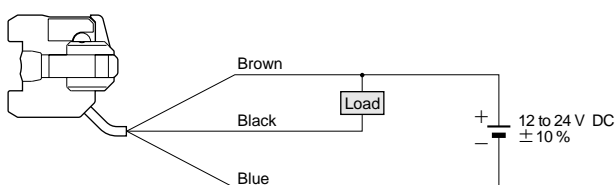
- Notes: 1) Unclear or highly viscous liquid may not be detected stably.  
 2) Do not use the sensor with pipes other than the above specified.  
 3) Liquid being detected should also be kept within the rated ambient temperature range.

## I/O CIRCUIT AND WIRING DIAGRAMS

### I/O circuit diagram



### Wiring diagram



Symbols ... D : Reverse supply polarity protection diode  
 Zd: Surge absorption zener diode  
 Tr : NPN output transistor

## PRECAUTIONS FOR PROPER USE

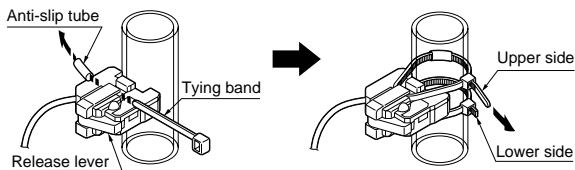
Refer to p.1135~ for general precautions.



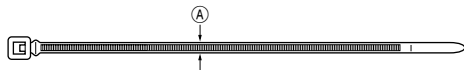
This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

### Mounting

- Mount the sensor on a pipe with the attached tying bands and anti-slip tubes as shown in the figure below. Make sure that the release lever is retracted (position as in the figure) before mounting. Fasten two tying bands, as shown, and cut off the excess portions.



- If other tying bands are to be used, the dimension (A) shown in the figure below should be 2.5 mm 0.098 in or less.

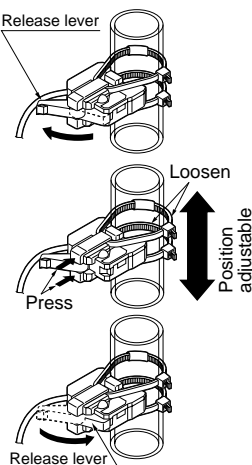


### Position adjustment

- After it is mounted on the pipe with tying bands, the sensor position can be easily adjusted.

#### Adjustment

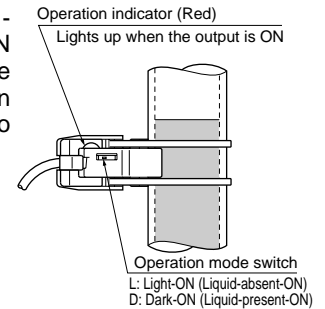
- Unlock the release lever (in the direction of the arrow).
- Press the movable center holders forward to loosen the tying bands and adjust the position.
- Lock the release lever to its original place.



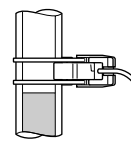
Note: The lever mechanism must be used only to adjust the position, and not for tightening the tying bands. If tying bands are tightened while the lever is open, and then the lever is locked, the sensor may be damaged.

### Selecting output operation

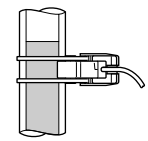
- Either Light-ON (Liquid-absent-ON) or Dark-ON (Liquid-present-ON) can be selected with the operation mode switch according to your application.



- The indicator operation and the output operation change with the setting of the operation mode switch as given in the table below.



Liquid-absent



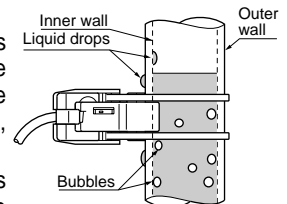
Liquid-present

☼ : Lights up ● : Lights off

MODE	Sensing condition	Operation indicator	Output operation
Light-ON (Liquid-absent-ON)	Liquid-present	●	OFF
	Liquid-absent	☼	ON
Dark-ON (Liquid-present-ON)	Liquid-present	☼	ON
	Liquid-absent	●	OFF

### Others

- Do not use during the initial transient time (50 ms) after the power supply is switched on.
- Do not use this sensor with a pipe which is not transparent.
- Unclear or highly viscous liquid may not be detected.
- Fit the sensor to the pipe securely, otherwise the operation may be erroneous.
- Take care that no dew condenses on the pipe's sensing surface or the pipe's inside wall and that no bubble attaches on the pipe's inside wall, since it can affect the operation.
- If a liquid drop flows down across the sensing point or an air bubble sticks on the wall at the sensing point, the operation may be erroneous. Make sure that no bubble arises in the liquid, and that no dew or liquid drop is present on either surface of the pipe wall.
- EX-F1** is not water-proof or chemical-resistant. Installation should be avoided at any place where it could come in direct contact with water or chemicals.



## DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX website: <http://www.sunx.co.jp/>

