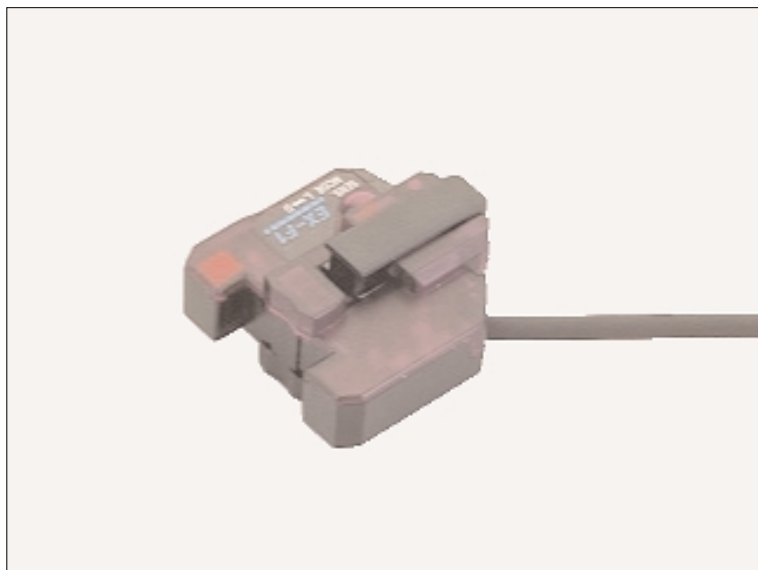


EX-F1 SERIES

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

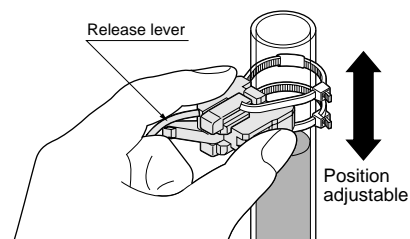
EX-F1 amplifier built-in sensor saves space as there is no need to install a separate amplifier.

Low price

EX-F1 is very cost-effective.

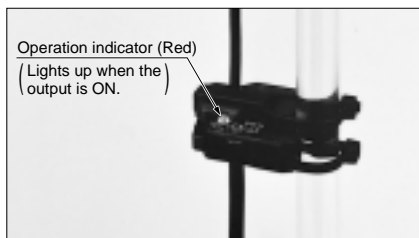
Easily mountable and adjustable

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.

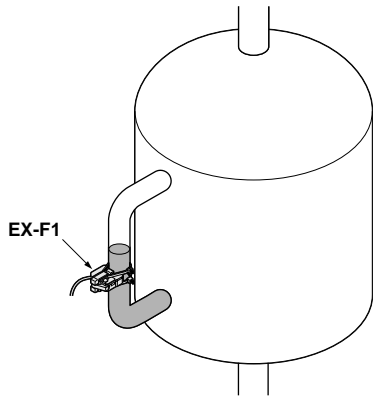


Operation mode switch

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

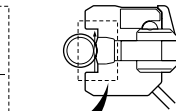
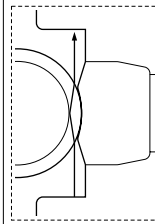
Detecting liquid level in a tank



Principle of Detection

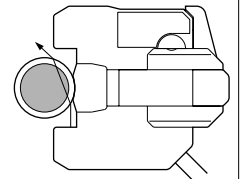
When the pipe is empty, the beam is reflected from the inner surface of the pipe wall and returns to the beam-receiving part, since the difference in the refractive indexes of the pipe and air is large.
 When there is liquid in the pipe, the beam enters the liquid through the wall and does not return to the beam-receiving part, since the difference in the refractive indexes of the pipe and the liquid is small.

<Empty pipe>



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

<Filled pipe>



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

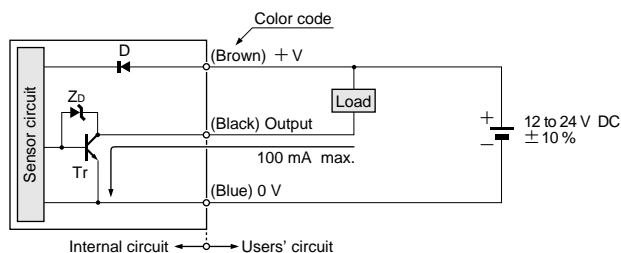
SPECIFICATIONS

| Type | Amplifier built-in • Pipe-mountable | |
|--------------------------|---|---|
| Item | Model No. | EX-F1 |
| 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"> • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1 V or less (at 100 mA sink current) 0.4 V or less (at 16 mA sink current) | |
| | 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 Ω , 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 ² 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 ² 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 ² , 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.

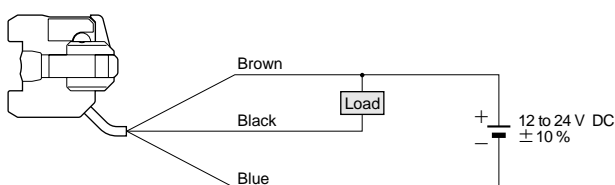
I/O CIRCUIT AND WIRING DIAGRAMS

I/O circuit diagram



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

Wiring diagram



PRECAUTIONS FOR PROPER USE

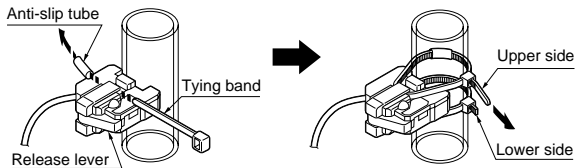
Refer to p.1135~ for general precautions.



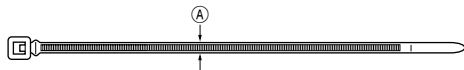
This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

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.

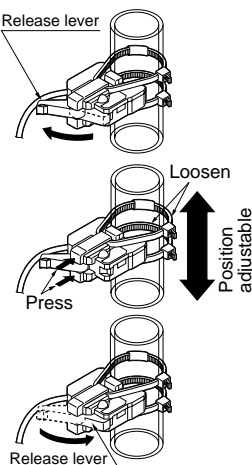


Position adjustment

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

Adjustment

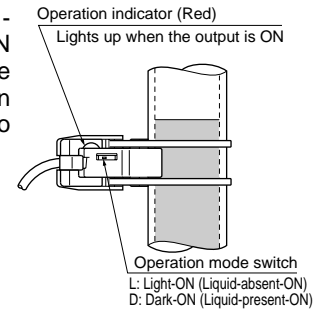
- Unlock the release lever (in the direction of the arrow).
- Press the movable center holders forward to loosen the tying bands and adjust the position.
- Lock the release lever to its original place.



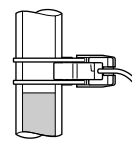
Note: The lever mechanism must be used only to adjust the position, and not for tightening the tying bands. If tying bands are tightened while the lever is open, and then the lever is locked, the sensor may be damaged.

Selecting output operation

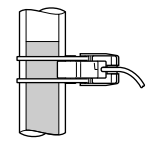
- Either Light-ON (Liquid-absent-ON) or Dark-ON (Liquid-present-ON) can be selected with the operation mode switch according to your application.



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



Liquid-absent



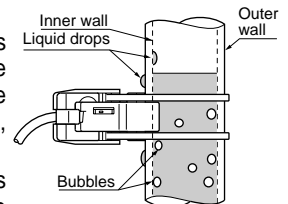
Liquid-present

☼: 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/>

