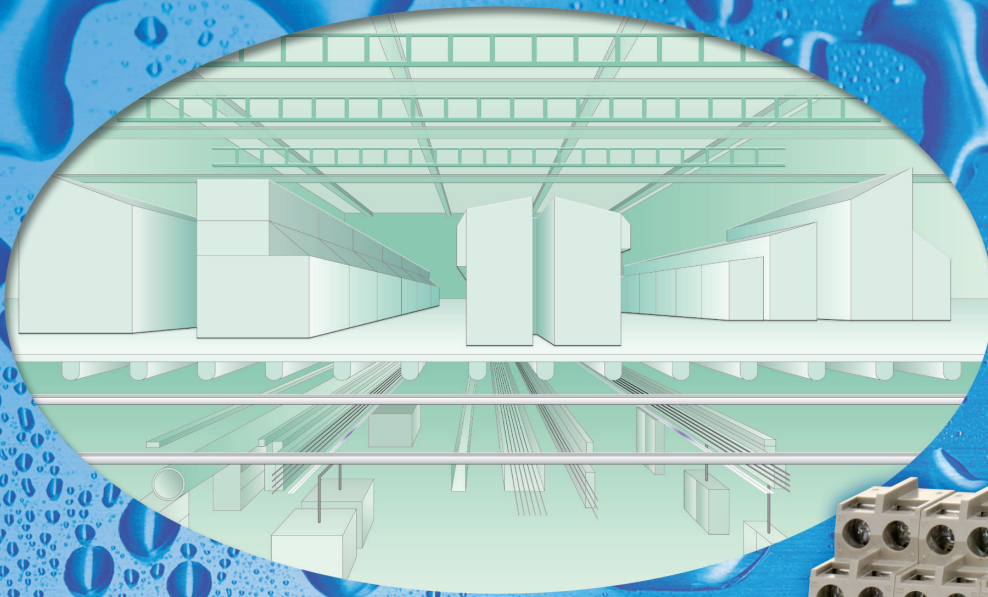


## Liquid Leakage Sensor Amplifiers for Long-distance Wiring

### K7L-U/K7L-UD

A new long-distance wiring model joins the K7L Series.  
The industry's smallest size and longest wiring ability — ideal  
for detecting liquid leakage on factory floors and ceilings.



Enables long-  
distance wiring  
up to 400 m.

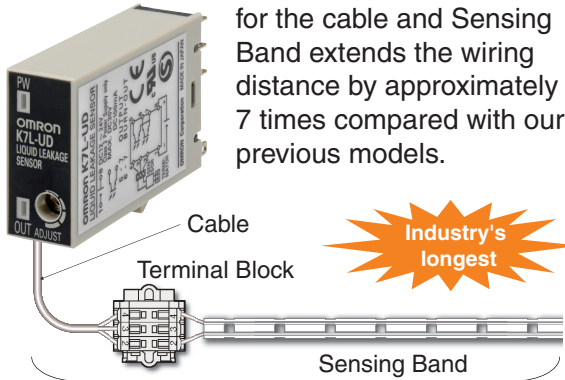


# K7L-U/-UD



# A total distance of 400 m is achieved for cable and Sensing Band to minimize leakage damage.

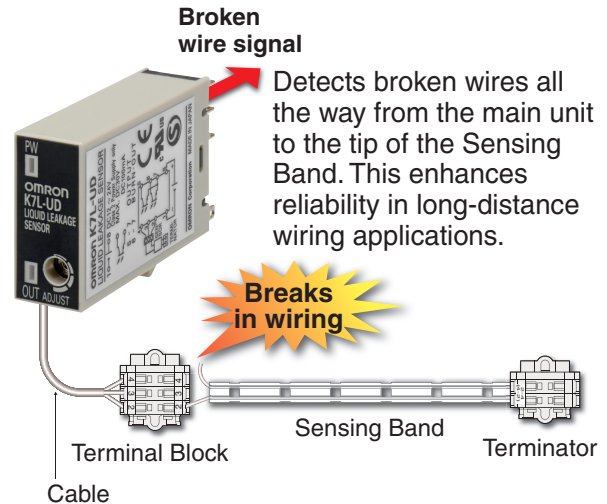
## Greatly expands the detection area.



Total length of cable and Sensing Band is **400 m max.**

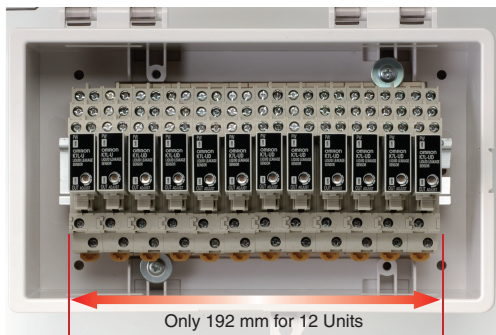
\*According to an OMRON survey

## Detects broken wires.



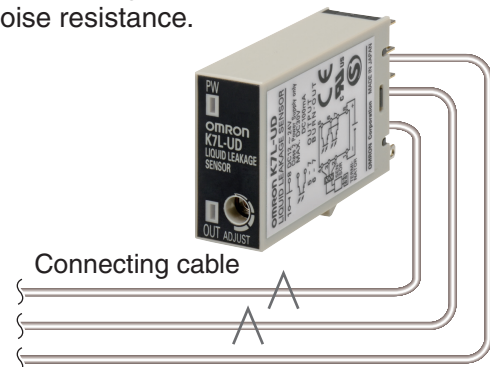
## Helps to downsize gang-mounted panels.

The extremely compact size, with a width of only 16 mm, helps to save panel size when mounting several Units together.



## Features a Noise Canceller (Patented)

A noise canceling circuit employing a three-conductor cable enables stable liquid leakage detection with excellent noise resistance.

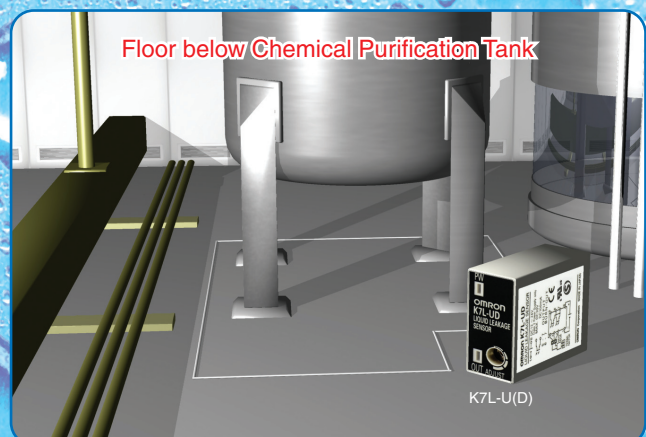


## Application Examples

Floor or Ceiling of Semiconductor or Flat Panel Display Factory



Floor below Chemical Purification Tank



# Liquid Leakage Sensor Amplifiers for Long-distance Wiring

## K7L-U/-UD

### Ultra-miniature Liquid Leakage Sensor Amplifier Enables Longest Liquid Leakage Monitoring Distance in Industry



- Stable detection of liquids with impedance as high as 1 MΩ using inter-electrode resistance detection. Detection of chemical liquids and pure water is possible.
- Higher noise immunity with a noise canceller circuit connected to a 3-conductor cable.
- Prevents electrode corrosion with an AC detection method.
- The power supply circuit and detection circuit are isolated, allowing several Amplifiers to be installed in the same place.
- After a disconnection is detected, operating status is held to eliminate instability due to contact of the disconnected part. \*1
- CE Marking and UL/CSA certification. \*2

\*1 For the K7L-UD.

\*2 CE EMS : ESD EN50082-2, EN61000-4-2



Refer to "Safety Precautions" on page 10.



For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

## Ordering Information

Product name		Model
Amplifier	Liquid Leakage Sensor Amplifier (See note.)	K7L-U
	Liquid Leakage Sensor Amplifier with Disconnection Detection Function (See note.)	K7L-UD
Sensors	Sensing Band	F03-15
		F03-16PE
		F03-16PT
		F03-16SF
		F03-16SFC
	Point Sensor	F03-16PS
Mounting Brackets and Stickers	Sensing Band Stickers	F03-16PS-F
		F03-25
		F03-26PES
		F03-26PEN
	Point Sensor Mounting Brackets	F03-26PTN
Track-mounted Socket	Round terminals can be used.	F03-26PS
	Round terminals cannot be used.	P2RF-08
Terminal Blocks		P2RF-08-E
		F03-20

**Note:** Accessories are available. Check the ratings for details.

## Characteristics

<b>Ambient temperature</b>	Operating: -10 to 55°C
<b>Ambient humidity</b>	Operating: 45% to 85%
<b>Insulation resistance</b>	10 MΩ at 100 VDC between case and current-carrying parts
<b>Dielectric strength</b>	1,000 VAC at 50/60 Hz for 1 min between case and current-carrying parts
<b>Power consumption</b>	1 W max.
<b>Response time</b>	Operate: 800 ms max. Release: 800 ms max. Startup time after power ON: 2 s max.
<b>Weight</b>	Approx. 14 g

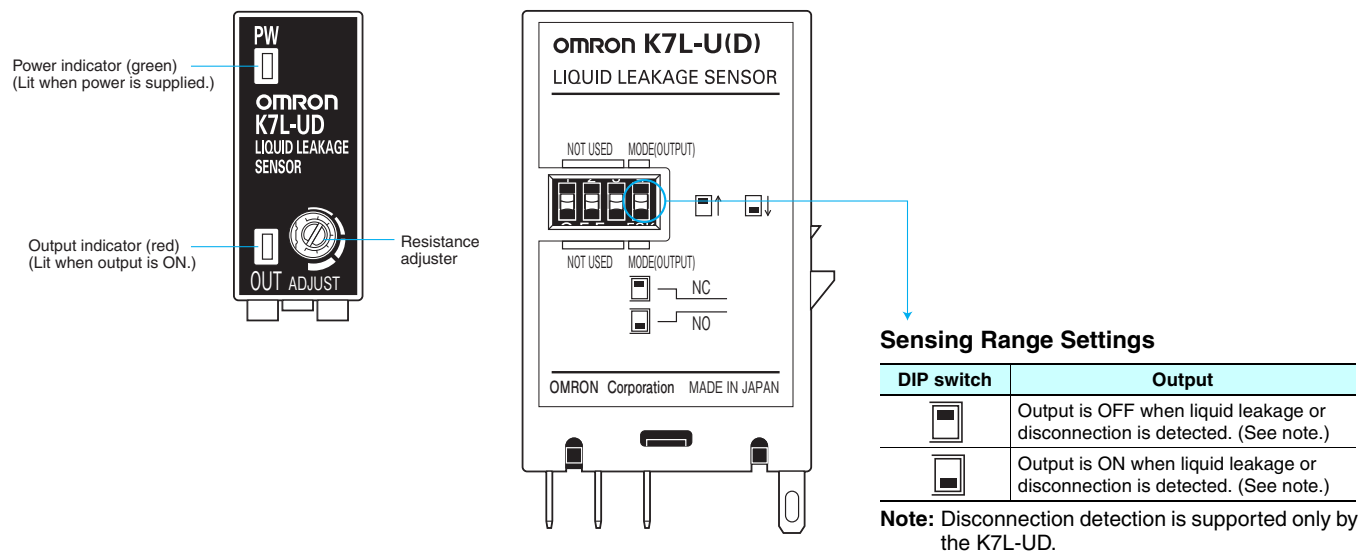
## Ratings

Rated power supply voltage	12 to 24 VDC (Allowable voltage fluctuation range: 10 to 30 VDC)																
Operate resistance	0 to 1 MΩ variable <b>Note:</b> The adjuster (ADJUST) on the top of the Sensor Amplifier sets the resistance for detection within the setting range. It is factory-set to the upper limit. (Normally, the K7L can be used with the adjuster at this setting.)																
Disconnection detection function (See note.)	Detection signal: 10 VDC max., 200 ms Detection time: 10 s max. Recovery: Operation is recovered by resetting the power supply.																
Release resistance	105% min. of operate resistance																
Output configuration	NPN open-collector transistor output with 100 mA at 30 VDC max. for both liquid leakage detection and disconnection detection. <b>Note:</b> If the rightmost pin of the DIP switch on the side of the Sensor Amplifier is set to the down position, the output turns ON when liquid is detected; if it is set to the up position, the output turns OFF when liquid is detected.																
Vibration resistance	10 to 150 Hz, 0.1-mm single amplitude with 50-m/s <sup>2</sup> acceleration for 8 minutes 10 times each in X, Y, and Z directions																
Shock resistance	150 m/s <sup>2</sup> 3 times each in six directions on 3 axes																
Wiring distance	<div>Wiring cable                      } Total: 400 m max. Sensing Band                    }</div> <b>Note:</b> These values are possible on the condition that a completely insulated 3-conductor VCT cable with a thickness of 0.75 mm <sup>2</sup> and a dielectric strength of 600 V is used together with the Liquid Sensing Band specified by OMRON. (A 0.2-mm <sup>2</sup> cable can also be used.)																
Accessories	<table><tr><td>Product Name</td><td>Terminal Block</td><td>Screwdriver for ADJUST</td><td>Terminator</td></tr><tr><td>Model</td><td>F03-20</td><td>---</td><td>F03-20T</td></tr><tr><td>K7L-U</td><td>1</td><td>1</td><td>---</td></tr><tr><td>K7L-UD</td><td>1</td><td>1</td><td>1</td></tr></table>	Product Name	Terminal Block	Screwdriver for ADJUST	Terminator	Model	F03-20	---	F03-20T	K7L-U	1	1	---	K7L-UD	1	1	1
Product Name	Terminal Block	Screwdriver for ADJUST	Terminator														
Model	F03-20	---	F03-20T														
K7L-U	1	1	---														
K7L-UD	1	1	1														

**Note:** For the K7L-UD.

# K7L-U/-UD

## Nomenclature and DIP Switch Settings



## Noise Countermeasures (Common)

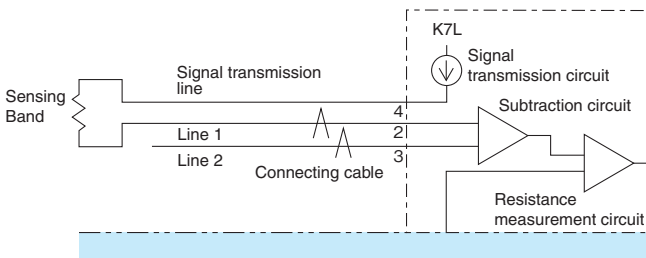
### Noise Canceller Function for Highly Sensitive Impedance Detection

The K7L-U Liquid Leakage Sensor Amplifier detects liquids with impedance as high as 1 MΩ and connects to the Sensing Band through a cable that can be extended up to 400 meters. Countermeasures against external noise are especially important for the Sensing Band and connecting cable because they pick up external noise like an antenna. The K7L incorporates the noise canceller function described below.

### Connected with 3-conductor Cable that Offsets Inductive Noise (Patent Pending)

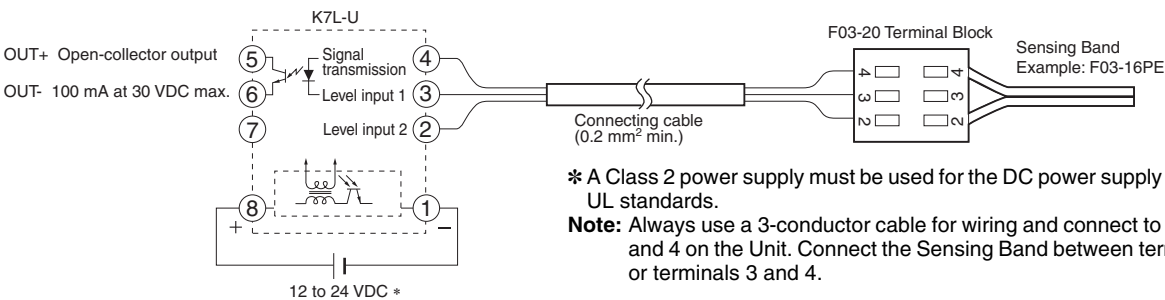
A VCT cable with three conductors (lines) is used as shown in the diagram. Line 1 is connected to the Sensing Band and line 2 is left

open. Lines 1 and 2 are almost in the same position and thus will experience the same noise level. The K7L detects the difference between these signals (including noise). This means that the noise signals in lines 1 and 2 are offset against each other and a reading for the signal, without inductive noise, can be made.



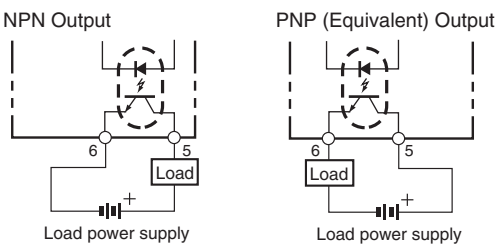
## Connections

### K7L-U



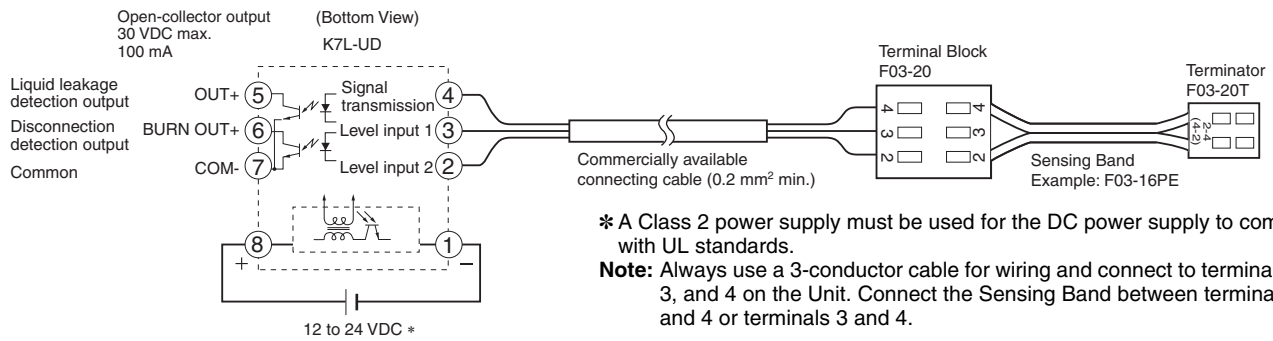
### Output Circuit Examples

The NPN open-collector output of the K7L-U is isolated from the internal circuits by a photocoupler, so you can use either an NPN open-collector output or a PNP (equivalent) output.





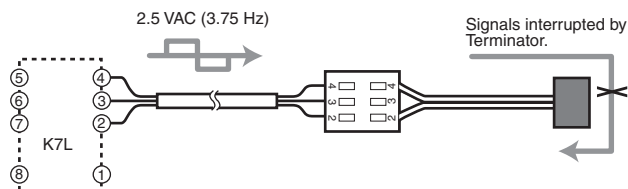
## K7L-UD



## Disconnection Detection Function (K7L-UD)

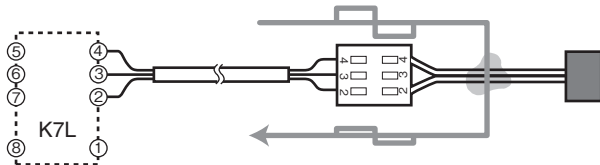
## Operation While Monitoring for Liquid Leakage

- Short-wave signals (2.5 VAC, 3.75 Hz) for liquid leakage detection are output from terminal 4 of the K7L.
- When there is no liquid leakage, the liquid leakage detection signals that are output are interrupted by the Terminator and the core of the Sensing Band will form an open loop.



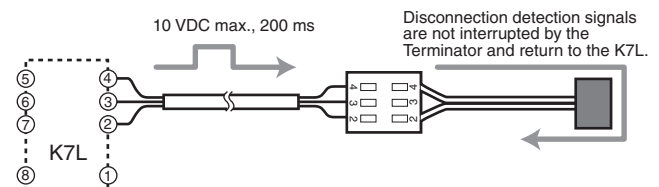
## Operation at Liquid Leakage Detection

- When liquid leakage occurs within the sensing range, the liquid leakage detection signals output from terminal 4 are input to terminal 2 through the leaked liquid.
- The voltage of the input signals will vary with the resistance of the leaked liquid. This voltage is compared with the detection level set at the K7L.
- As a result of the comparison, if the K7L determines that liquid leakage has occurred, the K7L's output LED will light, and the liquid detection output will either turn ON or OFF.



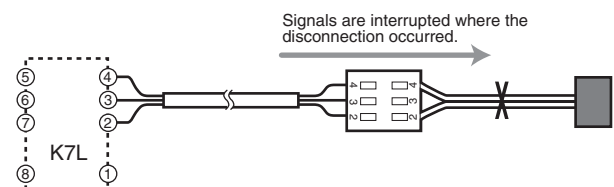
## Operation While Monitoring for Disconnection

- Output of disconnection detection signals starts within 2 s after power is supplied to the K7L and is repeated at approximately 7-s intervals.
- Disconnection signals are DC signals of 10 V max. that are output for approximately 200 ms. During this time, the K7L is in disconnection monitoring mode, i.e. it monitors for disconnections only and the liquid leakage detection signals are stopped.
- If there is no disconnection, the disconnection detection signals (10 VDC) that are output pass through the Terminator and return to the K7L. The K7L takes this as normal, i.e., there is no disconnection.



## Operation at Disconnection Detection

- If there is a disconnection, the signals will be interrupted at the place where the disconnection occurred, and will not return to the K7L.
- If the signals do not return, it will determine that a disconnection has occurred. The output indicator will flash, and the disconnection output will turn ON/OFF.

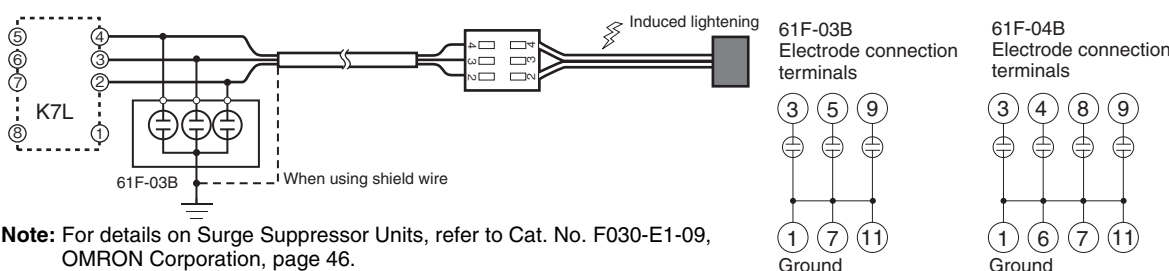


- Note:**
1. Disconnection detection is only performed between terminals 2 and 4. Therefore, be sure to connect the Sensing Band between terminals 2 and 4.
  2. The K7L will switch from liquid leakage detection to disconnection detection if either of the following conditions occur while liquid leakage is detected.
    - 2-1 Disconnection occurs between the K7L and the place where liquid is leaked.
    - 2-2 While liquid leakage is detected, disconnection occurs between the place where liquid is leaked and the Terminator (F03-20T) and, subsequently, the leaked liquid is removed (e.g., wiped up or dried).
  3. During disconnection detection, liquid leakage will not be detected. Once disconnection has been detected, reset the power supply to stop disconnection detection.

## Surges

Use in conjunction with a 61F-03B/04B Surge Suppressor Unit in environments exposed to surges.

Install the Surge Suppressor Unit near the K7L. The surge suppression may not be sufficient if the Surge Suppressor Unit is installed near the Sensing Band.



## Sensing Band/Point Sensor F03-16PE/-16PT/-15/-16PS

### F03-16PE

#### Liquid Leakage Sensing Band



- SUS316 used for core and polyethylene used for sheath to ensure high resistance to both acidic and alkaline liquids.
- Sensing Band Stickers that use the same material as the Sensing Band's insulating resin are available in 2 types: adhesive-tape type and screw type.

### Ordering Information

Name	Model number
Liquid Leakage Sensing Band	F03-16PE
Sensing Band Stickers	F03-26PES
	F03-26PEN

### Specifications

Sheath	Polyethylene
Core	SUS316 stainless steel
Ambient operating temperature	-15 to 55°C
Weight	Approx. 16 g (1 m)

### Dimensions Sensing Band

#### F03-16PE (Unit: mm)

Appearance	
Structure	

### Sensing Band Stickers

#### F03-26PEN (screws) (Unit: mm)

Appearance	
Structure	

#### F03-26PES (adhesive tape) (Unit: mm)

Appearance	
Structure	

\* The shape of the adhesive tape shown above is for securing the F03-16PE.

### Chemical Resistivity

	Polyethylene	SUS316	Fluoroplastic
Water	A	A	A
Acetone	C	A	A
Ammonia	A	A	A
Ethanol	B	A	A
Hydrochloric acid	A	C	A
Hydrogen peroxide solution	A	A	A
Xylene	B	A	A
Cyclohexane	C	---	A
Trichloroethylene	C	A	A

A: Not affected at all or only very slightly affected.

C: Affected but may still be used. (Replace the Sensing Band immediately after detection.)

	Polyethylene	SUS316	Fluoroplastic
Toluene	C	B	B
Phenol	B	A	B
Butanol	B	---	A
Fluorine	A	C	A
Hexane	C	---	A
Benzene	C	A	A
Methanol	B	A	A
Sulfuric acid	C	B	A
Phosphoric acid	A	B	B

B: Slightly affected but, depending on the conditions, sufficient for use.

### F03-16PT

#### Fluoroplastic Sensing Band



- Compared to the F03-16PE (polyethylene), the F03-16PT has higher resistance to both high temperatures and chemicals.
- Detection precision remains constant even with a loopback, thanks to a two-sided detection design.

### Ordering Information

Name	Model number
Fluoroplastic Sensing Band	F03-16PT
Fluoroplastic Sensing Band Stickers	F03-26PTN

### Specifications

Sheath	PTFE fluoroplastic
Core	SUS316 stainless steel
Ambient operating temperature	-50 to 200°C
Weight	Approx. 16 g (1 m)

### Dimensions Fluoroplastic Sensing Band

#### F03-16PT (Unit: mm)

Appearance	
Structure	

### Fluoroplastic Sensing Band Stickers

#### F03-26PTN (screws) (Unit: mm)

Appearance	
Structure	

#### Note:

- The F03-16PE Sensing Band is made from the following materials.  
Core: SUS316  
Insulated sheath: Polyethylene
- In order to prevent secondary fire damage, consider the effect of the atmosphere of the environment and the solution to be detected on the Sensing Band.
- If the Sensing Band changes shape or color when a liquid is detected, replace the Sensing Band.



## F03-15 Sensing Band



- Ideal for harsh electrical room environments that are dusty and humid.
- For installation in locations requiring insulated materials.

### Ordering Information

Name	Model number
Liquid Leakage Sensing Band	F03-15
Sensing Band Stickers	F03-25

### Specifications

Sheath	Flexible, transparent vinyl chloride
Core	SUS304 stainless steel
Ambient operating temperature	-15 to 50°C
Weight	Approx. 48 g (1 m)

## Dimensions Sensing Band

F03-15 (Unit: mm)

Appearance	
Structure	

## Sensing Band Stickers

F03-25 (Unit: mm)

Appearance	
Structure	

## F03-16PS Liquid Leakage Point Sensor



- Can be used in conjunction with Sensing Bands.
- Stud screw mounting requires no tools for installation.
- No tools means the Sensor can be wiped clean quickly and easily.
- The optional Mounting Bracket enables faster installation than three-screw mounting.
- Connect multiple Sensors to one K7L Amplifier for significant cost savings.

### Ordering Information

Name	Model number
Liquid Leakage Point Sensor	F03-16PS F03-16PS-F *1
Mounting Brackets *2	F03-26PS
Terminal Block *3	F03-20

\*1 The electrodes have a fluorine coating.

\*2 Use a commercially available bonding agent for PVC. One bag contains 10 Brackets.

\*3 One bag contains 10 Blocks.

### Specifications

Sensor Amplifier	Polyethylene
Material	Conductor: Outer sheath: PVC, Inner sheath: Fluorine resin
Core	F03-16PS: SUS304 stainless steel F03-16PS-F: SUS304 and fluorine coating
Ambient operating temperature range	-10 to 60°C
Weight	Approx. 30 g
Maximum number of Point Sensors connected per Amplifier	You can use as many Point Sensors as required as long as the following conditions are met. K7L-AT50 (K7L-AT50D cannot be used): 60 m max. K7L-U (K7L-UD cannot be used): 400 m max. 61F-WLA or 61F-GPN-V50: 200 m max.

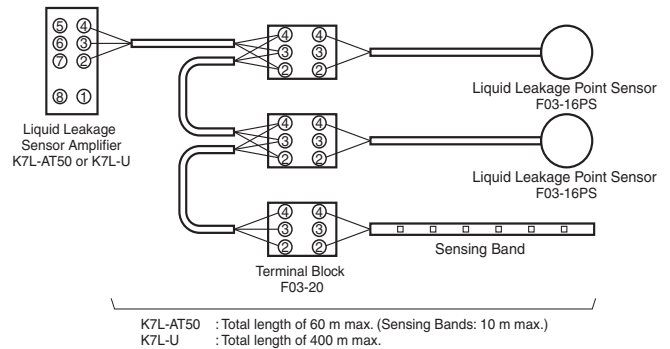
## Wiring Diagram

Any number of Sensors can be connected in parallel as long as the following cable lengths are not exceeded for the Sensing Bands and connecting cables.

K7L-AT50 (operate resistance of 50 MΩ max.): 60 m max.

K7L-U (operate resistance of 1 MΩ max.): 400 m max.

However, the leakage areas cannot be determined with the K7L-AT50.



## Dimensions

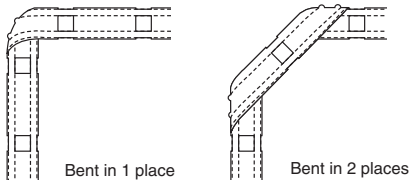
Refer to pages 9 and 10.

## K7L-U/-UD

### Connecting the Sensing Band

#### Bending the Sensing Band

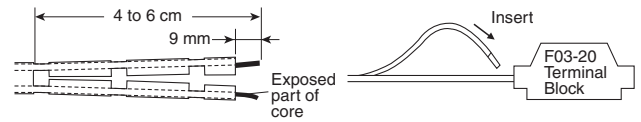
To change the direction of the Sensing Band, bend the Sensing Band in one or two places where the core is not exposed.



**Note:** Bend the Sensing Band approximately 4 cm (i.e., twice the distance between places where the core is exposed) away from places where a Sticker is attached. If the Sensing Band is bent at places further away than this, the Sensing Band may come away from the surface.

#### Stripping and Connecting Terminals

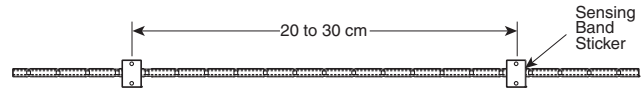
1. Cut into the Sensing Band approximately 4 to 6 cm in from the end as shown in the diagram below.
2. Strip away approximately the last 9 mm of the sheath to expose the core (SUS line).
3. To connect to the Terminal Block, insert the screwdriver (see note 3) from the top of the Terminal Block and insert the stripped end of the core from the side. (Refer to *Dimensions* on page 9.)



**Note:** Check that the wiring is secure before using the K7L in applications.

#### Interval Between Stickers

When securing the Sensing Band with Stickers, attach the Stickers at intervals of 20 to 30 cm in places where the core is not exposed.



- Note:**
1. When using the F03-26PES (adhesive-tape model), be sure to wipe all moisture, oil, and dust from the surface to which the Sticker is to be attached. Failure to do so may result in insufficient adhesion, and the Sticker may peel away from the surface.
  2. When using the F03-26PEN (screw model), before installing the Sensing Band, it is necessary to perform stud welding. For details on the pitch of the studs, refer to the information on the dimensions of Sensing Band Stickers.
  3. Commercially available screwdrivers can be used. It is recommended, however, that either a 210-350/01 screwdriver or a 209-132 operating tool to connect jumpers, both manufactured by Wago Japan, is used. Contact <http://www.wago.com>.

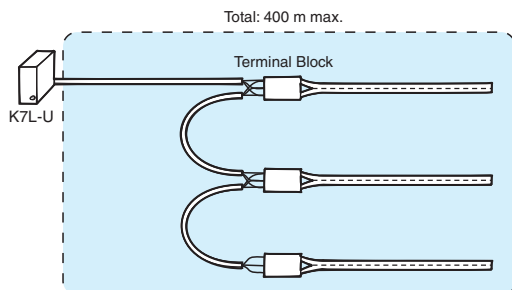
### Liquid Leakage Sensor Amplifier K7L FAQs

Some questions that are frequently asked about the K7L are given below. Use this information when selecting a model.

**Q** Can one K7L Amplifier be used for detection in more than one place?

**A** Yes.

By using Terminal Blocks to connect Sensing Bands in parallel, detection can be performed in more than place with only one K7L Amplifier.

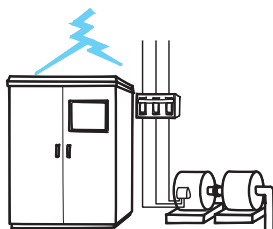


- Note:**
1. When wiring, be sure not to exceed the maximum possible wiring distances for both the connecting cable and the Sensing Band. Exceeding these distances may lead to faulty operation. Connect one Sensing Band to each Terminal Block.
  2. Not applicable to the K7L-UD.

**Q** Can the K7L Amplifier be used as a replacement for the 61F-GPN-V50 Water Leakage Detector?

**A** Yes.

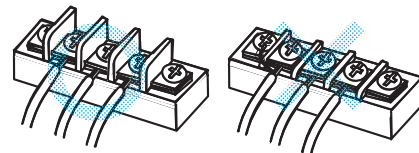
Because the surge withstand capability is different, however, do not use in locations where it will be exposed to impulses and surges, such as outdoor roofs or in pump panels. Also, items such as the power supply voltage and the connection sockets are different. Check these items before application.



**Q** Can a different terminal block (e.g. a commercially available terminal block or a terminal block constructed by the user) be used instead of the one provided?

**A** Yes.

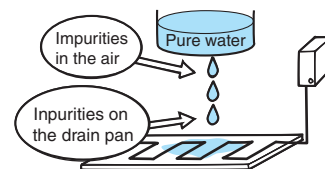
When using another terminal block, however, be sure to check that all the terminals are mutually isolated, and that there is no danger of ground faults in connecting cables or Sensing Bands.



**Q** Can the K7L Amplifier detect pure water?

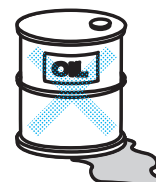
**A** Yes.

Even pure water, which has a resistance exceeding 10 MWΩ·cm, can nearly always be detected if the K7L is used at its maximum sensitivity. This is because impurities are mixed with the water when it is leaked and the resistance drops.



**Q** Can the K7L Amplifier detect oil?

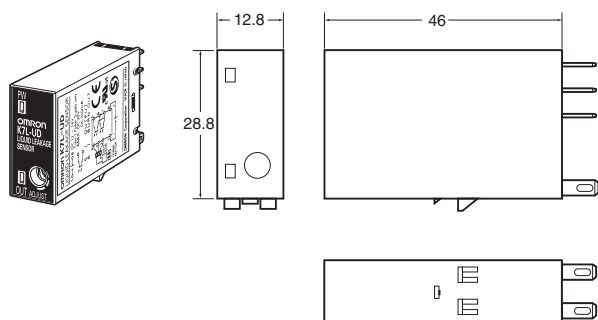
**A** No.



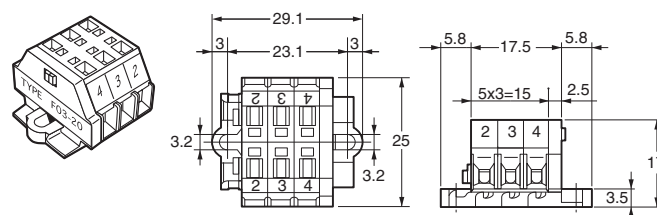


# Dimensions (Unit: mm)

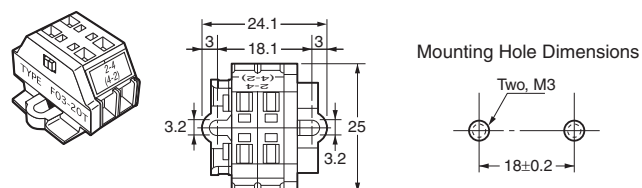
## Liquid Leakage Sensor Amplifier K7L-U/-UD



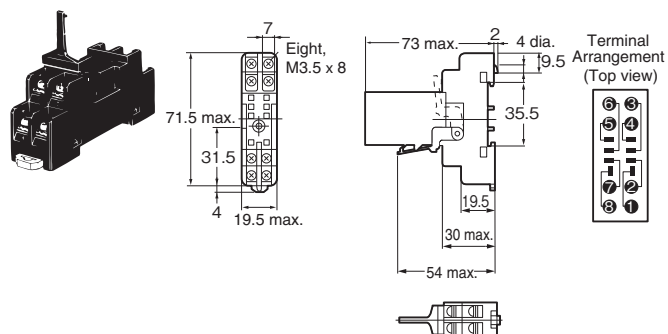
## Terminal Block \*1 F03-20



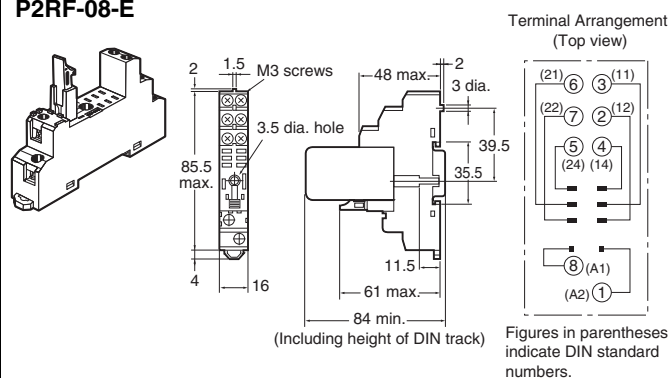
## Terminator \*1 F03-20T



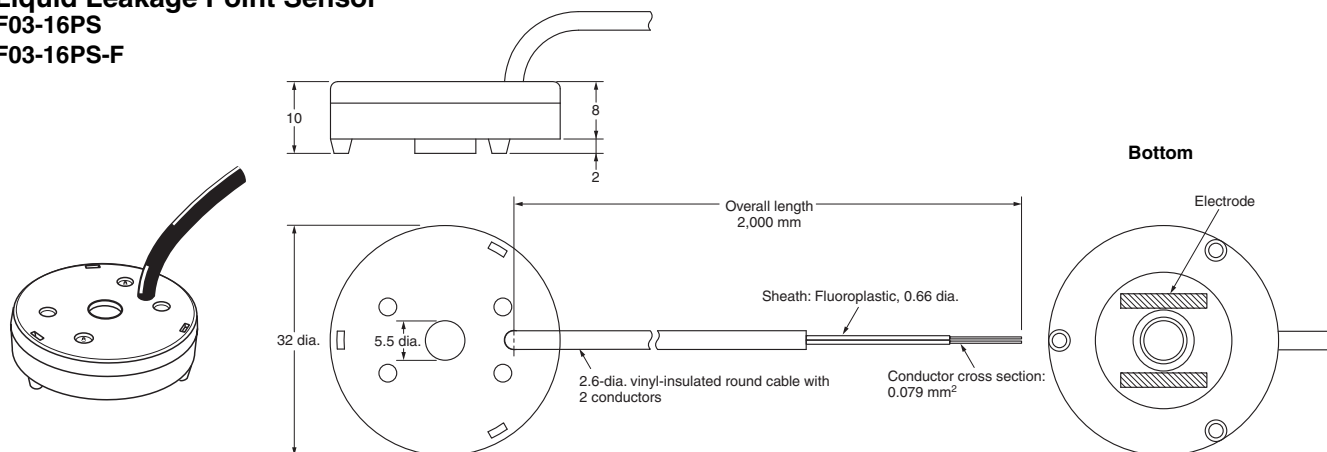
## Track-mounted Sockets \*2 P2RF-08 (Round terminals can be used.)



## Track-mounted Sockets \*2 P2RF-08-E

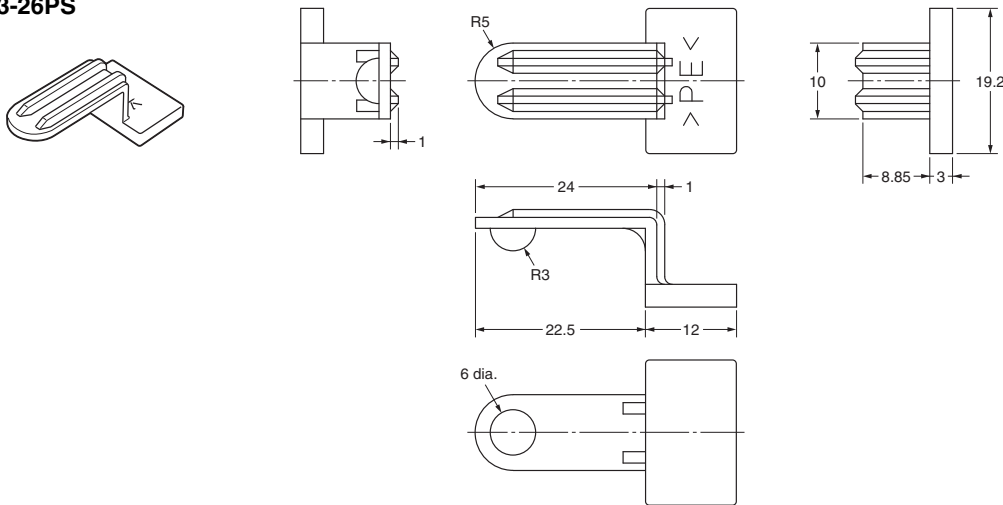


## Liquid Leakage Point Sensor F03-16PS F03-16PS-F



\*1 The Terminal Block is made of nylon 66. Mount the Terminal Block in locations not subject to liquid chemicals using M3 screws.  
\*2 Secure the Sockets with M3 screws at a torque of 0.78 to 1.18 N·m.

## Point Sensor Mounting Bracket F03-26PS



## Safety Precautions

### ⚠ WARNING

This product cannot be used as a detection device for protecting human life.



### Precautions for Safe Use

Observe the following points to ensure safe operation.

1. Be sure to use a power supply voltage within the specified range. Not doing so may result in burning or malfunction.
2. Do not use the product in locations subject to flammable gases or combustible objects. Doing so may result in fire.
3. Insert the connection points into Sockets until the connection is locked securely. Not doing so may result in burning or malfunction.
4. Do not short-circuit loads connected to output terminals. Doing so may result in burning.
5. Be sure to connect the power supply with the correct polarity. Not doing so may result in malfunction.

### Precautions for Correct Use

#### Installation

Attach to a panel of thickness 1 to 5 mm.

**Do not install in the following locations.**

1. Locations subject to shock or vibration
2. Locations where the temperature or humidity lies outside the specified range, or where condensation is likely to occur (To detect liquids with high impedances, do not use in locations with high humidity.)
3. Locations subject to dust
4. Locations subject to corrosive gases (particularly sulfide and ammonia gases)
5. Outdoors or locations subject to direct sunlight
6. Near devices that generate strong high-frequency noise (e.g., high-frequency welding devices etc.)

### Application Precautions

You must allow sufficient leeway in ratings and performance, and provide proper fail-safe or other safety measures when using these products in any of the following applications. Be sure also to consult with your OMRON representative before actually attempting any of these applications.

1. Applications under conditions or environments not specified in user documentation
2. Applications for nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, or safety equipment
3. Applications that may have a serious influence on lives and property and thus require particularly attention to safety



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## Read and understand this catalog.

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

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NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

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**OMRON Corporation** Industrial Automation Company  
Tokyo, JAPAN

Contact: [www.ia.omron.com](http://www.ia.omron.com)

**Regional Headquarters**

**OMRON EUROPE B.V.**

Wegalaan 67-69, 2132 JD Hoofddorp  
The Netherlands  
Tel: (31)2356-81-300/Fax: (31)2356-81-388

**OMRON ELECTRONICS LLC**

2895 Greenspoint Parkway, Suite 200  
Hoffman Estates, IL 60169 U.S.A  
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

**OMRON ASIA PACIFIC PTE. LTD.**

No. 438A Alexandra Road # 05-05/08 (Lobby 2),  
Alexandra Technopark,  
Singapore 119967  
Tel: (65) 6835-3011/Fax: (65) 6835-2711

**OMRON (CHINA) CO., LTD.**

Room 2211, Bank of China Tower,  
200 Yin Cheng Zhong Road,  
PuDong New Area, Shanghai, 200120, China  
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

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CSM\_2\_2\_0116  
Cat. No. F080-E1-01A

Printed in Japan  
1014-?M (0614) (?)