

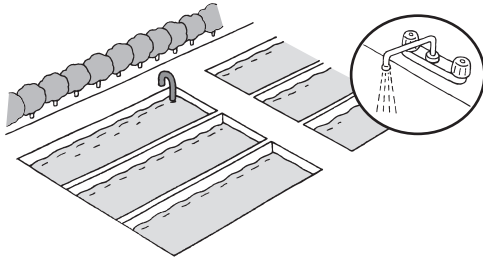
Level Controllers Glossary

Types of Water

Purified Water

Water that has been purified for drinking, tap water available in an average household.

Water in septic tanks is treated wastewater and should not be mixed.



Wastewater

Liquid waste that goes into the sewer, such as flushed water from toilets.

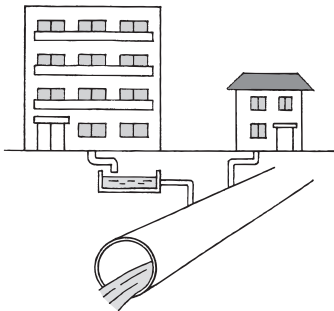
Note: Domestic and industrial wastewater contain solids and suspended matter and has a low electrical resistance. Be very careful when installing the electrodes.

Purified Water

Similar meaning to purified water; however, at water treatment plants it may refer to water at a stage before it is purified so it has a broader meaning than purified water.

Sewage (Sewer)

Better described as a wastewater drainage system than a type of water. Generally the more advanced a country, the more established its sewage system. Most of the metropolitan areas in Japan have good sewage systems, eliminating the need for septic tanks, and wastewater tanks can be drained directly into the sewers. In most cases there are pipes that are connected directly to the sewer so that wastewater can be dumped directly into the sewers without wastewater tanks.



Rainwater

Rain collected by rainwater pits. Electrical resistance is slightly higher than purified water.

Spring Water

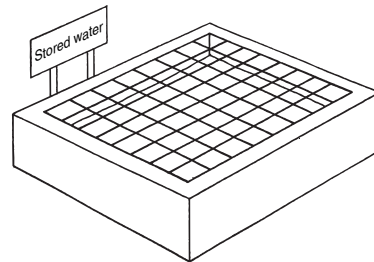
Water that flows from spring wells. Similar to rainwater, the electrical resistance is slightly higher.

Pumped Water

Water that is pumped to another location. Most tap water is pumped through the water mains.

Stored Water

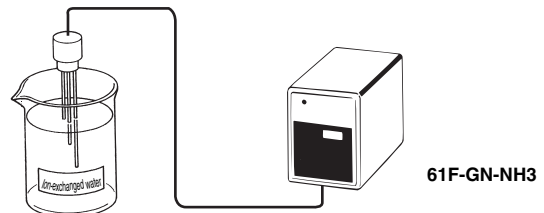
Water that is stored for a purpose. Most of the time its sensitivity is same as tap water. The use of water as fire-fighting water takes priority.



Ion-exchanged Water

Water that has had its ions removed. The ions are not removed by distillation, and thus electrical resistance is high.

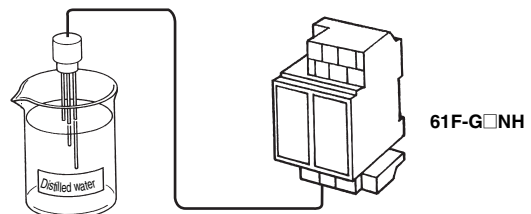
Note: Generally a device with an operate resistance of 200 kΩ is used. The 61F-GP-NH3 can be used in some cases; however, the water resistance can be higher depending on the method used to remove the ions (pure water).



Distilled Water

Water that has been distilled by boiling and re-condensing the vapors. Electrical resistance is not as high as pure water.

Note: High-sensitivity models can be used.



Return Water

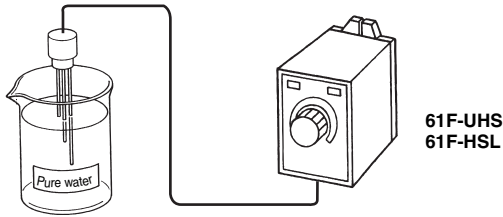
Water that circulates in a boiler as steam. It is the condensed water recovered from inside the pipes.

Pure Water

Water that is free of impurities.

It may have a resistance anywhere from 200 kΩ·cm up to 18 MΩ·cm, requiring a super high-sensitivity 61F.

Note: Titanium electrodes are used to preserve the purity level of the water.



Condensate

Cooling water from steam turbines and boilers.

Feed Water

Water that is injected into the boiler to keep the purity level constant. It has relatively low resistance.

Water Tanks and Ponds

Ground Tank

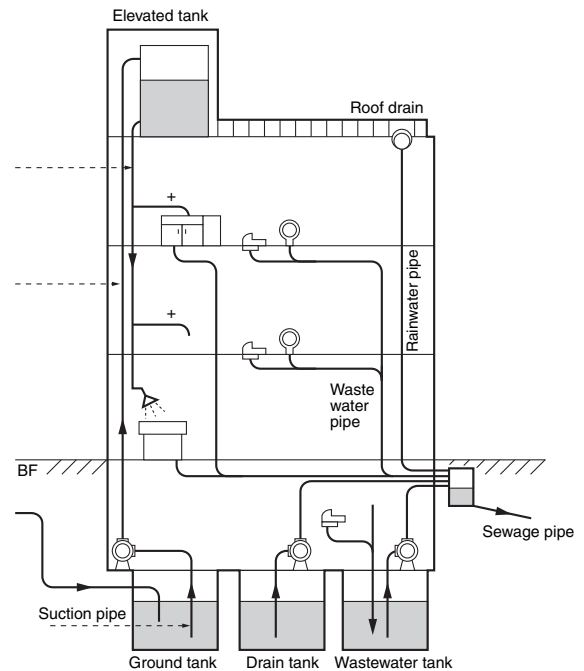
High-rise buildings and apartments that have elevated storage tanks on the rooftop temporarily store water in a ground tank before pumping it up to the elevated tank. The ground tank is often installed underground or on the ground floor.

Note: In this brochure, the generic term “water supply sources” is used instead of the term “ground tank.” Take into consideration the fact that ground tanks often double as fire hydrants when determining the length of electrodes. The water level of the ground tank will be controlled by a different 61F Level Controller or a float valve. (The 61F Level Controller for the elevated tank may be used and its electrodes will be in the ground tank together with the other electrodes.) The 61F-G4N is used for relatively larger buildings and apartments but due to recent Japanese government regulations that require the lower limit to be displayed, the 61F-GP-N may be added.

Elevated Tank

Water tanks that are installed on rooftops of high-rise buildings and apartments. They use the height of the tank (i.e., gravity) to supply water.

Note: Water is automatically pumped from the ground tank using the 61F-G4N or 61F-G1N. With the recent introduction of pressurized water systems, some buildings do not have elevated water tanks. However, their role as storage tanks in the event of blackouts and disasters is being reconsidered.



Distribution Reservoirs

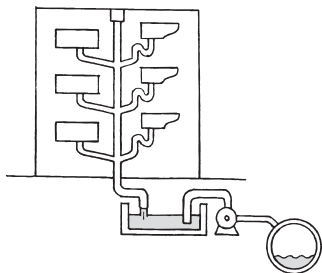
Water from the main water supply is distributed and temporarily stored in a reservoir for residential housing.

These are used for separate small water supplies.

Wastewater Tank

In cities where there are good sewage systems, the septic tank has been replaced with a temporary storage tank for wastewater from toilets and kitchens.

Note: In normal apartments, the wastewater will be drained directly into the sewer through the wastewater pipes; however, buildings with underground levels must use pumps to draw the wastewater up to the sewers. For this reason, a temporary storage tank for wastewater is required. These types of tanks contain grease and other solids, so each electrode must be mounted with enough separation to prevent short-circuiting.



Supply Reservoir

The main water supply reservoir for residents created by waterworks.

Water is delivered to this reservoir from various water sources, passed through a purification plant, and supplied to the residents.

Note: Supply reservoirs must be maintained above a certain water level at all times. The 61F Level Controllers are often used for this purpose, and the wiring distance between the relay and the electrodes are also often very long. There are some private as well as public supply reservoirs.

Septic Tank

Temporarily stores wastewater from toilets. The wastewater is treated to get rid of any solids before it discharges the fluid elsewhere.

Note: Electrodes used in septic tanks are weak alkaline types, so be careful with the insulation. In cities where the sewage system is well established, septic tanks are no longer necessary in buildings and any wastewater goes directly to the wastewater tank.

Specifications

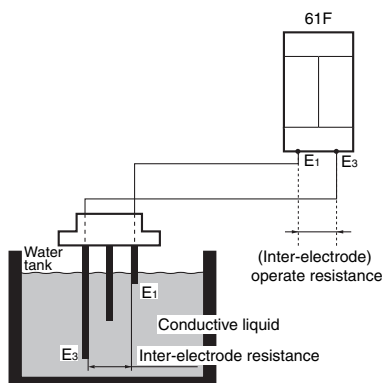
Operate Resistance

The amount of resistance between the electrodes required for a 61F Level Controller to operate. The resistance of the liquid or solid between the electrodes must be below this value for the Level Controller to operate.

Note: The higher the operate resistance, higher the sensitivity, and liquid with low conductivity can be detected

Inter-electrode resistance

Similar to the operate resistance. The operate resistance includes the resistance of the lead wires for the electrodes. If the lead wires are very long, these values are not exactly the same, but generally they can be regarded as the same.



Conductivity (Siemens: S)

Unit of electrical conductance for liquids. It is commonly expressed in micro-siemens (μS) although it used to be expressed in ohms (Ω). It is the inverse value of electrical resistance, so the smaller it is, the higher the resistance, requiring a Level Controller with higher sensitivity.

$1 \mu\text{S}/\text{cm} \rightarrow 1 \text{ M}\Omega\cdot\text{cm}$

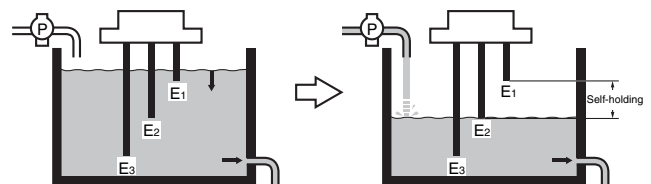
$2 \mu\text{S}/\text{cm} \rightarrow 500 \text{ k}\Omega\cdot\text{cm}$

$10 \mu\text{S}/\text{cm} \rightarrow 100 \text{ k}\Omega\cdot\text{cm}$

Self-holding Circuit

When the relay is triggered, the value is retained by a self-holding circuit.

For the 61F-GN, electrode E_2 is the self-holding circuit. A self-holding circuit enables a control range to be set and also prevents the relay from switching rapidly due to ripples on the liquid surface.



Contact Capacity (Output)

Maximum switching capacity of the relay contact.

Reset Resistance

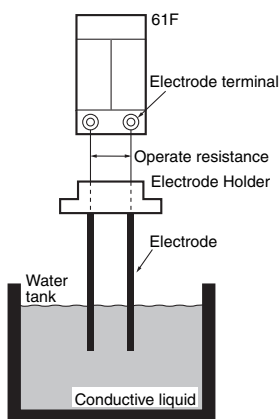
The amount of resistance between the electrodes required for the 61F Level Controller to reset. The resistance must be higher than this value for the device to reset.

Note: If there is no liquid, the resistance should be infinite; however, if there is liquid residue on self-holding electrode and separators, it won't be infinite immediately. This value is important for 61F Level Controllers because it affects the leakage current of the wire's float capacitance. The low-sensitivity and long distance Level Controllers are used for this purpose.

Specific Resistance

The liquid's resistance to current flow expressed in $k\Omega\cdot cm$.

It has an inverse relationship with conductance. (It is different to the operate resistance.)



Electricity flows between the electrodes along infinite routes through the liquid.

Specific resistance is a measure of how difficult it is for current to flow along these paths. Specific resistance varies with the installation conditions of the electrodes and the submersion depth, so the actual operation depends on the distance between the electrodes and the surface area of the fluid (submersion depth). It is difficult to find the resistance between the electrodes, so the specific resistance is used as a reference value.

Operating Voltage

The power supply voltage required for the 61F Level Controller to operate. For the 61F Level Controllers, it is at least 85% of rated voltage. Therefore the power supply voltage must not fall below 85% of rated voltage.

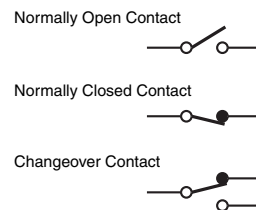
Minimum Applicable Load

An estimate of the smallest load for which switching is possible in electronic circuits.

Type of Contacts

Types of contact structure.

Note

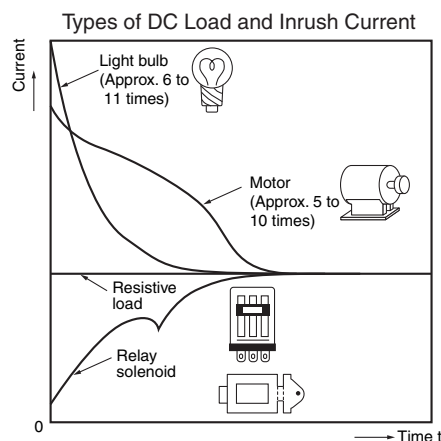


Load

Loads can be categorized into the following three types.

- 1. Resistive loads**
When voltage is applied to appliances such as heaters, it has a constant current flow. These types of loads are called resistive loads.
- 2. Inductive loads**
Loads that have inductive components such as motors and solenoids.
- 3. Reactive loads**
Loads that have reactance such as condensers.

Note

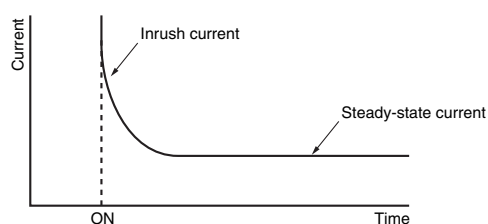


Types of AC Load and Inrush Current

Type of load	Inrush Current/ Rated Current	Waveform
Solenoid 	Approx. 60 times	
Incandescent light bulb 	Approx. 10 to 15 times	
Motor 	Approx. 5 to 10 times	
Relay 	Approx. 2 to 3 times	
Resistive load 	---	

Inrush Current

The instantaneous current flow when the contact is closed or the transitive current is higher than the steady-state current.



Switching Frequency

The number of times a relay switches in one time unit. The time unit is a discrete unit, such as per hour.

Initial Operation Method

The internal relay operates when power is applied to the 61F and resets when current flows between the electrodes. However, the operation after resetting and the wiring are the same as for models with sequential operation.

Sequential Operation Method

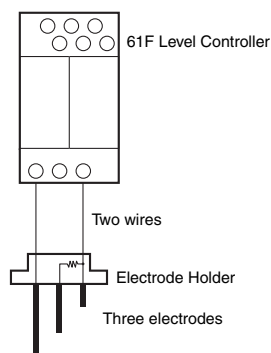
The internal relay switches when current flows between electrodes.

Note: All models except high-sensitivity models use this method. The 61F-G□NH also uses this method.

Operation

Two-wire Method (Type R)

The self-holding circuit is removed to reduce the number of lines between the 61F Level Controller and the electrodes. However, the self-holding electrode is still required, so make sure that all components (Level Controller, relay unit, electrode holder, etc.) are type R with 1 W, 6.8 kΩ resistance.



Three-wire Method

Called three-wire as opposed to the two-wire method. It is the standard operation method for 61F Level Controllers.

Idling Prevention

In high-rise buildings and apartments, water is pumped up from ground tanks to elevated tanks. If the ground tanks run out of water and the pump is still operating, the pumps starts pumping air and overheats the motors, potentially causing a burnout. To prevent this from happening, the pumps are stopped once the water drops below a certain level. The 61F-G1N/-G1 and 61F-G4N/-G4 have this function.

Alternate Operation

In larger applications where water is pumped using a motor, there will be a spare motor. If the spare motor is not used, it may get rusty and deteriorate. If it is used continuously, it will also deteriorate due to generation of heat.

By alternating control of the two motors, the effective life of the motors is extended and when one of them breaks down, it can maintain operation with the other one. (An external switch is required.) The 61F-AN/-APN2 support this function.

Reference

Model	Number of lines between electrodes and the 61F Level Controller	Model	Number of lines between electrodes and the 61F Level Controller
61F-GN/-G	3	61F-GNR/-GR	2
61F-G1N/-G1	6 (See note 1.) 4 (See note 2.)	61F-G1NR/-G1R	4 (See note 1.) 3 (See note 2.)
61F-G2N/-G2	4	61F-G2NR/-G2R	3
61F-G3N/-G3	5	61F-G3NR/-G3R	4
61F-G4N/-G4	9	61F-G4NR/-G4R	7

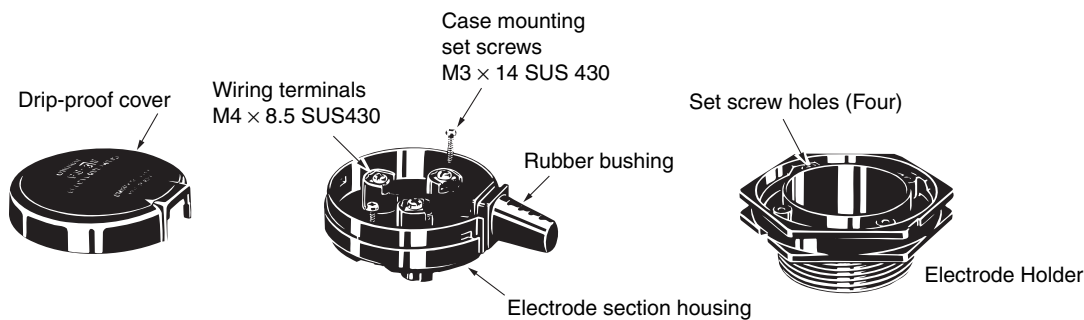
Note: 1. Indicates automatic water supply control with pump idling prevention.

2. Indicates automatic water supply control with abnormal water shortage alarm.

Level Controller Installation

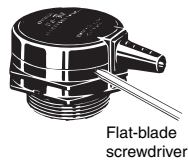
■ Attaching Electrodes to the Electrode Holder

Appearance

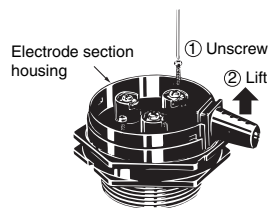


1. Removing the cover

- (1) Wedge a flat-blade screwdriver into the groove on either side of the rubber bushing and lever it off alternately. (The cover may break if you lever it too much on one side.)

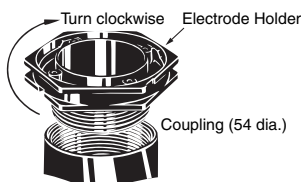


- (2) Undo the two set screws and lift off the electrode section.

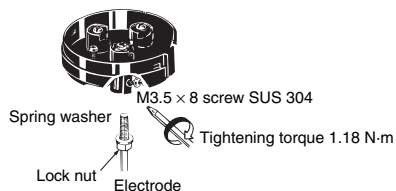


2. Mounting

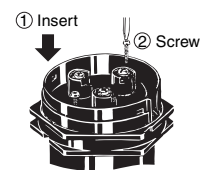
- (1) Screw the Electrode Holder into the coupling (54 dia.) secured at the installation location.



- (2) Screw in the electrodes until it cannot be turned any further, tighten the lock nut, and then secure them with the clamp screws (M3.5).



- (3) Attach the electrode section to the Electrode Holder.

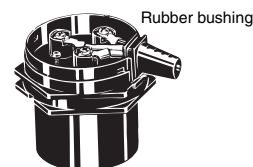


(Secure with the two case mounting screws. Tightening torque 0.7 N·m)

- (4) The rubber bushing can be cut with a utility knife if the hole size requires adjustment to fit the cables.



- (5) Connect the leads to the respective terminals. (Fit the rubber bushing in position as shown in the diagram below.)



- (6) Put the claw at the back of the cover into the hole at the back of the electrode section housing and push it close until you hear a click.

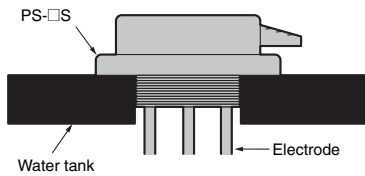


■ Installing an Electrode Holder on a Tank

Note: Electrode Holders should always be installed from above the tank.

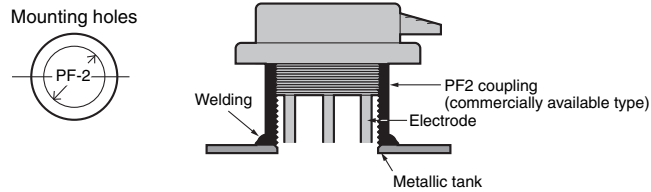
Method 1

Fabricate screw threads of the same size as PF2 in the tank.



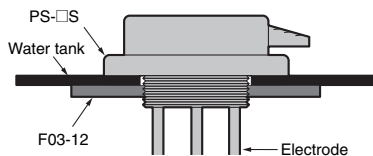
Method 2

Use a commercially available coupling (PF2 parallel thread (effective dia.: 58.135) JIS B0202.)



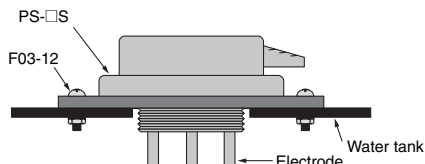
Method 3

Drill a hole (65 dia.) in the tank and insert the Electrode Holder. Use an F03-12 Frame (sold separately) as a nut from below and secure in place.

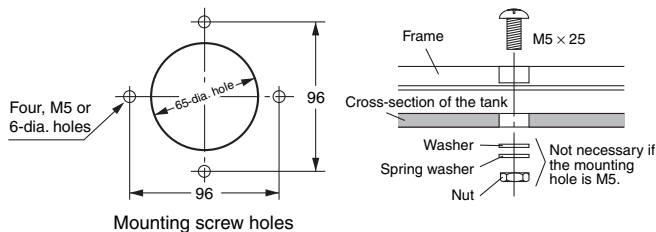


Method 4

Use the F03-12 Frame (sold separately) as a flange.

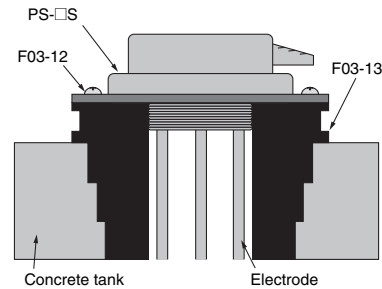


1. Drill a hole in the tank.
2. Attach the Frame over the hole.
(Tighten the four F03-12 mounting screws.)



Method 5

Use F03-12 and F03-13 Frames (both sold separately) together and embed them in the concrete.



■ Mounting the F03-11 Protective Cover (Sold Separately)

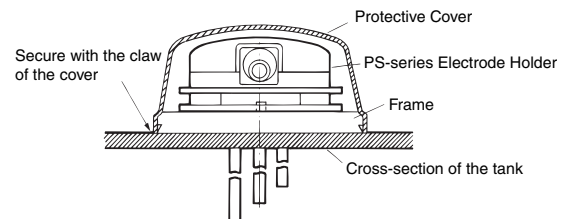
The protective cover can only be used for methods 4 and 5 described in the previous section.

PS-series (R) Series

Attach the F03-12 Frame to the bottom of the PS-series Electrode Holder. (See diagram below.)

Next, place the F03-11 Protective Cover on top of the Electrode Holder and press on it until it clicks into place.

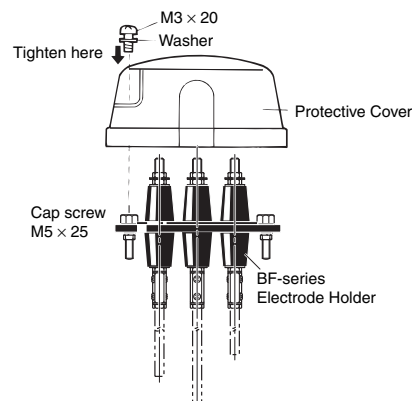
Note: The cap screw attached to the protective cover is not required for mounting.



BF-series Electrode Holder (Applicable to BF-3(R), -5(R))

Remove the two mounting screws (M5 x 25) of the BF-series Electrode Holder and attach the two cap screws (M5 x 25) provided with the F03-11 Protective Cover.

Next, put the Protective Cover over the top of the BF-series Electrode Holder, and then tighten the two enclosed screws (M3 x 20 with washers). See diagram below.



Note: The Protective Cover cannot be mounted on the BF-1.

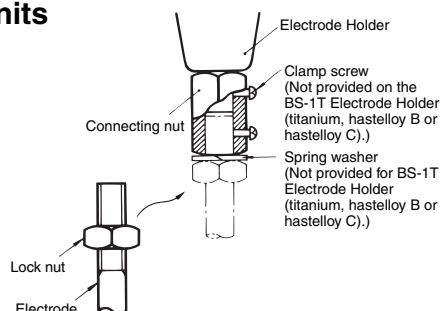
■ Mounting Electrodes

Connecting Electrodes to Electrode Holders

1. Place a lock nut onto the electrode.
2. Fully fit the electrode into the connecting nut attached to the Electrode Holder.
3. Tighten the lock nut.
4. Tighten the electrode with the two clamp screws.

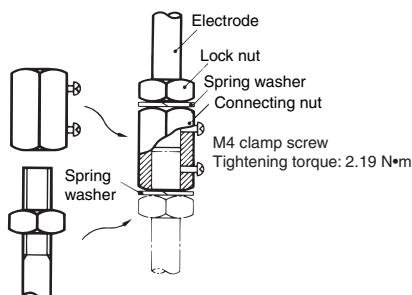
Applicable units

BF Series
BS Series

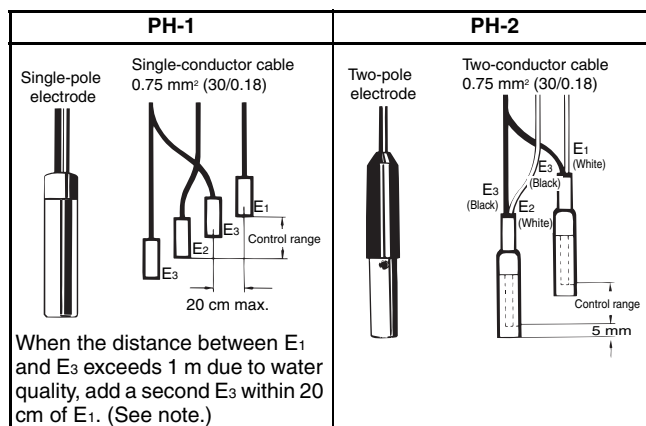


Connecting One Electrode to Another

1. Put a lock nut onto each electrode at its end.
2. Fit each electrode into the connecting nut so that the ends meet at the center.
3. Tighten the lock nuts.
4. Tighten the electrodes with the two clamp screws.

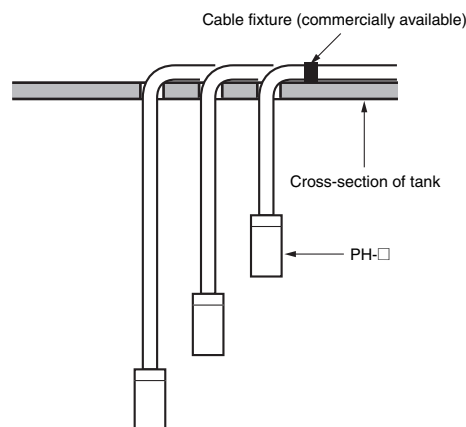


■ Spring washer



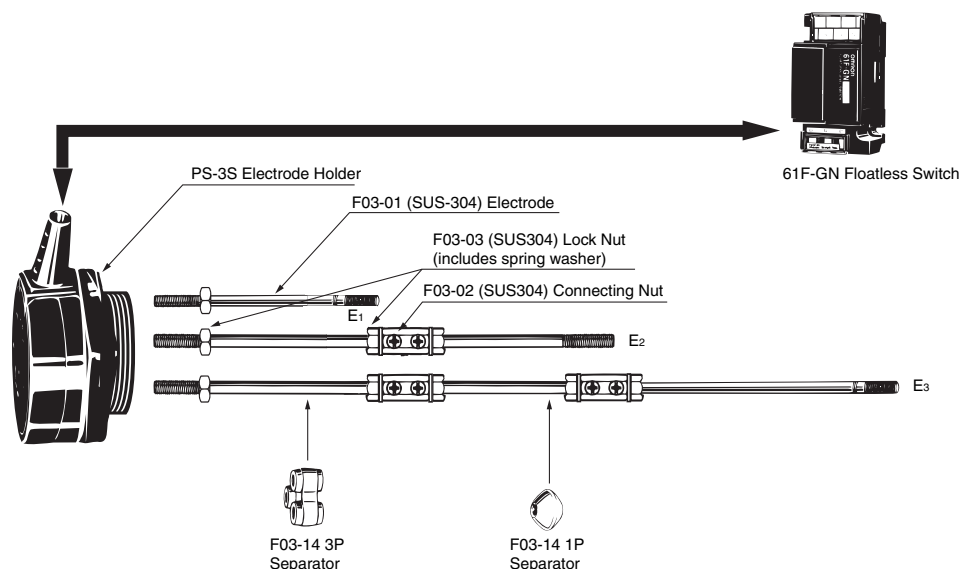
Note: Even when the distance is less than 1 m, the product may not operate due to the water quality.

Example



■ Accessories for Installation (Electrodes)

Automatic Water Supply and Drainage Control

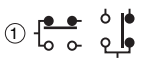


Number of devices
needed for E₁ = 1 m,
E₂ = 2 m, E₃ = 3 m

61F-GN	1
PS-3S	1
F03-01(SUS304)	6
F03-02(SUS304)	3
F03-03(SUS304)	9
F03-14 3P	1
F03-14 1P	1

Reference Material for Level Controllers

■ Summary of Element Symbols Used in Connection Diagrams

Element	Symbol		Details
	Denotation in product catalogs	Denotation by JIS	
NO contact	 or 		Normally open contact. Contact is open when the relay is inactive.
NC contact	 or 		Normally closed (NC) contact. Contact is closed when relay is inactive.
Changeover contact	 ①  ②		Changeover contacts control two circuits, one normally open contact and one normally closed contact with a common terminal. Symbols ① and ② are equivalent.
Relay			Magnetic relay.
Photocoupler			Photocoupler.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.