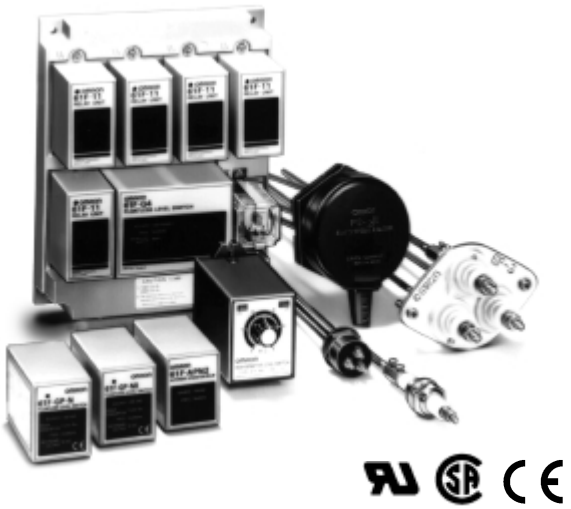
Floatless Level Controller

61F

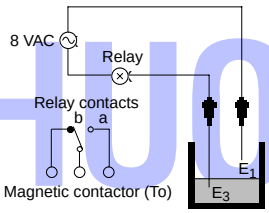
Automatic Water Supply and Drainage Control

- Ideal for level control of any conductive liquid
- Both general-purpose and panel-use models available
- Incorporates an arrester for surge and induced lightning protection
- Wide range of models: Long-distance, high- and low-sensitivity, two-wire, etc.
- LED indicator for quick operation check
- Conforms to EMC/IEC standards (61F-GP-N/-N8/-GPN-V50)
- UL/CSA approved (61F-GP-N8/-GPN-V50)



Operating Principle

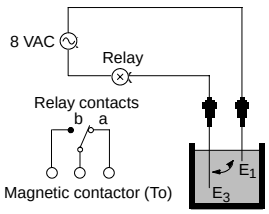
Unlike ordinary level switches that use a float for level detection, the 61F Floatless Level Controller uses electrodes to electrically detect the liquid level. The following figures illustrate this simple operating principle.



No current flows between E1 and E3.

When electrode E1 is not in contact with the conductive liquid, the electrical circuit is open, and no current flows between electrodes E1 and E3.

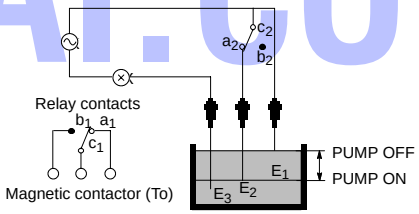
Consequently, relay X does not operate. Relay X's NC contacts (normally closed, b in the figure) remain closed. However, when liquid is supplied to the tank, so that the liquid contacts or immerses E1, the circuit closes. Relay X operates, and electrical devices connected to the NO (normally open, a in the figure) contacts of the relay begin operation.



Current flows between E1 and E3.

A pump is usually connected to a contactor, which in turn is connected to the Controller contact outputs. The Level Controller would automatically operate the pump, to control the liquid level in the tank.

However, in practice, with only two electrodes, ripples on the surface of the liquid cause the Controller to jump and start, shortening pump (and other equipment) life. This problem can be solved by adding another electrode to form a self-holding circuit. The additional electrode, E2, is connected in parallel with E1, as shown below.



As shown in the above figure, when the holding circuit relay is energized, contact a_2, its NO contact, is closed. The electrical circuit made through the liquid and the electrodes is then retained by E2 and E3, even when the liquid level falls below E1, as long as contact a_2 is closed.

When the liquid level falls below E2, the circuit made through the electrode circuit opens, which de-energizes relay X, thus closing the NC contact of X.

Operating as simply as it does, possible applications of the Floatless Level Controller are virtually endless. Not only liquid level control is possible, but such applications as leakage detection, object size discrimination, and many other problems may be solved by one of the reliable 61F Floatless Level Controllers.

Model Selection

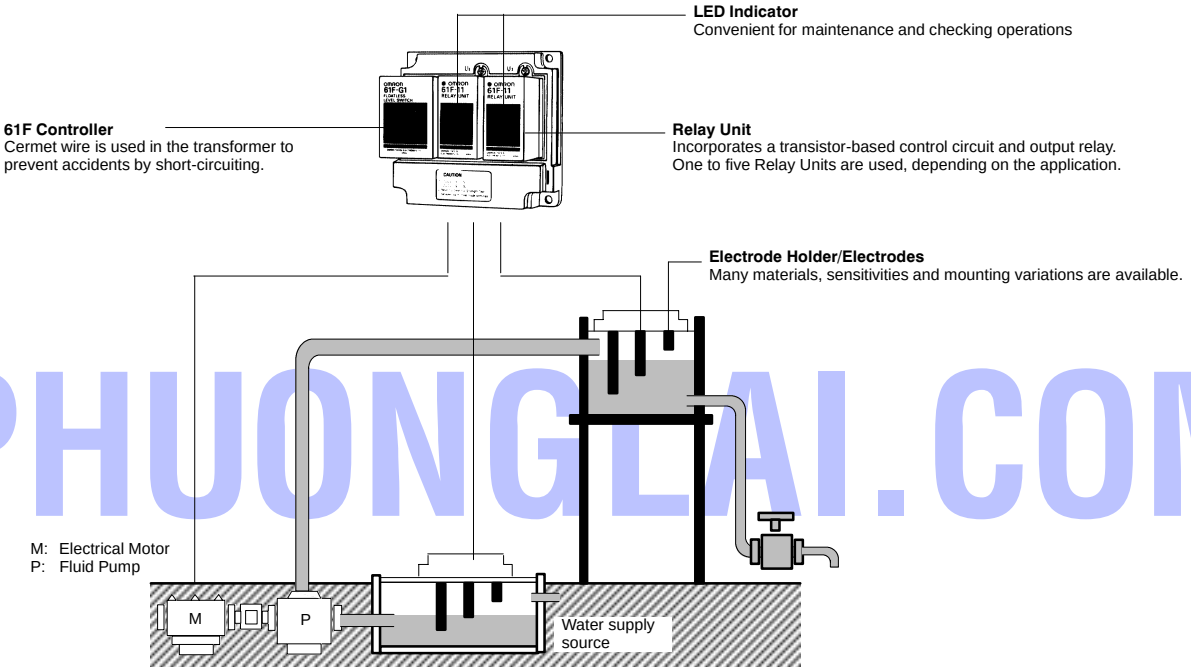
■ Basic Configuration of 61F Conductive Level Controller

To use a 61F Conductive Level Controller, the 61F itself, Electrode Holders, and Electrodes are required.

Basic configuration

- 61F
  - Select from the capability, function, and size to suit the application.
  - Refer to the following Controller selection guidelines.
- Electrode Holders
  - Select from the characteristics, application examples, and shape.
  - Refer to page 9−31 for cautions about the Electrode Holders.
- Electrodes
  - Select according to operating conditions and shape.
  - Refer to pages 9−29 to 9−31 for cautions about the Electrodes.

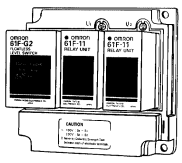
Typical Application Example



Ordering Information

■ 61F Controller Selection Guide by Installation Method

Standard Model

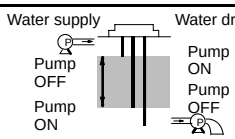
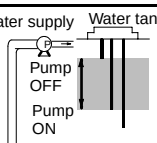
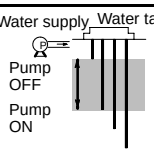
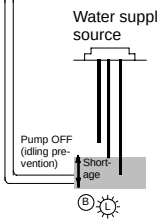
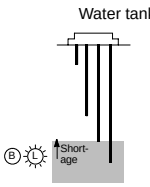
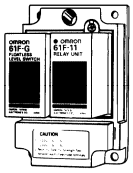
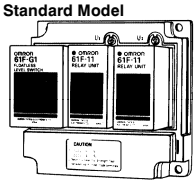
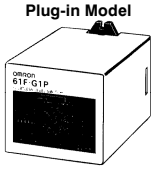


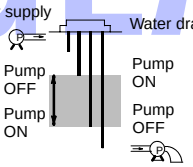
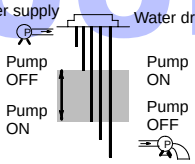
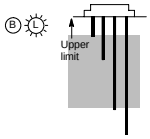
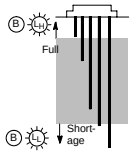
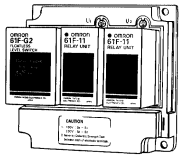
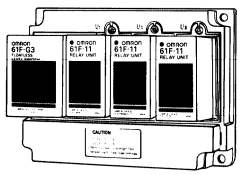
- When there is sufficient mounting space.
- When monitoring operation through LEDs.

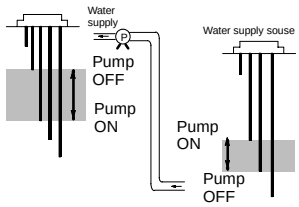
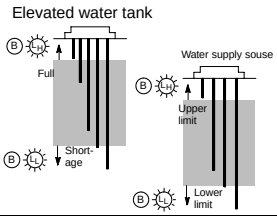
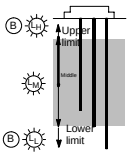
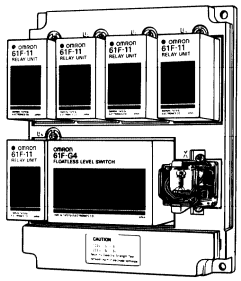
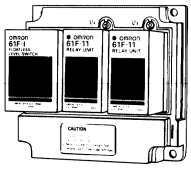
Plug-in Model
Compact Plug-in Model

- When using socket mounting.

■ 61F Controller Selection Guide by Application

Item		G Automatic water supply and drainage control	G1 Automatic water supply (idling prevention)	G1 Automatic water supply (abnormal shortage alarm)
Function	Automatic pump operation (constant water level)			
	Water level indication abnormal alarm	---		
Appearance		Standard Model  **61F-G-AP*** (Pages 9–6 to 9–15, 9–24) **AP – Asia Pacific Type** Compact Plug-in Model  **61F-GP-N** (Pages 9–16 to 9–18, 9–25)  **61F-GP-N8**	Standard Model  **61F-G1-AP*** (Pages 9–6 to 9–7, 9–9 to 9–10, 9–24) **AP – Asia Pacific Type**	Plug-in Model  **61F-G1P**

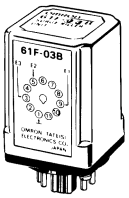
Item		G2 Automatic water supply and drainage control (abnormal water increase alarm)	G3 Automatic water supply and drainage control (abnormal filling/shortage alarm)
Function	Automatic pump operation (constant water level)		
	Water level indication abnormal alarm		
Appearance		Standard Model  **61F-G2** (Pages 9–6 to 9–7, 9–11, 9–24) Plug-in Model  **61F-G2P**	Standard Model  **61F-G3** (Pages 9–6 to 9–7, 9–12, 9–25)

Item		G4 Water source level indication, prevention of pump idling due to water shortage, automatic water supply control, and indication of water level in tank	I Liquid level indication and alarm	
Function	**Automatic pump operation (constant water level)**	Elevated water tank 	---	
	Water level indication abnormal alarm	Elevated water tank 		
Appearance		**Standard Model**  **61F-G4** (Pages 9–6 to 9–7, 9–24)	**Standard Model**  **61F-I**	**Plug-in Model**  **61F-IP**

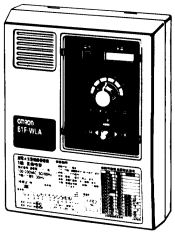
Related Products

Relay Unit for standard models (Page 9–7)

Surge Suppressor Unit (for protecting against induced voltage)



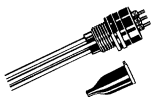
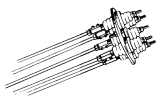
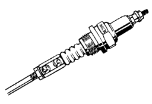
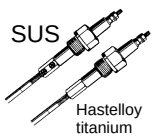
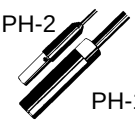
61F-WLA Water Leakage Alarm



61F-GPN-V50 Water Leakage Detector

■ Accessories

Electrode Holders

Applications	General applications such as water supply lines	Applications where only a small space is available	Liquid with low specific resistance	Applications where high mounting strength is required	Applications where high temperature/ high pressure conditions are severe	Applications where high corrosion resistance is required	Applications where distance to the water surface is long
Models	PS-3S/-4S/-5S (Two-wire models are also available.)	PS-31	BF-1	BF-3/-4/-5	BS-1	BS-1T	PH-1/-2
Appearance							

Electrodes

Sets of Electrodes, connecting nuts, lock nuts, and spring washers are available. When ordering individual parts, refer to page 9–19.

Applications	Purified city water, industrial water, sewage	Purified city water, industrial water, sewage, dilute alkaline solution	Sodium hydroxide, acetic acid, dilute sulfuric acid, dilute hydrochloric acid	Sea water, ammonia water, nitric acid	Acetic acid, dilute sulfuric acid, sea water
Models	F03-60-SUS201	F03-60-SUS316	F03-60 HAS B	F03-60 HAS C	F03-60 Titanium

Others

Item	Model
Protective Cover (for PS or BF electrode holders) 	F03-11
Spring Clamp (for PS electrode holders) 	F03-12
Electrode Separators (for preventing long electrodes from contacting with each other) 	F03-14 1P (for 1 pole) F03-14 3P (for 3 poles) F03-14 5P (for 5 poles)

Note: For more complete range of products, please contact nearest OMRON office.

Specifications

■ Standard Models

Specifications

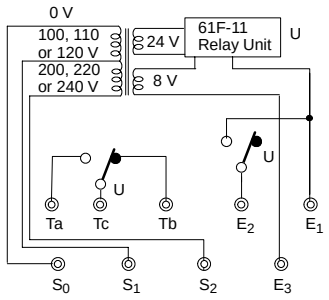
Items	General-purpose Controller 61F-□ (TDL) (see note 1 and 2)	High-temperature Controller 61F-□T (see note 1)	Long-distance Controllers 61F-□L 2KM (for 2 km) 61F-□L 4KM (for 4 km) (see note 1)	High-sensitivity Controllers 61F-□H (see note 1)	Low-sensitivity Controller 61F-□D (see note 1)
Controlling materials and operating conditions	For control of ordinary purified water or sewage water	For control of ordinary purified water or sewage water in cases where the ambient temperature is high.	For control of ordinary purified water in cases where the distance between sewage pumps and water tanks or between receiver tanks and supply tanks is long or where remote control is required.	For control of liquids with high specific resistance such as distilled water	For control of liquids with low specific resistance such as salt water, sewage water, acid chemicals, alkali chemicals
Supply voltage	100, 110, 120, 200, 220, 230 or 240 VAC; 50/60 Hz				
Operating voltage range	85% to 110% of rated voltage				
Interelectrode voltage	8 VAC			24 VAC	8 VAC
Interelectrode current	Approx. 1 mA AC max.				
Power consumption	Approx. 3.2 VA max. (One unit)				
Interelectrode operate resistance	0 to approx. 4 kΩ	0 to approx. 5 kΩ	0 to approx. 1.8 kΩ (for 2 km) 0 to approx. 0.7 kΩ (for 4 km)	Approx. 15 kΩ to 70 kΩ (see note 5)	0 to approx. 1.8 kΩ
Interelectrode release resistance	Approx. 15 k to ∞ Ω	Approx. 15 k to ∞ Ω	4 k to ∞ Ω (for 2 km) 2.5 k to ∞ Ω (for 4 km)	Approx. 300 k to ∞ Ω	Approx. 5 k to ∞ Ω
Cable length (see note 3)	1 km max.	600 m max.	2 km max. 4 km max.	50 m max.	1 km max.
Control output	2 A, 220 VAC (Inductive load: cosϕ = 0.4) 5 A, 220 VAC (Resistive load)				
Ambient temperature	Operating: –10°C to 55°C (–10°C to 70°C for 61F-□T)				
Ambient humidity	Operating: 45% to 85% RH				
Insulation resistance (see note 4)	100 MΩ min. (at 500 VDC)				
Dielectric strength (see note 4)	2000 VAC, 50/60 Hz for 1 min.				
Life expectancy	Electrical: 500,000 operations min. Mechanical:5,000,000 operations min.				

Note:
1. The □ in the model name represents G, G1, G2, G3, G4, and I.
2. The suffix “TDL” attached to the model name represents models designed for tropical regions (storage humidity of 45 to 90% RH).
3. The length when using completely-insulated, 600-V, 3-conductor (0.75 mm^2) cabtire cables. Usable cable lengths will become shorter as the cable diameter or number of conductors becomes larger.
4. The insulation resistance and dielectric strength indicate values between power terminals and Electrode terminals, between power terminals and contact terminals, and between Electrode terminals and contact terminals.
5. Possible to use with 15 kΩ or less, however, this may cause reset failure≥

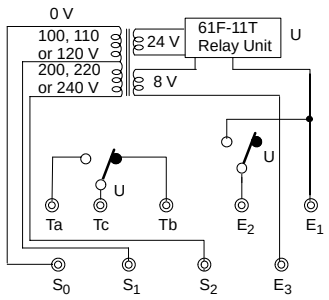
Internal Circuit Diagrams

The schematic diagrams shown below typify the internal connections of the various 61F models. The designations Ta, Tb, and Tc (sometimes referred to collectively as "U") may occur more than once in a product, however, the "a" terminal is always an NO contact, a "b" terminal is an NC contact, and the "c" terminal is the common terminal.

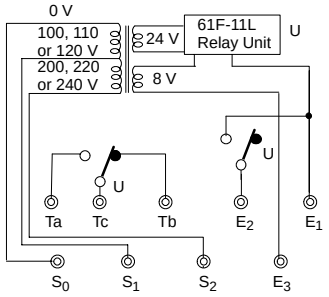
61F-G–AP



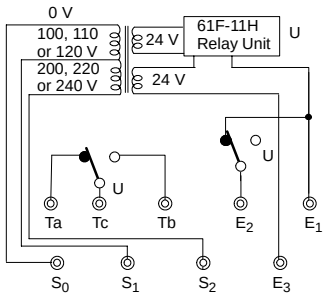
61F-GT



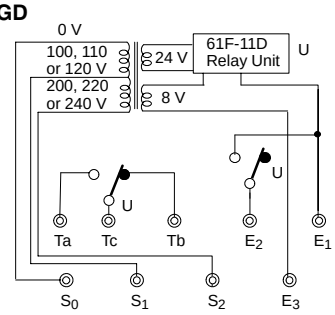
61F-GL



61F-GH (See note.)



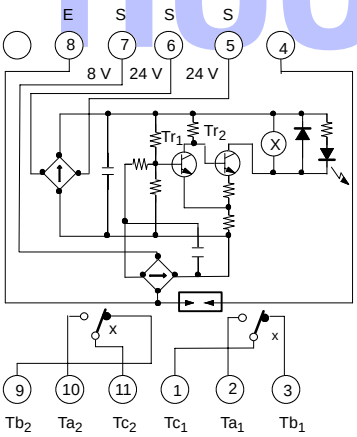
61F-GD



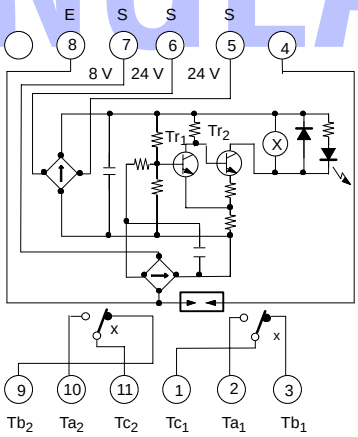
61F-11 Relay Units

Item	61F-11	61F-11T	61F-11L	61F-11H	61F-11D
Interchangeable with general-purpose model (61F-11)	---	Provided	Provided	Not provided	Provided
Color of band on name plate	---	Red	Yellow	Blue	Black

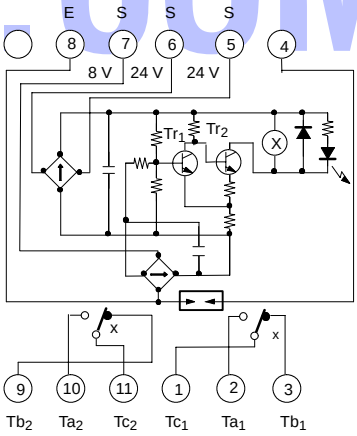
61F-11



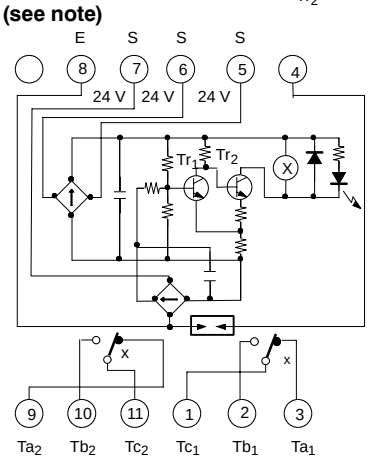
61F-11T



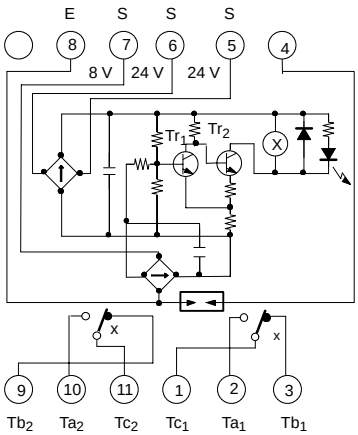
61F-11L



61F-11H (see note)



61F-11D

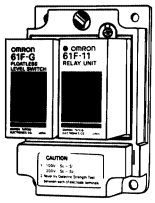


Note: The 61F-11H relay de-energizes when there is water present across the Electrodes, whereas the 61F relay energizes when there is water present across the Electrodes.
Also, the terminal connections of those Controllers provided with LED indicators differ from those which have no indicators.

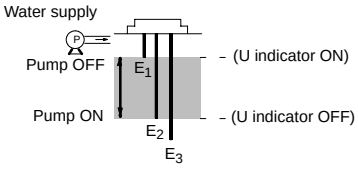
Connections

61F-G-AP

Automatic Water Supply and Drainage Control

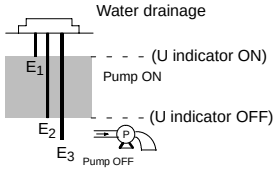


1. Water Supply

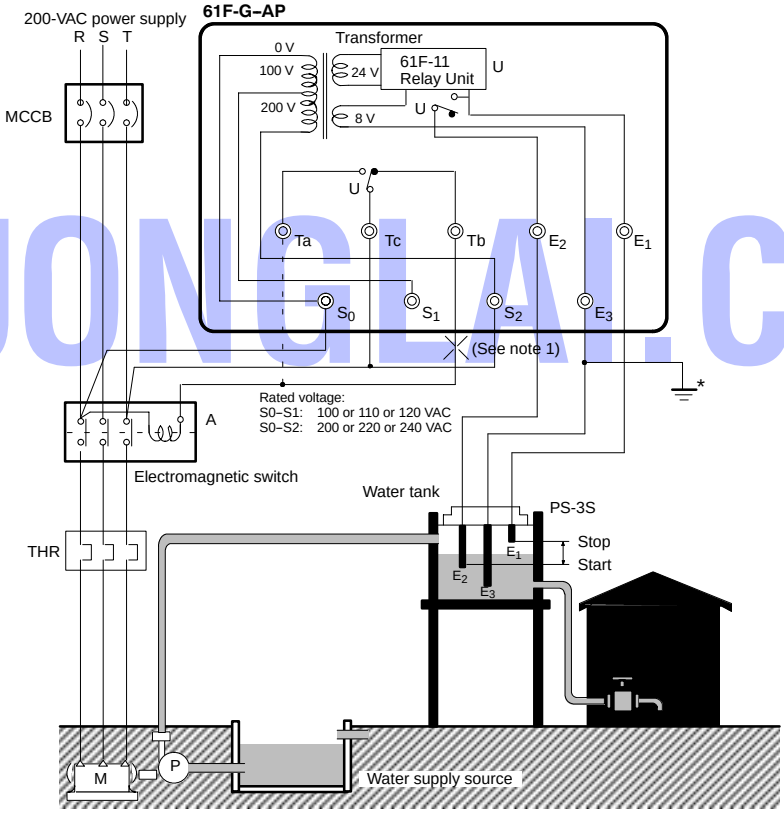


- Connect electromagnetic switch coil terminal A to Tb.
- The pump stops (indicator ON) when the water level reaches E1 and starts (indicator OFF) when the water level drops below E2.

2. Drainage

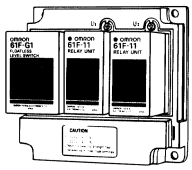


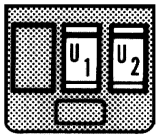
- Connect the electromagnetic switch coil terminal A to Ta.
- The pump starts (indicator ON) when the water level reaches E1 and stops (indicator OFF) when the water level drops below E2.



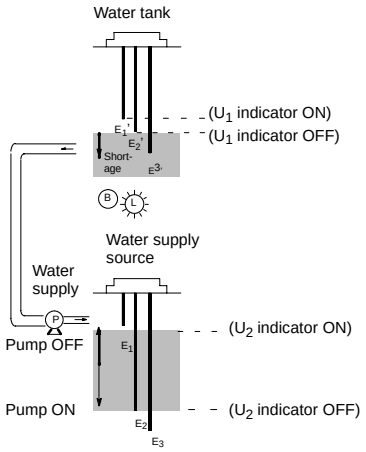
Note: 1. The diagram shows the connections for the water supply. When draining, change the connection from terminal Tb to terminal Ta.
2. Be sure to ground terminal E3.

61F-G1–AP



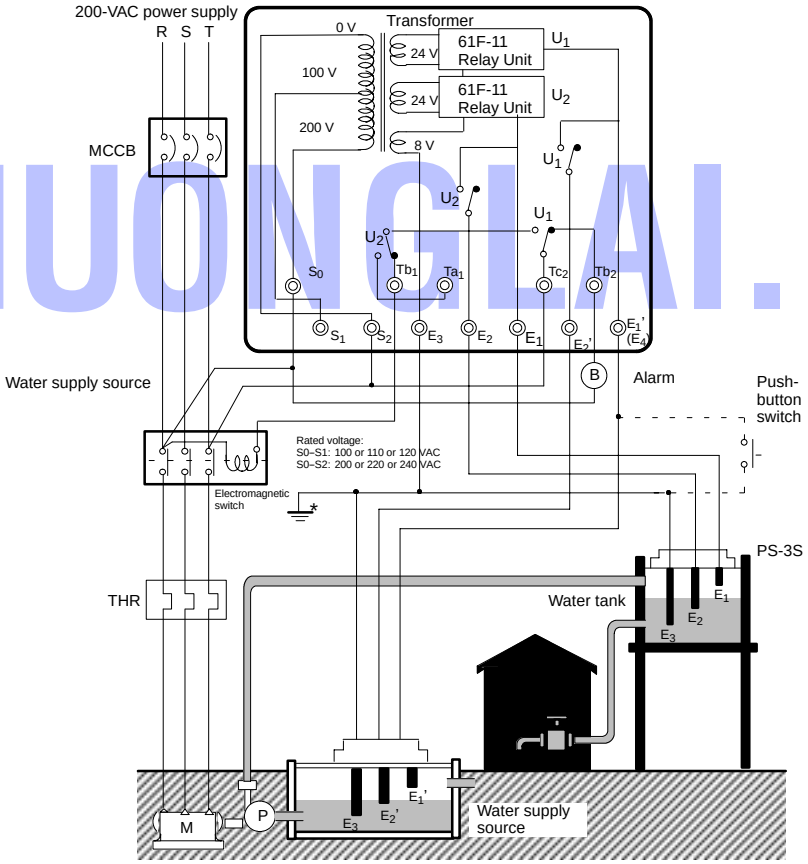


Application 1: Automatic Water Supply Control with Pump Idling Prevention



- The pump stops (U2 indicator ON) when the water level reaches E1 and the pump starts (U2 indicator OFF) when the water level in the tank drops below E2.
- When the level of the water supply source drops below E2', the pump stops (U1 indicator OFF). Pump idling is prevented and the alarm sounds.
- Insert a pushbutton switch (NO contact) between E1' and E3 as shown by the dotted line. When starting the pump or after recovering from a power failure, if the water supply source level has not yet reached E1', press the pushbutton switch to start the pump by momentarily short-circuiting E1' and E3. When the pump stops during normal operation subsequent to an alarm issued for a low water level (e.g., the water level does not reach E2'), do not press the pushbutton switch.

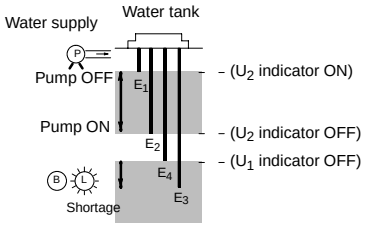
61F-G1–AP



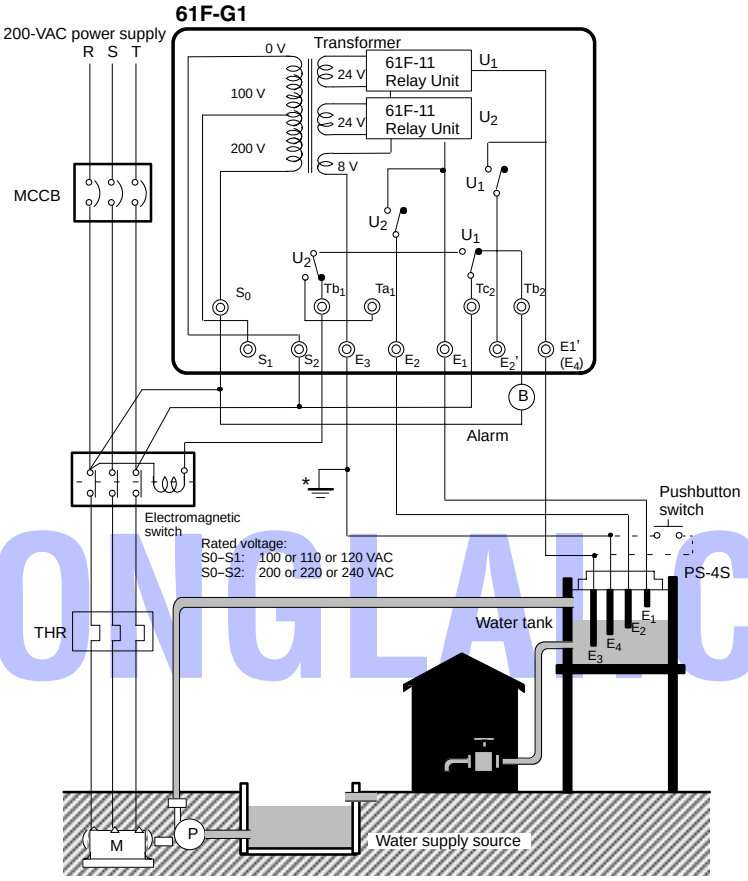
Note: Be sure to ground terminal E3.

61F-G1–AP

Application 2: Automatic Water Supply Control with Abnormal Water Shortage Alarm

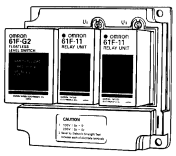


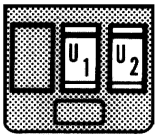
- The pump stops (U2 indicator ON) when the water level reaches E1 and starts (U2 indicator OFF) when the water level drops below E2.
- If the water level drops below E4 for any reason, the pump stops (U1 indicator OFF) and the alarm sounds.
- Insert a pushbutton switch (NO contact) between E3 and E4. When starting the pump or after recovering from a power failure, if the water level has not yet reached E4, press the pushbutton switch to start the pump by short-circuiting E3 and E4. If the pump stops upon releasing the pushbutton switch, keep pressing the pushbutton switch.



Note: Be sure to ground terminal E3.

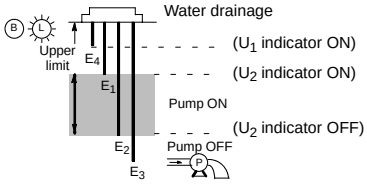
61F-G2





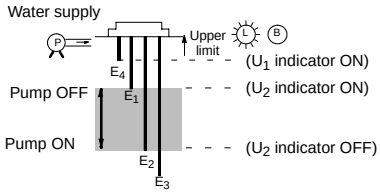
Automatic Drainage Control and Water Supply with Abnormal Water Increase Alarm

1. Drainage



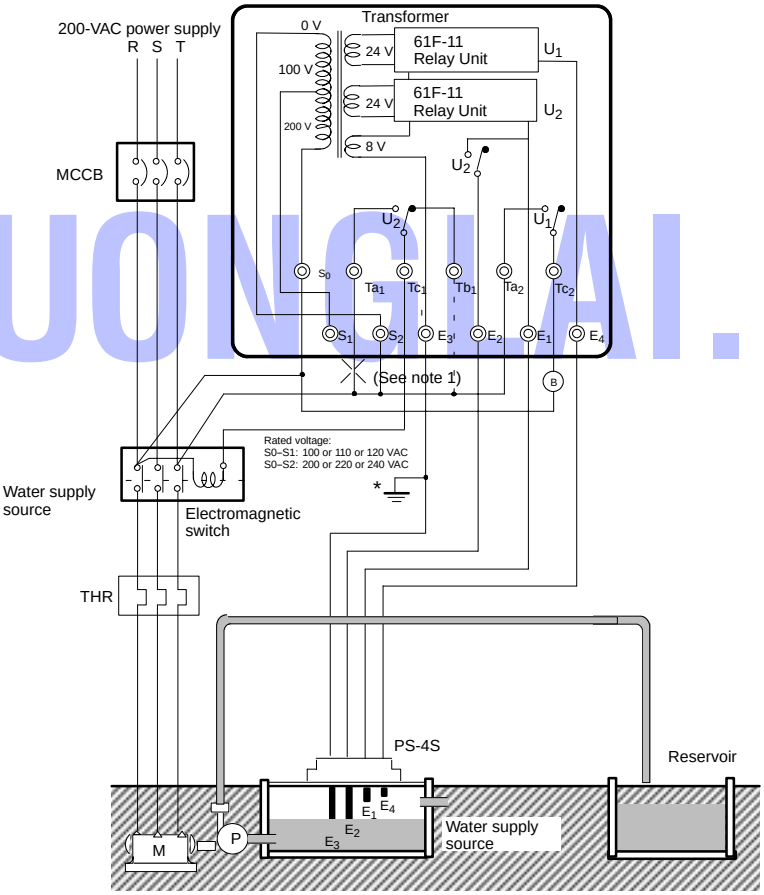
- Connect the electromagnetic switch terminal (T phase) to Ta1.
- The pump starts (U2 indicator ON) when the water level reaches E1 and stops (U2 indicator OFF) when the water level drops below E2.
- If the water level reaches E4 for any reason, the alarm sounds (U1 indicator ON).

2. Water Supply



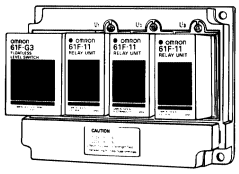
- Connect the electromagnetic switch terminal (T phase) to Tb1.
- The pump starts (U2 indicator OFF) when the water level reaches E2 and stops (U2 indicator ON) when the water level rises to E1.
- If the water level reaches E4 for any reason, the alarm sounds (U1 indicator ON).

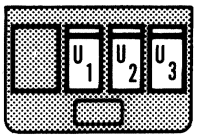
61F-G2 for drainage control



Note: 1. The diagram shows the connections for the water supply. When draining, change the connection from terminal Tb1 to terminal Ta1.
2. Be sure to ground terminal E3.

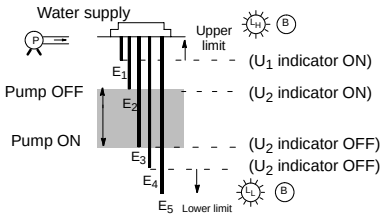
61F-G3





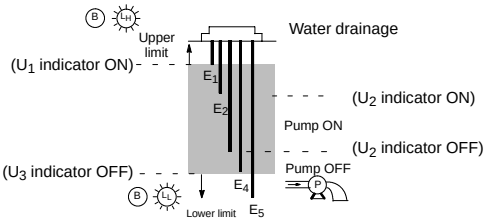
Automatic Water Supply and Drainage Control with Abnormal Water Shortage Alarm and Water Tank Repletion

1. Water Supply



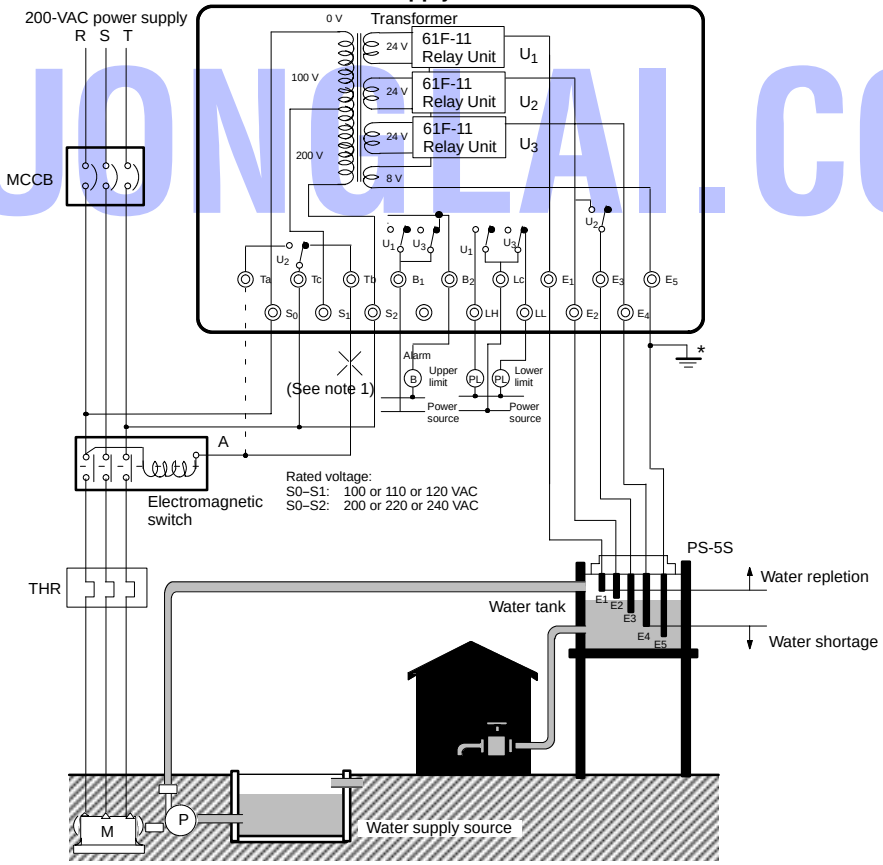
- Connect electromagnetic switch coil terminal A with Tb.
- The pump stops (U2 indicator ON) when the water level reaches E2 and starts (U2 indicator OFF) when the water level drops below E3.
- If the water level rises to E1 for any reason, the upper-limit indicator turns ON and the alarm sounds (U1 indicator ON).
- If the water level drops below E4 for any reason, the lower-limit indicator turns ON and the alarm sounds (U3 indicator OFF).

2. Drainage



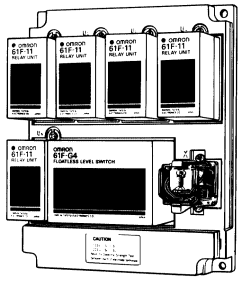
- Connect the electromagnetic switch coil terminals A with Ta.
- The pump starts (U2 indicator ON) when the water level reaches E2 and stops (U2 indicator OFF) when the water level drops below E3.
- If the water level rises to E1 for any reason, the upper-limit indicator turns ON and the alarm sounds (U1 indicator ON).
- If the water level drops below E4 for any reason, the lower-limit indicator turns ON and the alarm sounds (U3 indicator OFF).

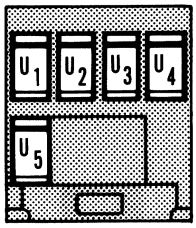
61F-G3 for water supply



Note: 1. The diagram shows the connections for the water supply. When draining, change the connection from terminal Tb to terminal Ta.
2. Be sure to ground terminal E5.

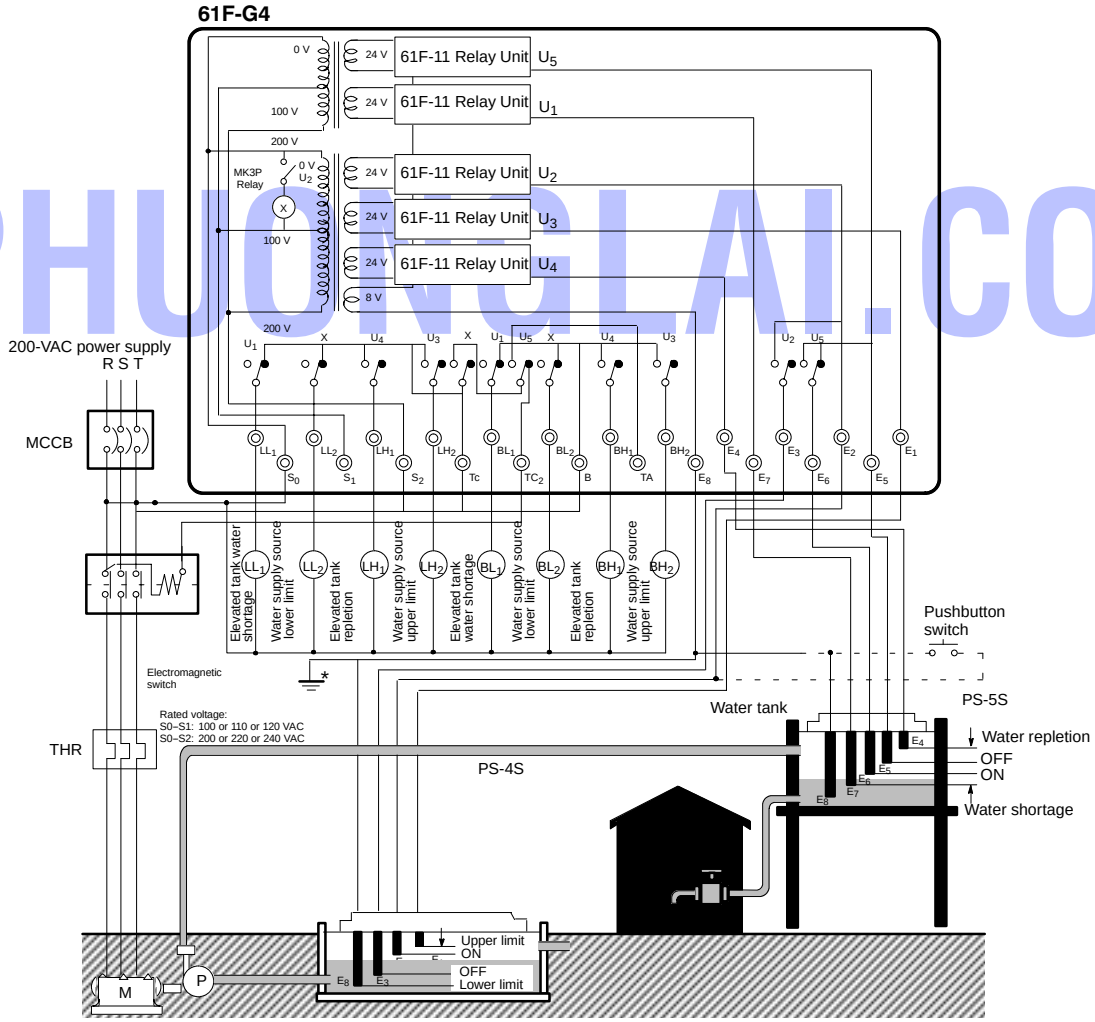
61F-G4





Water Source Level Indication, Prevention of Pump Idling Due to Water Shortage, Automatic Water Supply Control, and Indication of Water Level in Tank

- Insert four Electrodes in the water supply source and five Electrodes in the elevated water tank.
- The lower-limit indicator for the water supply source remains ON while the water source level is below E3 (U2 indicator OFF).
- When the water level rises to E2, the lower-limit indicator turns OFF (U2 indicator ON) and the pump is ready for operation.
- When the water level reaches E1, the upper-limit indicator turns ON (U3 indicator ON).
- The water-shortage indicator for the elevated tank remains ON while the water level in the elevated tank is below E7. The indicator turns OFF (U1 indicator ON) when the water level rises to E7.
- The pump stops (U5 indicator ON) when the water level reaches E5 and starts (U5 indicator OFF) when the water level drops below E6.
- If the water level reaches E4 for any reason, the tank repletion indicator for the elevated tank turns ON (U4 indicator ON).
- Insert a pushbutton switch (NO contact) between E2 and E8 as shown by the dotted line. When starting the pump and after recovering from a power failure, if the water source level has not yet reached E2 (U2 indicator OFF), press the pushbutton switch to start the pump by momentarily short-circuiting E2 and E8. When the pump stops during normal operation subsequent to an alarm issued for low water level (i.e., the water level has not reached E3), do not press the pushbutton switch.



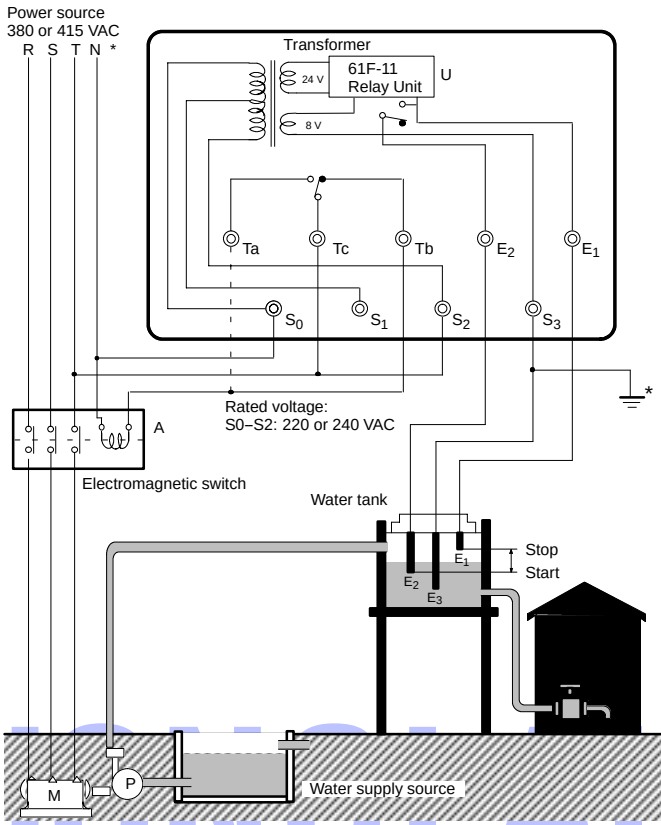
Note: 1. Be sure to ground terminal E8.

■ Connection with Three-phase Four-line Circuit

When supplying power from N-phase to the Controller in three-phase four-line circuit, refer to the following diagrams.
Line voltage (R-S, S-T, or R-T): 380 or 415 VAC
Phase voltage (N-R, N-S, or N-T): 220 or 240 VAC

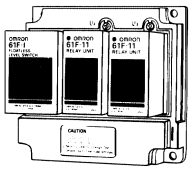
61F-G□, 220 or 240 VAC

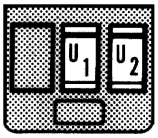
Water Supply



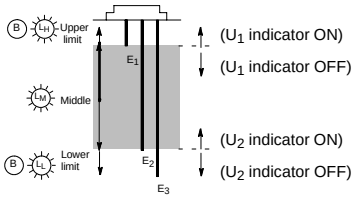
Note: Be sure to ground terminal E3.

61F-I



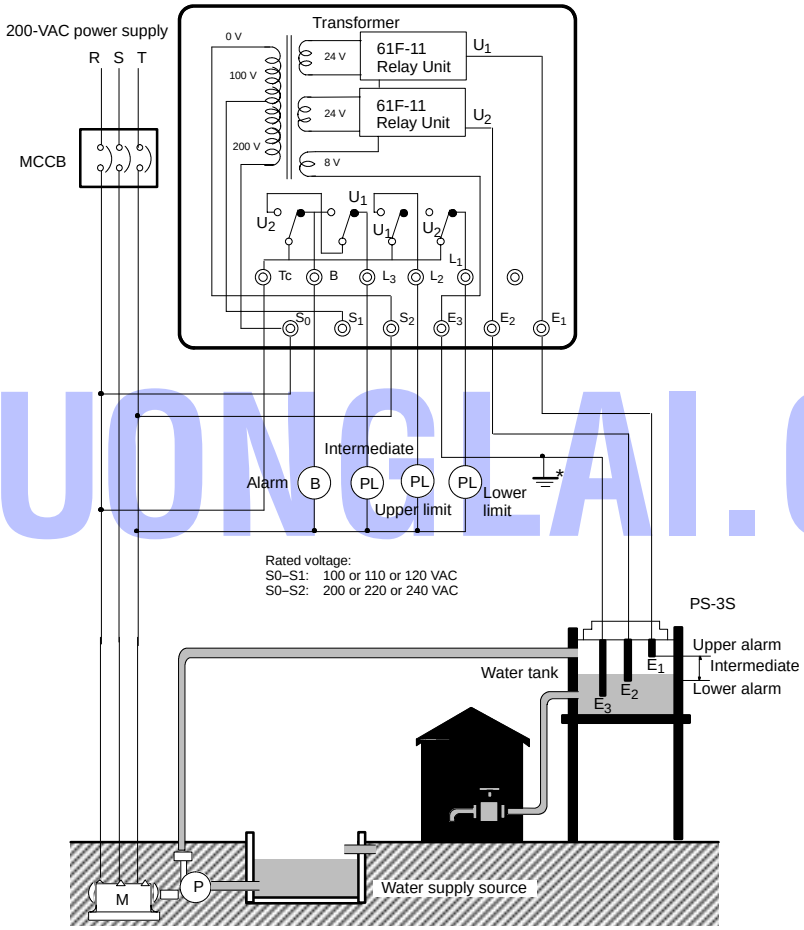


Liquid Level Indication and Alarm



- When the water level drops below E2, the lower-limit indicator turns ON and the alarm sounds (U2 indicator OFF).
- When the water level reaches E2, the alarm turns OFF and the intermediate indicator turns ON (U2 indicator ON).
- When the water level rises to E1, the upper-limit indicator turns ON and the alarm sounds (U1 indicator ON).

61F-I



Note: Be sure to ground terminal E3.

■ Compact Plug-in Models (11-pin Type)

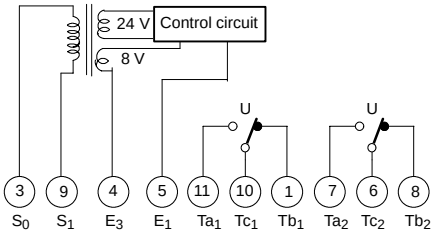
Specifications

Item	General-purpose Controller 61F-GP-N	High-temperature Controller 61F-GP-NT	Long-distance Controllers 61F-GP-NL 2KM (for 2 km) 61F-GP-NL 4KM (for 4 km)	High-sensitivity Controller 61F-GP-NH (see note 1)	Low-sensitivity Controller 61F-GP-ND
Controlling materials and operating conditions	For control of ordinary purified water or sewage water	For control of ordinary purified water or sewage where operating ambient temperature is high.	For control of ordinary purified water in cases where the distance between sewage pumps and water tanks or between receiver tanks and supply tanks is long or where remote control is required.	For control of liquids with high specific resistance such as distilled water	For control of liquids with low specific resistance such as salt water, sewage water, acid chemicals, alkali chemicals
Supply voltage	24, 100, 110, 120, 200, 220, 230 or 240 VAC; 50/60 Hz				
Operating voltage range	85% to 110% of rated voltage				
Interelectrode voltage	8 VAC				
Interelectrode current	Approx. 1 mA AC max.			Approx. 0.12 mA AC max.	Approx. 1 mA AC max.
Power consumption	Approx. 3.2 VA max.				
Interelectrode operate resistance	0 to approx. 4 kΩ	0 to approx. 4 kΩ	0 to approx. 1.3 kΩ (for 2 km) 0 to approx. 0.5 kΩ (for 4 km)	Approx. 10 kΩ to approx. 40 kΩ (see note 4)	0 to approx. 1.3 kΩ
Interelectrode release resistance	Approx. 15 k to □ Ω	Approx. 15 k to □ Ω	4 k to □ Ω (for 2 km) 0.5 k to □ Ω (for 4 km)	Approx. 100 k to □ Ω	Approx. 4 k to □ Ω
Response time	Operate: 80 ms max. Release: 160 ms max.				
Cable length (see note 2)	1 km max.	600 m max.	2 km max. 4 km max.	50 m max.	1 km max.
Control output	1 A, 250 VAC (Inductive load: cosϕ = 0.4) 3 A, 250 VAC (Resistive load)				
Ambient temperature	Operating: −10°C to 55°C (−10°C to 70°C for high-temperature controller)				
Ambient humidity	Operating: 45% to 85% RH				
Insulation resistance (see note 3)	100 MΩ min. (at 500 VDC)				
Dielectric strength (see note 3)	2000 VAC, 50/60 Hz for 1 min.				
Life expectancy	Electrical: 100,000 operations min. Mechanical:5,000,000 operations min.				

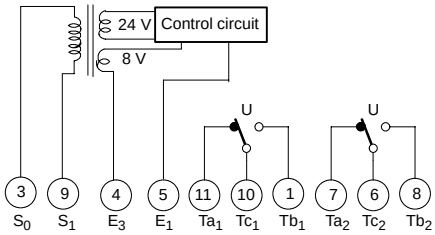
Note:
1. The relay in the 61F-GP-NH de-energizes when there is water present across the Electrodes, whereas the relay in the 61F-GP-N8HY energizes when there is water present across the Electrodes.
2. The length when using completely-insulated, 600-V, 3-conductor (0.75 mm^2) cabtire cables. Usable cable lengths will become shorter as the cable diameter or number of conductors becomes larger.
3. The insulation resistance and dielectric strength indicate values between power terminals and Electrode terminals, between power terminals and contact terminals, and between Electrode terminals and contact terminals.
4. Possible to use with 10 kΩ or less, however, this may cause reset failure.

Internal Circuit Diagrams

61F-GP-N/-NT/-NL/-ND



61F-GP-NH



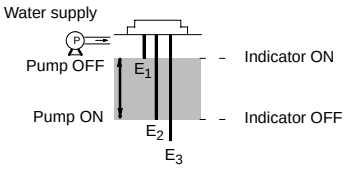
Note: When applying a self-holding circuit, short between terminals 5 and 6 and use terminal 7 as E_2.

Connections

61F-GP-N

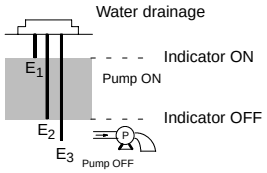
Automatic Water Supply and Drainage Control

1. Water Supply

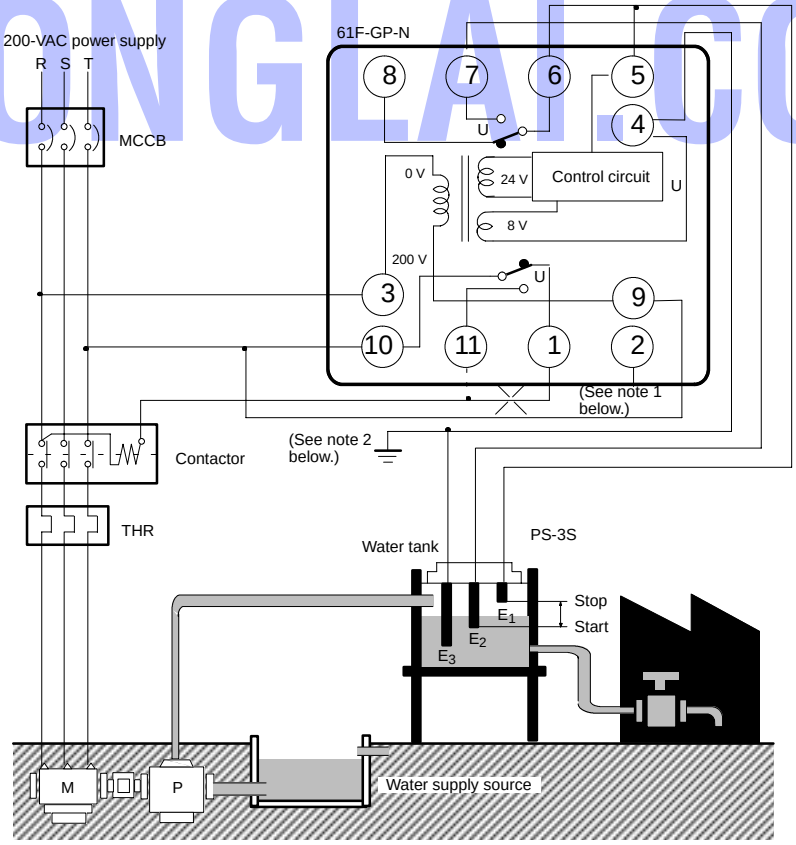


- Connect electromagnetic switch coil terminal A to terminal 1.
- The pump stops when the water level reaches E1 (indicator ON) and starts when the water level drops below E2 (indicator OFF).

2. Drainage



- Connect the electromagnetic switch coil terminal to terminal 11.
- Pump starts when the water level reaches E1 (indicator ON) and stops when the water level drops below E2 (indicator OFF).

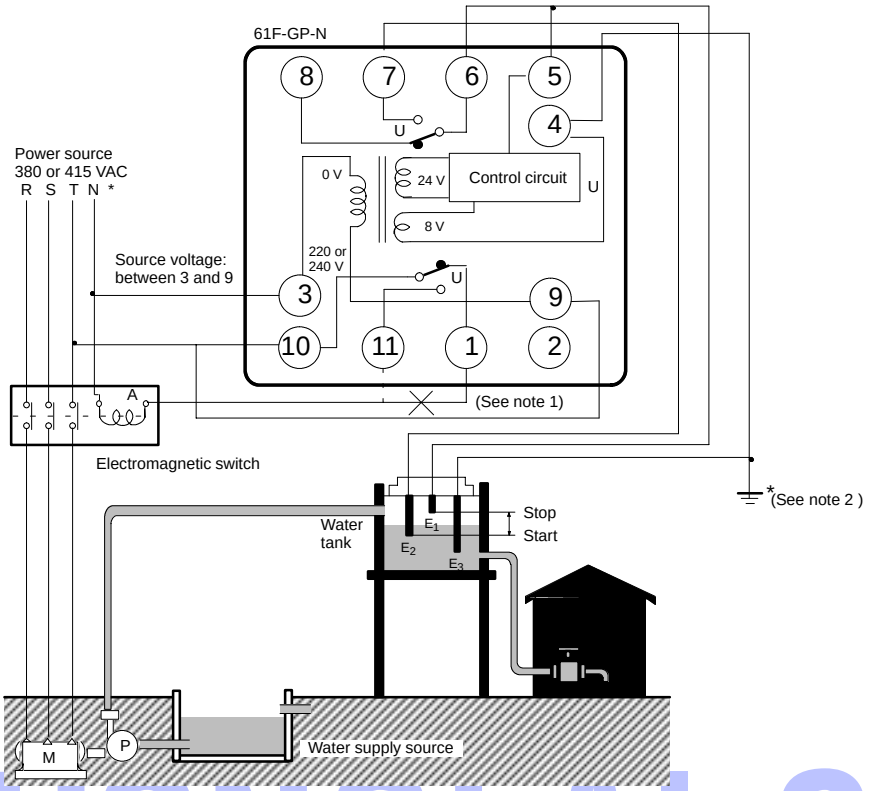


Note: 1. The diagram shows the connections for the water supply. When draining, change the connection from terminal 1 to terminal 11.
2. Be sure to ground terminal 4.

■ Connection with Three-phase Four-line Circuit

When supplying power from N-phase to the Controller in three-phase four-line circuit, refer to the following diagrams.
Line voltage (R-S, S-T, or R-T): 380 or 415 VAC
Phase voltage (N-R, N-S, or N-T): 220 or 240 VAC

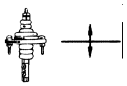
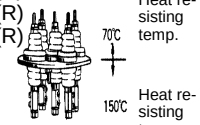
61F-GP-N□ 220 or 240 VAC



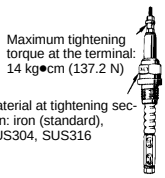
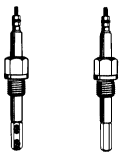
Note: 1. The diagram shows the connections for the water supply. When draining, change the connection from terminal 1 to terminal 11.
2. Be sure to ground terminal 4.

■ Accessories (Order Separately)

Electrode Holders

Applications		For city water and other General-use Electrodes. Easy-to-replace separate versions facilitate maintenance of Electrodes.	When mounting space is limited. Special 3-pole holder of small size and light weight. Ideal for soft drink vendors, etc., where only limited space is available.	For low specific liquids. Used for sewage, sea water, etc., having a low specific resistance. In sewage use, Electrode Holders must be installed 10 to 20 cm apart from one another. For acids, alkalis and sea water, Electrode Holders may be as much as 1 meter apart to operate properly.	When secure installation is required. For sewage, city water and other general use. 3-, 4-, and 5-pole models are available. In outdoor or dusty locations, or locations subject to water splashes, adherence of water, dust, dirt, or other foreign matter to the Electrode insulator may cause Controller malfunctioning due to leakage. Be sure to use the Protective Cover.
Mounting style		Flange	Screw	Flange	
Insulator material		Phenol resin		Ceramics	
Max. temperature		70°C max.		150°C max. (without water drips or vapor on the surface of the Electrode Holder)	150°C max.
Appearance		PS-3S(R) PS-4S(R) PS-5S(R) 	PS-31  (see note 2)	BF-1 	BF-3(R) BF-4(R) BF-5(R) 
No. of Electrodes	**1**	---	---	BF-1	---
	3	PS-3S(-3SR) (see note 1)	PS-31	---	BF-3(-3R) (see note 2)
	4	PS-4S(-4SR) (see note 1)	---	---	BF-4(-4R) (see note 2)
	5	PS-5S(-5SR) (see note 1)	---	---	BF-5(-5R) (see note 2)

Note: 1. Those with the suffix R in their model name are for 2-wire circuits.
2. The Electrode material for PS-31 is SUS304. (Length: 300 mm)

Applications		When resistance to high pressure is required. Ideal for use in tanks where temperature or pressure inside the tank is high, e.g. 250°C, 1.96 MPa {20 kg/cm^2}	When corrosion resistance is required. Since Teflon is used as the main part, the Electrode is free from rust and corrosion. Ideal for liquid level control in food processing, level control of strong alkaline liquids, etc. Withstand pressure: 981 kPa {10 kg/cm^2}	When Electrode positions are distant from water surface. For deep well, especially sewage. Several Electrodes are used in combination. Cable length: 100 m max. Single-core cord of 0.75 mm^2 (30/0.18) provided.	When Electrode positions are distant from water surface. For deep well and underwater pump. 2 sets of special Electrodes attached to cabtire cables for upper- and lower-limit control are to be suspended in water. Cable length: 100 m max. Two-core cord of 0.75 mm^2 (30/0.18) provided.
Mounting style		Screw		---	
Insulator material		Teflon		---	
Max. temperature		250°C max. (without water drips or vapor on the surface of the Electrode Holder)	150°C max.	With vinyl cord: −10°C to 60°C With chloroprene cord: −30°C to 70°C (without frost formation)	
Appearance			SUS 		
No. of Electrodes	**1**	BS-1	BS-1T	PH-1	---
	2	---	---	---	PH-2

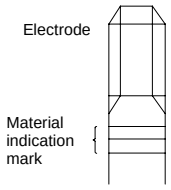
Note: 1. The BS-1 and BS-1T are pressure-proof models. The rest of models are not pressure-proof.
2. The BS-1 that uses SUS304 for clamping sections and screws of PT1/2 specifications is called BS-1S1.
3. The BS-1 that uses SUS304 for clamping sections is called BS-1S and one that uses SUS316 is called BS-1S2.
4. When using the BS-1T in liquids with low specific resistance, provide a large clearance between Electrodes. This clearance must be varied depending on the specific resistance, for example, approximately 1 m for acid or alkali liquids.

Electrodes, Connecting Nuts, and Lock Nuts

Applicable liquids	Material	Electrode assembly	Models for individual Electrode assembly components						
			Electrode (1 m long)		Connecting nut		Lock nut		Spring washer
		Model	Model	Indication mark	Model	Inscrip-tion	Model	Inscrip-tion	Model
Purified city water, industrial water, sewage	Equivalent to SUS 304 (AISI-304)	F03-60 SUS201	F03-01 SUS201	1 line	F03-02 SUS201	---	F03-03 SUS201	---	F03-04 SUS201
Purified city water, industrial water, sewage, dilute alkaline solution	SUS316 (AISI-316)	F03-60 SUS316	F03-01 SUS316	2 lines	F03-02 SUS316	6	F03-03 SUS316	316	F03-04 SUS316
Sodium hydroxide, acetic acid, dilute sulfuric acid, dilute hydrochloric acid	Hastelloy B	F03-60 HASB	F03-01 HASB	3 lines	F03-02 HASB	B	F03-03 HASB	B	---
Sea water, ammonia water, nitric acid	Hastelloy C	F03-60 HASC	F03-01 HASC	4 lines	F03-02 HASC	C	F03-03 HASC	C	---
Acetic acid, dilute sulfuric acid, sea water	Titanium	F03-60 CHITAN	F03-01 CHITAN	5 lines	F03-02 CHITAN	T	F03-03 CHITAN	T	---

Note: 1. An Electrode assembly consists of the following parts:
One Electrode (1 m)
One connecting nut
Two lock nuts
Two spring washers

2. The material indication mark(s) are inscribed near the screw threads, and represent the material composition of the Electrode.
3. Standard Electrodes are made of stainless steel and usable in purified water, sea water, sewage, acid (except acetic acid, sulfuric acid, etc.) and alkaline liquids. They may corrode depending upon the temperature and working conditions.
4. Corrosion-resisting Electrodes made of SUS316 (AISI-316) and acid-resisting Electrodes made of titanium or hastelloy are also available.



5. When long Electrodes are required, connect them with connecting nuts and lock nuts (2 pieces) every 1 m.

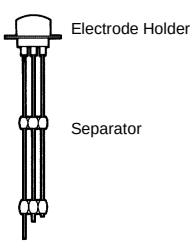
Electrode Separators

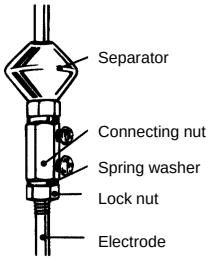
No. of Electrodes	Model
1	F03-14 1P
3	F03-14 3P
5	F03-14 5P

When the required length of Electrode is more than 1 m, use a Separator at each joint of two Electrodes so as to prevent the Electrodes from contacting one another.

Use a one-pole type for BF Electrodes. The five-pole type can be used for PS-5S and PS-4S Electrodes.

Material: Ceramic





Electrode Band

F03-05 3P, 4P, and 5P 

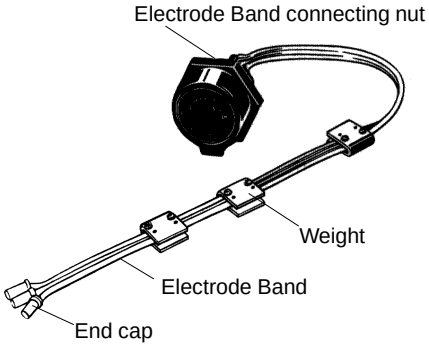
Sheath: Vinyl chloride
Core: 0.3 dia. x 21, straight wire, SUS304
Length: 50 m max. (When ordering, specify the length by meters.)

The Electrodes come in three types: 3P, 4P, and 5P. Each of them require the following accessories that are separately sold.

Accessories	Weight (per 1)	Electrode		
		3P	4P	5P
Connecting nut	Approx. 20 g	3	4	5
Weight	Approx. 50 g	3 to 4	4 to 6	5 to 8
End cap	Approx. 1 g	3	4	5
Insulation Cap	Approx. 10 g	2	3	4
Adhesive	Approx. 5 g	1	1	1
Electrode Band weight (1m)	---	Approx. 110 g	Approx. 140 g	Approx. 180 g

- The Electrode Band consists of polyvinyl-chloride-covered (PVC) stainless-steel wires SUS304 (AISI-304) which are free from mutual contact. As the Electrode Band can be cut, mounted, and removed with ease, it is most suitable for deep wells.
- Applicable Electrode Holders:
  PS-3S, PS-4S, PS-5S, BF-3, BF-4, BF-5
- Ambient operating temperature: −10°C to 60°C (with no icing)
- The Electrode Band cannot be used in flowing water, liquids over 60°C, or liquids which corrode PVC or stainless steel.

Application Example

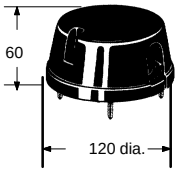


Other Accessories

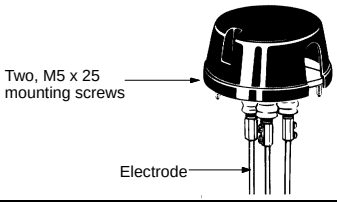
F03-11 Protective Cover

Use this Cover for PS-series Electrode Holders with Mounting Frames (upper one in the following illustration), This Cover can also be used when installing the BF-series Electrode Holders outdoors. Since this Cover is not water-proof, water or dust may enter through the wire hole (lower one below).

Applicable Electrode Holders:
BF-3, BF-4, BF-5, PS-3S(R), PS-4S(R), PS-5S(R)



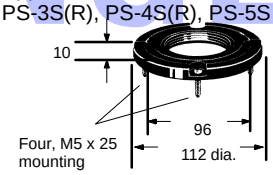
Weight: approx. 65g
Operating temp.: −10°C to 70°C

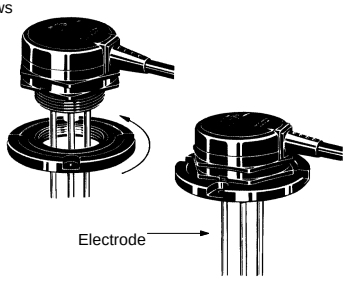


F03-12 Spring Clamp

Used to clamp an Electrode Holder with ease, as shown in the illustrations, when the Electrode Holder is applied to a tank without a coupling. Squeeze the mounting frame into the Holder as shown below.

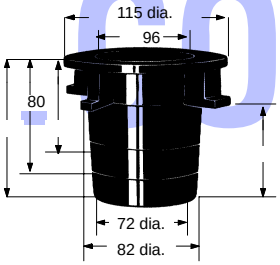
Applicable Electrode Holders:
PS-3S(R), PS-4S(R), PS-5S

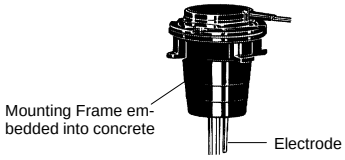




F03-13 Mounting Frame for installing in concrete

Useful frame for burying in concrete. Cut as required based on the concrete depth.

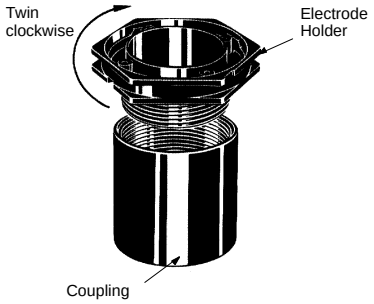
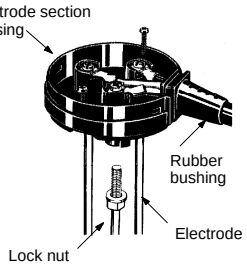
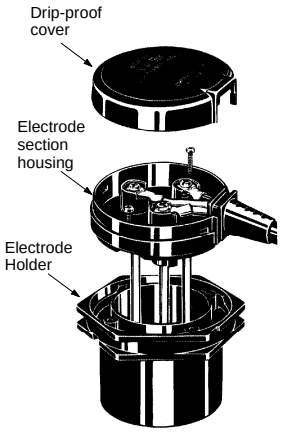




Commonly used with Mounting Frame

Mounting

■ PS-3S Electrode Holders

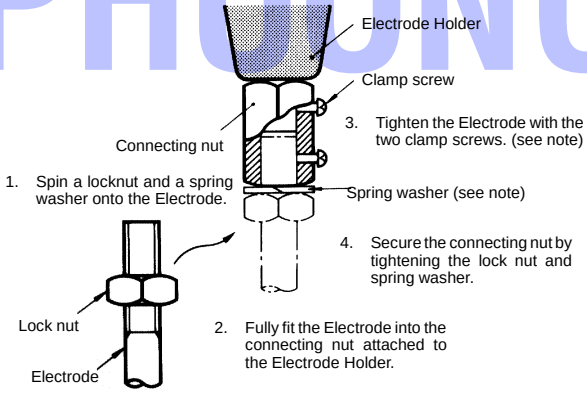
1. Mounting Electrode Holder	2. Attaching Electrode(s) to Electrode section	3. Inserting Electrode section into Electrode Holder
• Screw the Electrode Holder into the coupling secured at the installation location.	• Insert each Electrode into the connecting nut, secure the Electrode with the clamp screws, and then tighten the lock nut. • Connect the leads, inserted through the hole of the rubber bushing, into the respective terminals.	• Fit the Electrode section into the Electrode Holder and secure it with the two screws. • Check the Electrode section for proper wiring, fit the rubber bushing in position, and then cover the Electrode Holder with the drip-proof cover.
		

Note: 1. OMRON does not sell couplings.
2. Screw in the Electrode until it reaches the bottom of the nut. Insufficient insertion will cause a faulty connection.

■ Electrode Holder and Electrodes

How to Mount Electrodes

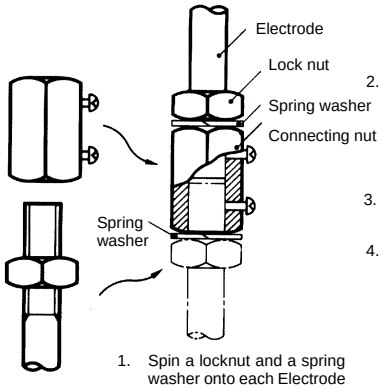
Connecting Electrodes to Electrode Holders



Note: Clamp screw and spring washer are not provided for the BS-1T Electrode Holder (titanium, hastelloy B, or hastelloy C).

Connecting One Electrode to Another

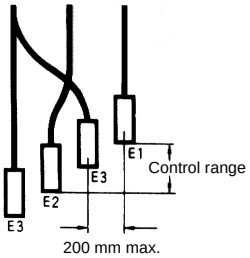
When a long Electrode is required, use two or more Electrodes by jointing them with a connecting nut and two lock nuts at intervals of 1 m.



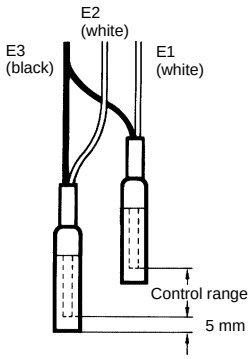
2. Fit each Electrode into the connecting nut so that the ends of the two respective Electrodes contact with one another at the center of the connecting nut.
3. Tighten the Electrodes with the two clamp screws.
4. Secure the connecting nut with the two lock nuts and two spring washers. at both ends of the connecting nut.

■ PH-1/PH-2 Electrodes

PH-1
(See Notes 1 and 2)



PH-2

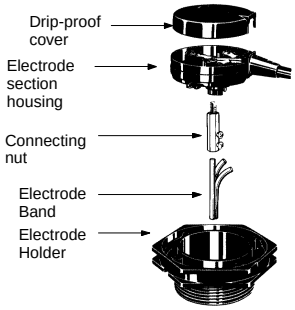


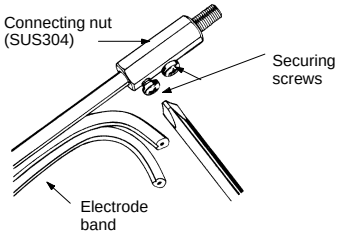
Note: 1. When the distance between E1 and E3 exceeds 1 m for supplying purified city water, for example, locate a second E3 within 200 mm of E1.
2. Even when the distance is less than 1 m, the product may not operate due to the water quality.

■ Electrode Bands

Connecting Electrode Holder and Electrode Band

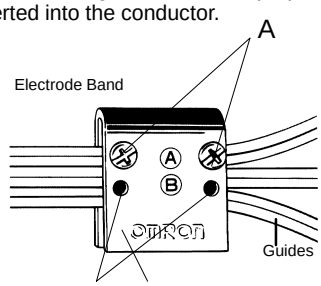
Connect the connecting nut to the Electrode section as shown in the illustration below and secure the connecting nut with the clamp screw. Insert the Electrode Band into the lower hold of the connecting nut, and tighten the two clamp screws so that the conductor in the Electrode Band will come into contact with the connecting nut. Then mount the Electrode Holder to the Electrode section and secure them with two mounting screws, which are provided with the model.





Mounting Weight(1)

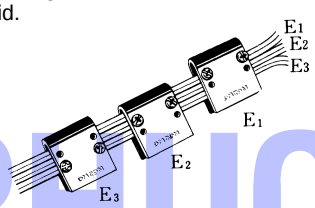
To mount an Electrode Band Weight on an Electrode Band, firmly tighten the two screws A or B. The needle screws will come into contact with the electrode wire (conductor) allowing the Electrode Band Weight to become an electrode plate. (Be sure to use screw holes A or B.). The Electrode has guides for connecting screws as shown by the arrows below so that connecting screws can be properly inserted into the conductor.



F03-07 Weight (SIS304)

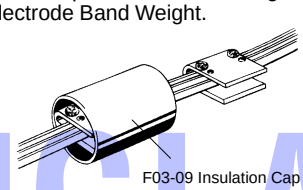
Mounting Weight (2)

Install Electrode Band Weights in three positions. The Electrode Band Weights work as short, medium, and long Electrodes, allowing the Electrode Band to detect high, medium, and low levels of liquid.



Mounting Insulation Cap

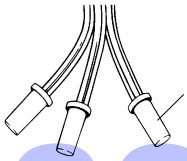
Cover each Electrode Band Weight with an Insulation Cap so as to prevent false detection due to contact between the Electrode and tank. Deform the Insulation Cap to an ellipsoid before installing it on the Electrode Band Weight.



F03-09 Insulation Cap (PVC)

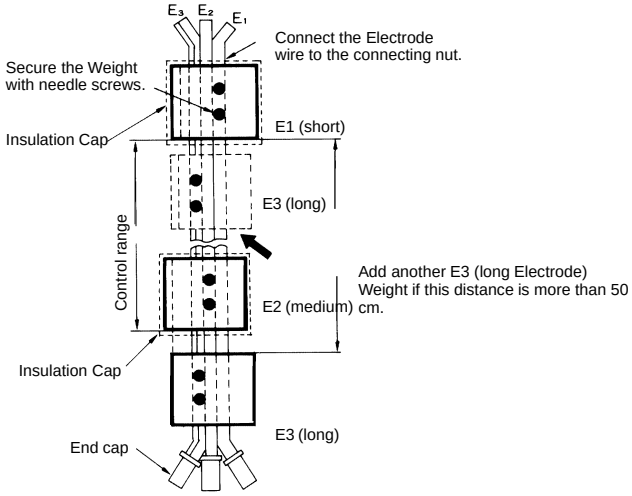
Mounting End Cap

Cover the Electrode Band end and apply the Adhesive sold separately to prevent water from entering between the sheath and the the End Cap.



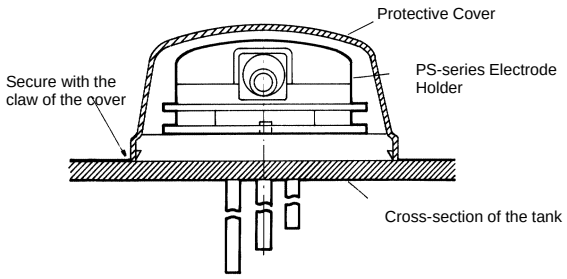
F03-09 End Cap (rubber)

In purified city water, if the distance between the long Electrode (E3) and short Electrode (E1) is more than 50 cm, install another Electrode Band Weight as E3 in the vicinity of E1 at intervals of 15 to 20 cm, referring to Mounting Weight (2) above. An Insulation Cap is not needed for the long Electrode.



■ Mounting the Protective Cover on the PS-series Electrode Holder

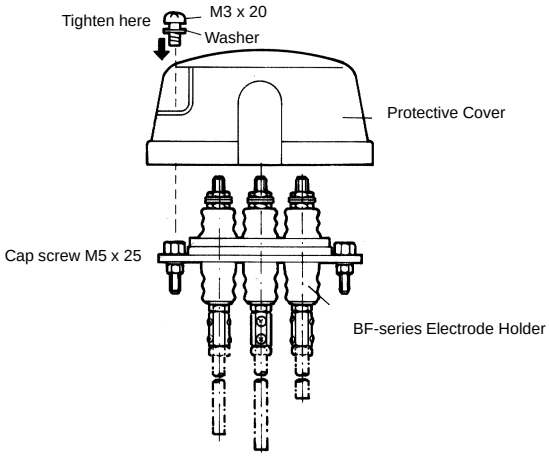
Attach the F03-12 Mounting Frame to the bottom of the PS-series Electrode Holder as shown below. Next, place the F03-11 Protective Cover on top of the Electrode Holder and press on it until a clicking sound is heard. For mounting purposes, the cap screw attached to the Protective Cover is not required.



■ Mounting the Protective Cover on the BF-series Electrode Holder (BF-3/4/5)

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

Next, put the Protective Cover over the top of the BF-series Electrode Holder, and then tighten the supplied two screws (M3 x 20 with washers). Refer to the following illustration.

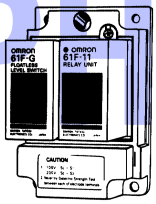


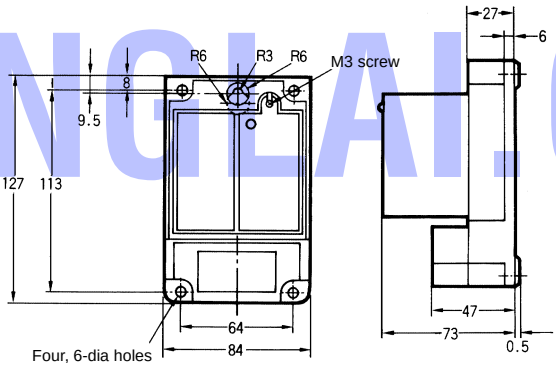
Dimensions

Note: All units are in millimeters unless otherwise indicated.

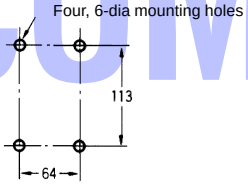
Standard Models

61F-G–AP*

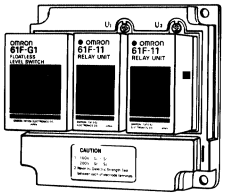


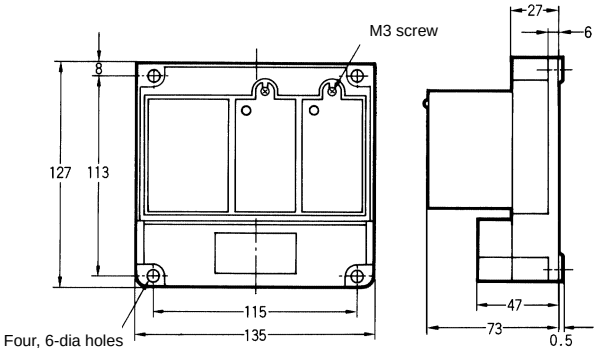


Mounting Holes

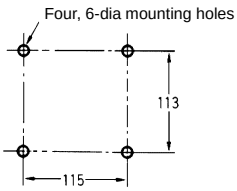


61F-G1–AP*
61F-G2
61F-I



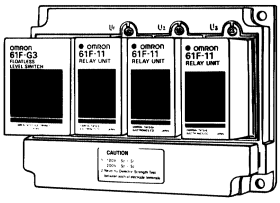


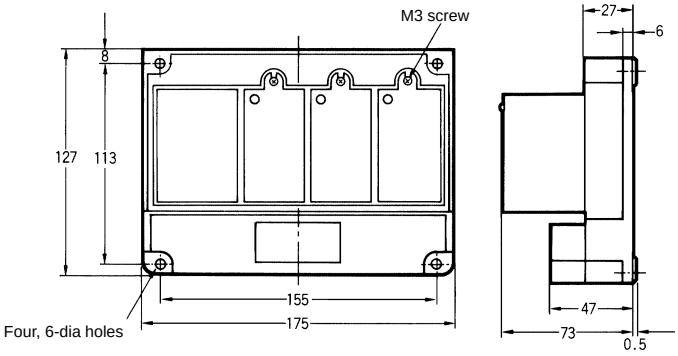
Mounting Holes



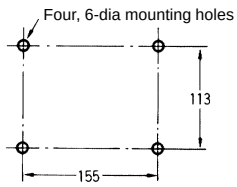
Note: AP: Asia Pacific Type

61F-G3

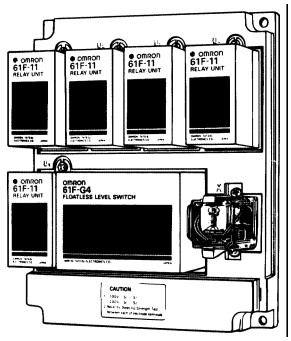


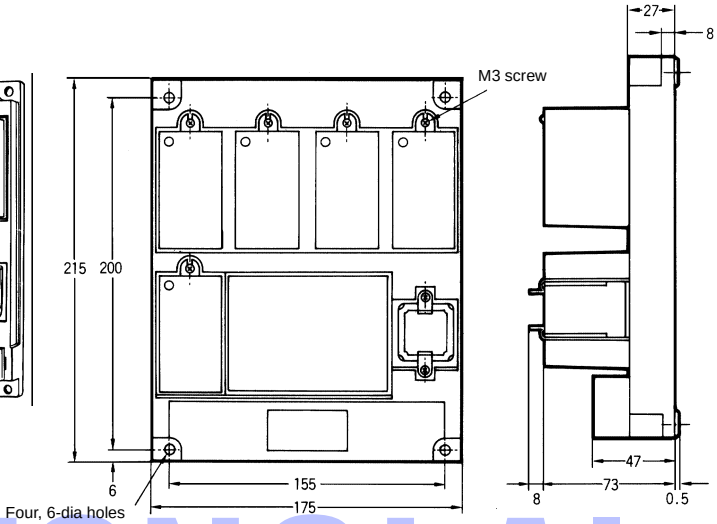


Mounting Holes

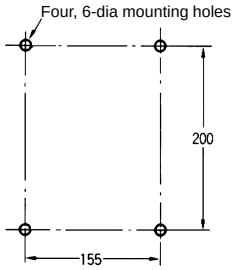


61F-G4



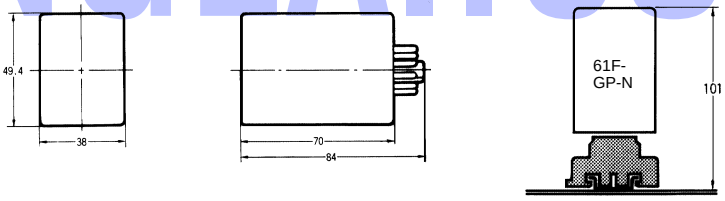


Mounting Holes



■ Plug-in Models

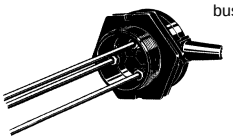
61F-GP-N

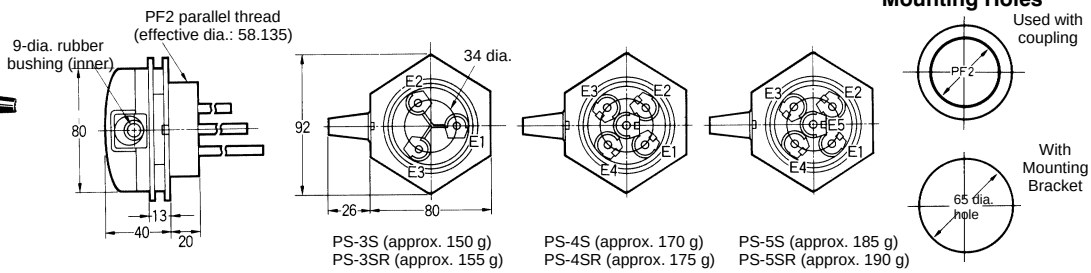


PF113A-E

Electrode Holders

PS-3S/-4S/-5S
PS-3SR/-4SR/-5SR
(see note)





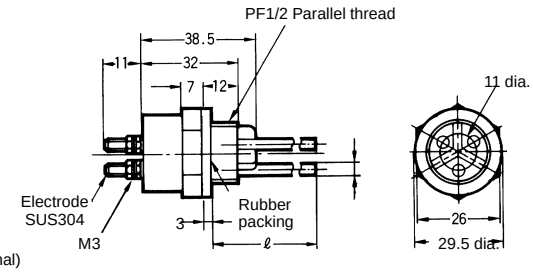
Mounting Holes

Mounting Screw Holes

Note: The PS-3SR, PS-4SR, and PS-5SR have built-in resistor of 6.8 kΩ and used for the two-wire 61F models.

PS-31

F03-31 Dust-preventive rubber cap (optional)
Weight: approx. 20 g

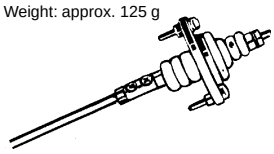


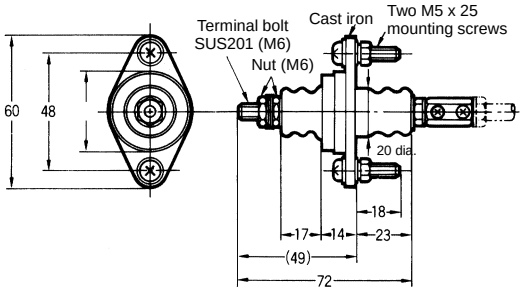
Mounting Holes

Note: Standard holder construction includes three integral 300-mm-long Electrodes. However, a model having 1,000-mm-long Electrodes is available on request.

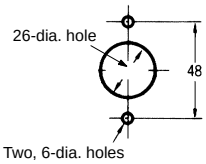
BF-1

Weight: approx. 125 g

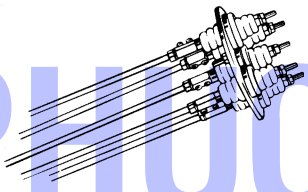




Mounting Holes

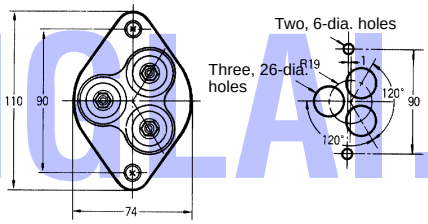


BF-3/-3R
BF-4/-4R
BF-5/-5R

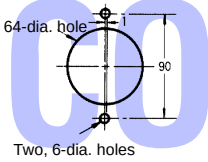


BF-3
Weight: approx. 420 g

BF-3R
Weight: approx. 425 g

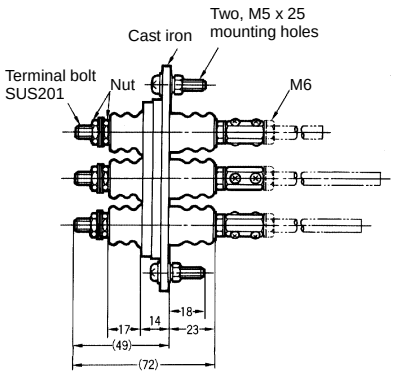


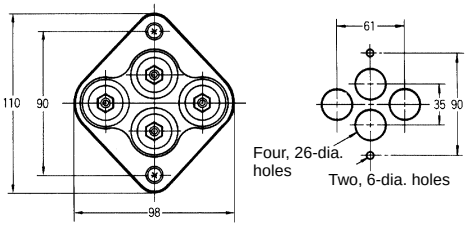
Mounting Holes



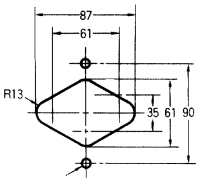
BF-4
Weight: approx. 520 g

BF-4R
Weight: approx. 525 g



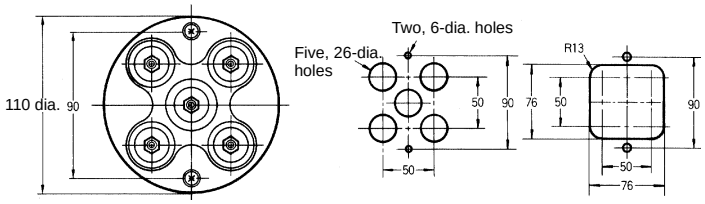


Mounting Holes



BF-5
Weight: approx. 710 g

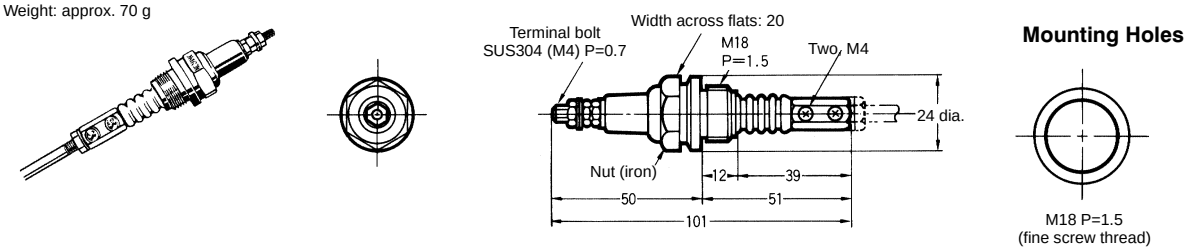
BF-5R
Weight: approx. 715 g



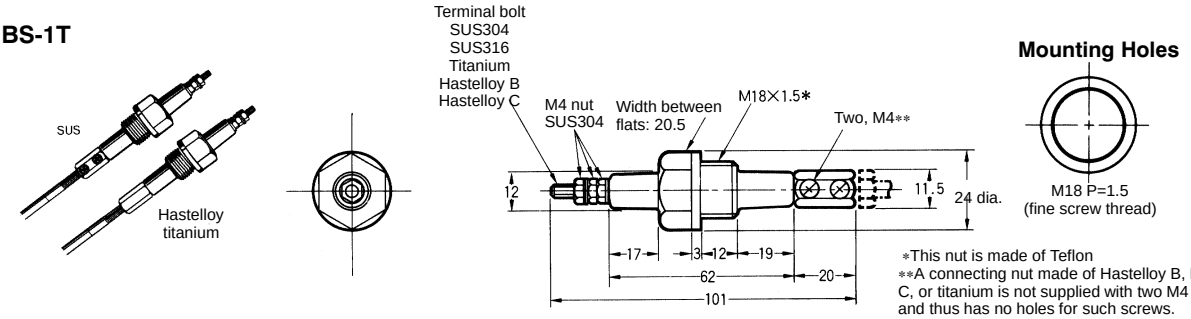
Mounting Holes

BS-1

Weight: approx. 70 g



BS-1T

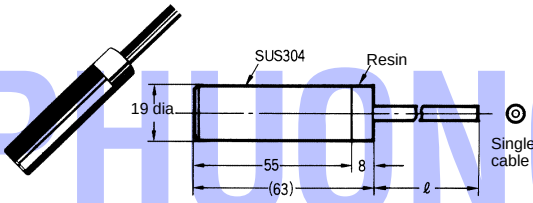


*This nut is made of Teflon
**A connecting nut made of Hastelloy B, Hastelloy C, or titanium is not supplied with two M4 screws and thus has no holes for such screws.

Material	SUS304	SUS316	Titanium	HAS B	HAS C
Weight	Approx. 55 g	Approx. 55 g	Approx. 45 g	Approx. 65 g	Approx. 60 g

PH-1

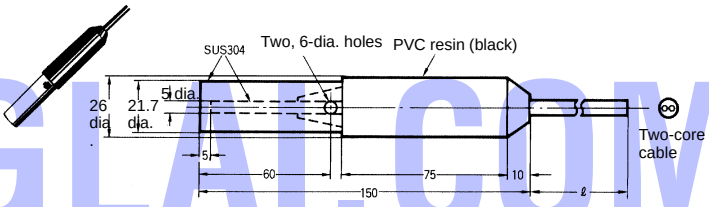
(Approx. 140 g with a 1-m cord)



Cable OD: Vinyl 5.0 dia., Chloroprene 6.5 dia.

PH-2

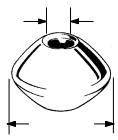
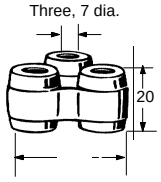
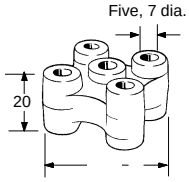
(Approx. 235 g with a 1-m cord)



Cable OD: Vinyl, Hypalon 6.8 dia.

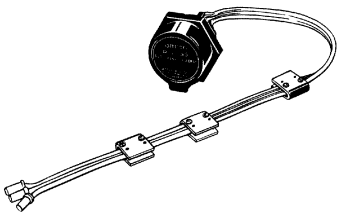
Note: Cable is supplied in lengths of 1, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, or 100 meters.

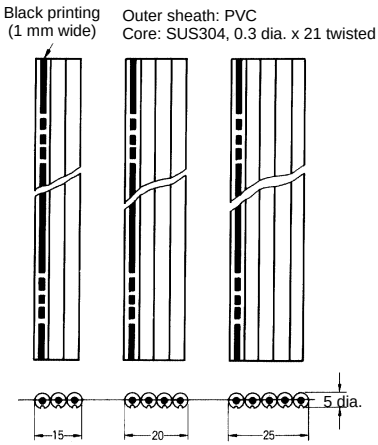
■ Electrode Separators

F03-14 1P for one pole	F03-14 3P for three poles	F03-14 5P for five poles
6.5 dia.  Weight: Approx. 15 g	Three, 7 dia.  Weight: Approx. 30 g	Five, 7 dia.  Weight: Approx. 30 g

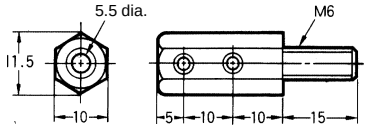
■ Electrode Bands

F03-05 3P, 4P, 5P

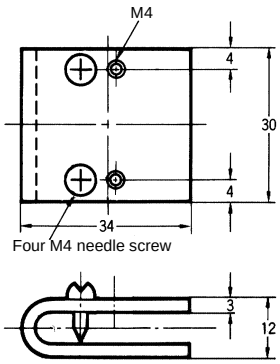




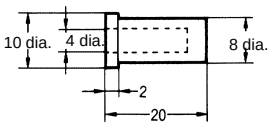
F03-06 Electrode Band Connecting Nut (SUS304)



F03-07 U-shaped Electrode Band Weight (SUS304)



F03-08 End Cap (Neoprene Rubber)



Application Examples

- Level control in tanks, reservoirs, sewage plants, underground wells, mixing plants etc.
- Level control for element protection in pipes, channels, and irrigation systems.
- Flow detection in pipes, channels, and irrigation systems.
- Ice bank control in cold drink dispensers, ice makers, water chillers, bulk milk tanks, etc.
- Dispensing of liquids by volume.
- Indication of liquid buildup due to filter blockages.
- Pollution/foul water detection for rivers, drains, etc.
- Alarm control warning of abnormal or dangerously high or low levels.

61F Selection Guidelines

- The limit of specific resistivity of a fluid controlled by the general-purpose model at an immersion depth not exceeding 30 mm is 30 Ω-cm, using PS-3S Electrode Holders. Use the high-sensitivity models (H type) for liquids with higher resistivity (see note 1). Refer to the resistivity values listed for water and other liquids in Table 1 and Table 3 when selecting the unit specification. The resistivity range detectable by the 61F is shown in Table 2. Refer to the information on the units and the fluid to be controlled when selecting the appropriate model.

Note:

1. The high-sensitivity models may suffer from resetting problems when used with certain types of water. In some cases it cannot substitute for the general-purpose models or low-sensitivity models. Be sure to select the model appropriate for the application.
2. The circuit configuration of the 61F-□H high-sensitivity model is designed so that the relay de-energizes when there is water present across the Electrodes. When power supply voltage is applied, the internal relay turns to the NO contact and, when the electrode between E1 and E3 becomes conductive, the relay is reset to the NC contact. This contact operation is reverse for models other than the high-sensitivity models. Although the internal relay operates (and operation indicator turns ON) simply when the power supply voltage is applied, this operation is not abnormal. (The relay in the 61F-□NH energizes when there is water present across the Electrodes.)

⚠ Caution

In case of the 61F-HSL ultra high-sensitivity variable model, malfunction due to electric corrosion may occur in the DC electrode circuit. Be careful not to use the product in such a way where current constantly flows between electrodes.

Table 1 Water Resistivity Values (Japanese Reference Values)

Water type	Resistivity
City water	5 to 10 kΩ • cm
Well water	2 to 5 kΩ • cm
River water	5 to 15 kΩ • cm
Rain water	15 to 25 kΩ • cm
Sea water	0.03 kΩ • cm
Sewage	0.5 to 2 kΩ • cm
Distilled water	250 to 300 kΩ • cm min.

Table 2 Detectable Resistivity Ranges

Model	Resistivity (recommended values)
Long-distance models (4 km)	5 kΩ • cm max.
Long-distance models (2 km)	10 kΩ • cm max.
Low-sensitivity models	10 kΩ • cm max.
2-wire models	10 kΩ • cm max.
General-purpose models	10 to 30 kΩ • cm
High-temperature models	10 to 30 kΩ • cm
High-sensitivity models (compact plug-in models)	30 to 200 kΩ • cm
High-sensitivity models (standard models)	30 to 300 kΩ • cm
Ultra High-sensitivity models	100 to 10 kΩ • cm

Note: The specific resistivity ranges of fluids to be controlled are given for the PS-3S at an immersion depth not exceeding 30 mm.

Table 1A Conductance Values of Water

Water type	Conductance
City water	100 to 200 μS/cm
Well water	200 to 500 μS/cm
River water	67 to 200 μS/cm
Rain water	40 to 67 μS/cm
Sea water	33,300 μS/cm
Sewage	500 to 2,000 μS/cm
Distilled water	3.3 to 4 μS/cm max.

Precautions

⚠ WARNING

Never touch any of the terminals. Doing so may result in electric shock.

Never attempt to disassemble the 61F or touch the inside of the 61F while the power is being supplied. Doing so may result in electric shock.

■ Correct Use

Use a Power Supply with Minimal Voltage Fluctuation

Avoid connection to a power supply with a voltage fluctuation greater than or equal to +10% or –15%.

Consider the Ambient Temperature

Do not install the 61F where it may be exposed to a temperature of 55°C or more and a humidity of 85% or more. In particular, install the 61F away from heat-generating equipment incorporating coils or windings. Also avoid locations subject to high humidity or corrosive gases.

Avoid Vibration and Shocks

Do not subject the 61F to vibration or shocks which can cause chattering problems. Do not install the 61F near contactors that generate severe shocks while the contactors are in operation.

Do Not Test with a Megaohmmeter

During insulation resistance measurements, never apply the megaohmmeter across the Electrode terminals.

Use Self-holding Electrodes

Use Self-holding (E2) Electrodes when contactor open/close control is carried out. If E_1 Electrodes are used, ripples on the liquid surface can cause incorrect contactor operation and damage to the contacts.

Be sure to turn OFF the power supply before replacing the plug-in models.

Short Wiring in Electrode Circuit

Keep the wires connecting the 61F to Electrode Holders as short as possible. If long leads are used, the floating capacity of the leads, and abnormal surges or noise in the Electrode circuit can cause malfunctions.

The thicker the cables, the shorter the permitted wiring length. The length of the cable connecting the 61F and Electrode described in the 61F datasheet will be available if a 600-V VCT0.75-mm^2, 3-core cabtire cable is used. Test results indicate that the actual wiring length using VCT 3.5-mm^2, 3-core cable laid over the ground is 50% of the indicated length for general-purpose applications and 80% of the indicated length for long-distance applications. When selecting the cable specification, remember that the wiring length is further decreased for underground cables and larger diameter cables because of the increased floating capacity with the ground.

Keep Power Cables Separate from the Electrode Circuit

Do not pass the leads for the Electrode circuit through the same duct, or near to, high-tension cables or power cables. This can cause noise which leads to malfunctions.

Ground Correctly

Ground the common Electrode terminal to reduce the effects of noise.

Use a Surge Suppressor

Connect a 61F-03B(-04B) Surge Suppressor with the 61F Electrode terminals to protect the circuit from surges. This is particularly important in lightning-prone areas. To further improve protection, install a commercial surge suppressor in the power supply to eliminate surges in the power system.

Consider the Response Times

The 61F requires a response time not exceeding 80 ms for operation or 160 ms for reset. Take these response times into account in cases where precise sequence control is required.

Consider the Liquids to Be Controlled

The 61F cannot be used for any liquid that has almost no conductivity such as sewage containing oil.

The 61F cannot be used for any flammable liquid such as gasoline, kerosene, or heavy oil.

Do Not Share Electrodes

Do not connect a single Electrode to more than one 61F. If the phases of the 8-VAC Electrode-circuit power supplies are opposite to each other, as shown in Fig. 1, an internal close circuit (return circuit) is created (indicated by the arrows). The 61F may malfunction regardless of the liquid level when the 61F power is turned ON. This problem can be overcome by matching the power supply phases, as shown in Fig. 2, but in this configuration the internal impedance of the 61F calculated from the Electrode will be approximately half as large as the internal impedance of a single 61F. The same phenomenon can occur if multiple (not shared) Electrodes, connected to separate 61F units, are installed close together inside a single tank. Maintain sufficient clearance between Electrodes connected to separate 61F units so that they do not interfere with each other. Common leads, however, can be connected to the ground Electrode.

Fig. 1 Internal Closed Circuit

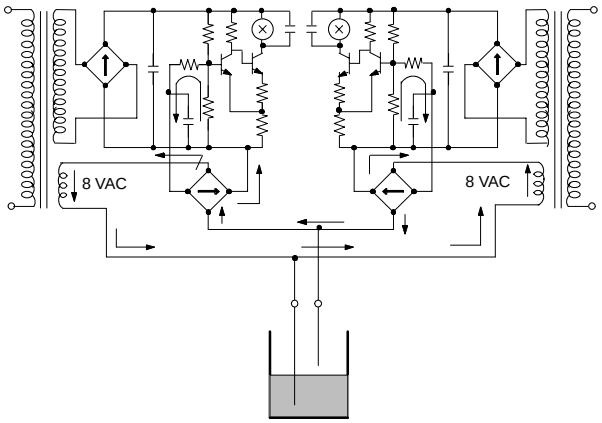
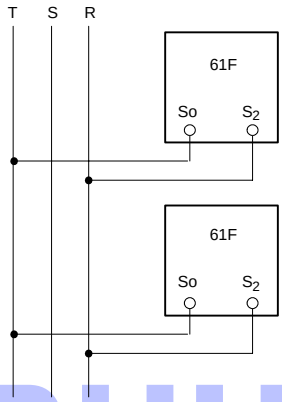


Fig. 2 Match Phases



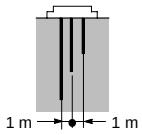
■ Cautions on Electrodes

Be sure to disconnect the 61F before conducting a insulation test on the Electrode circuit for inspection purposes.

When cutting an Electrode, be sure to chamfer cut surfaces of the electrode.

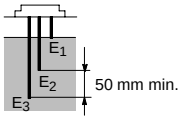
Maintain a Clearance Between Electrodes

Maintain sufficient clearance (normally 1 m) between Electrodes in sea water or contaminated water. Use the 61F-□D (or -□ND) low-sensitivity models if this clearance is difficult to maintain.



Long Ground Electrode

The Electrodes are mounted in sets of three. Connect the shortest Electrode to E_1, the medium Electrode to E_2 and the longest Electrode to E_3. The longest Electrode, E_3, must be at least 50 mm longer than the other Electrodes.

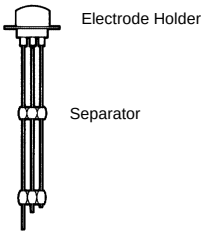


Consider the Operating Level

Due to the liquid type and fluctuations in the power supply voltage, the operating level may fluctuate to a small degree from the level at which the liquid surface makes contact with the Electrode tip.

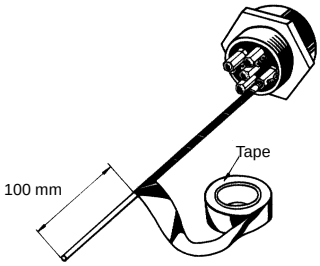
Use Separators

If the Electrode length reaches 1 m min., insert Separators at the joint positions to prevent the Electrodes touching each other in the liquid.



Take Care When Taping the Electrodes

When applying vinyl tape to the Electrodes to prevent them touching each other in the liquid, leave at least 100 mm at the end of the rod untaped. Do not tape to the very tip.



Mount Electrodes Vertically

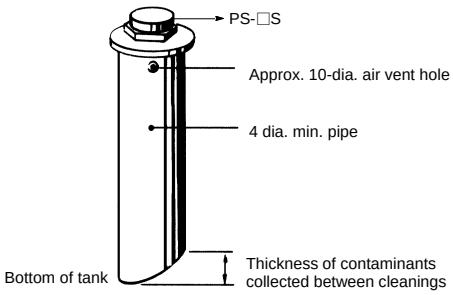
Install the Electrodes vertically to avoid the accumulation of slime which can form an insulating layer on the Electrode surface.

Keep Electrodes Clean

Lift the Electrodes and remove the surface film with fine sandpaper about 6 months after installation. Subsequently, repeat this cleaning once or twice per year.

Cleaning is particularly important for Electrodes used in a liquid containing large amounts of dirt or slime, which can build up into an insulating film on the Electrode surface and cause malfunctions. Clean the surface insulating film from Electrodes used in this environment once every three months. Use a pipe, as shown in the diagram below in situations where the water contains large amounts of dirt.

Use a pipe as shown to keep dirt and oil films from the Electrode in situations where the liquid is highly contaminated with dirt and oil, such as sewage holding tanks.

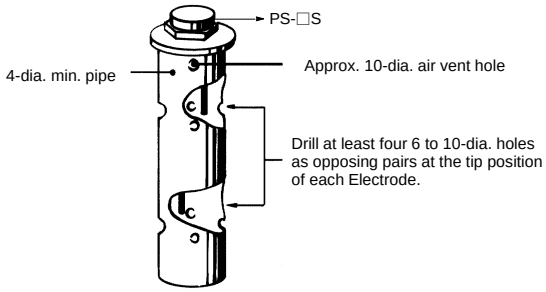


Use a pipe at least 4 inches in diameter.

Cut off the end of the pipe at an angle to clear the estimated amount of contaminants accumulating at the bottom of the tank.

Drill an approximately 10-dia. vent hole at the top of the pipe.

Using an Anti-ripple Pipe:
Use an anti-ripple pipe as shown below in cases where large ripples are produced by a rapid fluid flow rate.



Use a pipe at least 4 inches in diameter.

To improve liquid circulation inside the pipe, drill at least four 6 to 10-dia. holes as opposing pairs at the tip position of each Electrode.

Drill an approximately 10-dia. vent hole at the top of the pipe.

Follow the information above with regard to using Electrodes.

■ Cautions on Electrode Holders

Do not mount horizontally or a malfunction may occur.

BS and BF Electrode Holders

When installing the Electrodes, first tighten the connection nut with a wrench before tightening the Electrodes and lock nut. Tightening the terminals or other parts can lead to damage of the insulating parts due to tightening torque.

When mounting a BS-1 Electrode Holder to a boiler, wrap Teflon tape 2 or 3 times around the mounting position and use the gasket supplied.

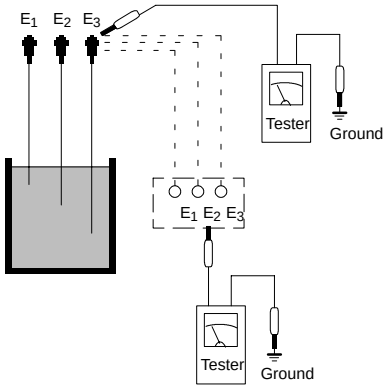
Always apply the F03-11 Protective Cover if the BF-3 (-4 or -5) is used outside or in a position subject to water splashes or where dust or dirt can settle. Foreign matter on the Electrode insulation can cause electrical leakage and malfunctions.

■ Inspecting the Electrode Circuits

In cases where the Electrodes cannot be withdrawn to test the Electrode circuit, a tester can be used to measure the resistance between the Electrode and ground, as shown in the diagram below. The measured resistance value indicates the length, contact condition, and mounting condition of the Electrode. For example, the sequence of Electrodes ordered from low measured resistance to high is E_3 (long), E_2 (medium), and E_1 (short).

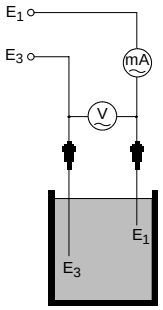
Follow the guidelines below to use this test method.

1. Detach the leads from the 61F.
2. Measure the conducting status with the tank full. (The water level must be at E_1 minimum.)
3. Measure the insulating status with the tank empty. (The water level must be at E_3 maximum.)



■ Measuring the Resistance Between Electrodes

Measure the resistance between the Electrodes if the wiring is correct but the 61F does not operate. Measure with a voltmeter using the voltage drop method, as shown below.



mA An ammeter able to read approximately 1 mA with as low an impedance as possible.

V A voltmeter able to read a value of several volts with as high an impedance as possible.

The resistance between Electrodes (resistance of liquid between E_1 and E_3) is given by the following equation.

$R = V/I$

Where,
R: resistance of liquid between Electrodes (Ω)
V: voltmeter indicated voltage (V)
I: ammeter indicated current (mA)
Select the 61F model according to the R (resistance) value.

■ Inspecting the 61F-11N Relay Unit

Apply the specified power supply voltage with the Relay Units connected to the 61F. Refer to the connection diagrams (internal wiring diagrams) and short the 61F ground terminal to the operating terminal of each Relay Unit. Check the operation of the relay output contacts with a tester. With the 61F-11 models, the indicator will be lit when the Relay Unit operates.

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