Instruction Manual

Estimated Terminal Pressure Constant Control of Water Supply Unit

NX-VFC-e

Important Notice

Thank you very much for purchasing the TERAL water supply unit.

In order to use the water supply nuit appropriately, read this instruction manual before using, and do not perform operation, maintenance and inspection before understanding the description in this manual thoroughly.

For safety purpose, observe the cautions and warnings in this instruction manual and those on the labels affixed on the water supply unit.

Keep this manual carefully at hand where it can be consulted at any time of operation, maintenance and inspection of the water supply unit.

Warning

Do not keep combustible materials such as the manual or other drawing inside the control panel of the water supply unit (except when a drawing holder is inside).

To whom performing utility work:

Be sure to submit this manual to the customer performing operation, maintenance and inspection of the water supply unit.

TERAL INC.

Limited warranties

1. In the event of failure or breakage under proper use of the product during the warranty period, equipment supplied by TERAL INC. shall be repaired or replaced free of charge within the scope of the relevant part, provided that such failure or breakage is attributable to inadequacy of the design or workmanship of the equipment.
2. The warranty mentioned in the above clause shall be only the mechanical warranty of the defective part, and shall not cover any expenses or other damage arising from the failure or breakage.
3. In the event of the following failures and breakage, the costs of the repairs and consumables (i.e. parts whose consumption or wear is expected at the beginning of purchase) shall be borne by the user.
   (1) Failures and breakage attributable to equipment that was not delivered by TERAL INC.
   (2) Failures and breakage after the expiration of the warranty period
   (3) Failures and breakage caused by disasters or force majeure, such as fire, acts of God or earthquakes
   (4) Failures and breakage resulting from repairs, disassembly or modifications made without the consent of TERAL INC.
   (5) Failures and breakage when parts other than those designated by TERAL INC. are used
   (6) Failures and breakage caused by any use outside the specification limit of the equipment
4. TERAL INC. shall not be liable for any damage caused by incorrect or reckless use of the water supply unit even if such damage occurs within the warranty period. Cost and expenses incurred for sending engineer(s) in such a case shall be borne by the user.
5. If the cause of the failure is unclear, necessary actions shall be determined through mutual consultation.
6. In order to improve performance, some parts and/or components of the product may be changed without prior notice.
   In addition, upon repairs of the product, TERAL INC. may use recycled parts that conform to our quality standards or may use substitutes that are functionally equivalent.

Purpose of this manual / Notice to users

1. The purpose of this manual is to provide the user with detailed information necessary to operate, maintain and inspect the water supply unit (or “the unit”) properly.
   This manual does not cover work that requires highly specialized knowledge (disassembly, repairs, etc.). If the unit needs to be repaired, be sure to contact TERAL INC.
2. This manual is intended for:
   - persons experienced in the operation of water supply units, or those who have been trained by such experienced operators
   - qualified persons, such as licensed electrical engineers, for the content regarding electric wiring work
3. This manual mainly covers standard products. If you have purchased a customized product, some part of this manual may not be applicable to your unit. In such a case, refer to other documents such as the delivery specifications to confirm the product specifications.
4. The product specifications and information in this manual are subject to change without prior notice.
5. In the illustrations of this manual, some part of the product is omitted or simplified to make it easy to understand. Therefore, the illustrations may look different from the actual product you use.

Contents

1. Safety precautions

Before using the unit, thoroughly read this “Safety precautions” to properly use the product. Information described below is vital to safe and proper use of the unit and prevention of hazard and/or damage.

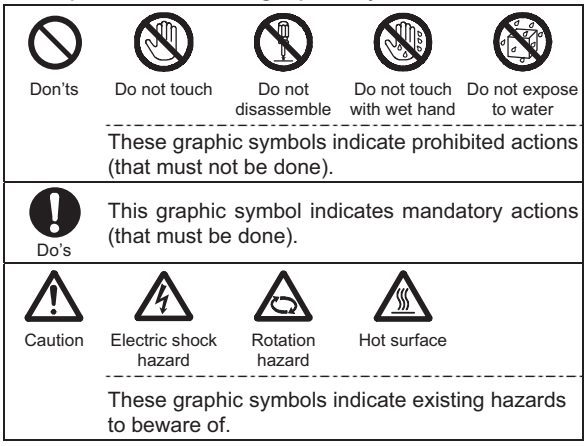
1.1 Explanation of safety indications and graphic symbols

This instruction manual divides safety indications into four categories according to the level of hazard (the extent of damage/losses and the urgency). In addition, the type of user instructions is indicated with a graphic symbol.
This manual uses the following signs. Fully understand these terms and symbols before reading this manual further.

■ Explanation of the safety indications

Indications	Meaning
Danger	Indicates an imminently hazardous situation. Failure to observe this will result in death or serious injury.
Warning	Indicates a potentially hazardous situation. Failure to observe this will result in death or serious injury.
Caution	Indicates a potentially hazardous situation. Failure to observe this will result in minor or moderate injury or property damage.
Note	Indicates information that is in particular to be noted or emphasized.

■ Explanation of the graphic symbols



1.2 Safety precautions

The following are important instructions about safety. Be sure to observe these precautions.

Danger

Once the main power is turned on, do not touch any live parts inside or outside the control panel.
A high voltage applied to live parts causes a serious electric shock.

Warning

Properly move the unit according to lifting instructions. Otherwise, the unit may fall, resulting in injury and/or damage.	Do not carry out any work by/on the water supply unit that is being lifted. Otherwise, the unit may fall, resulting in injury and/or damage.
Only those who are authorized by the site manager may operate the water supply unit. Operation by unskilled personnel may lead to an unforeseen accident.	Only those who are trained to handle the water supply unit may install, maintain, and inspect it. Operation by unskilled personnel may lead to an unforeseen accident.
Only qualified personnel, such as licensed electrical engineers, are allowed to carry out any electric work. Otherwise, it may lead to an electric shock, fire, failures, and/or other problems.	Use the wiring equipment and devices compliant with the use conditions, and carry out wiring work safely and securely according to the technical standards for electrical facilities, as well as the indoor wiring regulations. Otherwise, it may lead to an electric shock, fire, and/or other problems.
Before starting wiring work, be sure to turn off the main power and confirm that the pilot lamp is turned off. Take measures to prevent erroneous power supply. Otherwise, it may lead to an electric shock.	At the power supply source, be sure to install a ground fault interrupter dedicated to this unit. Otherwise, it may lead to an electric shock, fire, and/or other problems.

Warning

 Securely install the ground wire and ensure to carry out grounding work. Otherwise, it may lead to an electric leak and/or electric shock.	 Do not connect the ground wire to a gas pipe or water pipe. Such a connection is illegal and leads to an electric shock, explosion and/or fire.
 Ensure that all electric wires are securely connected. Otherwise, it may lead to fire and/or an electric shock.	 Before starting the maintenance or inspection work, be sure to stop the pump and turn off the main power of the panel board. Otherwise, it may lead to an electric shock, injury, damage, water leakage, and/or other problems.
 Before starting the unit or carrying out maintenance/inspection work, ensure that all the relevant workers are informed of the operation and that there are no workers in the dangerous zone around the unit. Otherwise, it may lead to an unforeseen accident.	 Before rotating the pump shaft by hand to check its smooth rotation, be sure to disconnect the main power supply. Otherwise, it may lead to injury and/or damage.
 After turning on the power, do not touch any parts of the water supply unit other than those required for operation. Otherwise, it may lead to an electric shock, injury, and/or other problems.	 Ensure to keep the cover of the control panel closed during operation. Otherwise, it may lead to an electric shock, fire, and/or other problems.
 Do not put your fingers or foreign objects into any openings or rotating part of the motor during operation. Otherwise, it may lead to injury and/or damage.	 Do not run the pump continuously for over one minute with the discharge valve shut (zero-discharge operation). Otherwise, the temperature and pressure will increase inside the pump, which may damage the pump and/or cause steam to blow off.
 Do not operate the unit if abnormal condition is observed in any actions and movement or in any parts, components, and others. Otherwise, it may lead to injury, failures and/or various accidents.	 If you need to carry out work that requires disassembly of the unit—such as replacement of parts, repairs, or inspection, ask the vendor or the service center specified by TERAL INC INC. If unskilled personnel carry out the work that requires special knowledge, it may lead to an accident and/or failures.
 Regularly inspect your equipment and perform maintenance on each component.	 If motors or control panels are used for more than a certain period of time, it may cause ignition or other accidents due to aging deterioration.
 Electric motor or control panel insulation degradation may result in electric leakage, electric shock, or fire. Keep the ambient temperature at 0 to 40°C with sufficient ventilation to prevent damage to the equipment and deterioration of its life. Avoid dust, corrosive or explosive gases, salinity, humidity, condensation. For indoor installations avoid direct sunlight or wind and rain.	

Caution

 Do not use the unit outside the range of the product specifications. Otherwise, it may lead to an electric shock, fire, water leakage, failures, and/or other problems.	 Do not use the unit at the power voltage other than the specification. An incorrect voltage may damage the control panel.
 Do not use a single unit as the only means of directly operating key facilities or sustaining life. In the event of a failure, the water supply may stop. Ensure to make a backup unit readily available.	 Do not use the unit to deliver pure water. Otherwise, pure water may be contaminated with impurities.
 Pay special attention to nails when opening the delivered container. Otherwise, it may lead to injury and/or damage.	 As for the installation environment of the unit, strictly observe the installation instructions. Otherwise, it may lead to premature failure.
 Ensure that the floor at the unit's installation place is waterproofed and fitted with drainage. Otherwise, it may lead to serious damage in the event of leakage.	 Only after detaching a companion flange from each pump, screw a pipe into it. Otherwise, it may lead to damage or water leakage.

Caution

Do not merge suction pipes. Otherwise, it may hinder the normal operation.	Do not use any piping materials that are prone to rust. Otherwise, it may damage the unit.
Do not install different or other cables or control wires in one pipe or duct. Otherwise, it may damage the unit and/or other equipment.	Provide a ground electrode dedicated to the inflow solenoid valve. Otherwise, it does not function normally.
Do not step on the control panel, pump, or pipes. Otherwise, it may lead to injury, damage, and/or other problems.	Try to prevent the control panel and the motor from being sprayed water. Otherwise, it may lead to an electric shock, electric leak, failures, and/or other problems.
For knockout work and wire insertion work, wear protective equipment, and pay attention to cut edges of sheet plates. Otherwise, you may get injured.	Properly make each setting of the control panel depending on the conditions of use. Otherwise, it may hinder the normal operation.
Implement each operation carefully. Otherwise, it may lead to injury and/or damage.	Carefully open and close the cover of the control panel with both hands. Otherwise, it may damage the cover.
Before operation, thoroughly clean (flush) the inside of the piping. Otherwise, the piping system may be contaminated with foreign matter, thus leading to an accident or a pump failure.	Do not run the pump without priming. Otherwise, it may damage the sliding parts inside the pump.
Do not perform automatic operation with the TJ valve shut. Otherwise, it may hinder the normal operation and damage the unit.	Do not touch the motor body or the cooling fins for the control panel while the unit is running or immediately after the unit has stopped. Otherwise, you may get burns from the hot surface.
Do not cover the motor or the control panel with cloths or other objects. Otherwise, it may lead to overheat and/or ignition.	Do not place anything on the water supply unit or do not step on the unit. Otherwise, it may lead to injury and/or damage.
In the event of an alarm or abnormal condition that cannot be resolved, immediately contact TERAL INC. Otherwise, it may lead to an accident.	Ensure to carry out inspection according to the maintenance checklist. Otherwise, you cannot prevent potential failures, thus leading to a higher risk of accidents.
Replace the packing and O-rings during inspection involving disassembly. Otherwise, it may lead to water leakage.	Before disassembling, shut the suction and discharge sluice valves, and then discharge pressured water from the pump and the piping. Otherwise, water may spurt out, thus leading to an accident.
Do not perform an insulation resistance test on the control panel. (Before performing an insulation resistance test on the motor, disconnect electric wires and cables from the control panel.) Otherwise, it may damage the control panel.	If you do not use the unit for a long time, turn off the power, drain water from the inside, and then store the unit. Otherwise, it may lead to insulation degradation, freeze cracking, and/or other problems.
When the water supply unit is used outdoors, fit the outdoor cover in the special accessories. Failure to observe this may cause damage to the unit.	If lifting operation is necessary, adopt the unit specified for lifting operation. Failure to observe this may cause discharge pressure drop and lead to a water cutoff.
Do not fit an advance phase capacitor to the secondary wiring in the control panel. Failure to observe this may damage the control panel.	

2. Before using the water supply unit

Caution	Make sure that the delivered package is placed right-side up before unpacking. Pay special attention to nails especially when opening a wooden crate or you may get injured.
Note	After unpacking, ask the vendor to dispose of packaging materials that are no longer necessary.

2.1 Points to be checked

When you receive the water supply unit, check the following points immediately after unpacking.

(1) Check the nameplate to verify that the delivered product is exactly what you ordered.

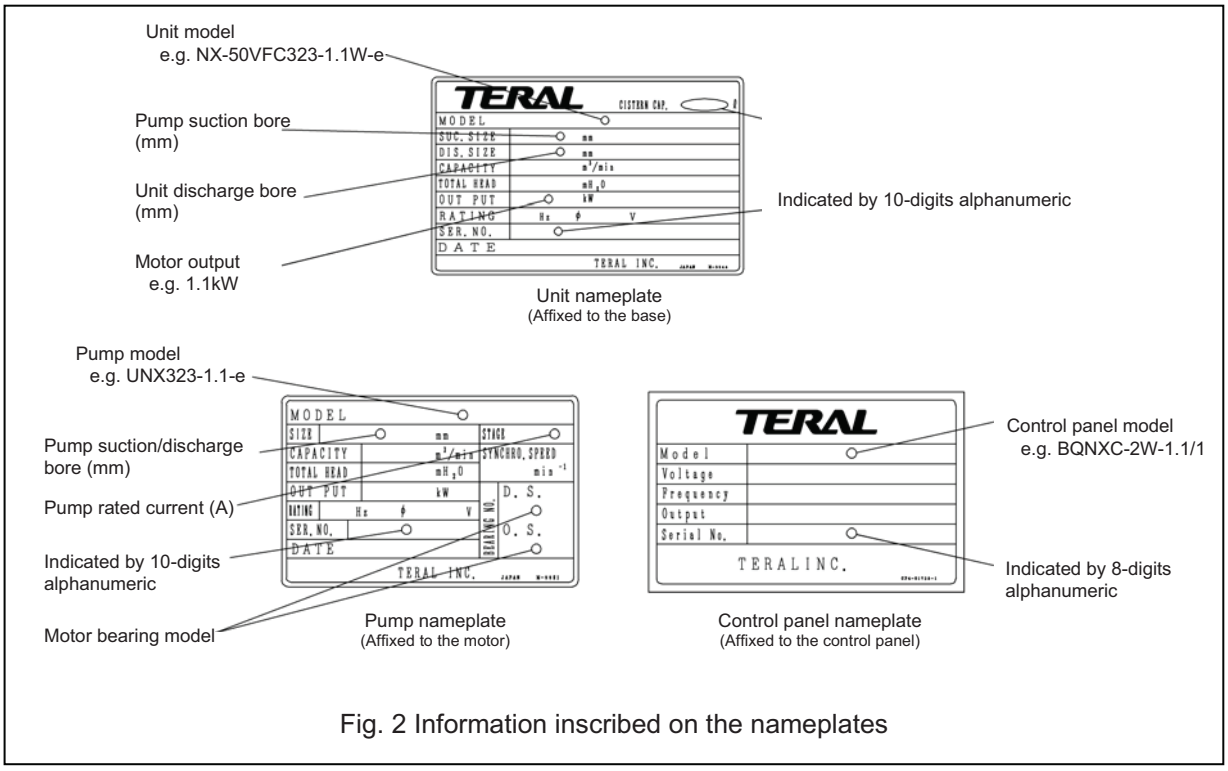


Fig. 2 Information inscribed on the nameplates

(2) Check that no part of the unit has been damaged during transportation.

(3) Check all fastening parts including bolts and nuts are securely tightened.

(4) Check all the accessories that you ordered have been completely delivered.

2.2 Model type description

NX－50 VFC 32 3－1.1 W－e
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① NX Pump
② Unit discharge nominal diameter
③ Estimated terminal pressure constant control of water supply unit
④ Pump nominal diameter
⑤ No. of pump stage
⑥ Output
⑦ Operation D : Automatic alternative operation
W : Automatic parallel operation
⑧ Motor efficiency e : Top Runner efficiency (IE3 equivalent) Motor-equipped

3. Configuration and overview of the water supply unit

This chapter describes standard specifications of the water supply unit. If you have purchased a customized product, some information in this chapter may not be applicable to your unit. Refer to the separately supplied delivery specifications and other documents to check the product specifications in such a case.

3.1 Specifications of the water supply unit

Caution	Do not use this unit under any conditions other than those provided in the specifications. Otherwise, electric shock, fire, water leakage, or property damage may occur.
Note	If the inflow pump head is 5m or more, contact TERAL INC. for consultation.

Table 3-1 Standard specifications of water supply unit

Operation mode		Automatic alternate operation	Automatic alternate parallel operation
Control system		Constant control of estimated terminal pressure based on frequencies/ Constant control of discharge pressure	
Applicable liquid	Liquid property	Fresh water	
	Temperature	0 to 40°C	
Installation location		Indoors (0 to 40°C, Max. RH85%, no condensation), Altitude: Max. 1,000m	
Suction conditions		Inflow (Inflow pump head: Max. 5 m)*	
Pump (Material)		Model NX-e stainless steel horizontal multistage centrifugal pump (Impeller: SUS304, Casing: SCS13, Main shaft: SUS304)	
Motor	Type	Totally-enclosed fan-cooled type for indoor use	
	Protection class	IP44	
	Number of poles	2 poles	
Companion flange		Dedicated companion flange	
Power supply		0.4 to 1.1 kW: Single-phase 200/200-220 V (50/60 Hz) 0.4 to 7.5 kW: Three-phase 200/200-220 V (50/60 Hz)	
Paint color		Common base: Munsell N-5 Pressure tank: Munsell 10Y5.5/0.5	
Pressure tank		Model DPT10 (10-L diaphragm tank)	
Pressure detection device		Pressure transmitter Transmission system: 5 VDC, 3-wire system Output voltage: 0.5 to 3.5 VDC	
Control panel	Model	BQNXC type	
	Motor Protection	Inverter (with electronic thermal protection)	
	Normal indications	Indicator status: Power, Pump operation (for each), Pump operation blocked (for each), Alarm (collective) Other indications: Discharge pressure, Voltage, Current (for each), Operating frequency (for each), Cumulative operation time (for each), Cumulative number of starts (for each), Number of starts of the unit on the previous day, Alarm log (last 5 alarms)	
	Alarm indications	Receiver tank full, Receiver tank low, Dry-run prevention, Electrode failure, Start frequency failure, Pressure transmitter 1 failure, Control panel high temperature, EEPROM error, Overload (for each), Discharge pressure abnormal drop (for each), Electric leak (for each), High temperature (for each), Flow switch failure (for each), Overcurrent (for each), Overvoltage (for each), Anti-stall (for each), Inverter overload (for each), Open-phase output (for each), Inverter overheat (for each), Communication failure (for each), Inverter trouble 1 (for each), Inverter trouble 2 (for each)	
	External outputs	Power for alarm (at power voltage), Inflow solenoid valve output (at power voltage), Operation/alarm signal (No-voltage a-contact)	
	External inputs	External stop signal (interlock): supports a/b-contacts	

* The lifting models support up to 4 m in the actual pump head and up to 6 m in the total pump head (at 20°C water temperature).

* If a flush valve or the like is used, a sudden pressure drop may occur, thus leading to the problems such as insufficient water supply, noise, premature damage of the pressure tank, or others. Contact us for such cases.

3.2 Names and functions of each part

3.2.1 Names and functions of the components of the water supply unit

① Control panel
The control panel controls the pump and supplies the power to the motor.
It enables to start/stop the pump, detects the operating status of the pump and automatically switch the No. of the pump to run.
Also it enables pump variable speed control by a pressure transmitter signal and thereby estimated terminal pressure constant control is conducted.

② Pump
Its motor rotates an impeller to generate pressure for delivering water.

③ Pressure transmitter
The pressure transmitter converts pressure into an electric signal so as to use it for control.

④ Pressure tank
The pressure tank maintains the pressure in the piping and reduces the number of start/stop and pressure fluctuations of the pump.

⑤ Junction pipe
The junction pipe joins the discharge pipes of the two pumps into one pipe.

⑥ Discharge elbow
The discharge elbow has a built-in cushion check valve and is equipped with the flow switch ⑦.

⑦ Flow switch
The flow switch outputs a signal to stop the pump when the water flow rate is not higher than the setup (stop) flow rate.

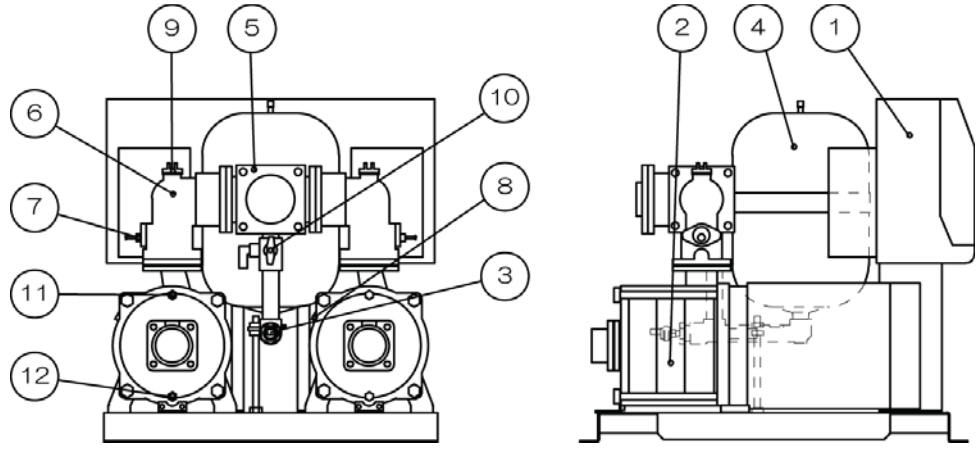
⑧ High temperature sensor
If the water temperature is not lower than the setup temperature due to zero-discharge operation, the high temperature sensor outputs a signal to stop the pump.

⑨ Priming plug
This plug is used to prime the pump.

⑩ TJ valve
This is a three-way valve used to discharge water from the pressure tank when you carry out the maintenance of the pressure tank and the pressure transmitter.

⑪ Air vent plug of pump
This plug is used to release air from the pump.

⑫ Pump drain
This drain is used to discharge water from the pump.



Automatic alternate operation
Automatic alternate parallel operation
Fig. 3-2-1 Water supply unit, Model NX-VFC-e

3.2.2 Names and functions of control panel elements

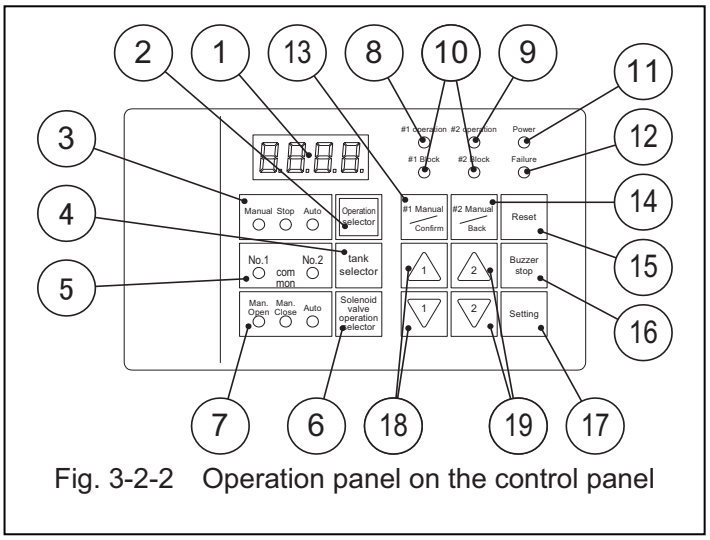


Fig. 3-2-2 Operation panel on the control panel

(1) Display
It displays a variety of information about the water supply unit. (→ see 7.4)

(2) Operation selector switch
The switch is to change the operation mode of the water supply unit. (→ see 7.1)

(3) Current mode indicator light
The light is to display the operation mode currently selected.

(4) Tank selector switch
Press this switch to select the receiver tank(s) to be used. (→ see 7.2)

(5) Current tank indicator light
The indicator light will be on for the receiver tank currently selected.

(6) Solenoid valve operation selector switch
Press this switch to change the solenoid valve operation mode. (→ see7.3)

(7) Current solenoid valve operation indicator Light
The indicator light will be on for the solenoid valve operation currently selected.

(8) No.1 operation indicator light
The indicator light will be on while the No.1 pump is running, and blinks while the low-flowrate-stop status is checked in the automatic mode of the No.1 pump.

(9) No.2 operation indicator light
The indicator light will be on while the No.2 pump is running, and blinks while the low-flowrate-stop status is checked in the automatic mode of the No.2 pump.

(10) No.1 block indicator light and No.2 block indicator light
The indicator light will be on when the Operation Permitted parameter is set to “Operation blocked” for each pump. (→ see 7.5)

(11) Power indicator light
The indicator light will be on while the power is turned ON.
It blinks in the inspection mode (→ see 8.2).

(12) Failure indicator light
The indicator light blinks when an alarm occurs.

(13) No. 1 Manual/Confirm switch
Press the switch to run the No.1 pump in the manual mode.
The switch is also used as the “Confirm” switch in the setting and other modes.

(14) No.2 Manual/Back switch
Press the switch to run the No.2 pump in the manual mode.
The switch is also used as the “Back” switch in the setting and other modes.

(15) Reset switch
This switch is used to reset an alarm.
Generated alarms can be reset by pressing the switch once the cause of the alarm is eliminated.

(16) Buzzer stop switch
The switch is used to manually stop the buzzer when an alarm occurs.
The switch is also used in combination with the cursor switch 1 to switch the basic information items on the display.

(17) Setting switch
The switch is used to switch to or to exit from the setting mode (→ see 7.5).

(18) Cursor switch 1
The operating frequency can be changed by pressing the switch in the manual mode of the No.1 pump.
The switch is used to switch the indication items, make the settings, and switch the indication items of the No.1 pump.

(19) Cursor switch 2
The operating frequency can be changed by pressing this switch in the manual mode of the No.2 pump.
The switch is used to switch the indication items of the No.2 pump.

3.2.3 Configuration of the control panel

Warning		Be careful when the control panel is powered on because a high voltage is running through the parts inside the control panel and it is very dangerous. Do not allow any persons other than qualified personnel to open the cover of the control panel. Otherwise, it may lead to an electric shock.
Caution		Be sure to open or close the cover with both hands to apply roughly the same amount of force to the right and left sides. For example, when the cover is opened or closed by using only the handle on one side, uneven force applied to the right and left sides of the cover may twist and distort the cover, resulting in disconnection or damage of the cover.
Caution		When opening the cover, do not let go of the cover until it reaches the stop position. Otherwise, a resulting impact may damage the cover and/or other parts.

(1) Opening/closing the cover (for models with a motor output of up to 3.7 kW)

① Open the cover.
Put your hands on the handles on the right and left sides of the cover, and pull the cover toward you with both hands. At that time, ensure that roughly the same amount of force is applied to the right and left sides. Do not let go of the cover until it reaches the stop position

② Close the cover.
Put your hands on the areas around the right and left handles of the cover, and lift the cover with both hands to close it. Firmly press the cover until the latch is securely locked in place.

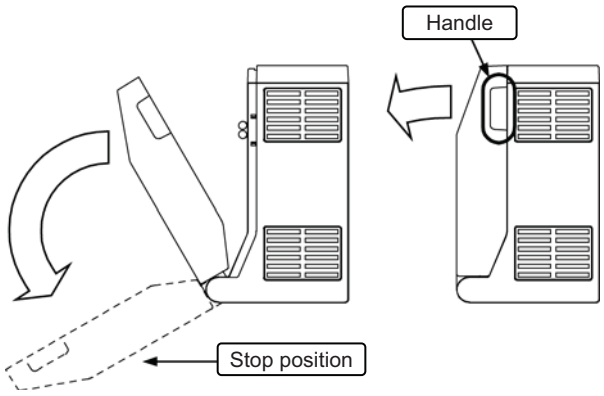


Fig. 3-2-3(a)
How to open the cover of the control panel
(For the models with a motor output of up to 3.7 kW)

(2) Components

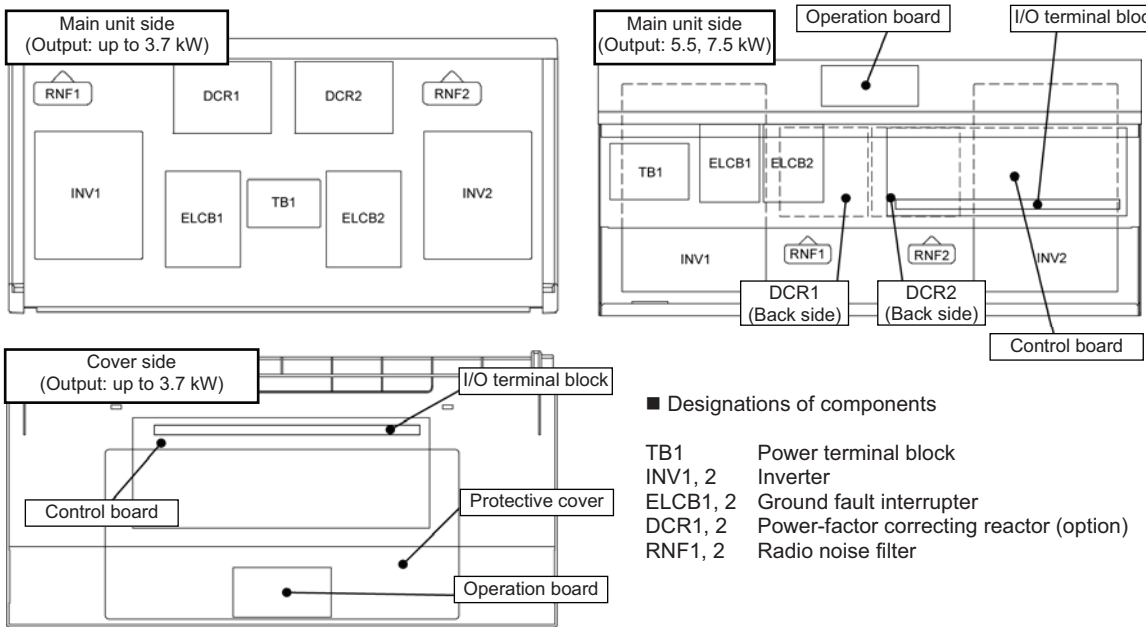


Fig. 3-2-3(b) Components in the control panel

3.2.4 Control board

The following are the details of the control board.

Warning

Do not remove the protective cover on the control board or the cover of the I/O terminal block when the power is turned on.
Otherwise, it may lead to an electric shock.

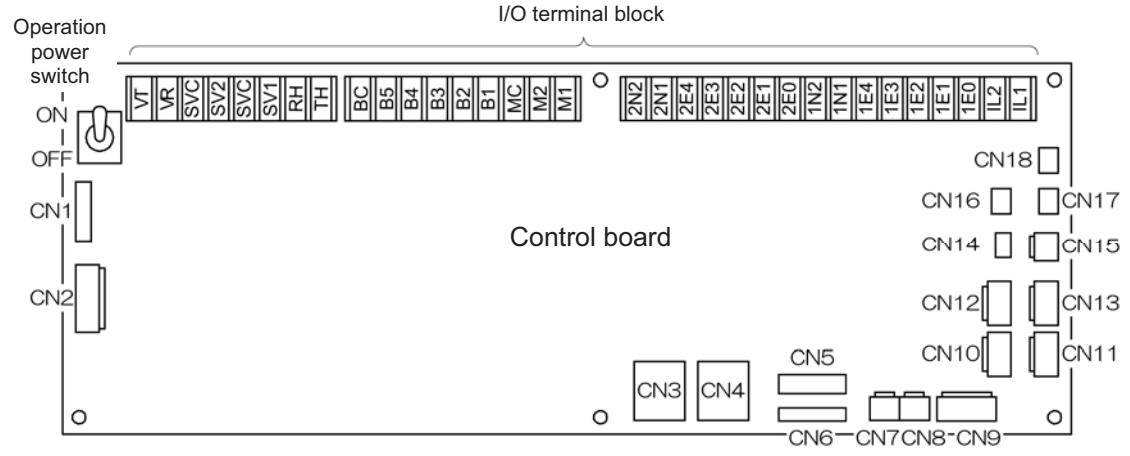


Fig. 3-2-4 Detailed drawing of control board

Table 3-2-4 (a) Connector assignments

No.	Connected to	No.	Connected to	No.	Connected to
CN1	Device in panel	CN7	Device in panel	CN13	Flow switch No.2
CN2	(Not in use)	CN8	Device in panel	CN14	(Not in use)
CN3	Device in panel	CN9	(Not in use)	CN15	Control panel high-temperature sensor *1
CN4	Device in panel	CN10	Pressure transmitter	CN16	High-temperature sensor No.1
CN5	(Not in use)	CN11	(Not in use)	CN17	High-temperature sensor No.2
CN6	Device in panel	CN12	Flow switch No.1	CN18	Low-temperature sensor *2

*1 For models fitted with outdoor cover, this sensor is connected depending on the specifications.
*2 The low-temperature sensor is connected only to freeze-proof models (special specifications).

Table 3-2-4 (b) Designations and applications of I/O terminal block

Designation	Application	Designation	Application
IL1, IL2	Interlocking signal	B1 to B5	Alarm signal output
1E0 to 1E4	Receiver tank No.1 level detection electrode	BC	Alarm signal output common
2E0 to 2E4	Receiver tank No.2 level detection electrode	VR, VT	Alarm power (power voltage)
1N1, 1N2	Receiver tank No.1 solenoid valve control electrode	RH, TH*3	Freeze-proof heater (power voltage)
2N1, 2N2	Receiver tank No.2 solenoid valve control electrode	SVC, SV1	Receiver tank No.1 solenoid valve (power voltage)
M1, M2	No.1, No.2 operation signal	SVC, SV2	Receiver tank No.2 solenoid valve (power voltage)
MC	Operation signal common		

*3 The freeze-proof heaters are connected only to freeze-proof models (special specifications).

3.3 Specifications of control panel

Table 3-3 Specifications of control panel

Item				Specifications 1	Specifications 2
Control panel model				BQNXC	
Operation mode				Automatic alternate/automatic alternate parallel	
Material and external color of casing				0.4 to 3.7 kW: ACS resin (light gray/material color) + steel plate (highly corrosion-resistant hot-dip plating)	
				5.5, 7.5 kW: steel plate (Munsell 5Y7/1 semigloss/baking finish)	
Output Range		Single-phase 200/200-220 V (50/60 Hz)		0.4 to 1.1 kW	
		Three-phase 200/200-220 V (50/60 Hz)		0.4 to 7.5 kW	
Circuit configuration		Ground fault interrupter	Individual pump systems	S	
		Power-factor correcting reactor (DCR)	Individual pump systems	—	S
		Motor protection	—	Inverter (electronic thermal protection)	
		Double receiver tank circuit	Can be switched on the operation panel	S	
		Inflow solenoid valve circuit	Can be operated on the operation panel	S	
		Electrode 5P circuit	—	S	
Functions		Dry-run prevention	—	S	
		Automatic switching upon failure	—	S	
		Pump continuous operation prevention function	—	S	
		Pump operation time equalization function	—	S	
		Freeze-proof operation function	—	O	
		External stop signal (interlock) available	a/b-contact available	S	
		Buzzer stop timer setting	1 to 60 min, ∞, no buzzer	S	
		Full/low waTERAL INC.arm automatic recovery setting	—	S	
		Inflow solenoid valve automatic alternation setting	—	S	
		Inspection mode	—	S	
		Alarm buzzer	—	S	
		Buzzer stop switch	—	S	
		Energy-saving operation setting	—	S	
Indications on control panel	Indicator light	Power	—	S	
		Operation (for each pump)	—	S	
		Block (for each pump)	—	S	
		Alarm (collective)	—	S	
	Various indications	Discharge pressure	Unit: m·H_2O	S	
		Power voltage	Unit: V	S	
		Operation current (for each pump)	Unit: 0.1 A	S	
		Operation frequency (for each pump)	Unit: 0.1 Hz (only automatic)	S	
		Cumulative operation time (for each pump)	Unit: Hour	S	
		Cumulative number of starts (for each pump)	Unit: times	S	
		Number of starts time of the unit	Number of starts on the previous day	S	
		Alarm log	5 latest alarms	S	
		Interlocking in operation	—	S	
		Freeze-proofing in progress	—	O	
	Alarm indications	Receiver tank full	No: E001	S	
		Receiver tank low	No: E002	S	
		Dry-run prevention	No: E003	S	
		Electrode failure	No: E004	S	
		Start frequency failure	No: E006	S	
		Pressure transmitter 1 failure	No: E051	S	
		Control panel high temperature	No: E070	O	
		EEPROM error	No: E080	S	
		Overload (for each pump)	No: E#01	S	
		Discharge pressure abnormal drop (for each pump)	No: E#02	S	
		Electric leak (for each pump)	No: E#03	S	
		High temperature (for each pump)	No: E#04	S	
		Flow switch failure (for each pump)	No: E#05	S	
		Overcurrent (for each pump)	No: E#11	S	
		Overvoltage (for each pump)	No: E#12	S	
		Anti-stall (for each pump)	No: E#14	S	
		Inverter overload (for each pump)	No: E#15	S	
		Open-phase output (for each pump)	No: E#16	S	
		Inverter overheat (for each pump)	No: E#17	S	
		Inverter communication failure (for each pump)	No: E#18	S	
		Inverter trouble 1 (for each pump)	No: E#19	S	
		Inverter trouble 2 (for each pump)	No: E#20	S	
External output		Power for alarm	Power voltage	S	
		Freeze-proof heater output	Power voltage	O	
		Inflow solenoid valve output	Power voltage	S (Normally open/closed type available)	
		Operation signal	No-voltage a-contact	S (for each)	
		Error signal	No-voltage a-contact	S (5 points: patterns 0 to 4)	

"S" indicates standard features, and "O" indicates optional features.

*1 Power voltage and operation current values are estimated values. There is an error of approximately 10% with respect to the full scale.

*2 "E006" and "E#04" can be disabled using settings. Refer to "7.5 Parameter setting."

*3 The character "#" is replaced by the corresponding pump number.

*4 The open-phase output error is detected by only the units with the rated output of 5.5 kW or more.

*5 For the patterns to output error signals using external relays, refer to "7.5 Parameter setting."

3.4 Specification tables

3.4.1 Standard models (boost models)

● Automatic alternate operation <boost models>

Suction condition	Nominal diameter mm		Model	Output kW	Phase/Voltage V	Standard specifications					Specified ranges		Pressure tank pre-charge pressure MPa (kgf/cm²)	
	Pump suction	Unit discharge				Maximum water supply m³/min	Total head m	Minimum sustained head m	Stop pressure (approximate value) MPa (kgf/cm²)		Water supply m³/min	Discharge head selection range m		
Boost models	25	25	NX-VFC252-0.4S2D-e	0.4	Single-phase 200 (50 Hz), single-phase 200 (60 Hz)	0.06	23	20	0.25	(2.5)	0.02–0.09	15–27	0.13	(1.3)
			NX-VFC252-0.75S2D-e	0.75		0.06	34	29	0.33	(3.4)	0.02–0.09	23-40	0.19	(1.9)
			NX-VFC253-1.1S2D-e	1.1		0.06	55	47	0.54	(5.5)	0.02–0.09	37–64	0.31	(3.2)
	32	32	NX-VFC322-0.4S2D-e	0.4		0.1	16	14	0.19	(1.9)	0.02–0.11	12–27	0.10	(1.0)
			NX-VFC322-0.75S2D-e	0.75		0.1	24	20	0.25	(2.5)	0.02–0.15	15–31	0.12	(1.2)
			NX-VFC323-1.1S2D-e	1.1		0.1	41	35	0.40	(4.1)	0.02–0.15	26–52	0.23	(2.3)
	40	40	NX-VFC401-1.1S2D-e	1.1		0.2	20	17	0.22	(2.2)	0.02–0.26	15–28	0.13	(1.3)
	25	25	NX-VFC252-0.4D-e	0.4	Three-phase 200 (50 Hz), three-phase 200/220 (60 Hz)	0.06	23	20	0.25	(2.5)	0.02–0.09	15–27	0.13	(1.3)
			NX-VFC252-0.75D-e	0.75		0.06	34	29	0.33	(3.4)	0.02–0.09	23–40	0.20	(2.0)
			NX-VFC253-1.1D-e	1.1		0.06	55	47	0.54	(5.5)	0.02–0.09	37–64	0.31	(3.2)
	32	32	NX-VFC322-0.4D-e	0.4		0.1	16	14	0.19	(1.9)	0.02–0.11	12–27	0.10	(1.0)
			NX-VFC322-0.75D-e	0.75		0.1	26	22	0.26	(2.7)	0.02–0.15	15–33	0.13	(1.3)
			NX-VFC323-1.1D-e	1.1		0.1	41	35	0.40	(4.1)	0.02–0.15	26–52	0.23	(2.3)
			NX-VFC323-1.5D-e	1.5		0.1	50	43	0.49	(5.0)	0.02–0.15	33–60	0.28	(2.9)
			NX-VFC324-2.2D-e	2.2		0.1	67	57	0.66	(6.7)	0.02–0.15	45–80	0.39	(4.0)
	40	40	NX-VFC401-1.1D-e	1.1		0.2	20	17	0.22	(2.2)	0.02–0.26	15–28	0.13	(1.3)
			NX-VFC402-1.5D-e	1.5		0.2	30	26	0.30	(3.1)	0.02–0.28	21–40	0.18	(1.8)
			NX-VFC402-2.2D-e	2.2		0.2	42	36	0.41	(4.2)	0.02–0.28	30–57	0.25	(2.6)
			NX-VFC402-3.7D-e	3.7		0.2	57	48	0.56	(5.7)	0.02–0.30	37–67	0.31	(3.2)
			NX-VFC403-3.7D-e	3.7		0.2	65	55	0.64	(6.5)	0.02–0.30	45–80	0.39	(4.0)
			NX-VFC403-5.5D-e	5.5		0.2	79	67	0.77	(7.9)	0.02–0.30	50–90	0.44	(4.5)
	50	50	NX-VFC501-1.5D-e	1.5		0.3	16	14	0.19	(1.9)	0.02–0.38	12–22	0.10	(1.0)
			NX-VFC502-2.2D-e	2.2		0.3	27	23	0.27	(2.8)	0.02–0.38	18–42	0.16	(1.6)
			NX-VFC502-3.7D-e	3.7		0.3	48	41	0.47	(4.8)	0.02–0.44	30–65	0.25	(2.6)
			NX-VFC503-5.5D-e	5.5		0.3	65	55	0.64	(6.5)	0.02–0.44	41–90	0.35	(3.6)
			NX-VFC503-7.5D-e	7.5		0.3	76	65	0.75	(7.6)	0.02–0.45	50–90	0.44	(4.5)
	65	65	NX-VFC652-3.7D-e	3.7		0.45	26	22	0.26	(2.7)	0.02–0.56	18–38	0.15	(1.5)
			NX-VFC652-5.5D-e	5.5		0.45	41	35	0.40	(4.1)	0.02–0.56	30–57	0.25	(2.6)
			NX-VFC653-7.5D-e	7.5		0.45	58	49	0.57	(5.8)	0.02–0.58	41–80	0.35	(3.6)

● Automatic alternate parallel operation <boost models>

Suction condition	Nominal diameter mm		Model	Output kW	Phase/Voltage V	Standard specifications					Specified ranges		Pressure tank pre-charge pressure MPa (kgf/cm²)	
	Pump suction	Unit discharge				Maximum water supply m³/min	Total head m	Minimum sustained head m	Stop pressure (approximate value) MPa (kgf/cm²)		Water supply m³/min	Discharge head selection range m		
Boost models	25	40	NX-40VFC252-0.4S2W-e	0.4	Single-phase 200 (50 Hz), single-phase 200 (60 Hz)	0.12	22	19	0.24	(2.4)	0.04–0.18	15–27	0.13	(1.3)
			NX-40VFC252-0.75S2W-e	0.75		0.12	34	29	0.33	(3.4)	0.04–0.18	23-40	0.19	(1.9)
			NX-40VFC253-1.1S2W-e	1.1		0.12	54	46	0.53	(5.4)	0.04–0.18	37–64	0.31	(3.2)
	32	50	NX-50VFC322-0.4S2W-e	0.4		0.2	16	14	0.19	(1.9)	0.04–0.23	12–27	0.10	(1.0)
			NX-50VFC322-0.75S2W-e	0.75		0.2	23	20	0.25	(2.5)	0.04–0.30	15–31	0.12	(1.2)
			NX-50VFC323-1.1S2W-e	1.1		0.2	41	35	0.40	(4.1)	0.04–0.30	26–52	0.23	(2.3)
	40	65	NX-65VFC401-1.1S2W-e	1.1		0.4	19	16	0.21	(2.1)	0.04–0.52	15–28	0.13	(1.3)
	25	40	NX-40VFC252-0.4W-e	0.4	Three-phase 200	0.12	22	19	0.24	(2.4)	0.04–0.18	15–27	0.13	(1.3)
			NX-40VFC252-0.75W-e	0.75		0.12	34	29	0.33	(3.4)	0.04–0.18	23–40	0.20	(2.0)
			NX-40VFC253-1.1W-e	1.1		0.12	54	46	0.53	(5.4)	0.04–0.18	37–64	0.31	(3.2)
	32	50	NX-50VFC322-0.4W-e	0.4		0.2	16	14	0.19	(1.9)	0.04–0.23	12–27	0.10	(1.0)
			NX-50VFC322-0.75W-e	0.75		0.2	25	21	0.25	(2.6)	0.04–0.30	15–33	0.13	(1.3)
			NX-50VFC323-1.1W-e	1.1		0.2	41	35	0.40	(4.1)	0.04–0.30	26–52	0.23	(2.3)
			NX-50VFC323-1.5W-e	1.5		0.2	50	43	0.49	(5.0)	0.04–0.30	33–60	0.28	(2.9)
			NX-50VFC324-2.2W-e	2.2		0.2	67	57	0.66	(6.7)	0.04–0.30	45–80	0.39	(4.0)
	40	65	NX-65VFC401-1.1W-e	1.1		0.4	19	16	0.21	(2.1)	0.04–0.52	15–28	0.13	(1.3)
			NX-65VFC402-1.5W-e	1.5		0.4	29	25	0.29	(3.0)	0.04–0.56	21–40	0.18	(1.8)
			NX-65VFC402-2.2W-e	2.2		0.4	41	35	0.40	(4.1)	0.04–0.56	30–57	0.25	(2.6)
			NX-65VFC402-3.7W-e	3.7		0.4	57	48	0.56	(5.7)	0.04–0.60	37–67	0.31	(3.2)
			NX-65VFC403-3.7W-e	3.7		0.4	65	55	0.64	(6.5)	0.04–0.60	45–80	0.39	(4.0)
			NX-65VFC403-5.5W-e	5.5		0.4	78	66	0.76	(7.8)	0.04–0.60	50–90	0.44	(4.5)
	50	65	NX-65VFC501-1.5W-e	1.5		0.6	15	13	0.18	(1.8)	0.04–0.74	12–22	0.10	(1.0)
			NX-65VFC502-2.2W-e	2.2		0.6	27	23	0.27	(2.8)	0.04–0.75	18–42	0.16	(1.6)
			NX-65VFC502-3.7W-e	3.7		0.6	48	41	0.47	(4.8)	0.04–0.87	30–65	0.25	(2.6)
			NX-65VFC503-5.5W-e	5.5		0.6	65	55	0.64	(6.5)	0.04–0.87	41–90	0.35	(3.6)
			NX-65VFC503-7.5W-e	7.5		0.6	76	65	0.75	(7.6)	0.04–0.90	50–90	0.44	(4.5)
	65	80	NX-80VFC652-3.7W-e	3.7		0.9	25	21	0.25	(2.6)	0.04–1.08	18–38	0.15	(1.5)
			NX-80VFC652-5.5W-e	5.5		0.9	39	33	0.38	(3.9)	0.04–1.09	30–57	0.25	(2.6)
			NX-80VFC653-7.5W-e	7.5		0.9	57	48	0.56	(5.7)	0.04–1.13	41–80	0.35	(3.6)

3.4.2 Special models (lifting models)

● Automatic alternate operation <lifting models>

Suction condition	Nominal diameter mm		Model	Output kW	Phase/Voltage V	Standard specifications					Specified ranges		Pressure tank pre-charge pressure MPa (kgf/cm²)	
	Pump suction	Unit discharge				Maximum water supply m³/min	Total head m	Minimum sustained head m	Stop pressure (approximate value) MPa (kgf/cm²)		Water supply m³/min	Discharge head selection range m		
Lifting models	25	25	NX-VFC252-0.4S2D-e	0.4	Single-phase 200 (50 Hz), single-phase 200 (60 Hz)	0.06	21	18	0.23	(2.3)	0.02–0.09	15–26	0.10	(1.0)
			NX-VFC252-0.75S2D-e	0.75		0.06	32	27	0.31	(3.2)	0.02–0.09	20-39	0.16	(1.6)
			NX-VFC253-1.1S2D-e	1.1		0.06	51	43	0.50	(5.1)	0.02–0.09	33–62	0.28	(2.9)
	32	32	NX-VFC322-0.75S2D-e	0.75		0.1	22	19	0.24	(2.4)	0.02–0.14	15–30	0.12	(1.2)
			NX-VFC323-1.1S2D-e	1.1		0.1	39	33	0.38	(3.9)	0.02–0.14	25–51	0.22	(2.2)
	40	70	NX-VFC401-1.1S2D-e	1.1		0.2	19	16	0.21	(2.1)	0.02–0.25	15–27	0.10	(1.0)
	25	25	NX-VFC252-0.4D-e	0.4	Three-phase 200 (50 Hz), three-phase 200/220 (60 Hz)	0.06	21	18	0.23	(2.3)	0.02–0.09	15–26	0.10	(1.0)
			NX-VFC252-0.75D-e	0.75		0.06	32	27	0.31	(3.2)	0.02–0.09	20–39	0.17	(1.7)
			NX-VFC253-1.1D-e	1.1		0.06	51	43	0.50	(5.1)	0.02–0.09	33–62	0.28	(2.9)
	32	32	NX-VFC322-0.75D-e	0.75		0.1	24	20	0.25	(2.5)	0.02–0.15	15–32	0.13	(1.3)
			NX-VFC323-1.1D-e	1.1		0.1	39	33	0.38	(3.9)	0.02–0.14	25–51	0.22	(2.2)
			NX-VFC323-1.5D-e	1.5		0.1	48	41	0.47	(4.8)	0.02–0.15	30–59	0.25	(2.6)
			NX-VFC324-2.2D-e	2.2		0.1	65	55	0.64	(6.5)	0.02–0.15	42–79	0.36	(3.7)
	40	40	NX-VFC401-1.1D-e	1.1		0.2	19	16	0.21	(2.1)	0.02–0.25	15–27	0.10	(1.0)
			NX-VFC402-1.5D-e	1.5		0.2	28	24	0.28	(2.9)	0.02–0.28	19–40	0.16	(1.6)
			NX-VFC402-2.2D-e	2.2		0.2	40	34	0.39	(4.0)	0.02–0.28	28–57	0.25	(2.5)
			NX-VFC402-3.7D-e	3.7		0.2	56	48	0.55	(5.6)	0.02–0.30	34–66	0.29	(3.0)
			NX-VFC403-3.7D-e	3.7		0.2	63	54	0.62	(6.3)	0.02–0.30	42–80	0.36	(3.7)
			NX-VFC403-5.5D-e	5.5		0.2	78	66	0.76	(7.8)	0.02–0.30	47–90	0.41	(4.2)
	50	50	NX-VFC501-1.5D-e	1.5		0.3	15	13	0.18	(1.8)	0.02–0.31	15–22	0.08	(0.8)
			NX-VFC502-2.2D-e	2.2		0.3	27	23	0.27	(2.8)	0.02–0.40	15–42	0.13	(1.3)
			NX-VFC502-3.7D-e	3.7		0.3	47	40	0.46	(4.7)	0.02–0.44	28–65	0.25	(2.5)
			NX-VFC503-5.5D-e	5.5		0.3	63	54	0.62	(6.3)	0.02–0.44	39–90	0.34	(3.5)
			NX-VFC503-7.5D-e	7.5		0.3	75	64	0.74	(7.5)	0.02–0.45	47–90	0.41	(4.2)
	65	65	NX-VFC652-3.7D-e	3.7		0.45	25	21	0.25	(2.6)	0.02–0.58	16–37	0.14	(1.4)
			NX-VFC652-5.5D-e	5.5		0.45	40	34	0.39	(4.0)	0.02–0.57	28–56	0.25	(2.5)
			NX-VFC653-7.5D-e	7.5		0.45	57	48	0.56	(5.7)	0.02–0.57	41–79	0.35	(3.6)

● Automatic alternate parallel operation <lifting models>

Suction condition	Nominal diameter mm		Model	Output kW	Phase/Voltage V	Standard specifications					Specified ranges		Pressure tank pre-charge pressure MPa (kgf/cm²)	
	Pump suction	Unit discharge				Maximum water supply m³/min	Total head m	Minimum sustained head m	Stop pressure (approximate value) MPa (kgf/cm²)		Water supply m³/min	Discharge head selection range m		
Lifting models	25	4	NX-40VFC252-0.4S2W-e	0.4	Single-phase 200 (50 Hz), single-phase 200 (60 Hz)	0.12	21	18	0.23	(2.3)	0.04–0.17	15–26	0.10	(1.0)
			NX-40VFC252-0.75S2W-e	0.75		0.12	32	27	0.31	(3.2)	0.04–0.18	20-39	0.16	(1.6)
			NX-40VFC253-1.1S2W-e	1.1		0.12	51	43	0.50	(5.1)	0.04–0.18	33–62	0.28	(2.9)
	32	50	NX-50VFC322-0.75S2W-e	0.75		0.2	22	19	0.24	(2.4)	0.04–0.29	15–30	0.12	(1.2)
			NX-50VFC323-1.1S2W-e	1.1		0.2	38	32	0.37	(3.8)	0.04–0.29	25–51	0.22	(2.2)
	40	65	NX-65VFC401-1.1S2W-e	1.1		0.4	19	16	0.21	(2.1)	0.04–0.50	15–27	0.10	(1.0)
	25	40	NX-40VFC252-0.4W-e	0.4	Three-phase 200 (50 Hz), three-phase 200/220 (60 Hz)	0.12	21	18	0.23	(2.3)	0.04–0.17	15–26	0.10	(1.0)
			NX-40VFC252-0.75W-e	0.75		0.12	32	27	0.31	(3.2)	0.04–0.18	20–39	0.17	(1.7)
			NX-40VFC253-1.1W-e	1.1		0.12	51	43	0.50	(5.1)	0.04–0.18	33–62	0.28	(2.9)
	32	50	NX-50VFC322-0.75W-e	0.75		0.2	24	20	0.25	(2.5)	0.04–0.29	15–32	0.13	(1.3)
			NX-50VFC323-1.1W-e	1.1		0.2	38	32	0.37	(3.8)	0.04–0.29	25–51	0.22	(2.2)
			NX-50VFC323-1.5W-e	1.5		0.2	47	40	0.46	(4.7)	0.04–0.30	30–59	0.25	(2.6)
			NX-50VFC324-2.2W-e	2.2		0.2	64	54	0.63	(6.4)	0.04–0.30	42–79	0.36	(3.7)
	40	65	NX-65VFC401-1.1W-e	1.1		0.4	19	16	0.21	(2.1)	0.04–0.50	15–27	0.10	(1.0)
			NX-65VFC402-1.5W-e	1.5		0.4	28	24	0.28	(2.9)	0.04–0.57	19–40	0.16	(1.6)
			NX-65VFC402-2.2W-e	2.2		0.4	40	34	0.39	(4.0)	0.04–0.57	28–57	0.25	(2.5)
			NX-65VFC402-3.7W-e	3.7		0.4	56	48	0.55	(5.6)	0.04–0.60	34–66	0.29	(3.0)
			NX-65VFC403-3.7W-e	3.7		0.4	63	54	0.62	(6.3)	0.04–0.60	42–80	0.36	(3.7)
			NX-65VFC403-5.5W-e	5.5		0.4	78	66	0.76	(7.8)	0.04–0.60	47–90	0.41	(4.2)
	50	65	NX-65VFC501-1.5W-e	1.5		0.6	15	13	0.18	(1.8)	0.04–0.60	15–22	0.08	(0.8)
			NX-65VFC502-2.2W-e	2.2		0.6	26	22	0.26	(2.7)	0.04–0.78	15–42	0.13	(1.3)
			NX-65VFC502-3.7W-e	3.7		0.6	47	40	0.46	(4.7)	0.04–0.87	28–65	0.25	(2.5)
			NX-65VFC503-5.5W-e	5.5		0.6	63	54	0.62	(6.3)	0.04–0.87	39–90	0.34	(3.5)
			NX-65VFC503-7.5W-e	7.5		0.6	74	63	0.73	(7.4)	0.04–0.90	47–90	0.41	(4.2)
	60	80	NX-80VFC652-3.7W-e	3.7		0.9	24	20	0.25	(2.5)	0.04–1.10	16–37	0.14	(1.4)
			NX-80VFC652-5.5W-e	5.5		0.9	38	32	0.37	(3.8)	0.04–1.10	28–56	0.25	(2.5)
			NX-80VFC653-7.5W-e	7.5		0.9	56	48	0.55	(5.6)	0.04–1.11	41–79	0.35	(3.6)

4. Installation

4.1 Precautions for installation

Warning	When moving or installing the unit, never lift it in an unstable condition or with any load applied to the pressure tank, pipes, or control panel. Otherwise, the unit may fall, resulting in injury and/or damage. Before lifting the unit, refer to the catalog, the external dimensions drawing, or other documents to check the weight of the unit, and use an appropriate lifting device of which rated load is over the the unit. Otherwise, the unit may fall, resulting in injury and/or damage.
Warning	Electric motor or control panel insulation degradation may result in electric leakage, electric shock, or fi re. Keep the ambient temperature at 0 to 40°C with sufficient ventilation to prevent damage to the equipment and deterioration of its life. Avoid dust, corrosive or explosive gases, salinity, humidity, condensation. For indoor installations avoid direct sunlight or wind and rain.
Caution	For the installation environment, follow the precautions described below. Otherwise, it may lead to failures and/or other problems as well as a shorter life of the units.
Caution	This water supply unit is designed for indoor use. For outdoor use, install the outdoor hood, which is available as a special accessory. Otherwise, it may lead to failures.
Caution	To suck up water from a lower position, use a water supply unit designed for lifting operation. Otherwise, discharge pressure may drop, thus leading to disruption of water supply.

(1) Install the unit at a place that meets the following conditions:
- a place that meets the requirements in Section “3.1 Specifications of the water supply unit “;
- a place that is not exposed to the wind or rain;
- a dry, well-ventilated environment, which as free of dust or moisture as possible;
- a location where unauthorized persons cannot easily enter or operate the product;
- a location as close to the water source as possible so that the suction pipe can be short.; and
- a location where mainance can be conducted easily and abnormality can be readily coped with.

(2) Fix the water supply unit firmly on a level concrete foundation with anchor bolts.

(3) Be sure to provide a drain ditch around the water supply unit, and waterproof the floor.

(4) If the system could be exposed to the freezing temperature in winter, be sure to take measures to prevent freezing in the pump room or prevent the pump, valves, piping, pressure transmitter, pressure tank, and other devices from freezing. We can offer the special models designed to prevent freezing. Contact us.

(5) Use sound insulating materials for the door and walls of the pump room. Particularly when generated noise may pose a problem, take necessary measures against the noise.

(6) If you need to lift the water supply unit (with motor output: up to 3.7 kW), attach four eyebolts as shown in the following figure. Separately place an order for the eyebolts as they are optional.
When the motor output is 5.5 or 7.5 kW, there are lifting holes in the common base.
Place cushioning materials to prevent damage to the unit.

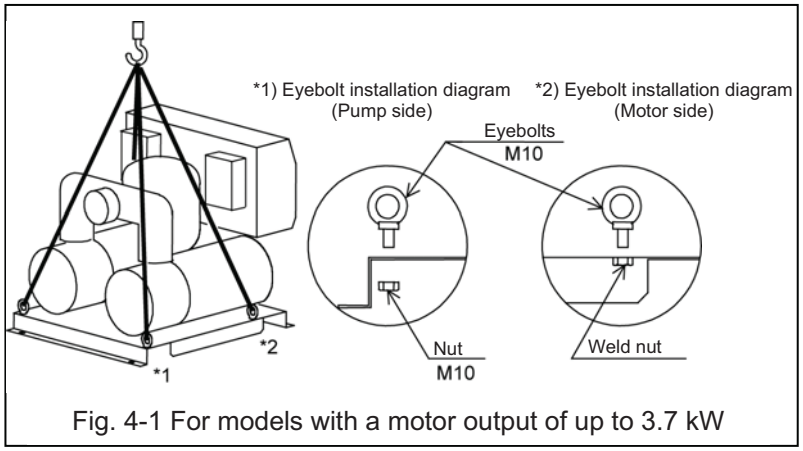


Fig. 4-1 For models with a motor output of up to 3.7 kW

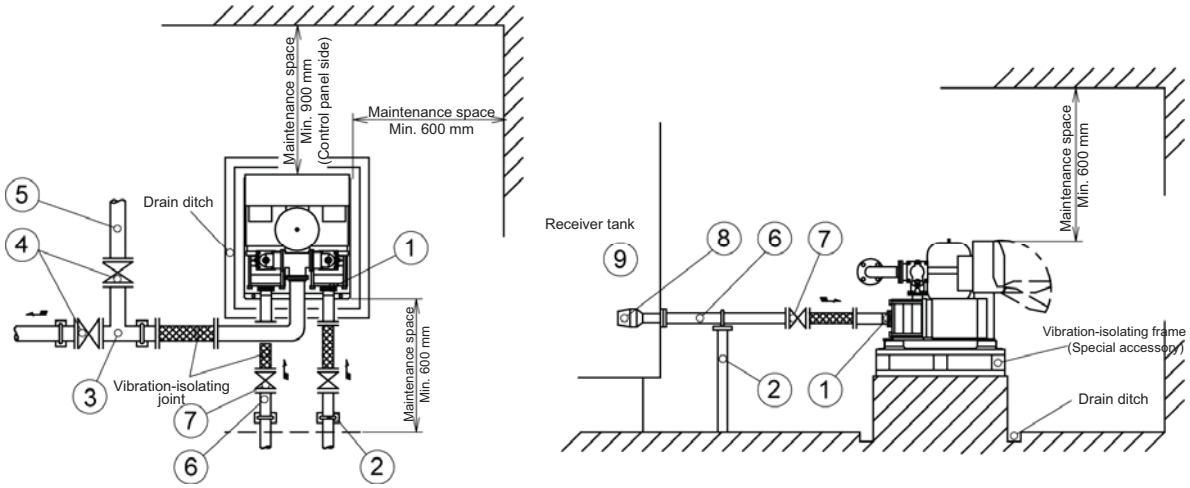
(7) If the unit is operated for a long time at low flow rate, a pressure relieving device might be necessary. Please contact us.

4.2 Precautions for piping work

Caution	⊘	Do not screw a pipe into the pump with the companion flange attached to the pump. Otherwise, it may damage the pump.
Caution	⊘	Do not merge the suction pipes. Do not install the piping with a shape of upward bend (i.e. providing the piping with a rising slope and then a descending slope). Otherwise, it may hinder the normal operation.
Caution	⊘	Do not use any piping materials that are prone to rust. Otherwise, it may damage the unit.
Caution	❗	After work, thoroughly clean (flush) the inside of the receiver tank and piping.

(1) Attach a companion flange ① to the water supply unit after connecting the pipe.
(2) Install an adequate pipe support ② so that the weight of the piping system will not be applied to the main unit.
(3) For test operation and adjustments, be sure to attach sluice valves ④ and a test pipe ⑤ to the discharge pipe ③.
(4) Ensure to install a suction pipe ⑥ to each pump.
(5) The suction pipes ⑥ must be as short and straight as possible with minimal bends.
(6) To minimize the piping loss, the bore of the suction pipes ⑥ must be equal to or one size larger than that of the pump. Pay special attention to an automatic alternate parallel operation type because the flow rate of the subsequently activated pump exceeds half the maximum flow rate of water to be used.
(7) For maintenance, be sure to attach sluice valves ⑦ to the suction pipes ⑥.
(For lifting models, do not attach sluice valves ⑦ to the suction pipes.)
(8) Ensure to attach strainers ⑧ to the ends of the suction pipes ⑥ in order to block the entrance of foreign matter.
(9) After piping work, be sure to clean the inside of a receiver tank ⑨ to prevent the entry of foreign matter into the pumps.

<Example of piping work>



Note: The minimum maintenance spaces shown here are the manufacturer's recommended values.

Fig. 4-2 Example of piping work (for boost models)

4.3 Precautions for wiring work

Warning		Use the wiring equipment and devices compliant to use conditions, and carry out wiring work safely and securely according to the technical standards for electrical facilities, as well as the indoor wiring regulations. Only qualified personnel such as licensed electrical engineers are allowed to carry out electric wiring work. Incomplete wiring work by unqualified persons is prohibited by law.

4.3.1 Wiring work for power supply

Warning		Be sure to install a ground fault interrupter dedicated to this unit at the primary power supply. Otherwise, it may lead to an electric shock and/or fire.
Warning		Ensure to securely install a ground wire to the control panel. Ensure to perform grounding work.
Warning		Connecting a ground wire to gas or water pipes is not only prohibited by law but also extremely dangerous.
Caution		Do not install different or other cables or control wires in one pipe or conduit.
Caution		Do not attach a phase advance capacitor to the secondary wiring of the control panel. Otherwise, it may lead to failures in the inverter or the phase advance capacitor.

(1) On the primary power supply side of the water supply unit, be sure to install a ground fault interrupter dedicated to this unit.
Check the capacity of the ground fault interrupter fitted inside the control panel, and then select a ground fault interrupter on the power supply side in consideration of protection coordination.

(2) Be sure to attach a ground wire to prevent an electric shock.
Connect the ground wire to the ground terminal inside the control panel.

(3) Connect the primary power line to the power terminal block inside the control panel.
Pass each wire through a metal tube or a metal conduit for shielding, and ground the covering of the tube.

(4) Control the fluctuation of the voltage within ±10% of the rated voltage, and the frequency within ±5% of the rated frequency.
Keep in mind that if you use the unit at a voltage or frequency out of the range, the unit may break down.
Also note that if the power voltage is lower than the rated voltage, an overload may occur even if the flow rate is within the specified range.

(5) Before running the pump, check the following points again:

- An appropriate ground fault interrupter is installed.
- Wiring is correct.
- The unit is securely grounded.
- None of the three wires (two wires for single-phase power) of the motor has come loose or is disconnected.
  Note that poor or incorrect connection of motor terminals may burn out the motor.

4.3.2 Instrumentation

Carry out wiring work for instrumentation according to the following procedure:

Connect all the wires for instrumentation (hereafter “the instrumentation wires”) to the terminal block on the control board.
For the models with a motor output of up to 3.7kW, observe the following instructions on connecting the wires to the control board.

① Use highly flexible electric wires for instrumentation.
② Insert the instrumentation wires into the inlet ports for instrumentation wires, pass them through either side of the cover, and then connect them to the board.
The inlet ports for instrumentation wires are knockout openings.

Caution	For knockout work and wire insertion work, be sure to wear protective clothing such as gloves. Otherwise you may get injured by the cut edges of the sheet plate. Attach grommets (22 mm in diameter) to the wire inlet ports to protect the wires, or use conduit tubes.

③ Tie and fix the instrumentation wires to the right and left sides of two places (i.e. the sheet plate of the main unit and the cover; thus four places in total). Plastic cable ties are provided with the unit.

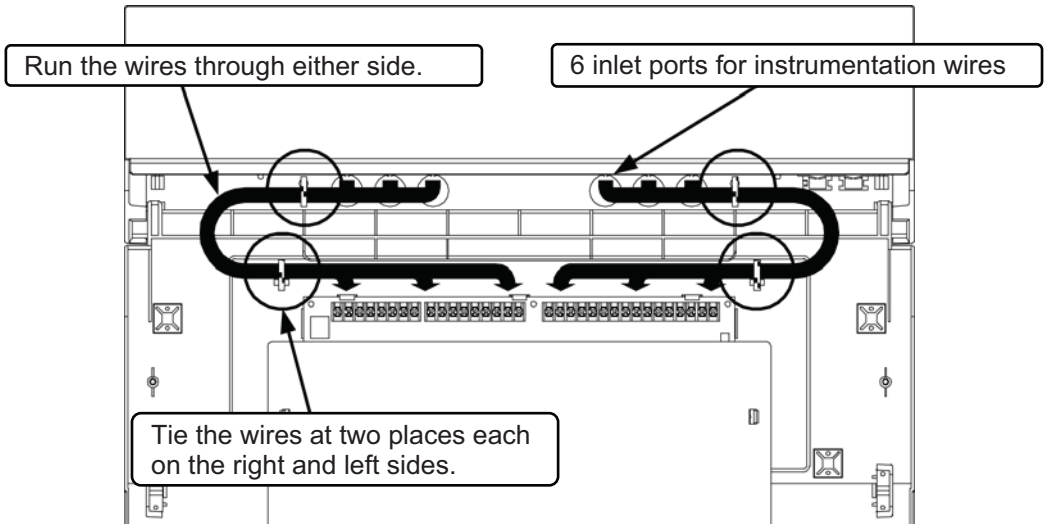


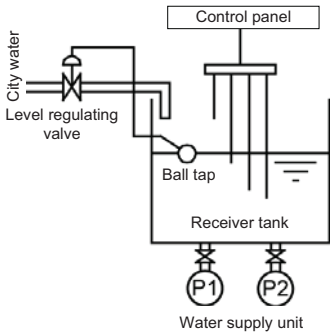
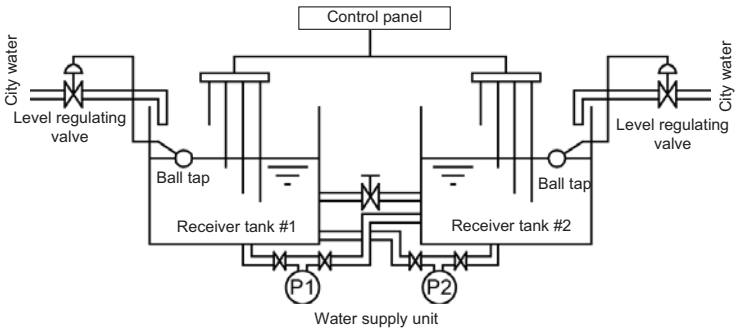
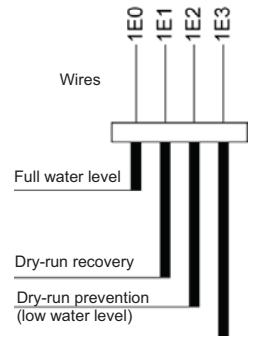
Fig. 4-3-2 (a) Connections for instrumentation wires (for motor output of up to 3.7 kW)

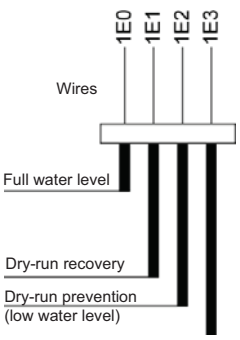
(1) Wiring work for water level control

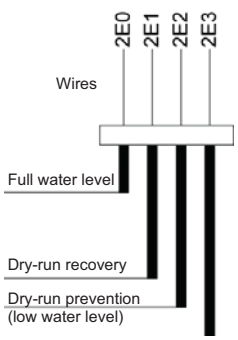
Referring to the following table, connect wires to receiver tank electrodes.
· Ball tap type ·····Table 4-3-2(a)
· Inflow solenoid valve type·····Table 4-3-2(b)

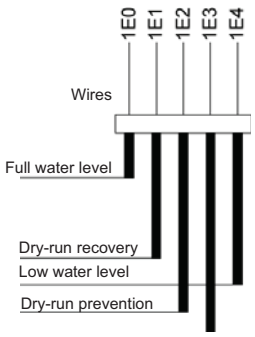
Note	· The Tank Selection setting is set to “No tank” before shipment. Before starting the operation of the pumps with receiver tank electrodes connected, select water tank(s) you use on the operation panel. (→ see 7.2.) · When using an inflow solenoid valve, check the type of the solenoid valve (normally open or normally closed), and set the type (parameter P103). (→ see 7.5.) · Set the Solenoid Valve Operation setting to “Auto” on the operation panel before use. (→ see 7.3.)

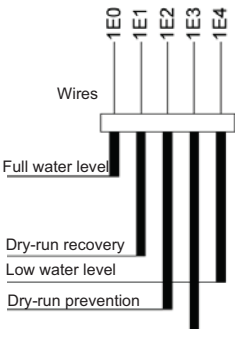
Table 4-3-2 (a) Wiring patterns (ball tap type)

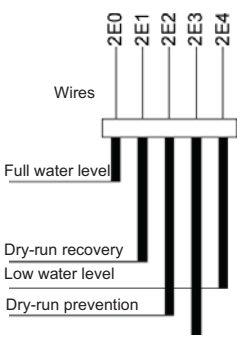
<table>
<tr><th colspan="2"></th><th>Single receiver tank</th><th colspan="2">Double receiver tank</th></tr>
<tr><td colspan="2"></td><td> 
</td><td colspan="2"> 
</td></tr>
<tr><td rowspan="2">4P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: Man. Close
Parameter P101: 4</td><td colspan="2">Tank Selection setting: Common
Solenoid Valve Operation setting: Man. Close
Parameter P101: 4</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank No.1</td><td>Terminal block for receiver tank No.2
 

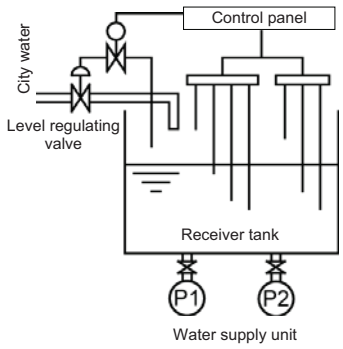
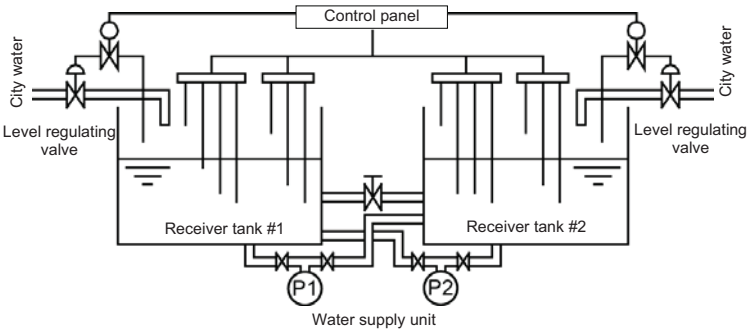
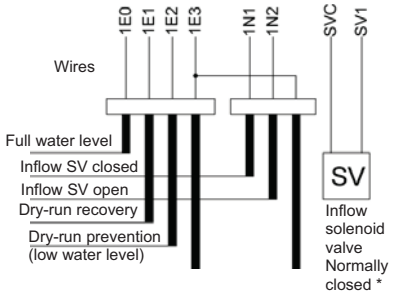
Electrodes for receiver tank No.2</td></tr>
<tr><td rowspan="2">5P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: Man. Close
Parameter P101: 5</td><td colspan="2">Tank Selection setting: Common
Solenoid Valve Operation setting: Man. Close
Parameter P101: 5</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

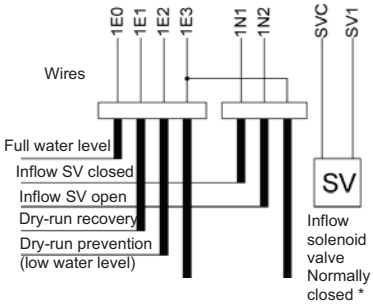
Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1
 

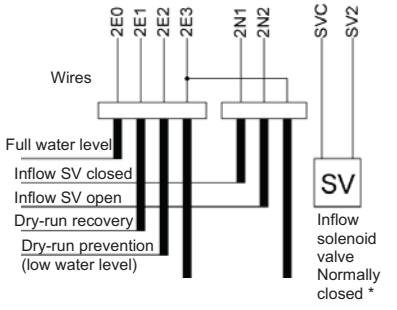
Electrodes for receiver tank No.1</td><td>Terminal block for receiver tank No.2
 

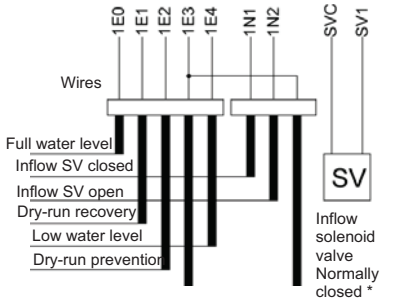
Electrodes for receiver tank No.2</td></tr>
</table>

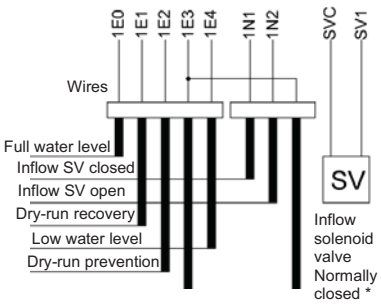
Table 4-3-2 (b) Wiring patterns (inflow solenoid valve type)

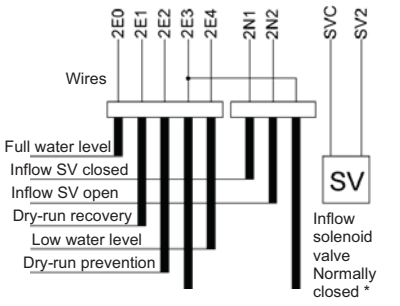
<table>
<tr><th colspan="2"></th><th>Single receiver tank</th><th>Double receiver tank</th></tr>
<tr><td colspan="2"></td><td> 
</td><td> 
</td></tr>
<tr><td rowspan="2">4P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: Auto
Parameter P101: 4</td><td>Tank Selection setting: Common
Solenoid Valve Operation setting: Auto
Parameter P101: 4</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank No.1
Terminal block for receiver tank No.2
 

Electrodes for receiver tank No.2</td></tr>
<tr><td rowspan="2">5P type electrode</td><td>Settings</td><td>Tank Selection setting: No.1
Solenoid Valve Operation setting: Auto
Parameter P101: 5</td><td>Tank Selection setting: Common
Solenoid Valve Operation setting: Auto
Parameter P101: 5</td></tr>
<tr><td>Wiring pattern</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank</td><td>Terminal block for receiver tank No.1
 

Electrodes for receiver tank No.1
Terminal block for receiver tank No.2
 

Electrodes for receiver tank No.2</td></tr>
</table>

* A normally-open type inflow solenoid valve can also be used by setting the parameter P103 to the type.

Caution

Provide a ground electrode dedicated to the electrodes for the inflow solenoid valve.

(2) External output signals

Connect wires to the external output terminals as shown in the following diagram.

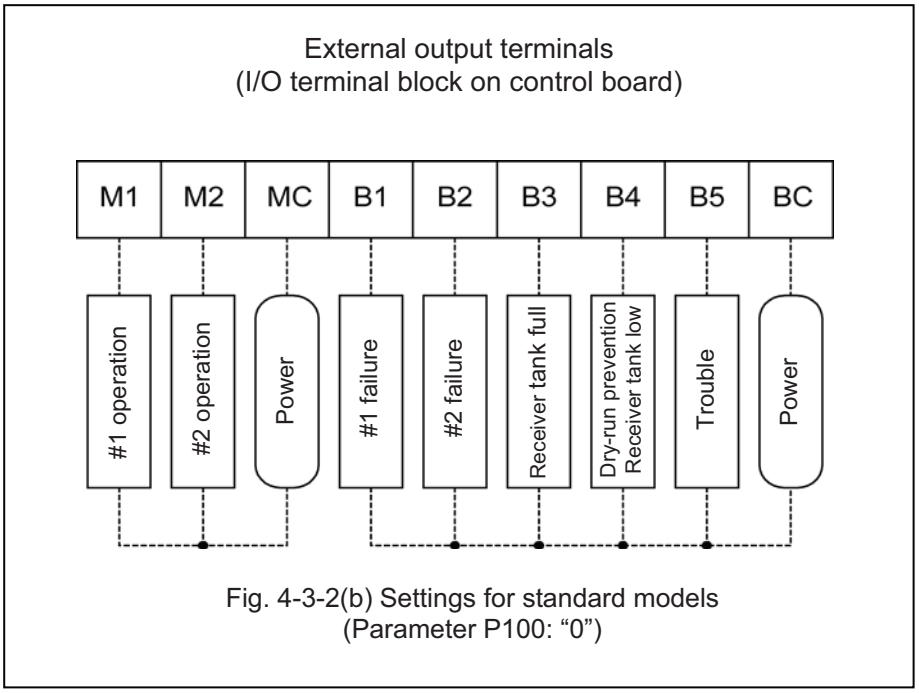


Fig. 4-3-2(b) Settings for standard models
(Parameter P100: “0”)

Note

The parameter P100 allows you to select an external relay output pattern from 5 options.
For details and the setting method, refer to “7.5 Parameter setting.”

5. Preparation for operation

5.1 Points to be checked before test operation

5.1.1 Electrical system

Before carrying out work such as wiring change, be sure to shut down the power of the panel board and confirm that the pilot lamp is turned off. Otherwise, it may lead to an electric shock.

(1) Check if the unit is correctly wired.
(2) Check if the terminals are securely connected.
(3) Check if the unit is securely grounded.

5.1.2 Pump system

(1) Check that the water level of the receiver tank is between the dry-run recovery level and the full water level.
(2) Ensure to fully open each sluice valve on the suction side, and to fully close each sluice valve on the discharge side.
(3) Check that the TJ valve is open.
If the TJ valve is shut, the water supply unit does not run normally.
(4) Rotate each pump shaft by hand to check that it can rotate smoothly.
To rotate it by hand, insert a screwdriver into the slot at the shaft end through the hole on the external fan cover of the motor. The rotation must be smooth without binding (no sticking points).

Always turn off the main power of the water supply unit, before rotating each pump shaft by hand to check.

(5) Loosen the air vent plug of each pump to relrease air from the pump. At the same time, rotate the pump shaft by hand to completely expel air from the impeller.
When water overflows and no air bubbles out, priming is complete.

Never run the pumps without priming.
Otherwise, the sliding parts inside each pump may seize up, thus resulting in damage to the mechanical seal, water leakage, and/or other problems.

5.2 Turning on the power

Danger	After turning on the power, do not touch any parts other than those mentioned below that are required for operation. Otherwise, it may lead to an electric shock.
Warning	Do not operate the control panel with a wet hand. Otherwise, it may lead to an electric shock and/or a short circuit.

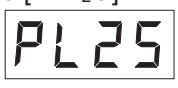
(1) Open the cover of the control panel.
(2) Turn on the main power of the panel board.
(3) Turn on the ground fault interrupter inside the control panel.
(4) Turn on the operation power switch on the control board.
(5) Check that the pilot lamp on the control board is turned on.
(6) At that time, the initial setting values and other information are shown on the display of the panel, in the following order:

① Program version
When the power is supplied to the board, the system shows the version of the installed control program twice.
Note that the program version is subject to change without notice.

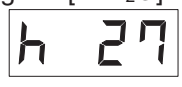
② Initial check monitor
When the power is turned on, the system checks its status. If no abnormal condition is detected, the flashing Good message appears on the display of the panel for about 2 seconds. If any abnormal condition is detected, the system generates the corresponding alarm.

③ Total head
The total head appears on the display.
e.g. Total head: 29 [m·H_2O]

④ Minimum sustained head
The minimum sustained head appears on the display.
e.g. Minimum sustained head: 25 [m·H_2O]



⑤ Indication in normal mode
On the display, the pressure inside the discharge piping is indicated as the head.
e.g. Pressure in discharge piping: 27 [m·H_2O]



(7) Close the cover of the control panel.

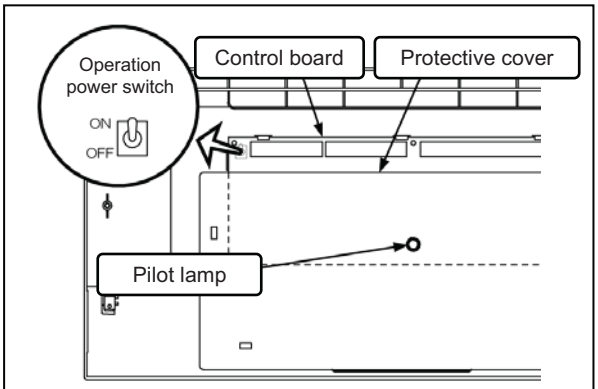


Fig. 5-2-1 Operation power switch and pilot lamp
(Motor output: up to 3.7 kW)

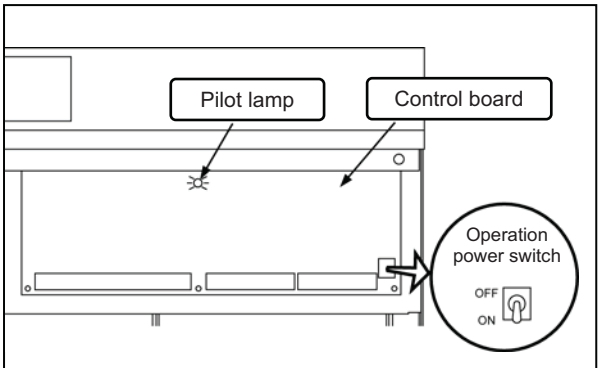


Fig. 5-2-2 Operation power switch and pilot lamp
(Motor output: 5.5, 7.5 kW)

6. Test operation

6.1 Check items related to manual operation

Note Check the following items related to manual operation for all the pumps.

(1) Select “Manual” with the Operation select switch.

(2) Press the “Manual” switch of the pump that you wish to run, and then hold down the cursor switch △ to gradually increase the operating frequency. At that time, confirm that the pump is running properly with respect to the following points:

① Installation and piping conditions (No leakage, abnormal vibration, or any other problems)
② Rotation direction of the pump
Check the rotation direction of the motor fan. If it is rotating clockwise viewed from the motor side, the direction is correct.
③ Priming conditions (if you hear water flowing or not)

Switches to be pressed

For No.1 pump operation: ····· # 1 Manual Confirm, ▽1, △1

For No.2 pump operation: ····· # 2 Manual Back, △2, ▽2

(3) While confirming that the pump is running properly, gradually open the sluice valve of the test pipe until air is completely removed from the pump.

Warning Do not run the pump continuously for over one minute while the sluice valve on the discharge line is shut (zero-discharge operation). Otherwise, the temperature and pressure will increase inside the pump, which may damage the pump and/or cause steam to blow off.

(4) After air has been completely removed, shut the sluice valve of the test pipe.

(5) Press the “Manual” switch of the running pump to stop the pump.

6.2 Check items related to automatic operation

Select “Automatic” with the Operation Selector switch to perform automatic operation.

First, carefully read the following sections to understand how automatic operation works, and then confirm that the unit runs properly in the automatic modes using the test pipe. During the operation, also check each pump for any abnormal pressure, noise, or vibration.
Note that you can change the Total Head setting and the Minimum Sustained Head setting from their factory defaults, depending on the conditions on site. Follow the instructions in “7.5 Parameter setting” in such a case.

6.2.1 Automatic alternate operation type

In automatic alternate operation, two pumps alternately start automatically when the pressure in the pipe drops to a certain level, and the running pump stops automatically when the water usage drops to a certain level.

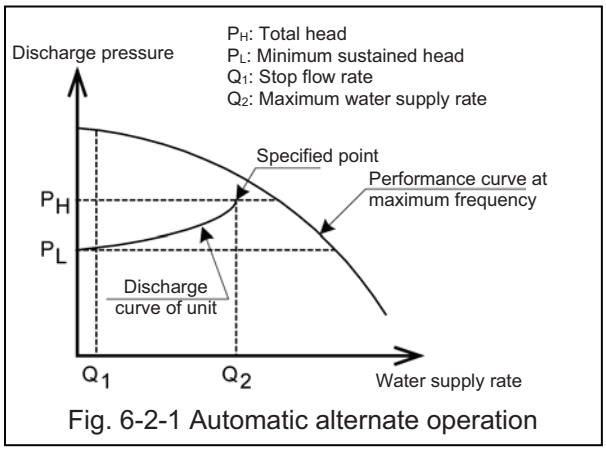


Fig. 6-2-1 Automatic alternate operation

(1) When the water tap is opened and water is used, the pressure in the discharge piping drops. If the pressure in the discharge piping drops to a value close to the preset minimum sustained head (P_L), the pressure transmitter detects the drop and the system starts up a pump.

(2) For constant control of estimated terminal pressure until the flow rate reaches the maximum water supply rate (Q_2), the inverter controls the rotation speed according to the increase/decrease in water usage to change the discharge pressure from P_L to P_H.

(3) If the water usage drops to the stop flow rate (Q_1), the flow switch detects the drop and the system stops the pump. The operation indicator light blinks while the system checks that the pump is being stopped. If the energy-saving operation is enabled, the period for checking the pump-stop changes depending on the operation conditions. (→ see 7.5.3)

(4) When the water tap is opened and water is used again, the system starts up the pump which was not running last time.

6.2.2 Automatic alternate parallel operation type

In automatic alternate parallel operation, two pumps run alternately when the water usage does not exceed the maximum water supply rate of one pump, and they run in parallel (simultaneous operation of the two pumps) when the usage exceeds the maximum water supply rate of one pump.

(1) When the water tap is opened and water is used, the pressure in the discharge piping drops. If the pressure in the discharge piping drops to a value close to the preset minimum sustained head (P_L), the pressure transmitter detects the drop and the system starts up a pump.

(2) For constant control of estimated terminal pressure until the flow rate reaches the maximum water supply rate (Q_3), the inverter controls the rotation speed according to the increase/decrease in water usage to change the discharge pressure from P_L to P_H.

(3) If the water usage increases to a value close to the parallel water flow rate (Q_2), the system starts up the inactive pump at rest (“the subsequent pump”) to follow the operation of the first-started pump.

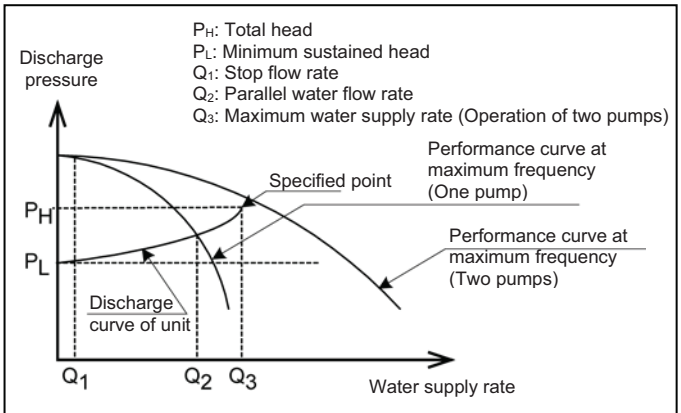


Fig. 6-2-2 Automatic alternate parallel operation

(4) If the water supply rate changes also in parallel operation, the pumps continuously run at a pressure along the discharge curve of the unit.

(5) If the water usage drops to the parallel water flow rate (Q_2), the system stops the subsequent pump and keeps only the first-started pump running.

(6) If the water usage further drops to the stop flow rate (Q_1), the flow switch detects the drop and the system stops the pump. The operation indicator light blinks while the system checks that the pump is being stopped. If the energy-saving operation is enabled, the period for checking the pump-stop changes depending on the operation conditions. (→ see 7.5.3)

(7) When the water tap is opened and water is used again, the system starts up the pump which stopped first.

7. Basic operations and indications/settings

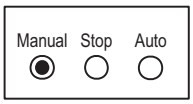
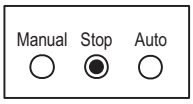
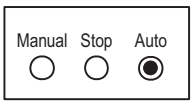
This chapter mainly covers the details of operations/indications/settings.

7.1 Operating the pump

7.1.1 Selecting the operation mode

Select an operation mode with the [Operation Selector] switch on the operation panel.

Table 7-1 Selecting the operation mode

	**"Manual mode"** Allows the user to manually operate each pump. For the procedures, refer to "6.1 Check items related to manual operation."
	**"Stop mode"** The pumps do not run under any circumstances.
	**"Automatic mode"** Automatically starts and stops the pump(s) on detecting a preset pressure in the discharge piping or a preset flow rate for use with the pressure transmitter, flow switches, or other means. Normally, select this mode.

The system enables the setting of "Manual mode" or "Automatic mode" one second after the indicator light comes on.

7.1.2 Manual operation

In the "manual mode," you can start and stop each pump with the [#1 Manual Confirm] [#2 Manual Back] switches on the operation panel. You can also change the operation frequency of each pump with the [△] [▽] switches on the operation panel.

① While the pump is not running, you can start the pump by pressing the corresponding Manual switch.
② While the pump is running, you can stop the pump by pressing the corresponding Manual switch.

7.1.3 Automatic operation

As soon as the "automatic mode" is enabled, the system starts the automatic operation.
For the procedures, refer to "6.2 Check items related to automatic operation."

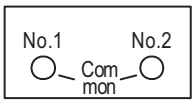
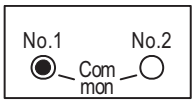
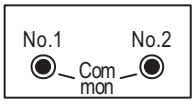
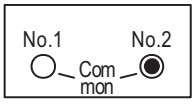
Note	When a pump is running in either mode (manual or auto), the system turns on the corresponding operation indicator light in steady or blinking light and outputs the operation signal.

7.2 Selecting a receiver tank

Select a receiver tank to be used with the Tank selector switch on the operation panel.

For the tank selection and the circuits to be used, see Table 7-2(b).

Table 7-2 (a) Tank Selection Setting

	**"No tank"** Select this option if no control is carried out for receiver tanks. Selecting "No tank" enables the system to ignore electrode signals and disables dry-run prevention. Selecting this option turns off all the indicator lights for the Solenoid Valve Operation setting and disables the selection of any options.
	**"Tank No.1"** Selects the use of Tank No.1. Select this option if you use one receiver tank. In addition, select this option to clean Tank No.2 while both tanks are used.
	**"Common"** Select this option if you use two receiver tanks. When "Common" is selected, install a communicating tube between the tanks to ensure that both tanks have the same level of water.
	**"Tank No.2"** Selects the use of Tank No.2. Normally, select this option to clean Tank No.1 while both tanks are used.

The Tank Selection setting is set to "No tank" before shipment.
The system enables the setting one second after the indicator light comes on.

Table 7-2(b) Circuits to be used for each option of Tank Selection

Tank Selection setting	Water level electrode circuit		Solenoid valve circuit
	For alarms and dry-run prevention	For solenoid valves	
No. 1	1E0, 1E1, 1E2, 1E3, 1E4	1N1, 1N2	SVC-SV1
Common	1E0, 1E1, 1E2, 1E3, 1E4	1N1, 1N2	SVC-SV1 SVC-SV2
No. 2	2E0, 2E1, 2E2, 2E3, 2E4	2N1, 2N2	SVC-SV2
No tank	N/A	N/A	N/A

7.3 Selecting the operation of the inflow solenoid valve

You can select the operation of the inflow solenoid valve with the Solenoid valve operation selector switch on the operation panel.

Note that setting the Tank Selection to “No tank” disables these settings.

Table 7-3 Solenoid Valve Operation setting

Man. Open ◉ Man. Close ○ Auto ○	**“Man. Open”** The inflow solenoid valve is normally open.
Man. Open ○ Man. Close ◉ Auto ○	**“Man. Close”** The inflow solenoid valve is normally closed.
Man. Open ○ Man. Close ○ Auto ◉	**“Auto”** The inflow solenoid valve is automatically controlled depending on the level of the water tank.

Except for selecting “Man. Close,” the system enables the setting in one second after the indicator light comes on.

Note

For the electrode circuit and the solenoid valve circuit to be used, see Table 4-3-2.
Setting the Tank Selection to “No tank” turns off all the indicator lights for the Solenoid Valve Operation setting and disables the operation of the solenoid valve.
Then, if you change the Tank Selection to any options other than “No tank,” the system automatically seletcts the Solenoid Valve Operation to “Man. Close.”
Whether the solenoid valve is normally open or normally closed while energized depends on the solenoid valve type (Parameter P103) setting.

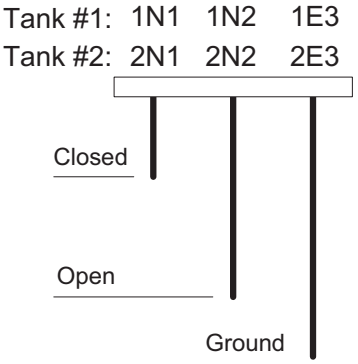


Fig. 7-3 Electrodes for automatic control of the solenoid valve

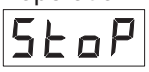
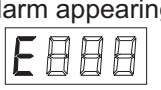
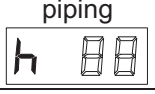
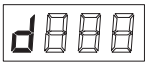
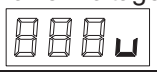
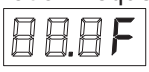
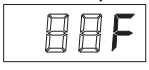
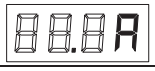
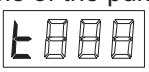
Caution

Provide a ground electrode dedicated to the electrodes for the inflow solenoid valve.

7.4 Indications on the display

The items described in Table 7-4 can be displayed, through display switching procedures.
For the procedures, refer to each section shown in the “Reference page” column.

Table 7-4 List of display items

Display item	Description	Priority	Category	Reference page
Interlocking in operation 	This item shows that the system is currently suspended by an interlock signal received from an external source. This message appears only when the interlock function is activated.	①	Basic information	7-5
Alarm appearing 	Displays the code of a generated alarm. This message appears only when an alarm occurs. If multiple alarms occur at the same time, the displayed codes are switched every two seconds.	②	Basic information	7-5
Freeze-proofing underway 	**[This item appears only for freeze-proof models.]** This message appears only when the freeze-proofing cycle is in progress.	③	Basic information	7-5
Pressure in discharge piping 	Displays the pressure in the discharge piping. Unit of indication: Head meter [m·H_2O]	④	Basic information	7-5
Number of starts time of the unit 	Displays the number of starts of the unit on the previous day. The counter starts when the power is turned on. When the counter exceeds 999, the indication shifts.	-	Basic information	7-5
Power voltage 	Displays the power voltage detected in the inverter section. Unit of indication: [V]	-	Basic information	7-5
Alarm log	Displays up to five incidents of the latest alarms.	-	Basic information	7-5 7-6
Operation frequency 	Displays the operation frequency of each pump during automatic operation. Unit of indication: Hertz [Hz] <with one decimal place>	-	Pump information	7-6
Preset frequency 	Displays the preset frequency of each pump during manual operation. Unit of indication: Hertz [Hz] <in increments of 1 Hz>	-	Pump information	7-7
Operation current value 	Displays the operation current value of each pump. Unit of indication: Ampere [A] <With one decimal place>	-	Pump information	7-6 7-7
Cumulative operation time of the pump 	Displays the cumulative operating period of each pump. Unit of indication: Hours When the time exceeds 999 hours, the indication shifts.	-	Pump information	7-6
Cumulative number of starts of the pump 	Displays the cumulative number of starts of each pump. When the counter exceeds 999, the indication shifts.	-	Pump information	7-6

When the indication shifts, a dot “.” is inserted after the digit of thousands or millions.

7.4.1 How to switch basic information on the display

Normally, the display shows the pressure in the discharge piping.

In special cases such as the activation of an interlock, the occurrence of an alarm, or during the freeze-proofing cycle, however, the display shows the corresponding message based on the sequence specified in Table 7-4.

To switch the indications on the display, press the keys at the “Indication Switching Operation” shown below.

The display automatically returns to normal indication when no operation is carried out for 30 seconds.

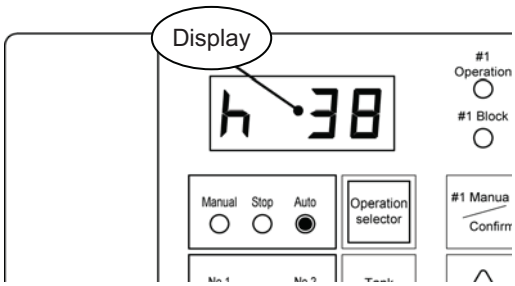


Fig. 7-4-1(a) Display
(e.g. when the pressure in discharge piping is 38 m·H_2O)

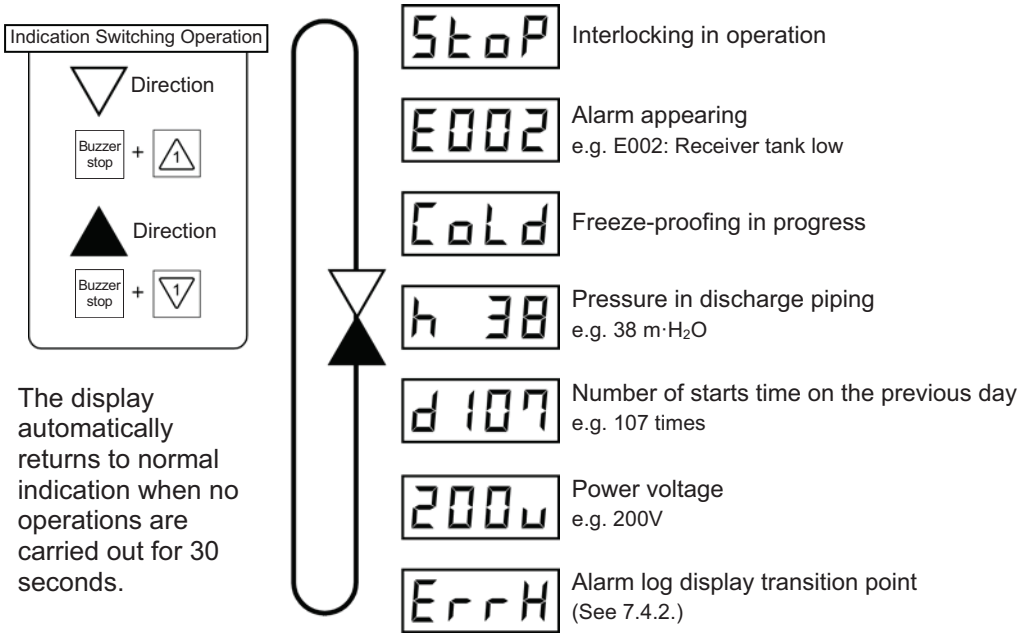


Fig. 7-4-1(b) Switching the basic information on the display

Note

The “Interlocking in operation,” “Alarm appearing,” or “Freeze-proofing in progress” message appears only when the respective conditions are met. The “Number of starts time on the previous day” remains “0” for 24 hours after the power is turned on.

7.4.2 How to display alarm logs

Press the #1 Manual Confirm switch at the alarm log display transition point ErrH to enter the alarm log display mode.

In the alarm log display mode, you can view up to 5 alarms by pressing the 1 or 1 switch.

The display returns to normal indication by pressing the #2 Manual Back switch or when no operation is carried out for 10 seconds.

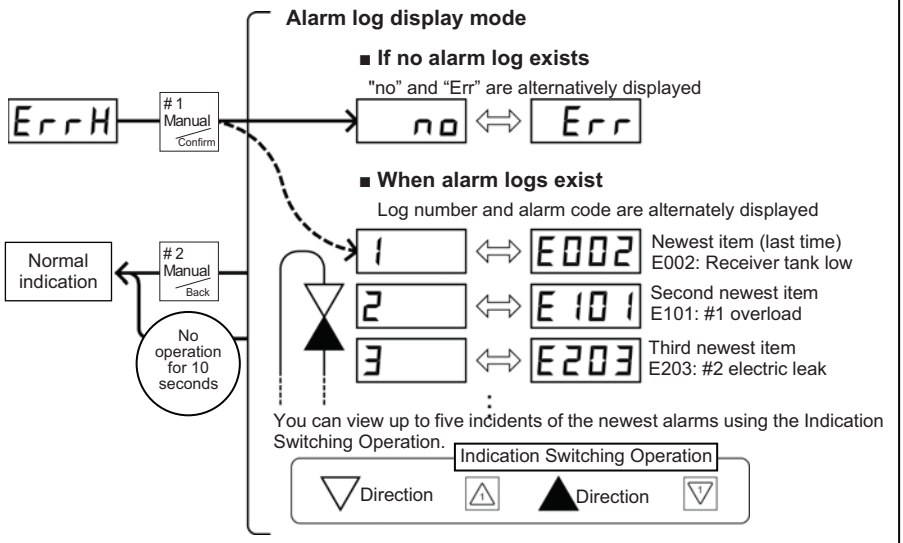


Fig. 7-4-2 Indications of alarm log

Note

- Alarms are recorded in the log as soon as they are generated.
- Smaller numbers are assigned to newer items: the latest item is 1 and the oldest item is 5.
- When five incidents are recorded in the log, the system discards the oldest alarm (item No.5) in the event of a new alarm.
- The alarm log is retained even when the power is turned off.

7.4.3 How to display pump information

(A) If the operation mode is set to "Auto" or "Stop":

When the basic information is displayed, press the 1 or 1 switch and No.1 pump information is displayed.
Similarly, press the 2 or 2 switch to display the No.2 pump information.
The display returns to normal indication when no operation is carried out for 10 seconds or through indication Switching Operation for basic information.

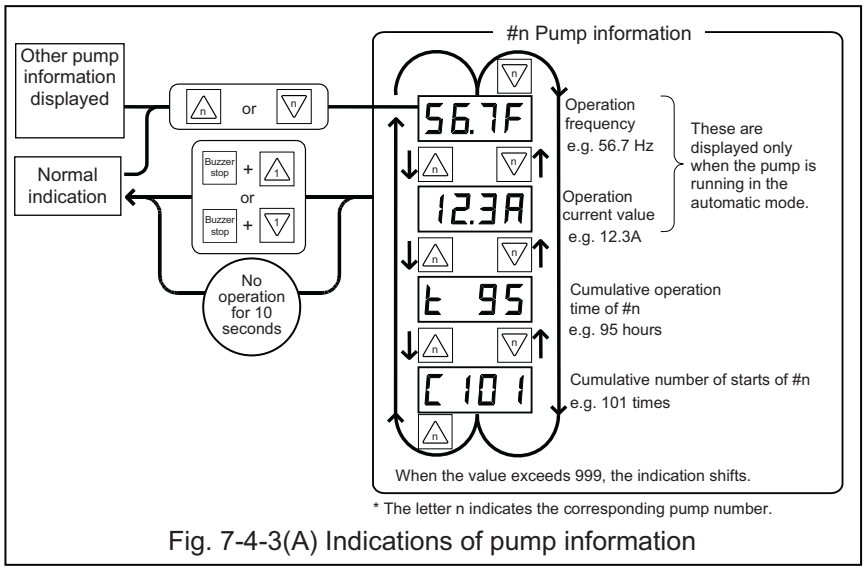


Fig. 7-4-3(A) Indications of pump information

Note

"Cumulative operation time" and "Cumulative number of starts" are retained even when the power is turned off.
Note that because the data is written into the memory device only once every 2 hours, unsaved new information (within up to 2 hours) is lost when the power is turned off.

(B) If the operation mode is set to “Manual”:

When basic information is displayed, press the △1 or ▽1 switch and the No.1 pump information is displayed. Similarly, press the △2 or ▽2 switch to display the No.2 pump information. The display returns to normal indication when no operation is carried out for 5 seconds or through the Indication Switching Operation for basic information.

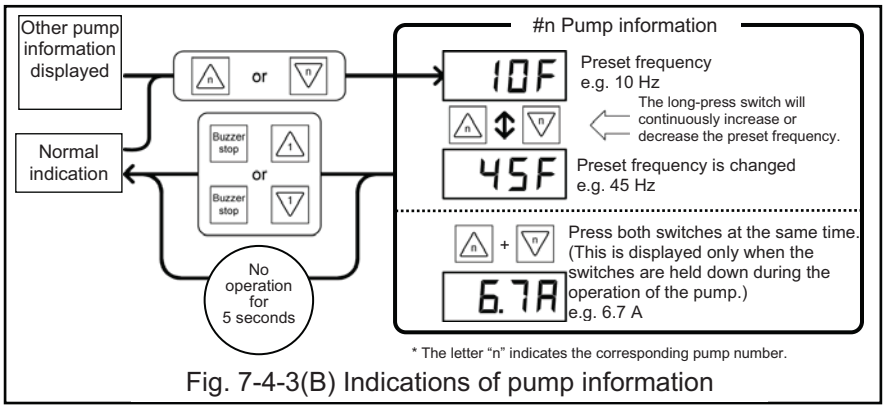


Fig. 7-4-3(B) Indications of pump information

7.5 Parameter settings

Functions of the water supply unit can be configured and sdjusted using parameters.
Parameter settings are retained when the power is turned off.

7.5.1 Parameter list

Table 7-5-1 Parameter list

Category	Display code	Parameter name	Initial setting	Adjustable range
Basic	PH	Total head	10	1 to 95 [m·H_2O]
	PL	Minimum sustained head	7	1 to PH [m·H_2O]
	1Go	No.1 operation permitted	on	on: No.1 pump operation permitted off: No.1 pump operation blocked
	2Go	No.2 operation permitted	on	on: No.2 pump operation permitted off: No.2 pump operation blocked
	CHEC	Inspection mode	off	on: In inspection mode off: In normal mode
	ECO	Energy-saving operation setting	on	on: enables energy-saving operation off: disables energy-saving operation
Extended	P100	External relay output pattern	0	0 to 4: → refer to 7.5.4(1)
	P101	Number of water level electrode bars	4	4: 4 electrode bars 5: 5 electrode bars
	P102	5P-electrode bar pattern	0	0: Standard 1: Special
	P103	Solenoid valve type	0	0: Normally open 1: Normally closed
	P104	Solenoid valve control method	0	0: Simultaneous control 1: Alternate control
	P105	Interlocking signal	0	0: a-contact 1: b-contact
	P200	Buzzer stop time	60	0: No buzzer 1 to 60: Period before the buzzer stops [minute] 99: The buzzer does not stop.
	P201	High temperature alarm detection	1	0: No detection. 1: Detection.
	P202	Starting frequency failure alarm detection	1	0: No detection. 1: Detection.
	P203	Water level alarm reset method	0	0: Manual 1: Automatic

Note

The initial settings shown above are standard factory defaults.
If you specify a different value or option upon placing an order, the specified value and option are preset in the parameter.

7.5.2 How to set the parameters

Parameters are set in “Setting mode.”

① Entering the setting mode

When the normal indication is displayed, hold down the Setting switch for at least 3 seconds to enter the “setting mode.”
When the system enters the setting mode, the basic parameter selection screen appears, and the indicator light alternately shows PH and the setting value.
The parameter selection screen alternately shows a parameter name and its setting value.

② Selecting a parameter to be set

Press the △1 or ▽1 switch to cycle through the parameters until the target parameter appears.
To select an extended parameter, press the #1 Manual Confirm switch while oPtn is displayed, which enters the extended parameter selection screen.
To return to the basic parameter selection screen from the extended parameter selection screen, press the #2 Manual Back switch.

③ Changing a setting value

Press the #1 Manual Confirm switch on the parameter selection screen to enter the setting value change screen.
Only the preset value is shown in the setting value change screen.
Press the △1 or ▽1 switch to change the setting value.

Note

Extended parameters can be changed only when the operation mode is set to “Stop.”
In the “Manual” or “Auto” operation mode, pressing the #1 Manual Confirm switch on the extended parameter selection screen the alartm will sound a warning buzzer and does not enter the setting value change screen.

④ Confirming the change of the setting value

When you have changed the setting value, press the #1 Manual Confirm switch to confirm the change of the setting value.
When the change is entered, the system makes a beep sound and the display flashes three times.
Then it automatically goes back to the parameter selection screen.

⑤ Canceling the change of the setting value

To cancel the change of the setting value and return to the parameter selection screen, press the #2 Manual/Back switch.

⑥ Exiting the setting mode

Press the Setting switch to exit the setting mode and return to the normal mode.

Also when no operation is carried out for 60 seconds in the setting mode, the system automatically exits the setting mode and returns to the normal mode.

Note

If you press the Setting switch to exit the setting mode without confirming the change, the setting change will be discarded.

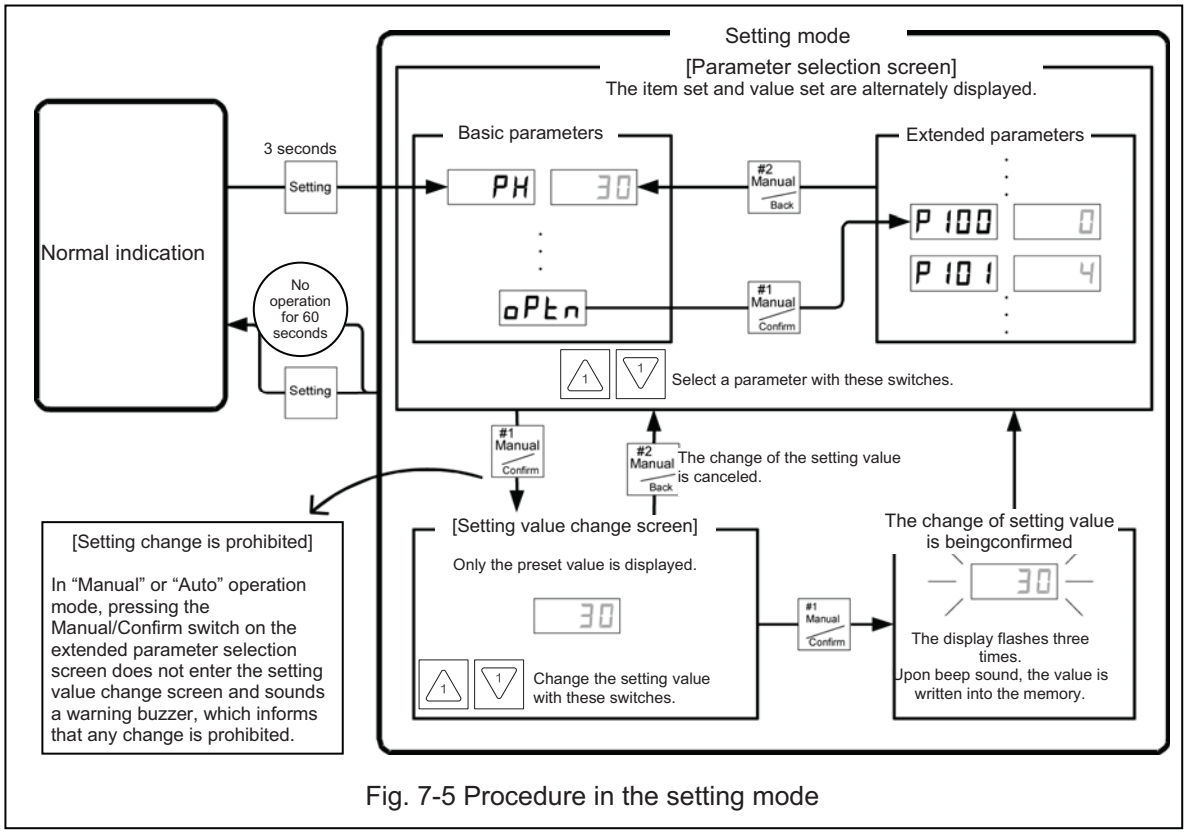


Fig. 7-5 Procedure in the setting mode

7.5.3 Basic parameters

The following are basic parameters for using the water supply unit.

(1) Total head setting

PH : Total Head

Function	Seletcts the total head for automatic operation. Referring to “3.4 Specification tables,” set the total head that complies with the specifications.
Adjustable range	1 to 95 [m·H_2O]
Remarks	Unless otherwise specified, the standard value of the unit is set before shipment (see the “Total head” column for standard models in “3.4 Specification tables”).

(2) Minimum sustained head setting

PL : Minimum Sustained Head

Function	Seletcts the minimum sustained head for automatic operation. Referring to “3.4 Specification tables,” set the minimum sustained head that complies with the specifications.
Adjustable range	1 to PH [m·H_2O]
Remarks	Unless otherwise specified, the standard value of the unit is set before shipment (see the “Minimum sustained head” column for standard models in “3.4 Specification tables”).

Caution

Properly make the settings depending on the conditions of use.
Incorrect settings may hinder the normal operation of the water supply unit.

(3) Operation permission setting

1Go : No.1 Pump Operation Permission Setting

2Go : No.2 Pump Operation Permission Setting

Function	Permits or prohibits the operation of each pump. If you set this to “Operation blocked” for a pump, you cannot run the pump in the manual or automatic mode.
Adjustable range	on : Operation permitted oFF : Operation blocked
Initial setting	on : Operation permitted
Remarks	Setting this to “Operation blocked” turns on the corresponding No.n block indicator light on the operation panel. * The letter “n” indicates the corresponding pump number (1 or 2).

(4) Inspection mode setting

CHEC : Inspection Mode

Function	Enters/Exits the inspection mode. * The inspection mode setting is not retained when the power is shut off.
Setting range	on : In inspection mode oFF : In normal mode
Initial setting	oFF : In normal mode
Remarks	For the inspection mode, refer to “8.2 Inspection mode.”

(5) Energy-saving operation setting

ECO : Energy-Saving Operation setting

Function	Enables/Disables the energy-saving operation. The energy-saving operation enables variable control of pump-stop period depending on the operation conditions of the unit in the automatic mode.
Adjustable range	on : Enables the energy-saving operation oFF : Disables the energy-saving operation
Initial setting	on : Enables the energy-saving operation
Remarks	If the energy-saving operation is disabled, the pump-stop check period is set to 60 seconds.

7.5.4 Extended parameters

The following are extended parameters for setting or adjusting various functions of the water supply unit.

Note	Extended parameters can be changed only when the operation mode is set to "Stop." Therefore, make the settings before starting the operation of the water supply unit.

(1) External relay output pattern setting

P 100 : External Relay Output Pattern

Function	Seletcts a pattern of the signals to be output from the relays M1, M2, and B1 to B5. For the patterns, see Table 7-5-4.
Adjustable range	0 to 4
Initial setting	0 (This can be preset to a value that is specified when an order is placed.)
Remarks	The common terminal for M1 and M2 is MC, and the common terminal for B1 to B5 is BC.

Table 7-5-4 External relay output pattern

Terminal	P100 setting				
	0	1	2	3	4
M1	No.1 operation	No.1 operation	No.1 operation	No.1 operation	Collective operation *7
M2	No.2 operation	No.2 operation	No.2 operation	No.2 operation	Inspection *8
B1	No.1 failure *1	Serious failure *3	Overload	INV trip *9	No.1 failure *1
B2	No.2 failure *1	Slight failure *4	Discharge pressure abnormal drop	Discharge pressure abnormal drop	No.2 failure *1
B3	Receiver tank full	-	Electric leak	Electric leak	Receiver tank full
B4	Receiver tank low, Dry-run prevention	-	Level anomaly *5	Level anomaly *5	Receiver tank low, Dry-run prevention
B5	Trouble *2	Collective failure *6	Collective failure *6	Collective failure *6	Trouble *2

*1 The "No.(n) failure" signal is output if one of the following alarms occurs at the No.(n) pump. (n: 1 or 2)
Discharge pressure abnormal drop, Electric leak, INV trip, High temperature, Flow switch failure

*2 The "Trouble" signal is output if one of the following alarms occurs.
Electrode failure, Start frequency failure, Pressure transmitter 1 failure, Control panel high temperature, EEPROM error

*3 The "Serious failure" signal is output if no pumps can run in the automatic mode in the event of an error.
Note that the signal is not output if the "Operation Permission" settings for all the pumps are set to "Operation blockeded."

*4 The "Slight failure" signal is output if any of the pumps can still run in the automatic mode in the event of an error.

*5 The "Level anomaly" signal is output if any of the "Receiver tank full," "Receiver tank low," "Dry-run prevention," or "Electrode failure" alarms occur.

*6 The "Collective failure" signal is output if any type of an alarm occurs.

*7 The "Collective operation" signal is output if any of the pumps are running.

*8 The "Inspection" signal is output in the inspection mode.

*9 The "INV trip" is output if one of the following alarms occurs.
Overload, Overcurrent, Overvoltage, Stall prevention, Inverter overload, Open-phase output, Inverter overheat, Communication failure, Inverter trouble 1, Inverter trouble 2

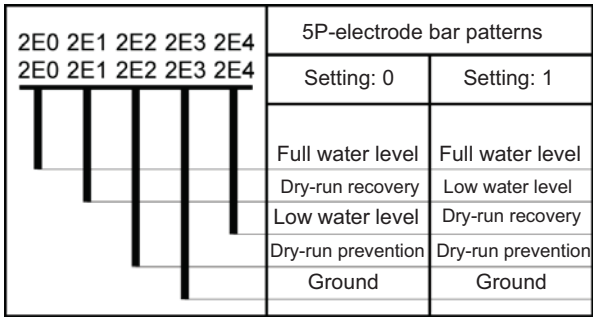
(2) Number of water level electrode bars setting

P101 : Number of Water Level Electrode Bars

Function	Seletcts the number of electrode bars for measuring the water level
Adjustable range	4: 4 electrode bars (4P) 5: 5 electrode bars (5P)
Initial setting	4: 4 electrode bars (4P) (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	Setting this to “4 electrode bars” causes the system to ignore the input of the electrode bars 1E4 and 2E4.

(3) 5P-electrode bar pattern setting

P102 : 5P-Electrode Bar Pattern

Function	Seletcts the pattern for assigning a monitoring task to each electrode when the “Number of Water Level Electrode Bars” setting is set to “5 electrode bars.”  5P-electrode bar patterns Setting: 0 / Setting: 1 Full water level / Full water level Dry-run recovery / Low water level Low water level / Dry-run recovery Dry-run prevention / Dry-run prevention Ground / Ground
Adjustable range	0: Standard 1: Special
Initial setting	0: Standard (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	This setting is ignored when 4 electrode bars are selected in P101.

(4) Solenoid valve type setting

P103 : Solenoid Valve Type

Function	Seletcts the type of the solenoid valve connected to the control panel.
Adjustable range	0: Normally open type 1: Normally closed type
Initial setting	0: Normally open type (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	-

(5) Solenoid valve control method setting

P 104 : Solenoid Valve Control Method

Function	When the Tank Selection is set to “Common” and the Solenoid Valve Operation is set to “Auto,” selects whether the solenoid valve for Tank No.1 and the solenoid valve for Tank No.2 are controlled simultaneously or alternately.
Adjustable range	0: Simultaneous control 1: Alternate control
Initial setting	0: Simultaneous control (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	When the Solenoid Valve Operation is set to “Man. Close” or “Man. Open,” both solenoid valves are simultaneously controlled regardless of this setting.

(6) Interlocking signal setting

P 105 : Interlocking Signal

Function	Seletcts the signal type used for the interlock function that forcibly stops the water supply unit. Usable signals are no-voltage a-contact or no-voltage b-contact. When no interlock is connected, select “Setting 0: no-voltage a-contact.”
Adjustable range	0: No-voltage a-contact activates the interlock mechanism when the contact is closed. 1: No-voltage b-contact activates the interlock mechanism when the contact is open.
Initial setting	0: No-voltage a-contact (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	When the system is in a state of suspension after a interlock signal has been input, the message StoP appears on the display. If StoP appears without any signal input, this setting may be improperly configured. In that case, check whether or not the type of signal used is consistent with the setting.

(7) Buzzer stop time setting

P200 : Buzzer Stop Time

Function	Seletcts the time period after which the buzzer automatically stops in the event of an alarm. If this is set to “0,” the buzzer does not sound in the event of an alarm.
Adjustable range	0: Disables the buzzer 1 to 60: Period after which the buzzer automatically stops [minutes] 99: Turns OFF the automatic buzzer stop function
Initial setting	60 [minutes] (If you specify a different value upon placing an order, the specified value is preset in the parameter.)
Remarks	In addition to this automatic stop function, it is possible to manually stop the buzzer by pressing the Buzzer stop switch.

(8) High temperature alarm detection setting

: High Temperature Alarm Detection

Function	Seletcts whether or not to detect a high temperature alarm.
Adjustable range	0: No detection 1: Detection
Initial setting	1: Detection (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	Use the water supply unit by selecting “Detection” for this setting, except when alarm signals need to be kept undetected until a damaged high temperature sensor is replaced.

(9) Starting frequency failure alarm detection setting

: Starting Frequency Failure Alarm Detection

Function	Seletcts whether or not to detect a start-frequency failure alarm.
Adjustable range	0: No detection 1: Detection
Initial setting	1: Detection (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	-

(10) Water level alarm reset setting

: Water Level Alarm Reset Method

Function	Seletcts the method to reset the water level alarms (Receiver tank full, Receiver tank low, and Dry-run prevention): Manual reset by using the reset switch or Automatic reset by the recovery of water level.
Adjustable range	0: Manual reset 1: Automatic reset
Initial setting	0: Manual reset (If you specify the other value upon placing an order, the specified value is preset in the parameter.)
Remarks	If Automatic reset is selected, the water level alarm is automatically canceled when the water level is recovered. In such a case, the generated alarms can be checked in the alarm log.

8. Maintenance and inspection

8.1 Precautions for maintenance and inspection

Carry out maintenance and inspection of the water supply unit according to the “8.3 Maintenance check list.”

Warning	If any problem is found during inspection, immediately stop operation, and remove the cause or contact TERAL INC. Otherwise, it may lead to an accident.
Warning	Regularly inspect your equipment and perform maintenance on each component.
Caution	Ensure to carry out a daily/periodic inspection according to the checklist. Otherwise, it may be impossible to prevent potential failures and accidents and it also shortens the product life.

(1) When carrying out a daily inspection, carefully observe the following points:

① A large deviation in the pump’s discharge pressure, current, vibration, noise, or other conditions from the normal status is a possible fault. Therefore, immediately perform detailed inspection and maintenance. For this purpose, it is recommended to keep an operation log.

② Check that the unit is running properly in the automatic mode.

③ Check the piping for any water leakage or damage.

④ Check the mechanical seal for any water leakage.
In the initial stage of pump operation,a small amount of initial leakage may occur until the sliding surfaces on the mechanical seal completely settle (or fit) into place.In the case of an initial leakage, the leakage will stop after 10 to 20 hours of operation.The initial leakage is not caused by the mechanical seal failure if the leakage stops.You can use the pump with ease.
High-frequency sounds (mechanical squeaks) may occur occasionally, but this is not a pump failure. Even if you use the pump as it is, there is not problem in the function of the pump.

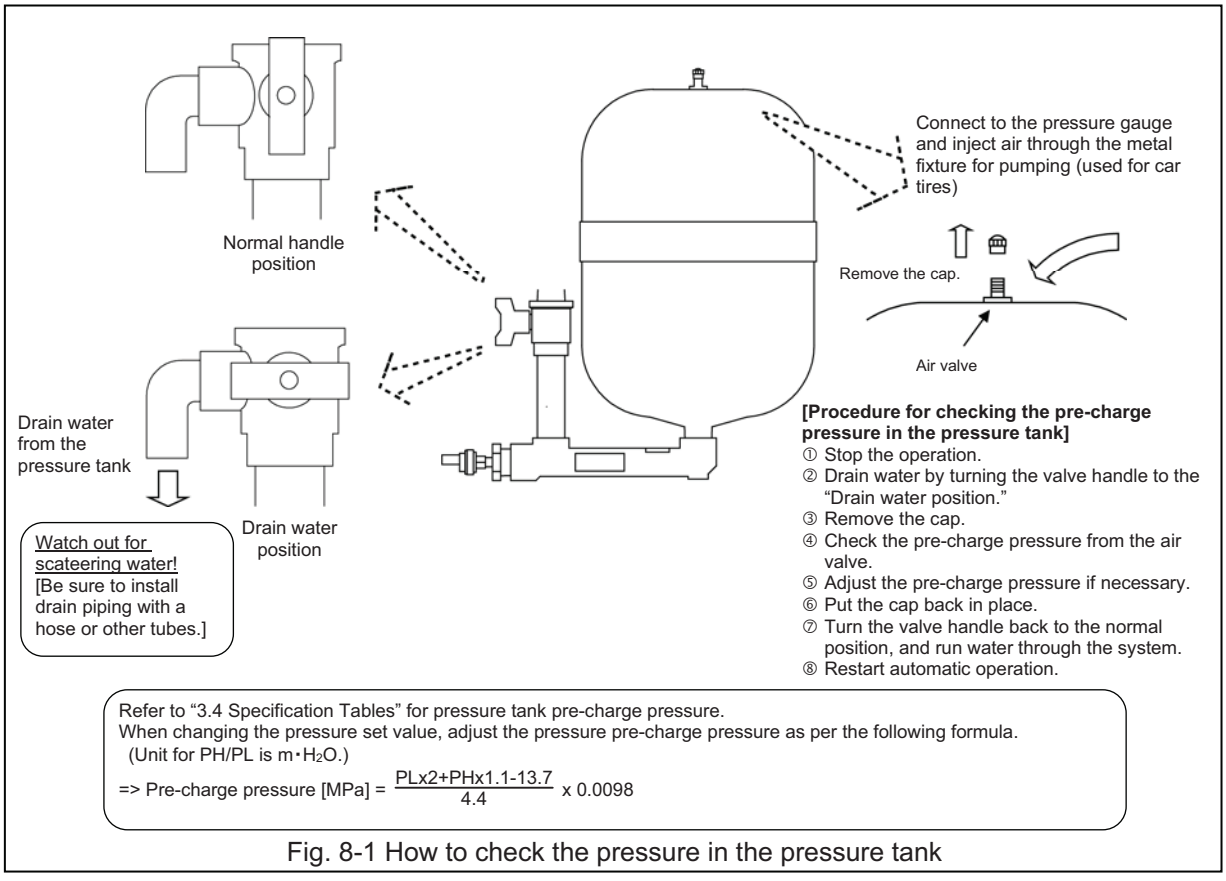


Fig. 8-1 How to check the pressure in the pressure tank

⑤ Check that the contacts, terminals, and other connections of the control panel are securely tightened and that there are no entries of water droplets inside.
⑥ Completely remove water from the pressure tank, and then check that the pre-charge pressure inside the tank complies with the specifications. Periodically check the pre-charge pressure (at least every 6 months) because the life of the pressure tank depends largely on the pressure.

■ If you do not use the pump for a long time, observe the following points:
① To prevent freezing inside the pump in winter, be sure to keep the pump warm enough or completely drain the pump.
② If you have a backup pump, run it from time to time to make it available for operation at any time.

8.2 Inspection mode

You can put the system into the inspection mode to nortify other personnel that inspection is in progress.

(1) Entering and exiting the inspection mode (→ see 7.5.)

① To enter the inspection mode
Set the basic parameter [CHEC] to “on.”
② To exit the inspection mode
Set the basic parameter [CHEC] to “off.”
* The system automatically exits from the inspection mode in 24 hours, just in case the user forgets cancellation.

(2) Operations in the inspection mode

① Display
The power indicator light flashes while in the inspection mode.
Any other indications are the same as in normal mode.
② External output
Signals are output externally via M2 and MC (no-voltage a-contact) in the inspection mode only when the External Relay Output Pattern setting (parameter: P100) is set to “4.”
No signals are output externally when the External Relay Output Pattern setting is set to a value between “0” and “3.”
③ Other operations
Other operations are carried out in the same way as in normal mode.

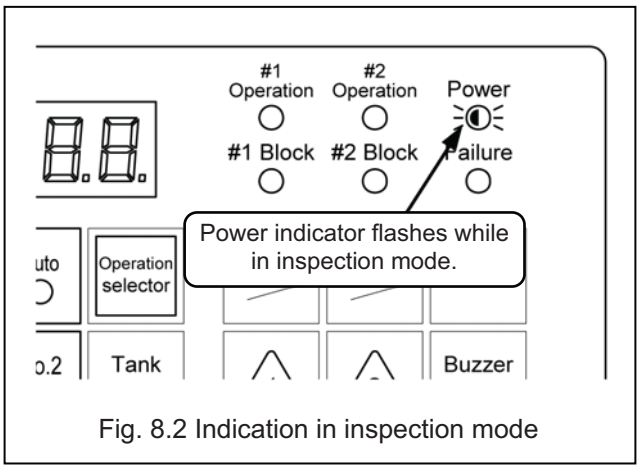


Fig. 8.2 Indication in inspection mode

8.3 Maintenance check list

Warning	Before carrying out inspection that requires disassembly and service, be sure to turn off the main power supply. Otherwise, it may lead to an electric shock, and/or causes the pump to start up suddenly in the automatic mode etc., thus exposing the personnel to great danger.
Warning	If motors or control panels are used for more than a certain period of time, it may cause ignition or other accidents due to aging deterioration.
Caution	Only the service personnel with special knowledge of repairs are allowed to disassemble the unit. For work such as replacement of parts, repairs, or inspection that requires disassembly of the unit, be sure to contact TERAL INC. Incorrect work may cause a failure or accident.
Caution	Do not perform an insulation resistance test on the control panel. Before performing an insulation resistance test on the motors, remove the wires from the control panel. Otherwise, it may lead to a failure in the control panel.
Caution	Replace any packing and O-rings during inspection involving disassembly. Otherwise, it may lead to water leakage.

Table 8-3(a) Maintenance check list

	Inspection point	Inspection item	Method	Criterion	Frequency			Consumables		
					Daily	Half-yealyr	Yearly	Part name	Qty.	Replacement cycle
Ambient environment	Temperature	Check against the specified range.	Measure	Between 0 and 40°C	○					
	Humidity		Measure	85%RH or less No condensation	○					
	Dust and other contaminants		Visual check	No dust or other contaminants	○					
Power	Power terminal block	Voltage	Measure	The specified voltage is applied.	○					
		Voltage fluctuation	Measure	Within the allowable fluctuation range	○					
Control panel	Panel display, indicator lights	Check if they are lit on	Visual check	No abnormal condition	○					
	Setting values	Setting values	Visual check	As per the requirements	○					
	Operations	Operations in the automatic mode	Visual check	No abnormal condition	○					
	Operating conditions	Startup pressure	Visual check	As per the setting value	○					
		Stop pressure	Visual check	As per the specifications	○					
		Number of starts time of the unit	Visual check	400 times or less	○					
		Cumulative operation time of each pump	Visual check	Check the adequacy.	○					
		Cumulative number of starts of each pump	Visual check	Check the adequacy.	○					
		Alarm log	Visual check	No alarms are active. Check the past alarms.	○					
	Ground fault interrupter	Operation point	Visual check	Not tripped	○					
	Power supply terminal block, Control circuit terminal block, Power line	Loose screws	Tighten	Securely tightened			○			
		Trace of heating	Visual check	No discoloration			○			
		Adhesion of dust, damage	Visual check	No dust or damage			○			
	Cover and its installation status	Open/close the cover.	By hand	Smoothly opens/closes			○			
		Loose connections	Tighten	Securely tightened			○			
	Structure and appearance	Insulator	Visual check	No cracks or deformation			○			
	Inverter	Looseness of screws	Tighten	Securely tightened			○	Inverter	1 to 2	Every 5 years
	Printed board	Operation	Visual check	No abnormal condition			○	Printed board	1	Every 5 years
	Cooling fan	Noise, vibration	Listen	No abnormal condition	○			Cooling fan	1 to 2	Every 3 years
		Operation	Visual check	Normal rotation	○					

Table 8-3(b) Maintenance check list

	Inspection point	Inspection item	Method	Criterion	Frequency			Replacement cycle of consumables (as a guide)		
					Daily	Half-yealyr	Yearly	Consumable	Qty.	Replacement cycle
Pumps and motors	Operating conditions	Head	Visual check	As per the specifications	○					
		Electric current value	Measure	As per the specifications	○					
		Noise, vibration	Listen Touch	No abnormal condition	○					
		Rotation direction	Visual check	Each motor rotates in the correct direction.	○					
	Mechanical seal	Water leakage	Visual check	No water leakage	○			Mechanical seal	n	Every year or after 8000 hrs of continuous operation
	Impeller	Clogging with foreign matter, wear, damage	Disassemble and inspect	No abnormal condition			○			
	Liner ring	Wear, damage	Disassemble and inspect	No abnormal condition			○	Liner ring	m x n*1	Every 3 years
	Guide vane	Clogging with foreign matter, wear, damage	Disassemble and inspect	No abnormal condition			○			
	Main shaft and its surrounding area	Smooth rotation	Rotate manually	Smoothly rotates			○			
	Bearing *2	Heat, noise, vibration	Touch	No abnormal condition			○	Bearing	2n	Every 3 years or after 15000 hrs of continuous operation
	Winding resistance	Resistance between wires (U-V, V-W, W-U)	Measure	Those resistance values are the same.			○			
	Insulation resistance	Insulation resistance between the ground and each lead	Measure	1 MΩ or more			○			
Accessories and others	Pressure tank	Pre-charge pressure	Measure	As per the setting pressure		○		Pressure tank	1	Every 3 years
		Painting conditions	Visual check	No abnormal condition			○			
	Pressure transmitter	Operation	Visual check	Pressure is indicated correctly.	○			Pressure transmitter	1	Every 5 years
	Pressure gauge	Check the reading	Visual check	No abnormal condition	○			Pressure gauge	1	Every 3 years
	Compound pressure gauge	Check the reading	Visual check	No abnormal condition	○			Compound pressure gauge	1	Every 3 years
	Flow switch	Operation	Visual check	Pump stops at a low flow rate.	○					
		Clogging with foreign matter, damage	Disassemble and inspect	No abnormal condition		○		Flow switch	n	Every 3 years
	High-temperature sensor	Operation	Visual check	High-temperature alarm is issued at a high temperature (50°C or more).		○		High-temperature sensor	n	Every 3 years
	Check valve	Clogging with foreign matter, wear, water leakage	Disassemble and inspect	No abnormal condition		○		Check valve	n	Every 3 years
	Each section of piping	Water leakage	Visual check	No water leakage	○					
	Packing and O-rings	Flaws, deformation, adherence of foreign matter	Visual check	No abnormal condition		○		Packing and O-rings	1 set	Whenever disassembled

*1: The letter “m” indicates the number of pump stages, and the letter “n” indicates the number of pumps.
Eg: UNX403-3.7-e = ①Bore(40A), ②Number of stage (3 stages), ③Rated output(3.7kW)
①② ③

*2: Long-life urea grease is used as lubricating grease in bearings.
When you replace parts, apply one of the following types of greases to each bearing.
① Bearings made by NTN: MP-1 grease
② Bearings made by NSK: ENS grease
③ Bearings made by KOYO: KTC grease

Note Information in the “Replacement cycle of consumables (as a guide)” column shows standard values that are applicable when the unit has been properly used and periodically inspected. The service life may be shortend depending on the operation conditions.

Note Waste parts and other disposal items removed during repairs or replacement must be disposed of by a specialized contractor.

9. How to handle troubles

> **Caution**
>
> In the event of an alarm or abnormal condition that cannot be resolved, immediately stop the operation and contact TERAL INC. Otherwise, it may lead to an accident.
> Before the contact, check the status of abnormal condition and the alarm code No., as well as information shown on the nameplate, and then let us know the information.

9.1 Alarm handling

9.1.1 Checking the alarm description

If an alarm occurs, the buzzer sounds, the Failure indicator light on the operation panel blinks, and the alarm code appears on the display.
Some failures do not generate an alarm immediately. Instead, the system takes back and retries the action several times and generates an alarm only if the failure still persists.
Referring to the “Table 9-1 Alarm code table,” identify the alarm status and eliminate the cause.
To find out the cause of the problem, refer to “9.2 Troubleshooting.”

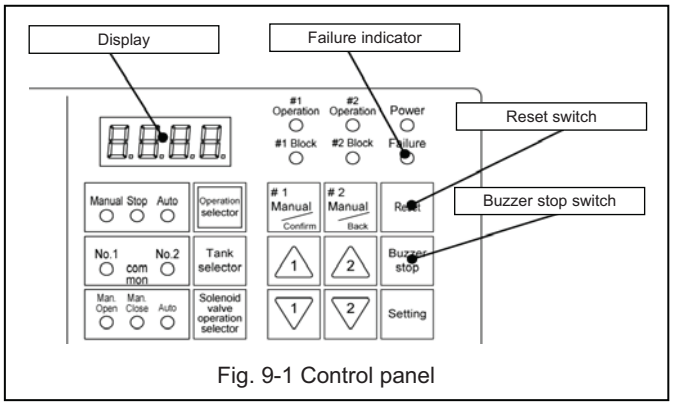


Fig. 9-1 Control panel

If multiple alarms occur at the same time, the displayed codes are switched every two seconds.

Table 9-1 Alarm code table

Alarm code	Description	Alarm code	Description	Alarm code	Description
E001	Receiver tank full	E101	No.1 overload	E201	No.2 overload
E002	Receiver tank low	E102	No.1 discharge pressure abnormal drop	E202	No.2 discharge pressure abnormal drop
E003	Receiver tank dry-run prevention	E103	No.1 electric leak	E203	No.2 electric leak
E004	Electrode failure	E104	No.1 high temperature	E204	No.2 high temperature
E006	Start frequency failure	E105	No.1 flow switch failure	E205	No.2 flow switch failure
E051	Pressure transmitter 1 failure	E111	No.1 overcurrent	E211	No.2 overcurrent
E070	Control panel high temperature	E112	No.1 overvoltage	E212	No.2 overvoltage
E080	EEPROM error	E114	No.1 anti-stall	E214	No.2 anti-stall
		E115	No.1 inverter overload	E215	No.2 inverter overload
		E116	No.1 open-phase output	E216	No.2 open-phase output
		E117	No.1 inverter overheat	E217	No.2 inverter overheat
		E118	No.1 communication failure	E218	No.2 communication failure
		E119	No.1 inverter trouble 1	E219	No.2 inverter trouble 1
		E120	No.1 inverter trouble 2	E220	No.2 inverter trouble 2

9.1.2 Resetting alarms

Eliminate the cause of the problem and then press the reset switch.
If the reset switch is pressed before the cause of the problem is eliminated, the alarm cannot be reset.
If multiple alarms occur, the system resets only the alarms whose cause has been removed.

9.1.3 Stopping the buzzer

You can stop a sounding buzzer by pressing the Buzzer stop switch.
The Buzzer Stop Time setting (P200) allows you to specify whether to stop the buzzer automatically after a specified period or to prevent the buzzer from sounding.
For the setting procedure, refer to “7.5 Parameter setting.”

9.2 Troubleshooting

Table 9-2(a) Troubleshooting

Alarm code	Description	Probable cause	Remedy
E001	Receiver tank full	Water flows into the tank continuously because the Solenoid Valve Operation setting is set to “Man. Open.”	Set the Solenoid Valve Operation to “Auto.”
		Water does not stop running because of a failure in the ball tap.	Check and/or replace the ball tap.
		Water does not stop running because of a failure in the inflow solenoid valve.	Check and/or replace the inflow solenoid valve.
		Water has seeped inside the electrode holder.	Check and/or correct the electrode holder section.
		Although water level has reached the point of closing the solenoid valve, water still comes out because an incorrect setting of the Solenoid Valve Type (P103) causes the solenoid valve to open.	Correctly set the Solenoid Valve Type to the type of the inflow solenoid valve in use.
E002 E003	Receiver tank low Dry-run prevention	The Tank Selection setting is set to a water tank not in use (to which no electrodes are connected or for which cleaning work is in progress).	Set the Tank Selection to the water tank to be used.
		Water does not flow into the receiver tank because the Solenoid Valve Operation setting is set to “Man. Close.”	Set the Solenoid Valve Operation to “Auto.”
		Water does not come out because of a failure in the ball tap.	Check and/or replace the ball tap.
		Water does not come out because of a failure in the inflow solenoid valve.	Check and/or replace the inflow solenoid valve.
		Although water level has reached the point of opening the solenoid valve, no water comes out because an incorrect setting of the Solenoid Valve Type (P103) causes the solenoid valve to close.	Correctly set the Solenoid Valve Type to the type of the inflow solenoid valve in use.
		Poor connection or disconnection of the electrode wiring	Check and/or correct the electrode wiring.
		Poor connection of the electrode holder section	Check and/or correct the electrode holder section.
E004	Electrode failure	Wrong electrode wiring	Check and/or correct the electrode wiring.
		Poor connection or disconnection of the electrode wiring	Check and/or correct the electrode wiring.
E006	Start frequency failure	Because of damage to the diaphragm of the pressure tank, its internal pressure cannot be maintained when no pumps are running, thus increasing the start frequency of the pump(s).	It is necessary to check and/or replace the pressure tank. Contact us.
		Water usage continues at a low flow rate because of water leakage or the user’s failure to close the faucet.	Check and/or replace the piping. Additionally install a pressure tank with a large capacity.
		A small flow rate is constantly detected because of malfunction of the flow switch.	It is necessary to check and/or replace the flow switch. Contact us.
E051	Pressure transmitter error	The pressure transmitter is broken.	It is necessary to check and/or replace the pressure transmitter. Contact us.
		The piping is frozen.	Protect the piping with a heat insulating material, or contact us to make modifications for the freeze-proof specifications.
E070	Control panel high temperature	The cooling fan of the outdoor cover is broken.	Check the cooling fan. If it is broken, replace it.
		The ambient temperature is too high. The unit is exposed to direct sunlight.	Improve the installation environment.
E080	EEPROM error	The memory device of the control board is broken.	Normal operation may not be possible because parameters and operating information cannot be stored. It is necessary to check and/or replace the control board. Contact us.

Table 9-2(b) Troubleshooting

Alarm code	Description	Probable cause	Remedy
E101 E201	No.1 overload No.2 overload	An overload has occurred because the unit is running at a flow rate outside the specified range.	Adjust the load so that it falls within the specified range.
		An overload has occurred because of damage to the bearings.	It is necessary to replace the bearings. Contact us.
		An overload has occurred because foreign matter is caught in the pump.	It is necessary to disassemble and inspect the pump. Contact us.
		A drop in power voltage or an imbalance between phases has led to an increase in the electric current value.	Check for any insufficient power capacity or any imbalance between phases, and fix the problem.
		A failure in the motor has led to an overcurrent flow.	It is necessary to check and/or replace the motor. Contact us.
E102 E202	No.1 discharge pressure abnormal drop No.2 discharge pressure abnormal drop	Because of insufficient priming or the escape of water from the piping system, the pump cannot lift water.	Sufficiently perform priming. If water escapes from the piping system, Check and/or correct the suction piping.
		An entry of air through the suction piping prevents the pump from delivering its rated performance.	Check and/or replace the suction piping.
		The discharge pressure cannot be detected because the TJ valve is shut.	Open the TJ valve to pass water through the pressure transmitter section.
		The setting value for starting the pump is set to a value beyond the pump capacity.	Check the pump capacity, and set the correct setting value for starting the pump.
		Because of problems such as a failure in each pump/motor or the disconnection of the power line, the pump does not run or the motor rotates in reverse.	Check the rotation direction. Check and/or correct the wiring. If it is necessary to disassemble and inspect the pump, contact us.
		Because the suction piping, pump, or other sections are clogged with foreign matter, the flow passage is blocked and the pump cannot lift water.	It is necessary to disassemble and inspect the pump. Contact us.
E103 E203	No.1 electric leak No.2 electric leak	There is electric leakage somewhere in the secondary circuit of the ground fault interrupter.	Find the location of electric leakage, and fix the problem.
		The ground fault interrupter is broken.	It is necessary to check and/or replace the ground fault interrupter. Contact us.
E104 E204	No.1 high temperature No.2 high temperature	Because of malfunction of the flow switch, the pump does not stop even when no water is used, thus leading to a high temperature.	It is necessary to check and/or replace the flow switch. Contact us.
		Water usage continues at a low flow rate because of water leakage or other conditions. At that time, the heat of stirring accumulates inside the pump, thus leading to a high temperature.	Check and/or replace the piping. Additionally install a pressure tank with a large capacity.
		Because of damage to the diaphragm of the pressure tank, its internal pressure cannot be maintained when no pump is running. The pressure drop starts running the pump even when no water is used, thus leading to a high temperature.	It is necessary to check and/or replace the pressure tank. Contact us.
		Flow-in water is hotter than the specification.	Check the conditions of use, and fix the problem.
		The high-temperature sensor is broken.	It is necessary to check and/or replace the high-temperature sensor. Contact us.

Table 9-2(c) Troubleshooting

Alarm code	Description	Probable cause	Remedy
E105 E205	No.1 flow switch failure No.2 flow switch failure	The flow switch is broken or its wiring is disconnected. Or, the flow switch is not working properly because of contamination with foreign matter or other causes.	It is necessary to check and/or replace the flow switch. Contact us.
E111 E211 E114 E214 E115 E215	No.1 overcurrent No.2 overcurrent No.1 anti-stall No.2 anti-stall No.1 inverter overload No.2 inverter overload	An overload has occurred because the unit is running at a flow rate outside the specified range.	Adjust the load so that it falls within the specified range.
		An overcurrent has occurred because of damage to the bearings.	It is necessary to replace the bearings. Contact us.
		An overcurrent has occurred because foreign matter is caught in the pump.	It is necessary to disassemble and inspect the pump. Contact us.
		A drop in power voltage or an imbalance between phases has led to an increase in the electric current value.	Check for any insufficient power capacity or any imbalance between phases, and fix the problem.
		A failure in the motor has led to an overcurrent flow.	It is necessary to check and/or replace the motor. Contact us.
E112 E212	No.1 overvoltage No.2 overvoltage	The power voltage is too high.	Check the power voltage.
E116 E216	No.1 open-phase output No.2 open-phase output	The motor has burned out.	It is necessary to check and/or replace the motor. Contact us.
E117 E217	No.1 inverter overheat No.2 inverter overheat	The ambient temperature is too high.	Improve the installation environment.
		The cooling fan is broken.	It is necessary to replace the cooling fan. Contact us.
E118 E218	No.1 communication failure No.2 communication failure	A cause other than electric leak has turned “off” the ground fault interrupter.	Turn on the ground fault interrupter.
		The communication connector is coming off.	Firmly insert the connector.
E119 E219 E120 E220	No.1 inverter trouble 1 No.2 inverter trouble 1 No.1 inverter trouble 2 No.2 inverter trouble 2	The inverter is broken.	It is necessary to check and/or replace the inverter. Contact us.

10. Special models

10.1 Lifting models

This section describes the lifting models.
The lifting models allow lifting operation of up to 4 m in the actual head and of up to 6 m in the total head.
The lifting models come standard with a constant relief kit (an orifice, a ball valve, a nipple, and a union). Connect a constant relief pipe to the kit to send water back to the source of water supply.

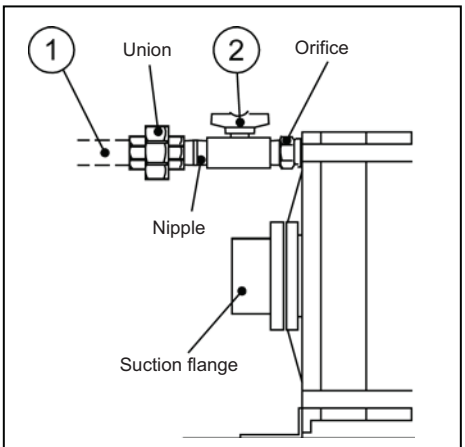


Fig. 10-1(a) Constant relief kit

Note	For the installation procedure of the constant relief pipe, there may be an applicable guideline or guidance from local governments or other official institutions. Carefully check for such guidelines and follow the instructions.
Note	A standard model can be modified to the lifting model. For further information, contact us.

[Instructions only applicable to lifting models]

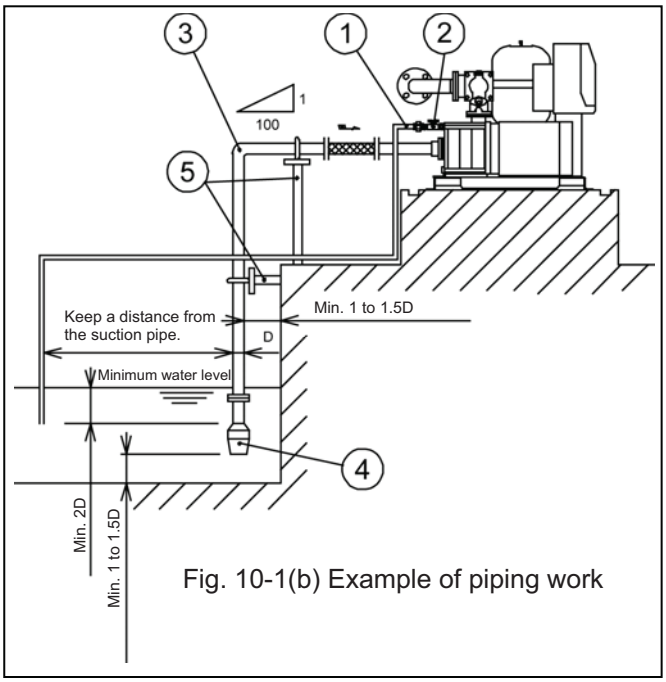


Fig. 10-1(b) Example of piping work

(1) Ensure to install the constant relief pipe ① for each pump.
(2) Submerge the end of the constant relief pipe deep enough to prevent exposure to air even if refilling of water creates waves on the surface. In addition, keep a distance from the suction pipe so that air from the constant relief pipe does not enter the suction pipe.
(3) Fully open the valve ② during operation. (Water flows at a rate of about 10 L/min.)
(4) Ensure to install the suction pipe ③ for each pump, and provide a rising slope (at least 1/100 degrees) leading up to each pump to prevent the formation of air pockets inside the pipe. Furthermore, install joints in a way that no air enters from there.
Pay special attention to determining the pipe diameter of an automatic alternate parallel operation type because the flow rate of the subsequently activated pump exceeds half the maximum flow rate of water to be used.
(5) Ensure to attach a foot valve ④ with a strainer to the end of the suction pipe ③ to block entrance of foreign matter or objects. The suction port must be located at a position more than twice as deep as the size of the suction pipe diameter (D) below the lowest water level, and at a distance of at least 1 to 1.5 times the pipe diameter (D) away from the bottom and the side of the water tank.
(6) Do not attach a sluice valve to the suction pipe ③.
(7) Install strong piping supports ⑤ to prevent the weight of the piping components from being applied to the unit.

10.2 Freeze-proof models

This section describes our freeze-proof models designed to protect the unit against freezing in winter. The freeze-proof models come standard with the freeze-proof kit.

Note

A standard model can be modified to the freeze-proof model.
For further information, contact us.

Freeze-proof kit

① Low-temperature sensor *1
② Cement heaters *1, *3
16W/200-220V
③ Fixing brackets *3
④ Fixing plate
⑤ Cross recessed head screw
⑥ Heat insulating materials *2, *3

*1 Connect the low-temperature sensor and the cement heaters to the control board. (→ see 3.2.4)
*2 Sandwich the heat insulating materials between the fixing bracket and the cement heater.
*3 For models with 5.5 kW or higher output, these items are provided at one place only.

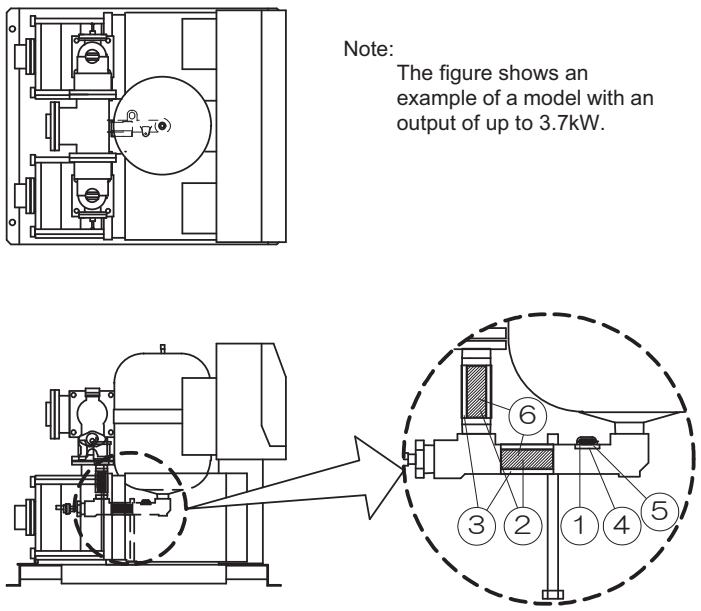


Fig. 10-2(a) Freeze-proof kit

(1) Operation cycle
The following cycle starts during the stop of both pumps if the low-temperature sensor detects a water temperature below 3°C:
a) The heaters start to heat water up to10°C.
b) The No.1 pump starts to perform zero-discharge operation for 10 minutes, followed by another 10-minute zero-discharge operation of the No.2 pump.
c) If the water temperature does not reach 10°C in 30 minutes after the end of both pumps' zero-discharge operations, the system repeats the above cycle.

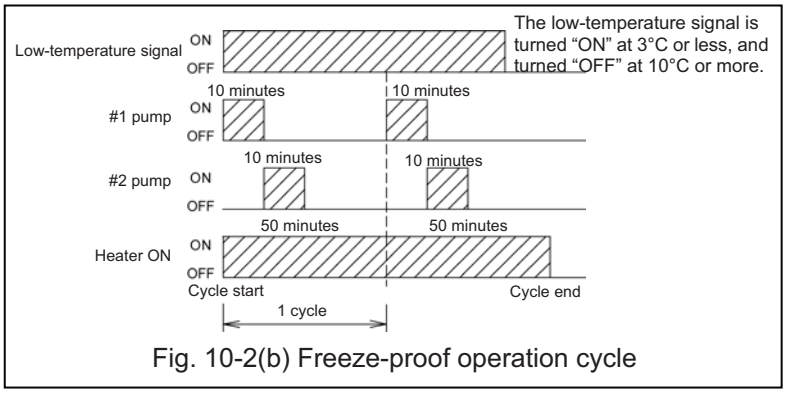


Fig. 10-2(b) Freeze-proof operation cycle

Note

CoLd appears on the display of the operation panel during the freeze-proofing cycle.
Use of water ends any ongoing freeze-proofing cycle and switches to normal operation.

TERAL INC.

Head Office

230, Moriwake, Miyuki-cho, Fukuyama-city, Hiroshima, 720-0003, Japan

Tel.+81-84-955-1111 Fax.+81-84-955-5777

www.teral.net

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