SINCE 1889

Yamato

Cooling Water Circulating Device
Model CLH312C/411C/610C

First Edition

● Thank you for purchasing "CLH Cooling Water Circulating Device" of Yamato Scientific Co., Ltd.

●To use this unit properly, read this "Instruction Manual" thoroughly before using this unit. Keep this instruction manual around this unit for referring at any time.

⚠WARNING!:

Carefully read and thoroughly understand the important warning items described in this manual before using this unit.

Yamato Scientific Co.,Ltd.

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MEANING OF ILLUSTRATED SYMBOLS

Illustrated Symbols

Various symbols are used in this safety manual in order to use the unit without danger of injury and damage of the unit. A list of problems caused by ignoring the warnings and improper handling is divided as shown below.Be sure that you understand the warnings and cautions in this manual before operating the unit.

⚠WARNING! If the warning is ignored, there is the danger of a problem that may cause a serious accident or even fatality.

⚠CAUTION! If the caution is ignored, there is the danger of a problem that may cause injury/damage to property or the unit itself.

Meaning of Symbols

This symbol indicates items that urge the warning (including the caution).
A detailed warning message is shown adjacent to the symbol.

This symbol indicates items that are strictly prohibited.
A detailed message is shown adjacent to the symbol with specific actions not to perform.

This symbol indicates items that should be always performed.
A detailed message with instructions is shown adjacent to the symbol.

1. Cautions in using with safety

Table of Illustrated Symbols

Warning


Warning,
generally


Warning,
high voltage


Warning,
high temperature


Warning,
drive train


Warning,
explosive

Caution


Caution,
generally


Caution,
electrical shock


Caution,
scald


Caution,
no load heating


Caution,
not to leak

Caution,
water only


Caution,
deadly poison

Prohibit


Prohibit,
generally


Prohibit,
inflammable


Prohibit,
to disassemble


Prohibit,
to touch

Compulsion


Compulsion,
generally


Compulsion,
connect to the
grounding
terminal

Compulsion,
install on a flat
surface


Compulsion,
disconnect the
power plug


Compulsion,
periodical
inspection

1. Cautions in using with safety

Fundamental Matters of "WARNING!" and "CAUTION!"

⚠ Warning

Do not use this unit in an area where there is flammable or explosive gas

Never use this unit in an area where there is flammable or explosive gas. This unit is not explosion-proof. An arc may be generated when the power switch is turned on or off, and fire/explosion may result. (Refer to page 61 "13. List of Dangerous Substances".)

Always ground this unit

Always ground this unit on the power equipment side in order to avoid electrical shock due to a power surge.

If a problem occurs

If smoke or strange odor should come out of this unit for some reason, turn off the power key right away, and then turn off the circuit breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result. Never perform repair work yourself, since it is dangerous and not recommended.

Do not use the power cord if it is bundled or tangled

Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.

Do not process, bend, wring, or stretch the power cord forcibly

Do not process, bend, wring, or stretch the power cord forcibly. Fire or electrical shock may result.

Substances that cannot be used

Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit. Explosion or fire may occur. (Refer to page 61 "13. List of Dangerous Substances".)

Do not touch high-temperature parts

The inside of the body or the door may become hot during and just after operation. It may cause burns.

Do not disassemble or modify this unit

Do not disassemble or modify this unit. Fire or electrical shock or failure may be caused.

⚠ Caution

During a thunder storm

During a thunderstorm, turn off the power key immediately, then turn off the circuit breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

2. Before using this unit

Requirements for Installation

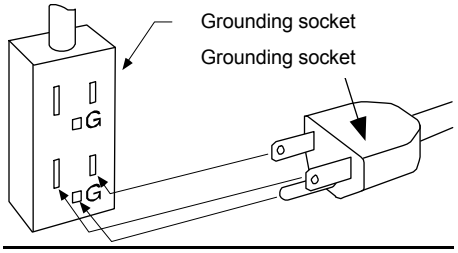
⚠ Warning

1. Always ground this unit

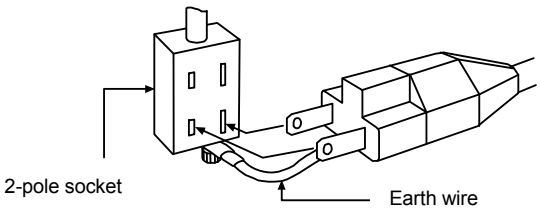
BK310C/BK410C/BK510C/BK610C/BK710C does not have power plug, uses single phase 220V power source and needs power cord connecting work, please consult your local electrical contractor for power connecting work, grounding as per electrical device technical benchmark.

- Be sure to connect the earth wire (the green cable of power cord) to the grounding conductor or ground terminal to prevent accidents caused by electric leakage.
- Do not connect the earth wire to gas or water pipes. If not, fire disaster may be caused.
- Do not connect the earth wire to the ground for telephone wire or lightning conductor. If not, fire disaster or electric shock may be caused.
- Do not use a branching receptacle, which may cause the heat generation.

Better to use grounding socket



2-pole socket



No grounding terminal

- Need power connecting work, please consult your local electrical contractor or Yamato Business Office.

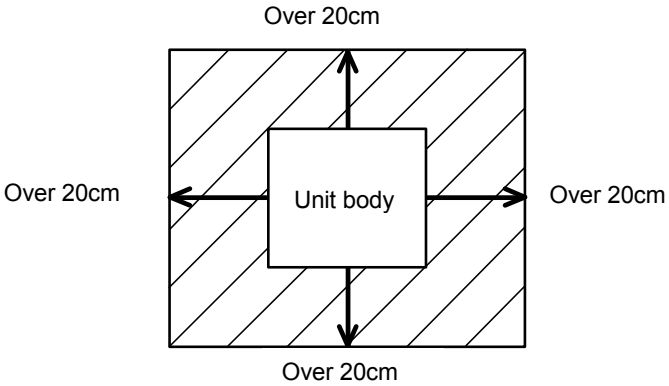
- Insert the grounding adaptor to power plug, confirm the socket polarity and connect. In addition, connect the earth wire (green) of grounding adaptor with grounding terminal of power unit.

2. Choose a proper place for installation

Do not install this unit in a place where:

- Rough or dirty surface.
- Flammable gas or corrosive gas is generated.
- Ambient temperature exceeds 35°C.
- Ambient temperature fluctuates violently.
- There is direct sunlight.
- There is excessive humidity and dust.
- There is a constant vibration.

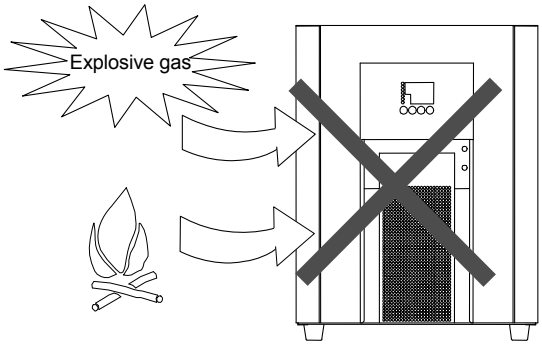
Install this unit on a stable place with the space as shown below.



3. Do not use this unit in an area where there is flammable or explosive gas

(Refer to page 61 "13. List of Dangerous Substances".)

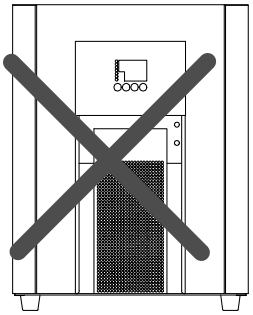
Never use this unit in an area where there is flammable or explosive gas. This unit is not explosion-proof. An arc may be generated when the power switch is turned ON or OFF, and fire/explosion may result.



4. Do not modify

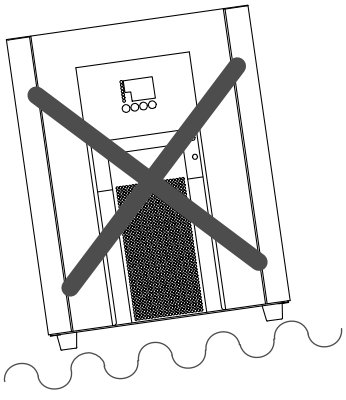
Modification of this unit is strictly prohibited. This could cause a failure.

Modify



5. Installation on horizontal surface

Set this unit to the flattest place. Setting this unit on rough or slope place could cause the vibration or noise, or cause the unexpectable trouble or malfunction.



6. Choose a correct socket

Choose a correct power socket that meets the unit's rated electric capacity.

Electric capacity	CLH312C	AC220V	6A
	CLH411C	AC220V	7.5A
	CLH610C	AC220V	11A

There could be the case that the unit does not run even after turning ON the power. Inspect whether the voltage of the main power is lowered than the specified value, or whether other device(s) uses the same power line of this unit. If the phenomena might be found, change the power line of this unit to the other power line.

7. Installation and layout

It may cause injure to a person if this unit falls down or moves by the earthquake and the impact. etc.. To prevent, take measures that the unit cannot fall down, and not install at a busy place.

8. Handling of power cord

- Do not entangle the power cord. This will cause overheating and possibly a fire.
- Do not bend or twist the power cord, or apply excessive tension to it. This may cause a fire and electrical shock.
- Do not lay the power cord under a desk or chair, and do not allow it to be pinched in order to prevent it from being damaged and to avoid a fire or electrical shock.
- Keep the power cord away from any heating equipment such as a room heater. The cord's insulation may melt and cause a fire or electrical shock.
- If the power cord becomes damaged (wiring exposed, breakage, etc.), immediately turn off the power at the rear of this unit and shut off the main supply power. Then contact your nearest dealer for replacement of the power cord. Leaving it may cause a fire or electrical shock.
- Connect the power plug to the receptacle which is supplied appropriate power and voltage.

9. Please select the circulating liquid according to the conditions of use.

⚠ Please select the circulating liquid according to the operating temperature.
Set temperature +10°C or more : Water
Set temperature +10°C or less: Cryophilic solution (nybrine 60%, ethylene glycol 50%)
When the set temperature is below +10°C, please be careful that if water is used, the cooling coil will freeze and cause failure.

10. Nybrine aqueous solution when used instead of water

❗ The freezing point of nybrine varies depending on concentration and species. Please use items with a low freezing point that is lower than the minimum temperature of 10°C or higher. Please note that if you use items above this freezing point, the cooler may freeze and the heat exchange may decrease.

11. Do not use anything other than nybrine (nybrine・ethylene glycol).

❗
・The water injected into the tank should be distilled or tap water. Water with poor water quality will cause the heater to accumulate scale, reduce performance and cause failure. (Well water, etc.)

・If a circulating liquid with a large specific gravity or viscosity is used, the load on the circulating pump will be too large and the performance of this machine will not be able to be utilized. (Fluorinert, Galden, etc.)

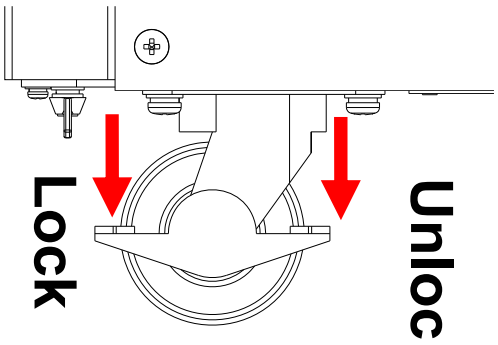
・If something that is corrosive or produces corrosive substances when heated may cause malfunction. (Fluorinert et al.)

・Please refrain from using harmful substances to avoid steam inhalation injuries. (methanol, etc.)

2. Before using this unit

Placement method ·precaution

(1) Please unlock the brake on the castor. (CLH411C/610C only)
Press the brake button of the castor to the low position as shown in the picture on the right to unlock it.
(Only the two casters in front of the body have brakes.) 〉
Model CLH312C has rubber feet.

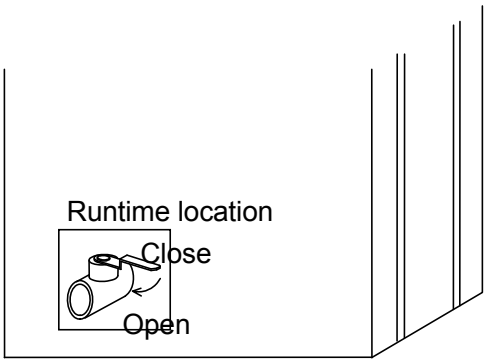


(2) Move it to the place where it was placed.

* If you move to an uneven place, it will cause excessive impact to the castor and may break. Therefore, please lift it to the installation site.
(In this case, please be carefully lifted and moved by two or more workers.) 〉

(3) When a place to place it is selected, lock the castor brakes.

(4) Confirm the drain plug.
Make sure that the drain plug on the left side of the body is in the "closed" position (perpendicular to the drain pipe) as shown in the figure on the right.



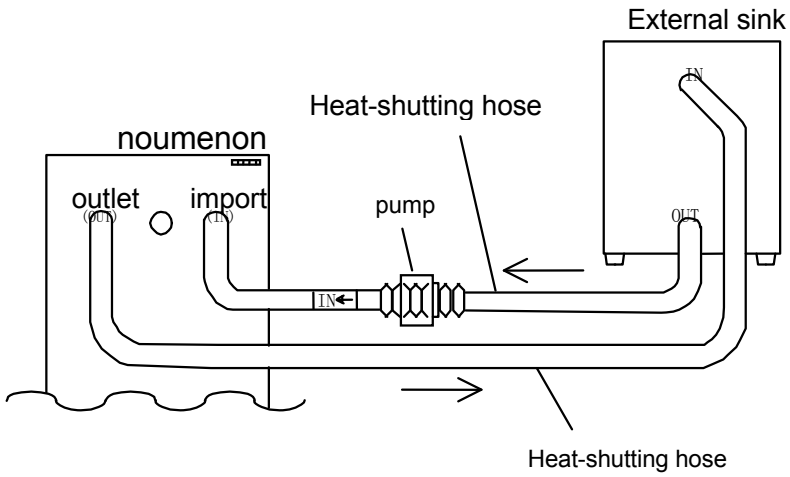
Location when draining

(5) Please connect the hose.

· The connection port of the body is connected to the external sink of the external open system to ensure that it does not leak.
Please refer to the figure below. The outer diameter of the outlet and inlet is 13mm.
Note: Please connect the pilot pump port (IN) to the main body inlet (IN).

· If the circulation path is closed by solenoid valves and regulating valves, etc., the circulation pump may malfunction and leak. Be careful not to tighten the regulating valve. Ensure that the flow rate of the circulating liquid is above 1.5L/min. ·

· When you want to change the traffic, proceed slowly. Sudden flow changes can shorten the service life of the pump.



(6) Connect the power supply.
Please confirm that the leakage protection switch and power switch are in the [cut] state before inserting the power plug into the socket.

(7) Setting of the external sink. (Standard accessories)
The external sink should be set higher than the unit. If placed in a low place, it will cause the flow rate to decrease or the air will not be smoothly extracted when the circulating liquid is initially put in.

(8) Fill the tank with the circulating liquid.

・Open the lid of the external sink and put in the circulating liquid.

(Please select the circulating liquid according to the set temperature.）

・Please open the extraction valve.

・Press the pilot pump 10 times.

(The circulating liquid is transferred from the external sink to the main circulating pump to drain the air inside the circulating pump.) After the air is exhausted, the circulating liquid begins to circulate.）

・Disconnect the leakage circuit breaker and turn on the power switch.

(Inject circulating fluid into the body fluid tank.）

・When the body fluid tank is filled with water, it will be discharged to the external fluid tank.

(Nevertheless, if the circulating liquid is not circulating, please immediately cut off the leakage circuit breaker and power switch.) Refer to Page.53「Trouble Shooting」to confirm.

・Please close the extraction valve.

⚠ **Operation of the circulating liquid without circulation will cause the circulating pump to fail.**

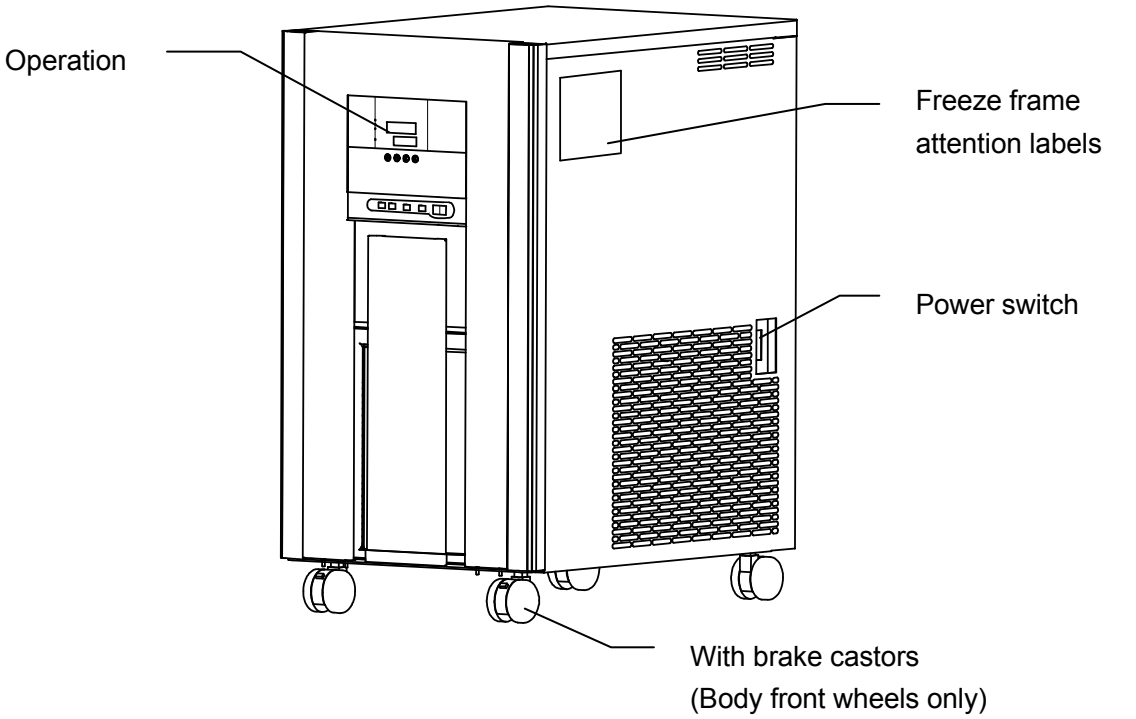
- After the circulation of the circulating liquid is stabilized, replenish the circulating liquid to 80% of the external sink.
- After the circulating fluid is replenished, turn off the leakage circuit breaker.
- Please close the outer sink cover.

⚠ **Be careful not to drop the circulating liquid onto the machine.**
Circulating droplets on electrical parts can cause leakage and electric shock.
When the circulating liquid droplets are on the operation panel, wipe them clean.

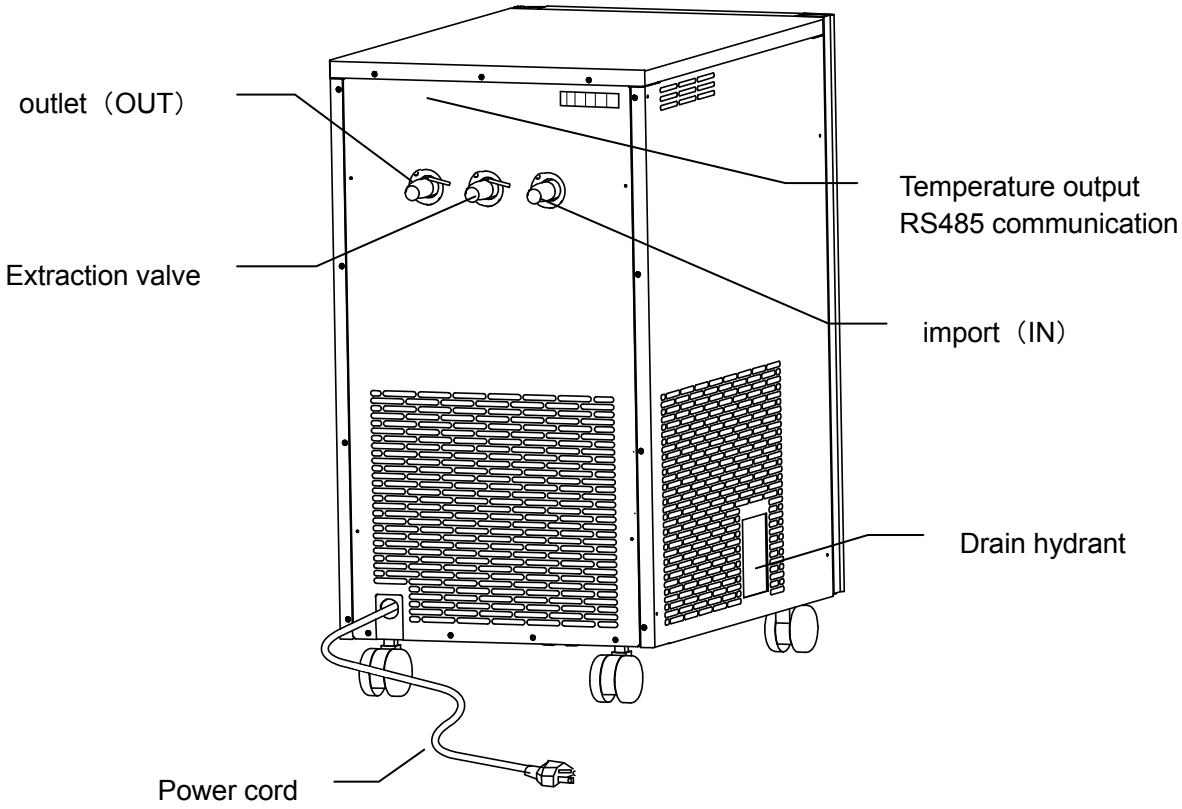
3. Name and Function of Each Part

Main Unit

front

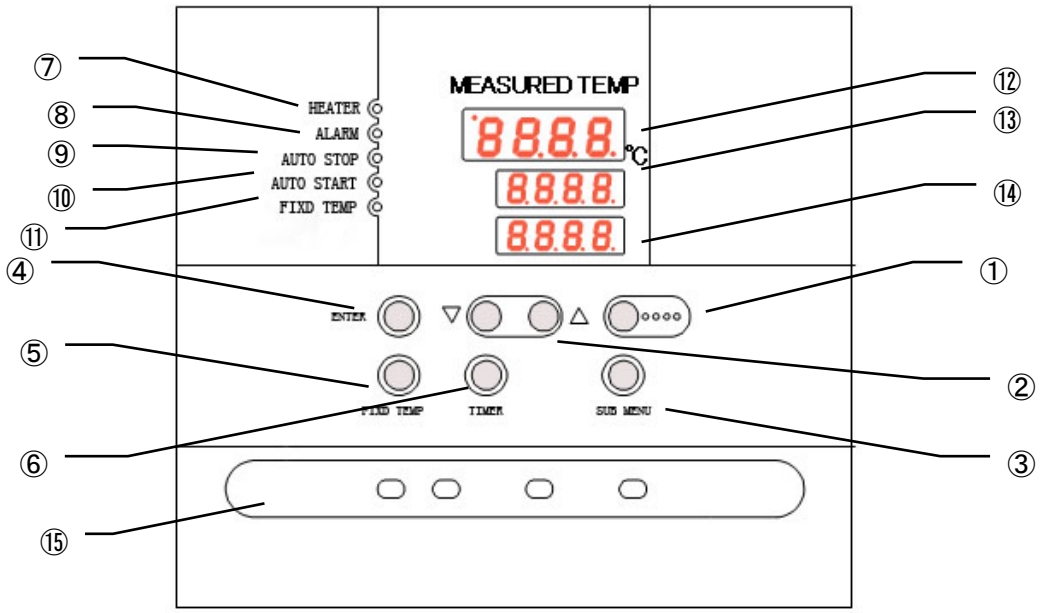


back



3. Name and Function of Each Part

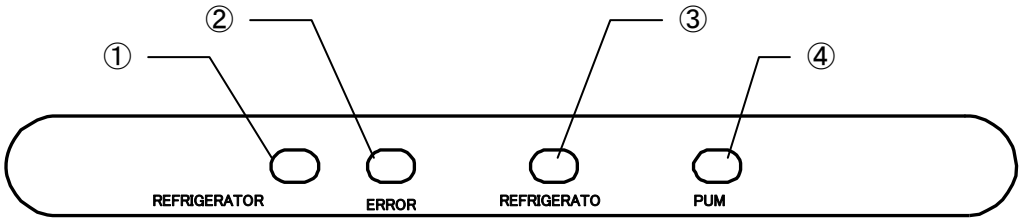
Operation panel



①	RUN/STOP key	Used for starting/stopping operation.
②	▲▼ Key	Uses for rising UP/lowering DOWN the setting value.
③	ENTER Key	Settles the inputted value.
④	FIXED TEMP Key	Chooses the fixed temperature operation.
⑤	TIMER Key	Chooses the timer operation (Quick Auto Stop/Auto Stop/Auto Start).
⑥	SUBMENU Key	Uses for setting the overheating prevention temperature, calibration offset temperature, key lock function, or program repeat function.
⑦	HEATER Lamp	Lights while the heater works.
⑧	ALARM Lamp	Lights up when an error occurs. (Buzzer sounds simultaneously.)
⑨	AUTO STOP Lamp	Blinks while setting quick auto stop timer or auto stop timer. Lights while quick auto stop timer or auto stop timer is running.
⑩	AUTO START Lamp	Blinks while setting auto start timer. Lights while auto start timer is running.
⑪	FIXED TEMP Lamp	Blinks while setting fixed temperature operation. Lights while fixed temperature operation is running.
⑫	Measurement Temp. Display	Displays the measured temperature, setting character, alarm information.
⑬	Setting Temp. Display	Displays the setting temperature, setting value for timer mode, remaining time.
⑭	Overheating Prevention Temp. Display	Displays the setting temperature for overheating prevention device.
⑮	Run the display	Refer to Page 13「Run the display」。

3. Name and Function of Each Part

Run the display

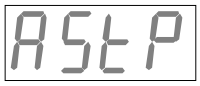
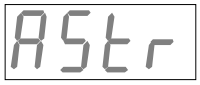
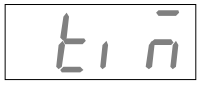
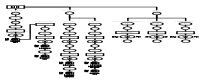


NO.	name	Actions
①	The freezer pressure is abnormal	The light comes on when the freezer is overloaded.
②	abnormal	The light turns on when the cooling water flow decreases.
③	refrigerator	The light is on during freezer operation.
④	Circulating pumps	The light is on when the circulating pump is working.

3. Name and Function of Each Part

Characters of the Controller

The explanation of VS6 controller characters are as follows:

Character	Identifier	Name	Purpose
	Fix	Fixed Temperature Setting Mode	Used for starting the fixed temperature operation.
	Sv	Temperature Setting	Used for setting the temperature.
	AStP	Timer Setting Mode Display	Represents the setting of quick auto stop or auto stop operation.
	AStr	Timer Setting Mode Display	Represents the setting of auto start operation.
	tim	Time Setting	Used for setting the time.
	End	Time Up	Displays when the timer operation is completed (Refer to Page 20, 23)
	cAL	Calibration Offset Setting	Used for inputting the calibration offset temperature. (Refer to Page 26 "Other Functions".)
	oH	Overheating Prevention Setting	Used for setting temperature for overheating prevention device. (Refer to Page 18 "Setting of Overheating Prevention Device".)
	Lock	Key Lock	Locks the keys on control panel to protect from unnecessary operation. (Refer to Page 27 "Other Functions".)

※Also refer to Page 17 "Operation Mode, Function Setting Key, and Characters".

※The operation mode cannot be changed during operation. If need to change the mode, conduct after operation stop.

4. Operation Method

Operation Mode and Function List

All the operation modes of this unit are as below:

No.	Name	Description	Page
1	Fixed Temperature Operation	Pressing the FIXED TEMP. key to enter the Fixed temperature operation setting mode. Pressing the FIXED TEMP. key again to enter the temperature setting mode. Set a temperature with the ▼▲ keys. Pressing the RUN/STOP key to start operation, and pressing the RUN/STOP key again to stop operation.	P.19
2	Quick Auto Stop Operation	Used when you want to “stop fixed temperature operation being performed automatically in several hours. Pressing the TIMER key during the fixed temperature operation to enable setting a time before operation stops. Set duration before stop with the ▼▲ keys. Pressing the RUN/STOP key starts quick auto stop operation and activates the timer in the middle of it to automatically stop it after the set period of time.	P.20
3	Auto Stop Operation	Used when you want to “set automatic stop for fixed temperature operation when making settings for it.” Press the TIMER key to display “AStP.” Pressing the ENTER key to set the temperature setting “Sv.” Pressing the ENTER key again to enable setting of the operation time “tim.” Pressing the RUN/STOP key starts auto stop operation.	P.22
4	Auto Start Operation	Used when you want to “start operation automatically after several hours” after power is turned on. Press the TIMER key to display “AStr.” Pressing the ENTER key to set the temperature setting “Sv.” Pressing the ENTER key again to enable setting of the operation time “tim.” Pressing the RUN/STOP key starts auto start operation.	P.24
※ This unit is impossible to be changed the mode during the operation. If the mode requires to be changed, stop the operation.			

4. Operation Method

Operation Mode and Function List

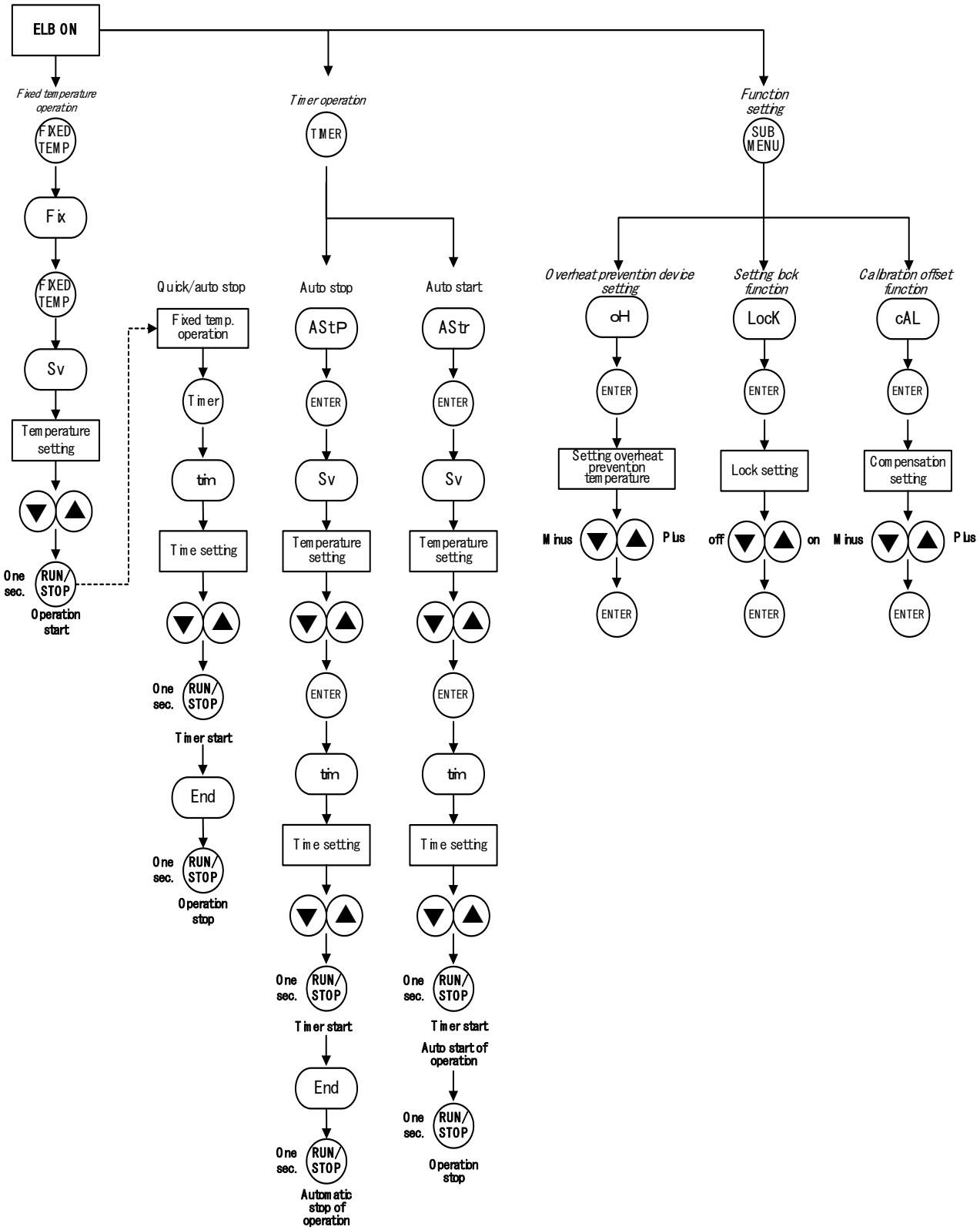
The operation functions of this unit are as below:

No.	Name	Description	Page
1.	Overheat prevention function	Automatic overheat prevention function: This function is linked to the unit set temperature and has been set to so that it is automatically activated (returned automatically) at a temperature 6℃ higher than the set temperature in the bath. Overheat prevention device: Although the power supply, the display and the key input assembly are in common with the controller, the device consists of the standalone temperature measurement circuit, the CPU, the sensor, and the output circuit enabling to set to a temperature you want on the operation panel. If the overheat prevention device is triggered, the unit will stop and will not recover until the ELB is turned on again. (Manual recovery) This compensation can be set with the SUB MENU keys.	P. 18
2.	Calibration offset function	Calibration offset function compensates any differences between the target temperature in the bath and the control temperature of the controller (sensor temperature.) The function can compensate to either plus or minus side for the whole temperature band of the unit. This compensation can be set with the SUB MENU keys.	P. 26
3.	Setting lock function	This function locks the set operation status. The lock can be set or released with the SUB MENU key.	P. 27
4.	Power outage compensation function	When power outage occurs in the middle of operation, the operation resumes from the settings immediately before the power outage.	-
5	Temperature output terminal	The measured temperature of the controller is transmitted and output at 4~20mA	P.28
6	RS485 communication function	This unit can communicate with VS3 controllers and PCs. When using external communication, you need to purchase an RS485-RS232C switching adapter separately. In addition, the reference procedure is described on the company's website. http://www.yamato-net.co.jp/support/program/index.htm	P.30

4. Operation Method

Operation Mode, Function Setting Key, and Characters

The operation mode setting and function setting use the key operation and characters show in the following figure.



Setting of Overheating Prevention Device

The unit has the overheating prevention device (manual reset) that consists of independent temperature measurement circuit, CPU, sensor and output circuit (it shares power source, display, and key input with the controller) in addition to the automatic overheating prevention function (auto reset) in the controller.

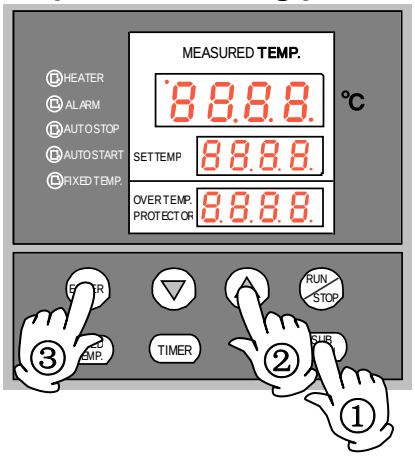
Setting range/function

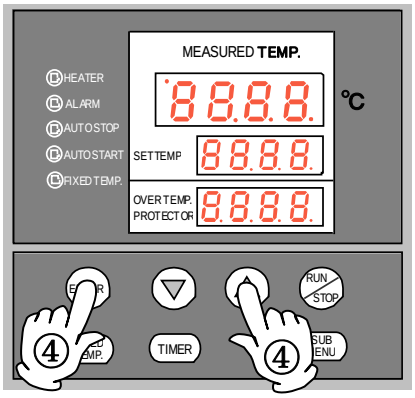
The unit has failsafe functions against overheating. One of them is built in the controller and previously set at factory shipment so to be automatically activated when the temperature exceeds the setting temperature of temperature controller by 6℃, where the heater repeats on and off.
The other is united with the controller, which can be set by operating the keys on the controller.

The setting range of latter is from 0℃ to max set temperature of main controller + 50℃.

In case the temperature in furnace exceeds the setting temperature of controller to reach to that of overheating prevention device, the circuit is shut off and "Er19" is displayed with blinking on the screen of controller with buzzer sound. If the device is once activated,"Er19"continues to be displayed until the power is newly turned on.

Temperature setting procedure





1. Turn on the power (turn on the ELB)
The default value is displayed for about four seconds after turning on the power. The screen then displays the initial setting. The current temperature in furnace, operation mode character and setting temperature of overheating prevention device are displayed on respective screens.

2. Set the temperature for overheating prevention

① Press the SUB MENU key.

② Press the "▼▲" several times to select the setting character of overheating prevention temperature "OH" oH.

③ Press the ENTER key. The current setting temperature is displayed with blinking on the setting temperature screen.

Note: To prevent improper operation, set the value 20℃ or more over the setting temperature of controller.

④ Select the value using the "▼▲"and then press the ENTER key. This completes the setting.

⚠ Note

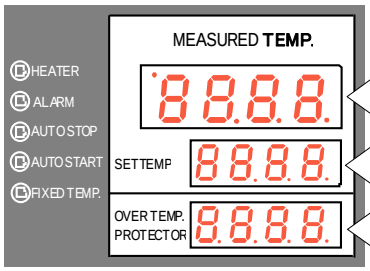
① The standard setting temperature of device is "the maximum setting temperature of unit plus 10℃" or "setting temperature plus 10℃". If the unit performs improper operation, increase it 5℃ more.

② Improper setting of temperature may cause inoperative of unit, malfunction of device, e.g. it is activated during increasing in temperature in furnace, or unexpected accidents such as fire disaster. To prevent such matters, set a proper value.
The temperature is set to 90℃ at factory shipment.

③ The purpose of overheating prevention device is to protect the unit from overheating. It does not intend to protect the samples, or to protect them from the accident caused by the use of explosive or inflammability.

4. Operation Method

Fixed temperature operation procedure



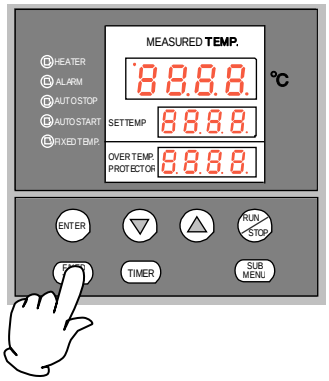
1. Turn on the power (turn on the ELB)

The default value is displayed for about four seconds after turning on the power. The screen then displays the initial setting. The current temperature in furnace, operation mode character and setting temperature of overheating prevention device are displayed on respective screens.

Measurement temperature screen: Displays the current temperature in furnace.

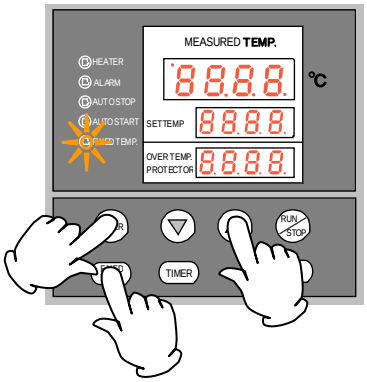
Setting temperature screen: Displays the operation mode character. (Refer to Page 14)

Overheating prevention screen: Displays the setting temperature of overheating prevention device



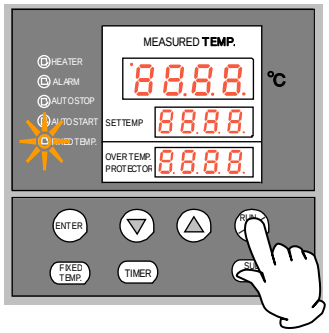
2. Select the operation mode

Press the FIXED TEMP key to display "FIX", which indicates the fixed temperature operation, on the center display screen.



3. Set the temperature

- Press the FIXED TEMP key again.
- The setting temperature screen displays the character "SV" which indicates the temperature setting. Also it displays the current setting temperature with blinking. The FIXED TEMP lamp blinks, too.
- Set the temperature by pressing the "▼▲".



4. Start operation

Press the orange RUN/STOP key for about one second. The unit starts operation and the blinking FIXED TEMP lamp lights on.

5. Stop operation

Press the orange RUN/STOP key for about one second. The unit stops operation and the FIXED TEMP lamp lights off. The screen returns to the initial setting screen.

To correct or check setting…

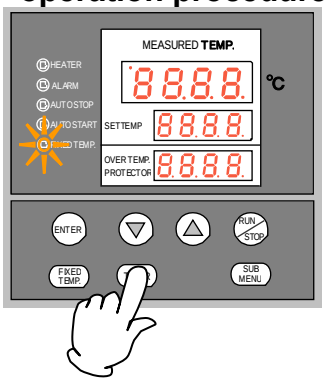
Press the FIXED TEMP key again to correct or check the setting.

Changing the setting temperature during operation is also possible by pressing the FIXED TEMP key.

4. Operation Method

Quick Auto Stop Operation

Quick auto stop operation procedure



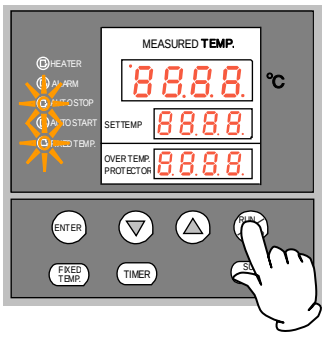
This operation is used to specify the period up to automatic stop, i.e., sets the auto stop timer during operation.

1. Set the time up to stop during fixed temperature operation

- Check that the FIXED TEMP lamp lights on and that the unit is under operation.
- Press the TIMER key.
- The measurement temperature display screen displays the character "tim", which indicates the timer setting. The setting temperature display screen displays the current setting time with blinking.
- Select the time by pressing the "▼▲".

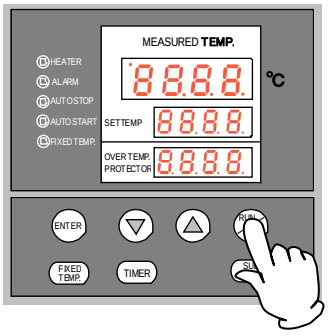
Timer function:

- The maximum setting time is "999hours and 50 minutes ".
- The time can be set in increments of a minute under 99 hours and 59 minutes.
- It can be set in increment of ten minutes over 100 hours.
- The "▼▲"can change the setting time quickly when it is pressed continuously. Press them discontinuously when fine adjustment is needed.



2. Start timer operation

- Press the RUN/STOP key for one second after deciding the time.
- Timer operation starts with the FIXED TEMP and AUTO STOP lamps lighting on.
- The timer is activated at the point when the RUN/STOP key is pressed.



3. Stop/terminate timer operation

- The operation stops automatically at setting time.
- Buzzer continues to sound for about five minutes at operation stop.
- The setting temperature screen displays the character "End", which indicates termination of operation, with the FIXED TEMP and AUTO STOP lamps lighting on. Press the RUN/STOP key to terminate the timer operation mode. The screen returns to the initial setting screen.

Change the set temp. and set time, confirm the set value

If need to change the set temp. during quick auto stop operation, press FIXED TEMP key to enter the setting mode.

If need to change the set time during quick auto stop operation, press TIMER key to enter the setting mode.

① After changing the time, press TIMER.
The remaining time on the timer is the time subtracting the elapsed time.
For example: set timer as 1hr30min, conduct quick auto stop operation, after 20min, change the set time to be 2hr, set it by TIMER, the remaining time is 1hr40min.

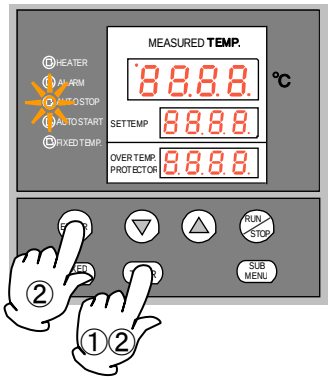
② After changing the time, press START/STOP for 1sec.
The quick auto stop operation proceeds again as per the changed time.
For example: set timer as 1hr30min, conduct quick auto stop operation, after 20min, change the set time to be 2hr, press START/STOP to set, the remaining time is 2hr.

Press ▼ key, switch over to display the set temp., operation mode and remaining time of set temp. displayer.

4. Operation Method

Auto stop operation procedure

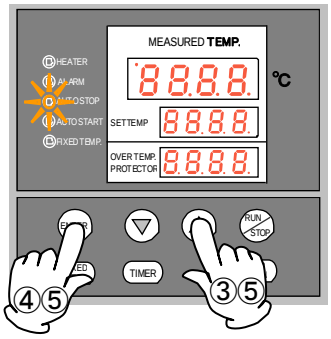
This operation is used to specify the automatic stop time in the fixed temperature operation.



1. Set stop time

① Press the TIMER key on the initial screen.
Press the TIMER key again. The setting temperature display screen displays the character "AstP", which indicates the auto stop operation, with blinking.

② Press the ENTER key.
The measurement temperature screen displays the character "SV", which indicates the temperature setting. The setting temperature screen displays the current setting temperature with blinking. The AUTO STOP lamp blinks, too.



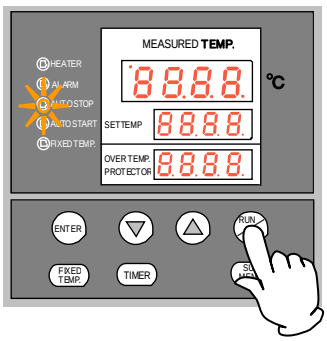
③ Set the temperature using the "▼▲".

④ Press the ENTER key again.
The measurement temperature display screen displays the character "tim", which indicates the timer setting. The setting temperature display screen displays the current setting time with blinking.

⑤ Set the time using the "▼▲".

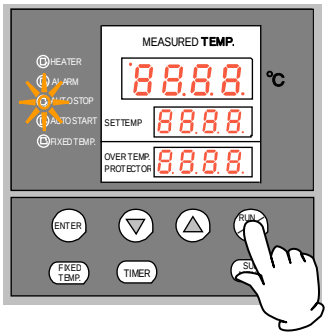
Timer function:

- The maximum setting time is "999hours and 50 minutes ".
- The time can be set in increments of a minute under 99 hours and 59 minutes.
- It can be set in increment of ten minutes over 100 hours.
- The "▼▲"can change the setting time quickly when it is pressed continuously. Press them discontinuously when fine adjustment is needed.



2. Start timer operation

- Press the RUN/STOP key for one second after deciding the time.
- Timer operation starts with the AUTO STOP lamp lighting on.
- The timer is activated at the point when the temperature in furnace (measurement temperature) reaches to the setting temperature.



3. Stop/terminate timer operation

- The operation stops automatically at setting time.
- Buzzer continues to sound for about five minutes at operation stop.
- The setting temperature screen displays the character "End", which indicates termination of operation, with the FIXED TEMP and AUTO STOP lamps lighting on. Press the RUN/STOP key to terminate the timer operation mode. The screen returns to the initial setting screen.

To correct or check setting…

When you want change the set temperature or a set time, press the TIMER key during operation, set temperature and time for the auto stop operation with the ▼▲ keys and press the ENTER key to complete.

Note, however, when you change the set time you need to set a time calculated by adding the time already passed to the time to be added.

Pressing the ▼ key during operation will display the set temperature, the operation mode and the remaining time on the SET TEMP. display.

In terms of the remaining time display 

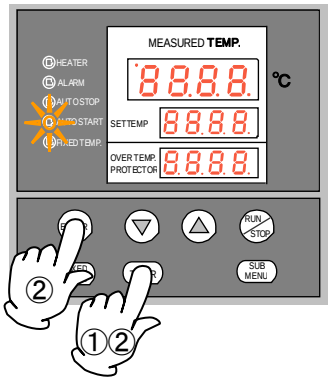
a blinking dot indicates count down and an illuminating dot indicates a wait status (while temperature is increasing or decreasing to the set temperature) during which the timer has stopped counting.

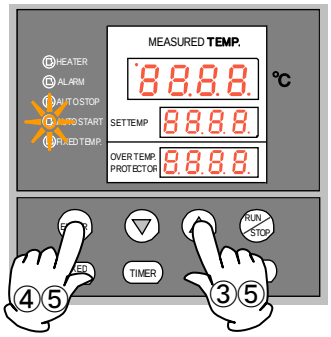
4. Operation Method

Auto Start Operation

Auto start operation procedure

This operation is used to specify the period up to automatic start after power on.





1. Set start time

① Press the TIMER key on the initial screen.
Press the TIMER key again. The setting temperature display screen displays the character "Astr", which indicates the auto start operation, with blinking.

② Press the ENTER key.
The measurement temperature screen displays the character "SV", which indicates the temperature setting. The setting temperature screen displays the current setting temperature with blinking. The AUTO START lamp blinks, too.

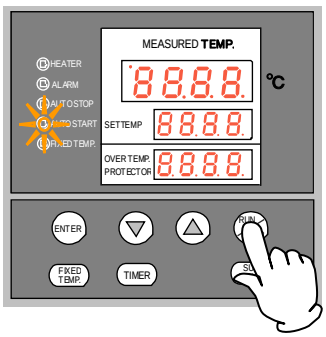
③ Set the temperature using the "▼▲".

④ Press the ENTER key again.
The measurement temperature display screen displays the character "tim", which indicates the timer setting. The setting temperature display screen displays the current setting time with blinking.

⑤ Set the time using the "▼▲".

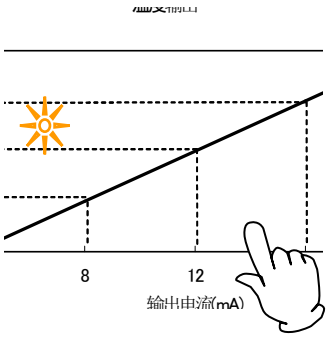
Timer function:

- The maximum setting time is "999 hours and 50 minutes ".
- The time can be set in increments of a minute under 99 hours and 59 minutes.
- It can be set in increment of ten minutes over 100 hours.
- The "▼▲"can change the setting time quickly when it is pressed continuously. Press them discontinuously when fine adjustment is needed.



2. Start timer operation

- Press the RUN/STOP key for one second after deciding the time.
- Timer operation starts with the AUTO START lamp lighting on.



3. Stop/terminate timer operation

- The operation starts automatically at setting time.
- Press the RUN/STOP key for one second to stop or terminate operation. The screen returns to the initial setting screen.

To correct or check setting…

When you want change the set temperature or a set time, press the TIMER key during operation, set temperature and time for the auto start operation with the ▼▲ keys and press the ENTER key to complete.

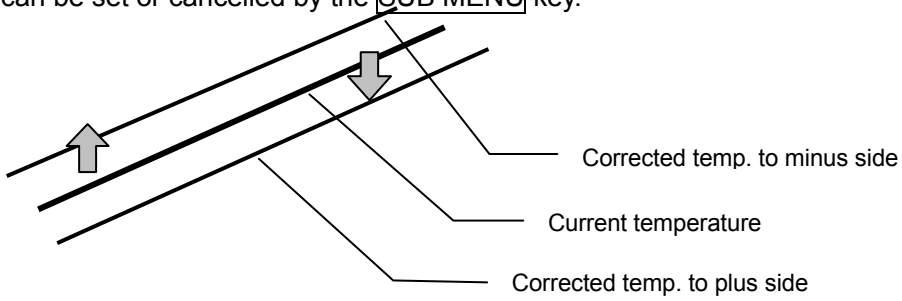
Note, however, when you change the set time you need to set a time calculated by adding the time already passed to the time to be added.

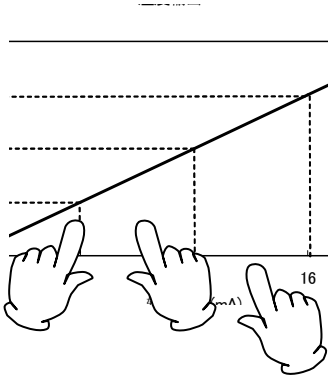
Pressing the ▼ key during operation will display the set temperature, the operation mode and the remaining time on the SET TEMP. display.

When operation has started after the auto start time, you cannot change the set time. In this case, first stop operation with the RUN/STOP key and repeat all settings.

Use calibration offset function

Calibration offset is a function which corrects the difference between the temperature in furnace and that of controller (sensor temperature) if arises. The function parallel corrects the difference either to the plus or minus side within the whole temperature range of unit. The function can be set or cancelled by the SUB MENU key.





① Start operation with the target setting temperature. Check the temperature in furnace (temperature of sample) with a thermograph after it is stabilized.

② Check the difference between the setting temperature and that in furnace (temperature of sample).

③ Press the SUB MENU key. Select the character "cAL", which indicates the calibration offset, using the "▲▼", and then press the ENTER key.

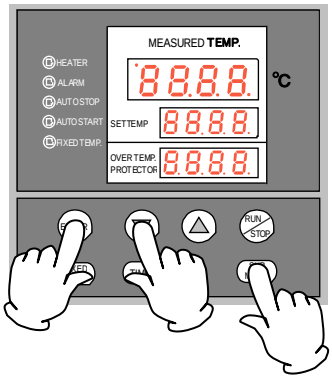
④ Input the difference using the "▲▼" and then press the ENTER key. This completes the setting.

❖ The setting range of offset correction temperature is +99℃ to plus side and -99℃ to minus side respectively.

When it is set to the minus side, the temperature on the measurement temperature display screen falls by the setting temperature, while the temperature on furnace rises.
When it is set to the minus side, the temperature on the measurement temperature display screen rises by the setting temperature, while the temperature on furnace falls.

❖ The unit has two-point correction function, which performs offset between low-temperature zone and high-temperature zone. Please consult our local branch office when carrying out validation of temperature controller.

Use lock function



This function locks the operation status previously set. The function can be set or cancelled by the SUB MENU key.

① Press the SUB MENU key. Select the character" "Lock", which indicates the lock of setting value, using the "▲▼", and then press the ENTER key.

② The setting temperature screen displays "oFF". The setting value is locked when it is turned to "on" using the "▲".

③ Press the SUB MENU key again to cancel the lock. Select the character" "Lock", which indicates the lock of setting value, using the "▲▼", and then press the ENTER key. Select "oFF" with the "▼" and then press the ENTER key to cancel the function.

All keys other than the RUN/STOP and SUB MENU keys are locked when the lock function is on.

Convenience function (temperature output terminal)

Before use

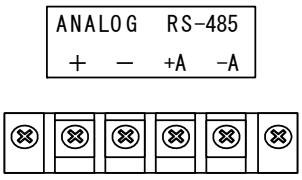
❗	Please operate this unit in accordance with this instruction manual. Violation of the law may result in machine failure. We shall not be liable for any consequences arising from failure to follow this manual.

⚠ Note

❗	1. Be sure to connect the circuit breaker OFF.
	2. On the temperature output terminal, be sure to connect a logger with an input resistance of 610CΩ or less.
	3. Please connect with the screws attached to the terminal block.

Connection points

❗	Please connect well to the terminal you are using.
	When using the temperature output, please use a cross-coiled wire to connect the wire to prevent interference.



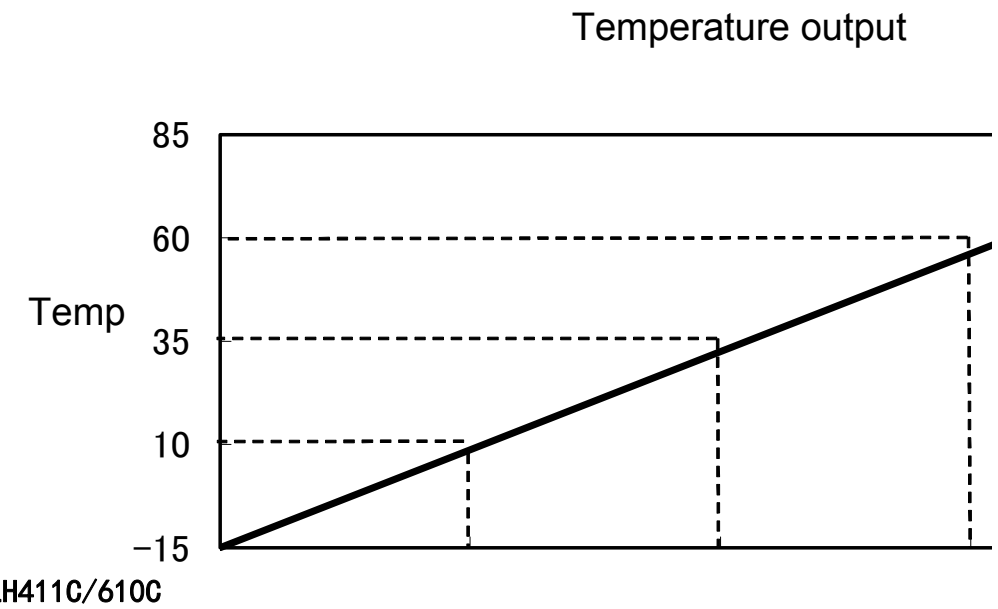
Connect the terminals

Convenience function (temperature output terminal)

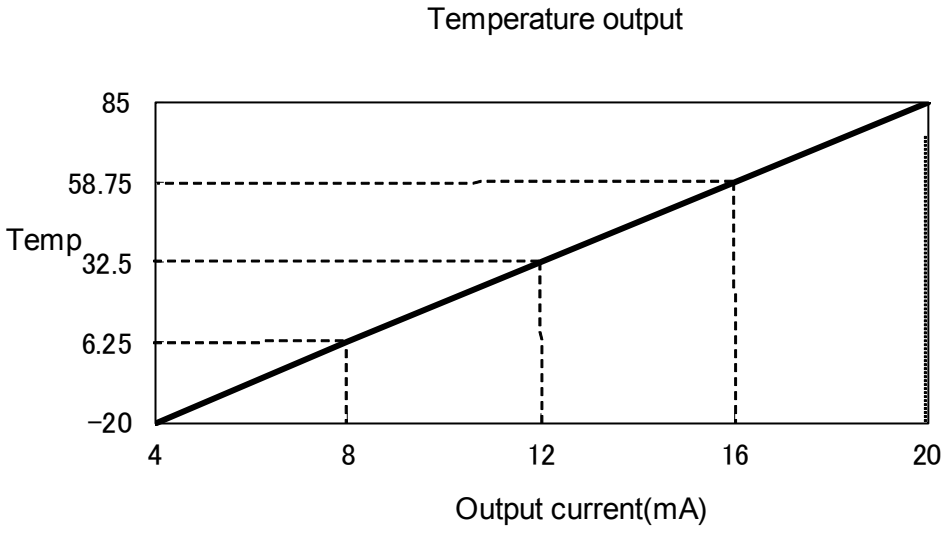
style

Temperature output （ANALOG）	• • Output current (DC) corresponding to the measured temperature • • Output temperature range: CLH312C -15~85°C CLH411C/610C -20～85℃ • • Output current: DC4~20mA • • Load resistance: 600Ω or less • • Accuracy: ±1°C • • Connection: Terminal block with M4 screws

CLH312C



CLH411C/610C



1.Setup about the communication

1.1. Setup of communication

Before doing communication with the VS3/4 controller (It is called controller from now on.), on the personal computer side, you must do the setup of six items on the table below.

	Item	Setup of communication
1	Data length	8 bit
2	Stop bit length	2 bit
3	Parity	not
4	BCC check	does
5	Communication speed	4800BPS
6	Response delay time	0msec

1.2. Communication connection

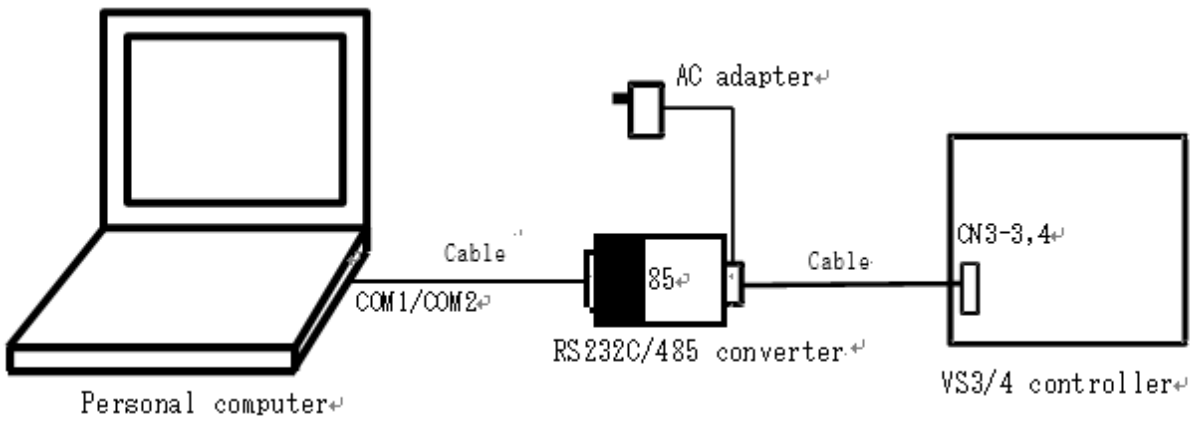
■ personal computer

- One channel (COM1/COM2) uses a RS232C interface.

■ RS232C/RS485 converter

- recommend is KS-485 manufactured by ［SYSTEM SACOM］

■ Communication cable for the connection



Note 1) The standard external [External Communication Adapter (RS485-232C) ODK18] consists of the following.

(1) Communication wire 1: PC side connector (for IBM 9 pin machine wiring) RS-232C wire 1m, KS-485 side connector (Dsub25 pin) (company) system sacom CBL16

(2) Communication wire 2: KS-485 side connector (Dsub9 pin), UL2464TASB 2-core AWG20 wire 3m, device end with Y terminal (with 100Ω termination resistance)

(3) RS-232C⇔KS-485 conversion combination: system sacom KS-485, with AC adapter

2. Data transmission form

Item	Specificatipons
Communication standard.	EIA standard RS-485 conformity
Synchronous form	Start-stop synchronization
Communication form	Half-duplex
Transmission code	ASCII code
Communication speed	1200/2400/4800/9600 BPS
Communication distance	Maximum 500m (But, the distance varies with the cable used and the environmental conditions.)
Network	Multi-drops form (maximum 1 to 31 stations)
Signal line	Two wires of transmission/reception
Stop bit length	1/2bit s
Data length	7/8bit s
Parity	No/odd/even
BCC check	Dose/dose not
Response delay time	~250msec
Communication address	~99stations
Communication mode switching	RO/RW

Note） is the initialization of controller.

3. Transmission control character

Sign	Item	Code	contents
STX	Start of text	02H	To show the start of the text
ETX	End of text	03H	To show the end of the text
R	Read	52H	Read out of the data from the controller
W	Write	57H	Write or store of the data to the controller
ACK	Acknowledge Character	06H	Affirmative response about the receiving
NAK	Negative Acknowledge	15H	Negative response about the receiving

Note) R: Read (The command of read out setup, measurement and conditions etc.) W: Write (The command of write or store the setup value)

R command can always communicate in all mode.

W command can usually communicate only in the standby mode, and the parameter which communication can be set up to by the operation condition varies in the W command. Refer to "7.Identifier/command list".

4.Transmission control process

4.1.Communication process

Controller returns "an Response message" toward "the request message" from the host computer.

Therefore, transmission is never started from controller.

Controller doesn't do communication for about four seconds power supply injection. (no Response)

Set up delay before you start communication after the power supply injectio

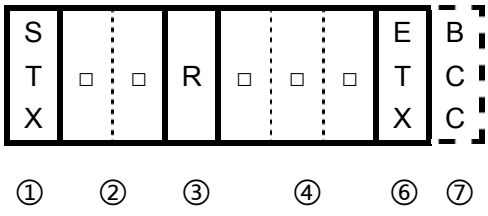
4.2. The kind of the message

The kind of the message is separated from the request message transmitted by host computer, and the Response message transmitted by controller.

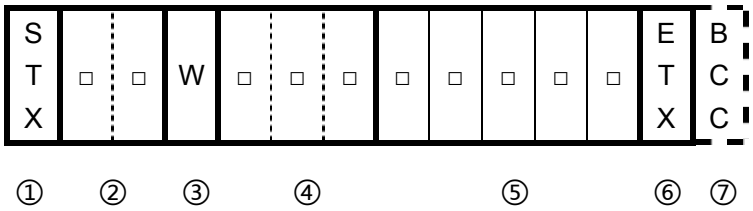
All the codes (except BCC) from STX to ETX include data etc. are shown in ASCII code.

4.3. Configuration of request messages (Transmission from the host computer to controller)

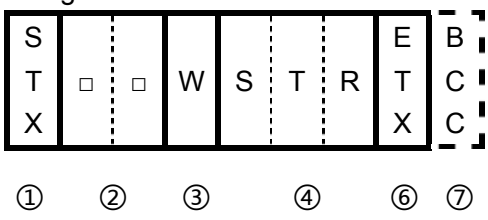
4.3.1. Configuration of request message for readout



4.3.2 Configuration of request message for writie



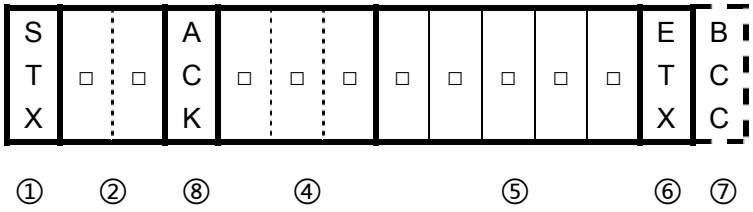
4.3.3 Configuration of request message for store



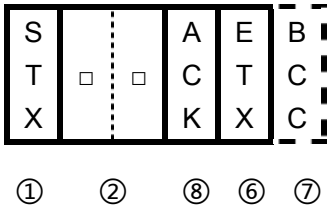
①Start code
②Address
③Request
④Identifier
⑤Numeric data
⑥End code
⑦BCC code

4.4 Configuration of Response message

4.4.1. Response message to request message for readout

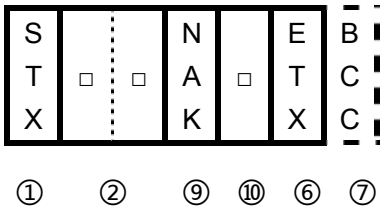


4.4.2 Response message to request message for write/store



①Start code
②Address
④Identifier
⑤Numeric data
⑥End code
⑦BCC code
⑧Affirmative acknowledge
⑨Negative acknowledge
⑩Form of error

4.4.3 Response message for error



4.5.Description of code

■ The code from "STX" to "the error kind" that it is expressed to the following is shown with the ASCII code.

■ Refer to "8.ASCII code list" for the ASCII

■ Refer to "5. communication example" for the change to the ASCII code.

① STX

A receiving side is a necessary code to detect the head of the message. It is put at the head of a character line to transmit.

② Address

It is the address of the controller with which the host computer communicates.The address in the Response message from controller indicates the source of the response message transmitted.

③ Requests

Put code R or W.

R : Readout of the data from the controller W: Write or store of data into the controller.

④ Identifier

It is shown with the classified sign (Identifier) for the data which is read out, or written in with 3-alphabetic character made of the ASCII code. (Refer to "7.Identifier/command list".）

⑤ Numeric data

All the data regardless of read out or written in are shown in 5-digit figures.

■ Minus data : Code "-" is on MSD(most significant digit).

■ The position of the decimal point : A decimal point isn't contained in 5-digit data.

Example) 5-digit numeric data 00101 is as mentioned on the table below.

Example		the meaning of the numeric data
Set temperature （SV1）	K thermocouple sensor	→ 101℃
	Pt100Ω sensor	→ 10.1℃
Set time（TIM）		→ 1hour 1minute

⑥ ETX

A receiving side is a necessary code to detect the end of the message. It is put at the end of a character line to transmit. (except BCC)

⑦ BCC

(EX-OR) of the exclusive logic of all the characters from STX to ETX in total is taken with the check code for the mistake detection.。This code (BCC) isn't included into the Response message when a BCC check is set up in no by the setup of the communication of controller.

⑧ ACK

This is the code for affirmative acknowledge.
When there is no error in the message that it was received, this code is incorporated in "the Response message" transmitted by the controller.

⑨ NAK

This is the code for negative acknowledge
When there is an error in "the request message" that it was received, this code is incorporated in "the Response message" transmitted by the controller.

⑩ Error

When there is an error in "the request message" that it was received,the form of the error is incorporated following “⑨ NAK” in the “Response message” transmitted from the controller. This error is an error about the communication, and it is omitted as for the details of the indication.
After the host computer transmits BCC, and it haven’t receied the STX that transmitted in the fixed Response waiting time by the controller.It is shown a receiving Time-out.

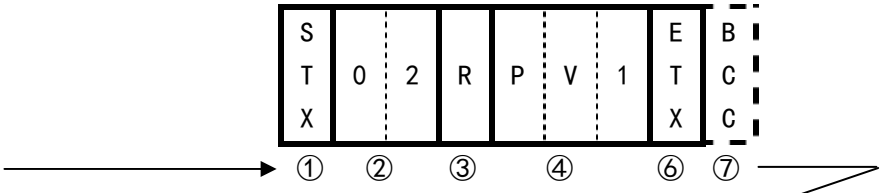
5. Communication example

5.1. An example of communication for readout

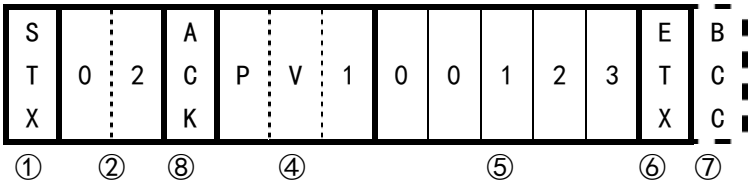
Example) Request message : Readout of PV is requested to the controller which is set ataddress 02.

Response message : The data (00123) of PV are sent back.

Request message for readout (Transmitted by the host computer.)



Response message (Transmitted by the controller.)



Code		Sign・Data	ASCII code note2)
Start code		STX	02H
Address		02	30H 32H
Request		R	52H
Identifier note 1)		PV1	50H 56H 31H
Numeric data		00123	30H 30H 31H 32H 33H
End code		ETX	03H
⑦ BCC data	Request		66H
	Response		02H
⑧Affirmative code		ACK	06H

Note 1)：Refer to “7.Identifier / Command list”

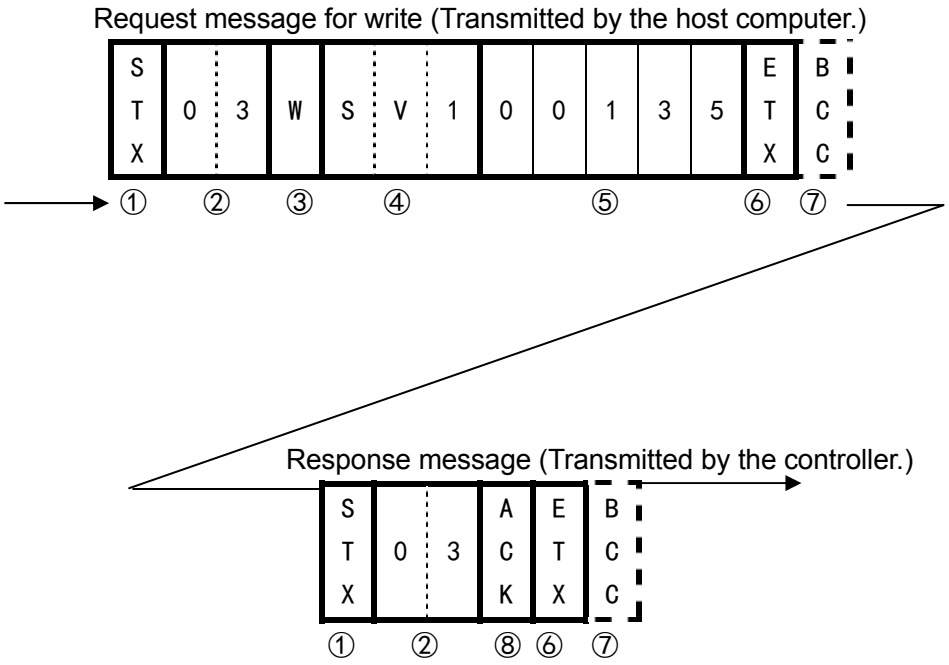
Note 2)：Refer to “8.ASCII code list” for the ASCII code.

5.2 An example of communication for write

Example) Request message : “Set SV1 to 135” is written into the controller which is set at address 03.

Response message : Response message is sent back confirming that the request message has been received.

☆ Readout data to confirm that it was written correctly.



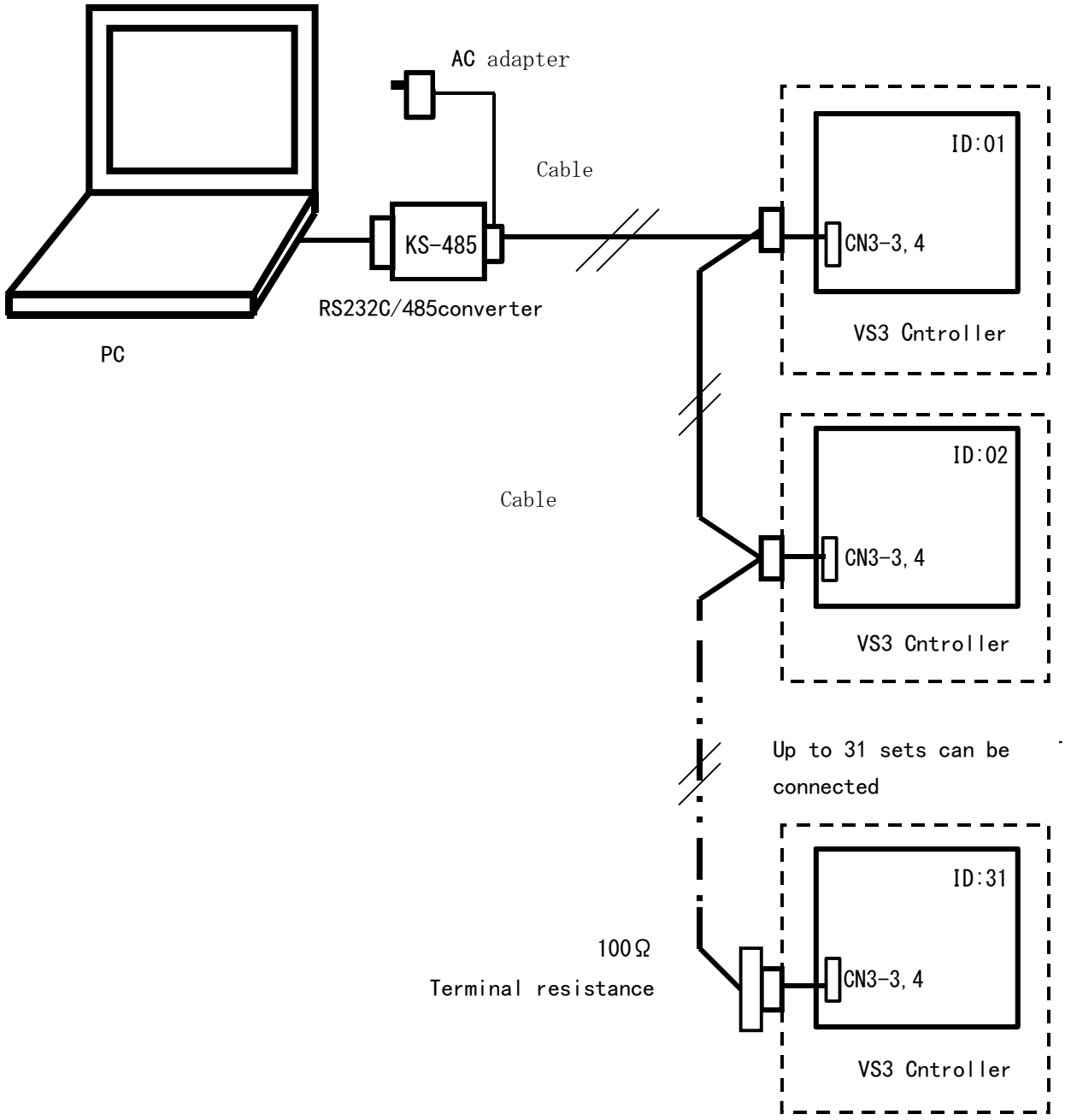
Code		Sign・data	ASCII code note2)
①Start code		STX	02H
②Address		03	30H 33H
③Request		W	57H
④Identifier note 1)		SV1	53H 56H 31H
⑤Numeric data		00135	30H 30H 31H 33H 35H
⑥End code		ETX	03H
⑦ BCC data	Request		56H
	Response		04H
⑧Affirmative code		ACK	06H

Note 1)： Refer to "7.Identifier/command list".

Note 2)： Refer to "8.ASCII code list" for the ASCII code.

6. Communication Wiring Diagram

Multi-drops communication wiring diagram as follows



It should be provide a terminal resistor both on Host computer side and the farthest controller side. Use a resistor whose resistance value matches with the characteristic impedance of the cable, but the total resistance must be greater than 75 ohms.

7.Identifier/command list

<About the Identifier and the setup value>

*1 ： This parameter only use for the VS-4 controller.

*2 ： A unit can't be set up for 1 minute that the time is more than 100 hours.

*3 ： _ means the space.

*4 ： A setup range varies with other parameter. (Refer to the table below.)

*5 ： Program No.2 pattern No.2: The Identifier of step 1 to 15 is "x16 to x30" Program No.3 pattern No.2: The Identifier of step 1 to 10 is "x11 to x20" Program No.3 pattern No.3: The Identifier of step 1 to 10 is "x21 to x30"

*6 ： It is parameter which “W” command is effective during operation mode.

Fixed value operation mode

Item	Identifier	Comm and	Setup value
Temperature Setting value	SV1	R/W	SLL～SLH：℃ setting value between low and high limit

Store command

Item	Identifier	Comm and	Setup value
Setup value memory	STR	W	NO (It is a necessary order to memorize the setup value of the temperature, time etc..)

Others parameter

Item	Identifier	Comm and	Setup value
Key lock	LOC	R/W	00000 : key lock release 00001 : key lock
Operation start/stop	RUN	R/W	00000 : stop *6 00001 : start
Operation kind choice	RST	R/W	00000 : fixed value operation *6 00002 : program operation
Step No. monitor	_TI	R	00000 : program stop *3 00001～00030 : step1～step30
Operation step the rest time monitor	OM1	R	00000 : timeup *3 00001～99950 : 000 hour 01 minute～999 hour 50 minutes
Output. monitor	ER1	R	00000 : digit-1＝heater output digit-2＝freezing machine output digit-3＝main output digit-4＝timeup output or alarm output digit-5＝overheat prevention2 output ＊output condition 0=Output Off 1= Output On
Error monitor 1	ER2	R	00000 : digit-1＝memory error digit-2＝sensor error digit-3＝AT error digit-4＝heater breakage error digit-5＝SSR short error ＊Error condition 0＝no error 1＝error.
Error monitor 2	PV1	R	00000 : digit-1＝water tank is empty digit-2 ＝ overheat prevention1 error digit-3 ＝ overheat prevention2 error digit-4＝inside CPU communication / temperature input circuit error digit-5＝no use ＊error condition 0＝no error 1＝error

8. ASCII code list

ASCII code	02H	03H	06H	15H						
Use sign	STX	ETX	ACK	NAK						

ASCII code	30H	31H	32H	33H	34H	35H	36H	37H	38H	39H
Use number	0	1	2	3	4	5	6	7	8	9

ASCII code	2DH	20H								
Use character	— minus	SP Space								

ASCII code	41H	42H	43H	44H	45H	46H	47H	48H	49H	4AH
Use character	A	B	C	D	E	F	G	H	I	J

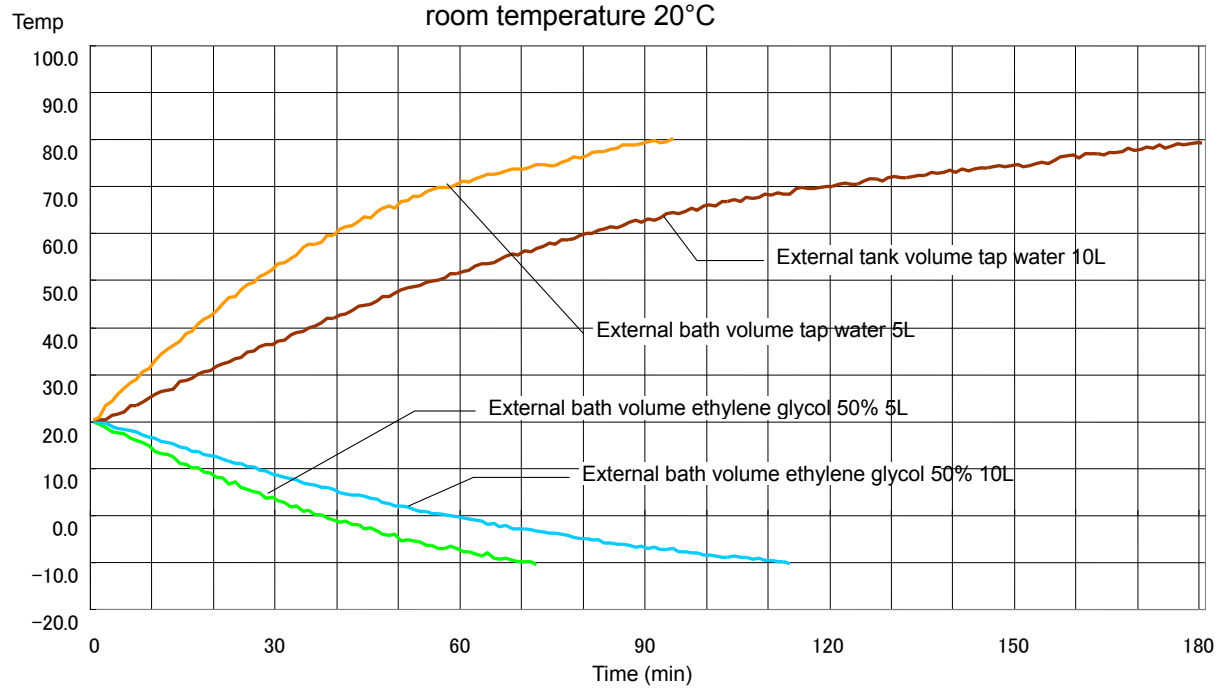
ASCII code	4BH	4CH	4DH	4EH	4FH	50H	51H	52H	53H	54H
Use character	K	L	M	N	O	P	Q	R	S	T

ASCII code	55H	56H	57H	58H	59H	5AH	20H			
Use character	U	V	W	X	Y	Z	SP Space			

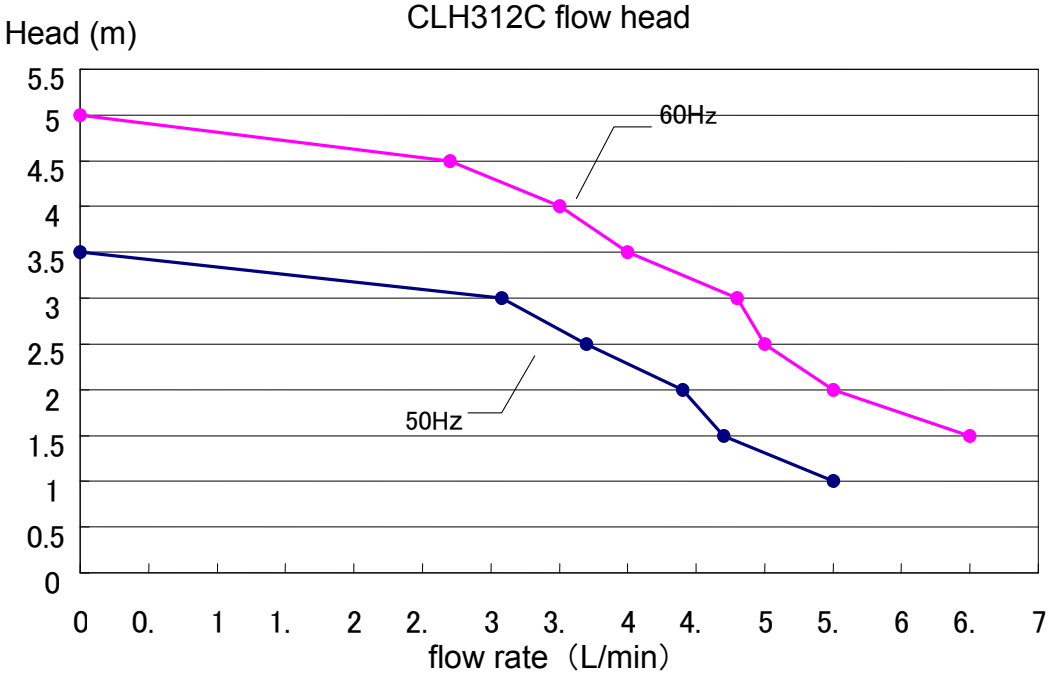
Cooling curve / cooling capacity curve (reference data)

⚠ The following chart shows the cooling curve and cooling capacity curve for each model. However, it varies depending on the sample and ambient temperature, so this graph is for reference only.

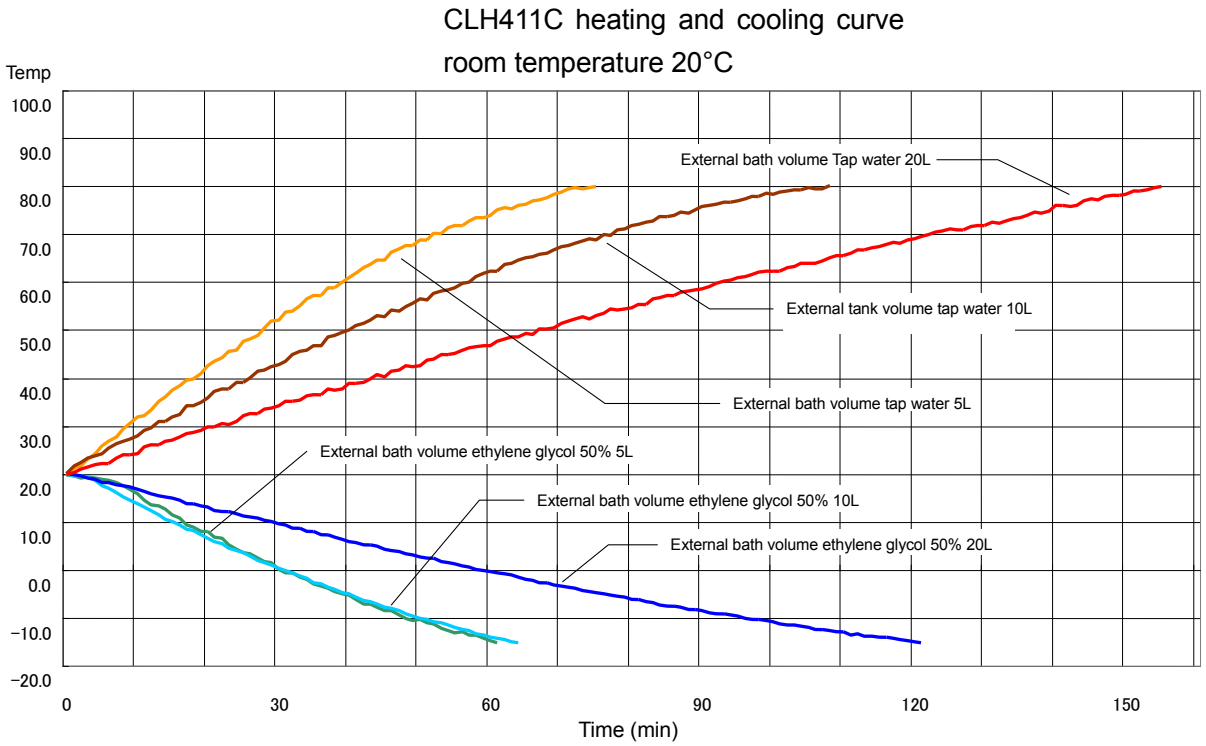
CLH312C heating and cooling curve
room temperature 20°C

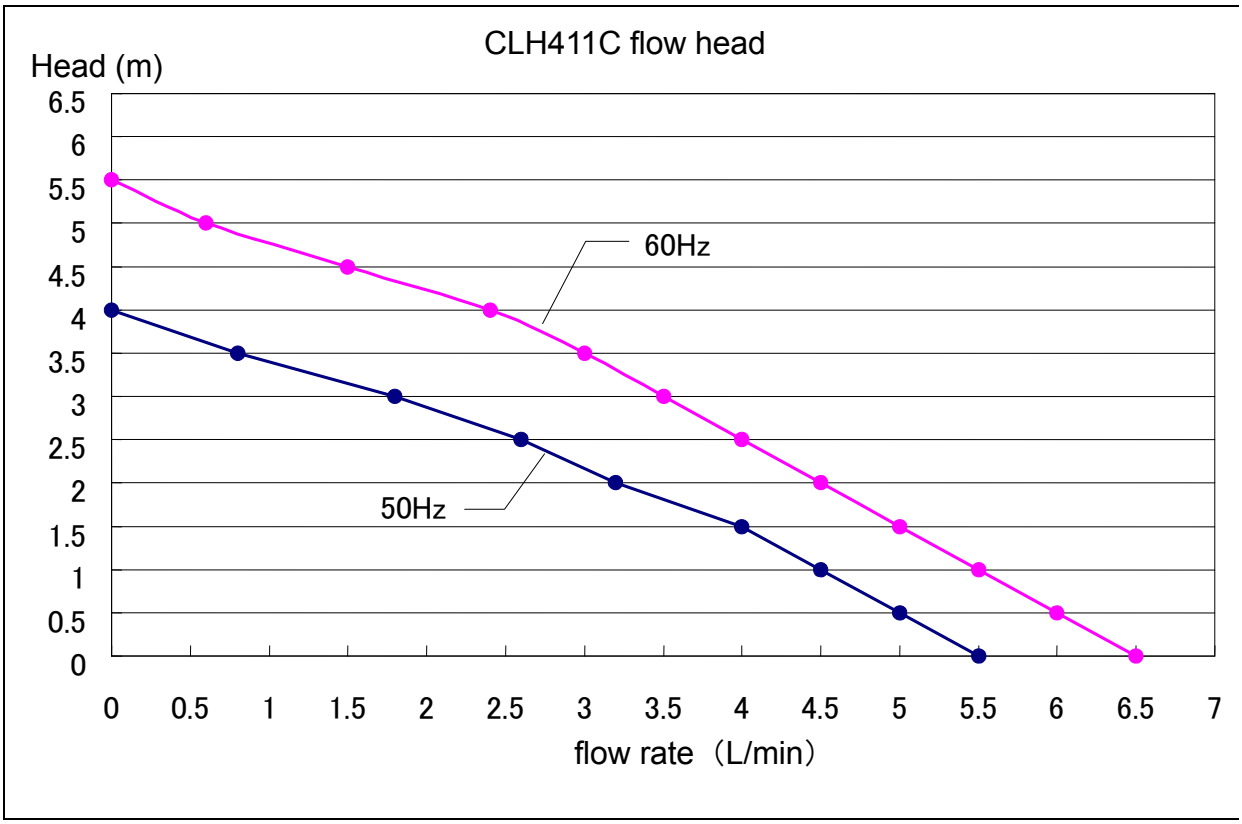


CLH312C flow head

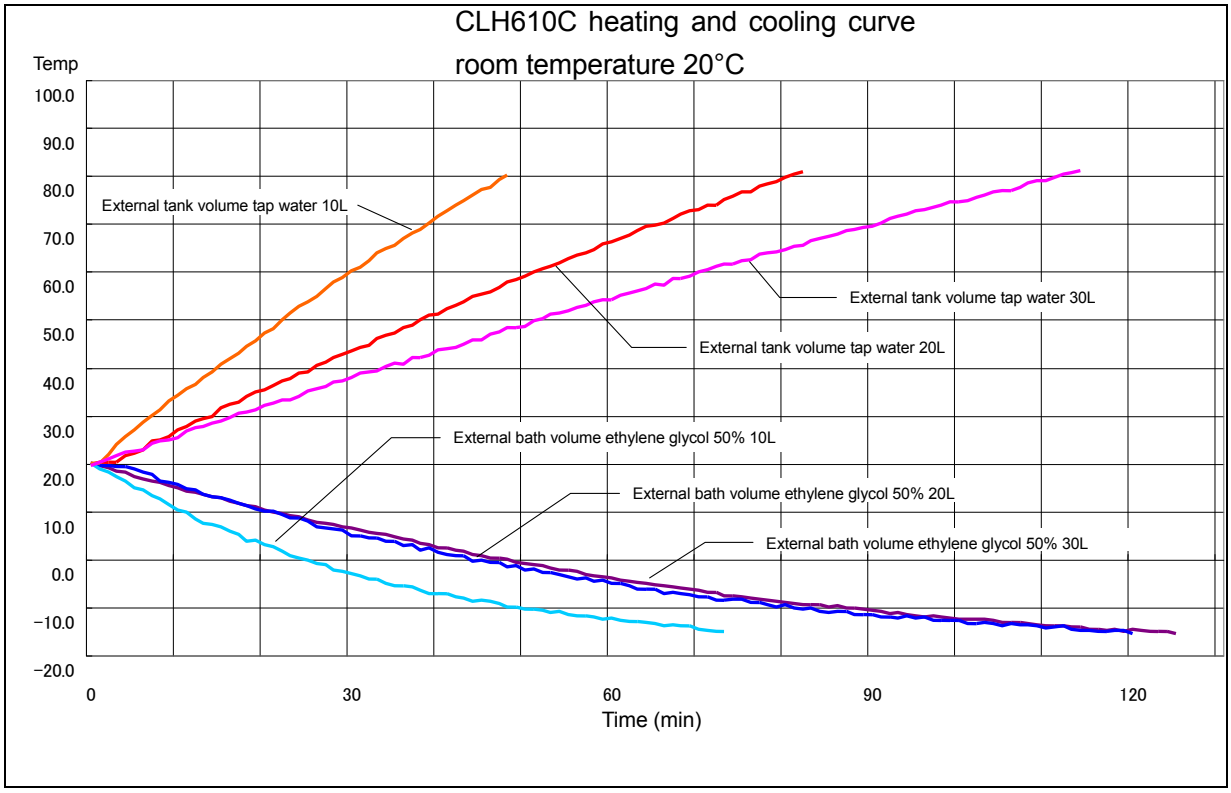


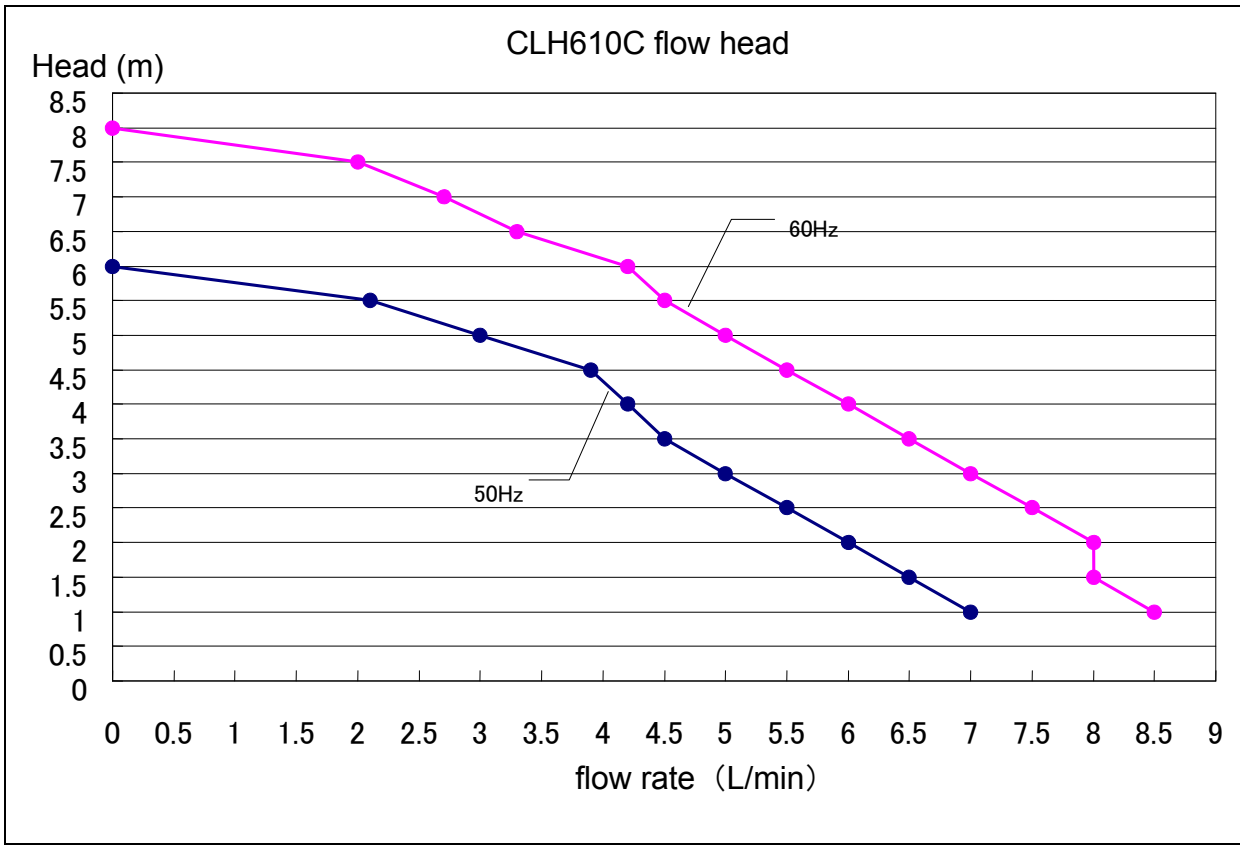
Cooling curve / cooling capacity curve (reference data)



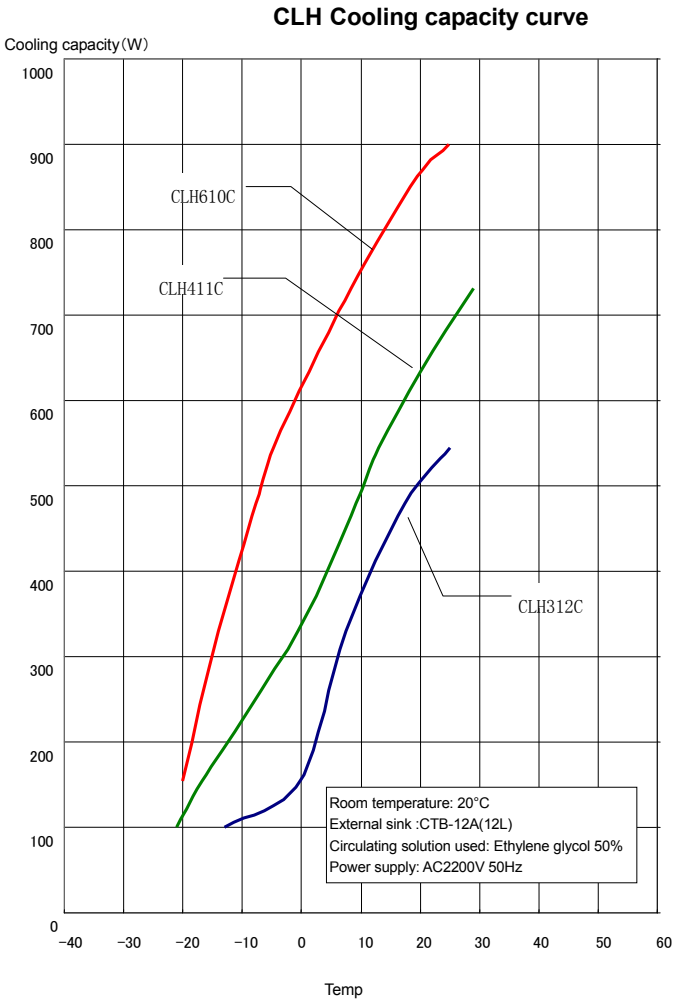


Cooling curve / cooling capacity curve (reference data)



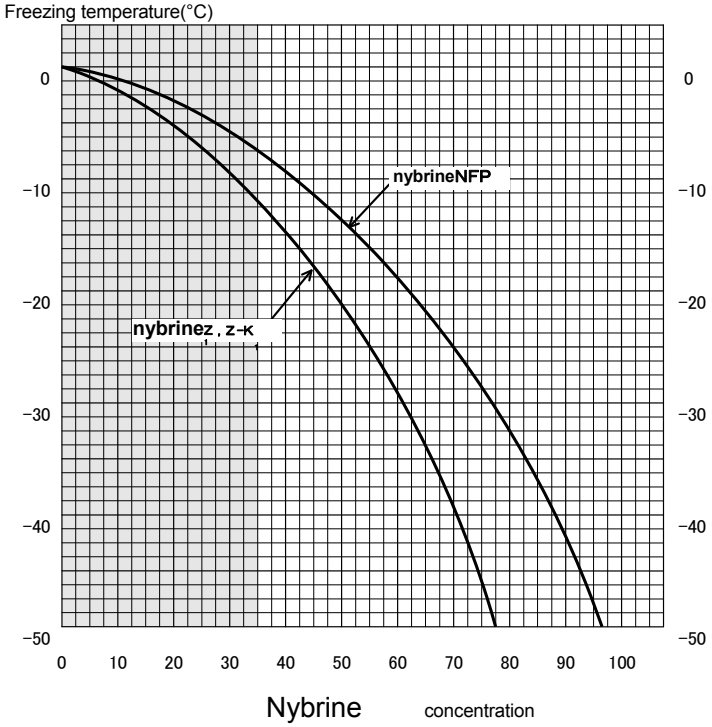


Cooling curve / cooling capacity curve (reference data)

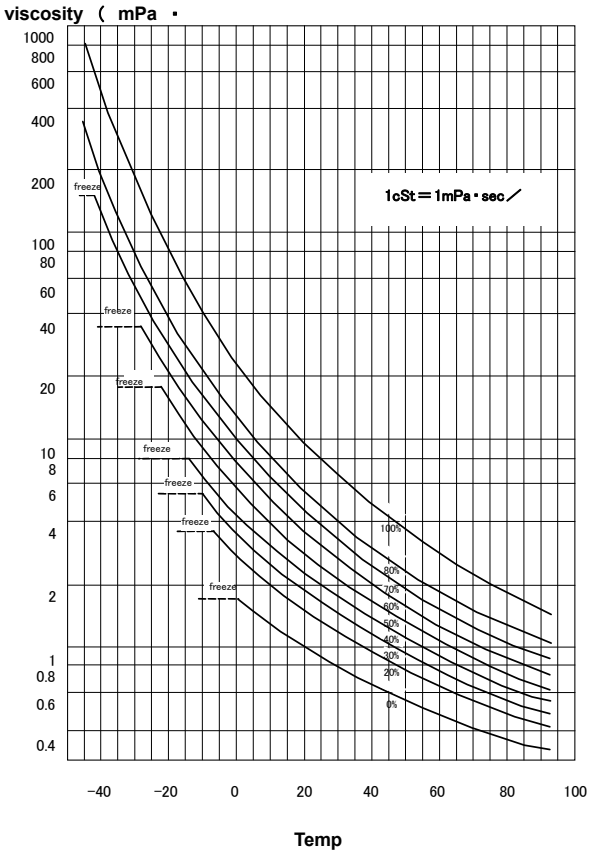


Nybrine freezing temperature and viscosity (reference data)

nybrine $_1$, Z_1–K and the freezing temperature of nybrine NFP



nybrineZ $_1$, Z_1–K , RH Aqueous solution



5. Handling Precautions

⚠ Warning

1. Substances that cannot be used

Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit. Explosion or fire may occur. (Refer to page 61 "13. List of Dangerous Substances".)

2. If a problem occurs

If smoke or strange odor should come out of this unit for some reason, turn off the power key right away, and then turn off the circuit breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result. Never perform repair work yourself, since it is dangerous and not recommended.

⚠ Caution

1. Do not sit on this unit

Do not sit on this unit. It will cause injury if this unit falls down or breaks.

2. Do not put anything on this unit

Do not put anything on this unit. It will cause injury if fall.

3. During a thunder storm

During a thunderstorm, turn off the power key immediately, then turn off the circuit breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

4. Please rinse thoroughly

Although this device has been rinsed thoroughly beforehand, when using it first time or not using for a long time, please rinse thoroughly.

5. About the circulating fluid used in the external sink.

For external sink circulation, please use an aqueous solution of glycol 50% (Vol%) or nybrine concentration 40% (Vol%).

6. Supplementation of ethylene glycol and nybrine.

When ethylene glycol or nybrine is used, its concentration gradually decreases. If it continues to operate in this state, ethylene glycol, nybrine will freeze or the viscosity will become high, causing the circulation pump to be abnormal.

In addition, if ethylene glycol or nybrine drips onto the operation panel, please wipe it clean to avoid leakage or electric shock.

5. Handling Precautions

⚠ **Caution**

7. At night or not use for a long time

⚠ If at night or not use for a long time, please turn the ELB to OFF.

8. About circulation pump protection.

⃠ ⚠ ・Idling of the circulating pump is absolutely prohibited. This can cause the circulation pump to fail.

・Foreign matter entering the tank may cause damage to the circulation pump.

・If a solenoid valve or regulating valve is installed on the circulation path, do not close or tighten the valve too tightly for the protection of the circulation pump.

・Ensure that the flow rate of the circulating liquid is 1.5L/min or more.

9. Recovering after power failure

⚠ When power is supplied after a power failure, the device automatically starts operation again with the same state as just before the power failure.

10. About the abnormal pressure of the freezer.

⚠ When running the freezer in the high temperature range, the freezer overload relay protection circuit action may occur, causing the freezer pressure abnormal indicator light to light up and the freezer to stop.
When replacing liquids, etc., please perform heat load reduction treatment.

6. Maintenance Method

Daily Inspection and Maintenance

In order to ensure the stable use of the product, please carry out daily inspection.
The use of tap water supplied by the city will produce a large amount of scale in this device, please use this as the main maintenance inspection.

⚠ Warning

- Be sure to pull out the power cord except under special circumstances before trying to do inspection and maintenance works.
- Start these works after the device has returned to the normal temperature.
- Never try to disassemble the unit.

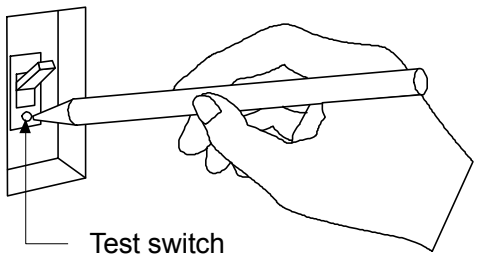
⚠ Caution

- Wipe off the dirt on resin parts or operation panel with a tightly wrung soft cloth. Never clean the unit with gasoline, banana oil or detergent, otherwise it may result in deformation, deterioration or discolor.

Every month

●Please inspect the ELB performance regularly.

- Power on to test
- Firstly, turn ELB on
- Then, use a tip (like pencil tip) to press the test switch of ELB. If ELB breaks off, it's normal.



Maintenance of sinks

Please remove foreign objects from the external sink frequently, if left unattended, the circulation pump will fail.

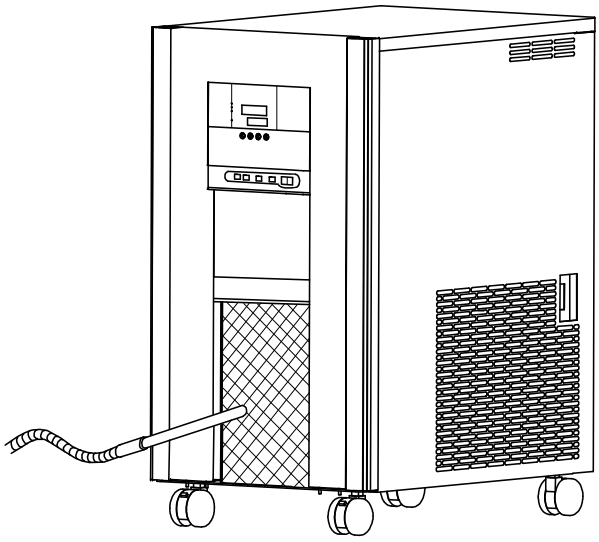
Hose exchange

For more stable use of this product, replace the hose every two years.
Please consult Yamato Science when replacing.

Maintenance of filters

The mesh filter plate is fixed with a magnet, please pull outward。

There are screws on the bottom of the mesh filter plate, please pull it up and remove it.



The filter cover is fixed with a magnet, and after removal, it is washed with water or vacuum the dust to remove it. Please pay attention to the condensing fan deep in the filter, do not touch it empty-handed, to avoid injury.

After cleaning, install them in reverse order.

◆If you have any questions, please contact the sales store, our sales office, or customer service center immediately.

7. Long storage and disposal

When not using this unit for long term / When disposing

⚠ Caution	⚠ Warning
When not using this unit for long term ● Turn off the power and disconnect the power cord.	When disposing • Keep out of reach of children. • Remove the door and driving parts. • Treat as large trash.

Disposal Notice

Environmental protection should be considered

We request you to disassemble this unit as possible and recycle the reusable parts considering to the environmental protection. The feature components of this unit and materials used are listed below.

Main Component Name	Material
Main Components of Exterior	
Exterior	Iron steel plate
Interior	Stainless steel SUS304
nameplate	PET resin film
Pillar	Aluminium
Decorative rubber, rubber plate	Chloroprene rubber
Main Electrical Parts	
Switch, relay	Resin, copper and other compound
Board	Glass fiber and other compound
Heating pipe	Copper
Power cord	Compound like Synthetic rubber, copper, nickel, etc.
Main piping components	
Hose	Ethylene propylene rubber
Water exhaust hose	PVC resin
Hose clamp	66 nylon
Drainage cap	POM

8. In the Event of Failure

Safety Device and Error Code

This unit has an automatic diagnosis function built in the controller and safety devices independent of the controller. The table below shows the cause and the solution method when the safety device operates.

Error Code

When an abnormal condition occurs, an error code appears and the alarm lamp lights in the controller, the buzzer sounds simultaneously. Record the error code and turn off the power of device immediately.

Safety Device	Notify	Cause/Solution
Sensor trouble detection	"**ALARM**" lamp lights on, "**Er.01**" appears	• Temperature sensor is broken or disconnected. • Make a call for service.
SSR short-circuit detection	"**ALARM**" lamp lights on, "**Er.02**" appears	• Triac is in short-circuit • Make a call for service.
Heater disconnecting detection	"**ALARM**" lamp lights on, "**Er.03**" appears	• Heater is disconnected. • Make a call for service.
Memory error	"**ALARM**" lamp lights on, "**Er.15**" appears	• Failure in internal memory. • Make a call for service.
Internal communication error	"**ALARM**" lamp lights on, "**Er.17**" appears	• Failure in internal communication or temperature inputting circuit. • Make a call for service.
Overheating	"**ALARM**" lamp lights on, "**Er.19**" appears	• Overheating prevention device is in operation. • Reset the power supply, and then adjust the setting temperature of the overheating protection device. • If the state does not recover, make a call for service.
Traffic abnormalities	"**ALARM**" lamp lights on, "**Er.20**" appears	• The circulating liquid is not circulating normally • The air in the circulation line is not extracted•Make a call for service.
Measurement temperature error	"**ALARM**" lamp lights on, "**----**" appears	• Measurement value is out of display range. • Make a call for service.
The freezer pressure is abnormal	The freezer pressure abnormality indicator light is on	• The condensation filter is dirty • Room temperature becomes high • The temperature of the circulating liquid is above 40 °C • Make a call for service.

8. In the Event of Failure

Trouble Shooting

If any of the symptoms below occurs:

symptom	Please confirm
Turning the ELB to on will not activate the unit.	●If the power cord is connected to the power supply securely. ●If power outage is not occurring.
The alarm light is on	●Whether the external sink is filled with circulating liquid.
The temperature does not drop	●Whether the set value is higher than the temperature in the tank ●Whether there is dust adhering to the condenser filter
The circulation pump has an abnormal sound	●Whether the air has not entered the circulation pump. Temporarily disconnect the power supply, open the extraction valve on the back of the unit to exhaust air.
Circulating water does not circulate	●Please check whether the connection direction of the heat-saving hose attached to the pilot pump is correct.（Refer to Page 9 「Please connect the hose」） ●Whether the amount of water in the external sink is sufficient. ●The number of pilot pump actions increases, please implement it again.
The freezer pressure abnormality indicator light is on	●Whether the condenser filter in the lower part of the front and bottom of the body is dirty. ● Whether the room temperature is too high. ●Whether the liquid temperature is above 40 °C.
Displayed temperature differs from the measurement.	●If the calibration offset setting is not other than “0”. Set it to “0.” Confirm settings in “Other Functions” on page 26.

After a power outage

If during operation, when the operation of the machine stops due to a power outage and the power supply is restored, the machine will return to the state before the power failure and continue to operate.
If the automatic recovery is not ideal, turn off the leakage protection switch.

- In the case if the error other than listed above occurred, turn off the power switch and primary power source immediately. Contact the shop of your purchase or Yamato Scientific Chongqing.

9. After Service and Warranty

When requesting a repair

If any trouble occurs, immediately stop operation, turn the ELB off, pull out the power plug and contact your dealer or our sales office.

Information necessary for requesting a repair

◆Model name of the product
◆Serial number
◆Date (y/m/d) of purchase

} Confirm on the warranty card or the nameplate installed on the unit.

◆Description of trouble （as in detail as possible）

Be sure to indicate the warranty card to our service representative.

Warranty card (attached separately)

- Warranty card is given by your dealer or one of our sales offices and please fill in your dealer, date of purchase and other information and store securely.
- Warranty period is one full year from the date of purchase. Repair service for free is available according to the conditions written on the warranty card.
- For repairs after the warranty period consult your dealer or one of our sales offices. Paid repair service is available on your request when the product's functionality can be maintained by repair.

Minimum holding period of repair parts

The minimum holding period of repair parts for this product is seven years after end of production. Repair parts here refer to parts necessary for maintaining performance of the product.

10. Specification

Model		Cooling Water Circulating Device		
System		CLH312C	CLH411C	CLH610C
circulatory system		The outer open system loops		
Ambient temperature range		5℃～30℃		
Performance ※	temperature control range	-10℃～80℃	-15℃～80℃	
	Temperature adjustment accuracy	±0.1℃		
	Cooling capacity	about 450W at15℃	about 570W at15℃	about 820W at15℃
	Maximum pump flow（50/60Hz）	10.0/11.0L/min		15.0/17.0L/min
	Maximum pump head（50/60Hz）	4.9/6.9m		8/11m
constitute	Inner groove	Stainless steel groove SUS304		
	Temperature control	PID control		
	sensor	Temperature regulator: Pt thermal resistance, overtemperature protection: K type thermocouple		
	Temperature setting and display method	Digital setting and digital display		
	Over-rise preventer setting method	Digital settings		
	Overrise preventer sensor	K thermocouple (Pt100Ω and W sensors)		
	heater	Stainless steel heating tubes		
		900W	900W	1500W
	refrigerator	Air cooled 200W	Air cooled 350W	Air cooled 600W
	Refrigerant and refrigerant dose	HFC R404A 220g	HFC R404A 380g	HFC R404A 350g
	Cooling pipes	copper		
	External circulation nozzle caliber	Water outlet, water return outlet Outer diameter 13mm hose connection		
	Circulating pumps	Magnetic pump		
		20W		45W
	timer	1 minute ~ 99 hours 59 minutes - 999 hours 50 minutes, digital setting Auto start, fast auto stop, auto stop		
Security features		Self-diagnostic functions (sensor abnormalities, heater disconnection, SSR short circuit, automatic overrise prevention) Overcurrent leakage protection, freezer overload relay protection circuit, Pump overheating protection, delay timing structure for freezer protection, Freezer pressure detection, circuit for circulating pump protection, over-rise preventer, Dust filter for capacitors		
Other features		Run display, drain plug, temperature output terminal, RS485 communication function		

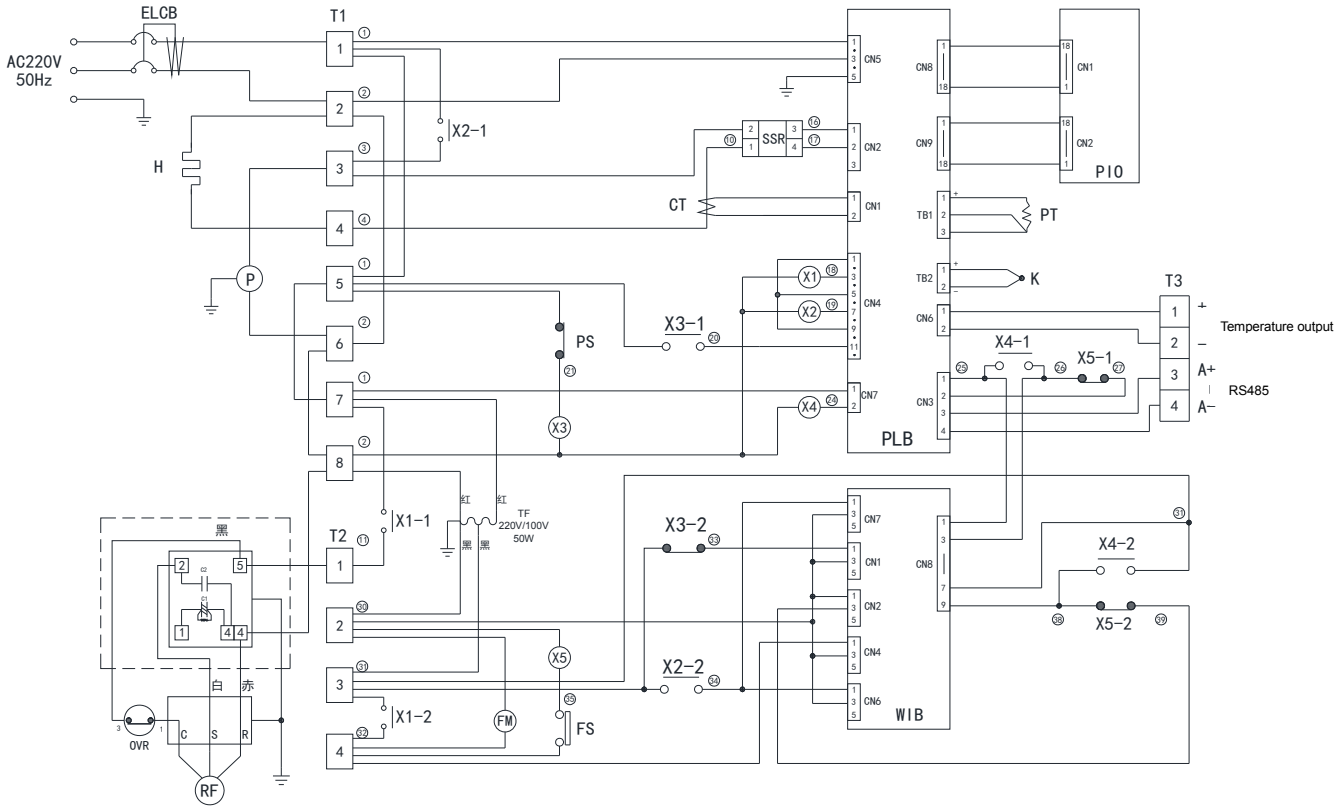
specification	Sink size (Inner diameter× height mm)	φ120×200	φ150×200	φ150×200
	Form factor (W× depth×H mm)	410×460×550	380×513×725	380×615×725
	Inner groove volume	1.5L	3L	
	power supply （50/60Hz）	220V		
		6A	7.5A	11A
	weight	about 40 kg	about 45 kg	about 60 kg
accessory		1m 1 heat insulation hose, 1 heat insulation hose with water pilot pump, Drain hose 0.5m 1pcs, hoop 4pcs, 1 manual, 1 warranty		

※ When the set temperature is above 40.1°C, the freezer stops for the protection of the freezer circuit.

Therefore, when the set temperature is 40.1 °C ~ 80 °C, the freezer cannot be cooled.

11. Wiring Diagram

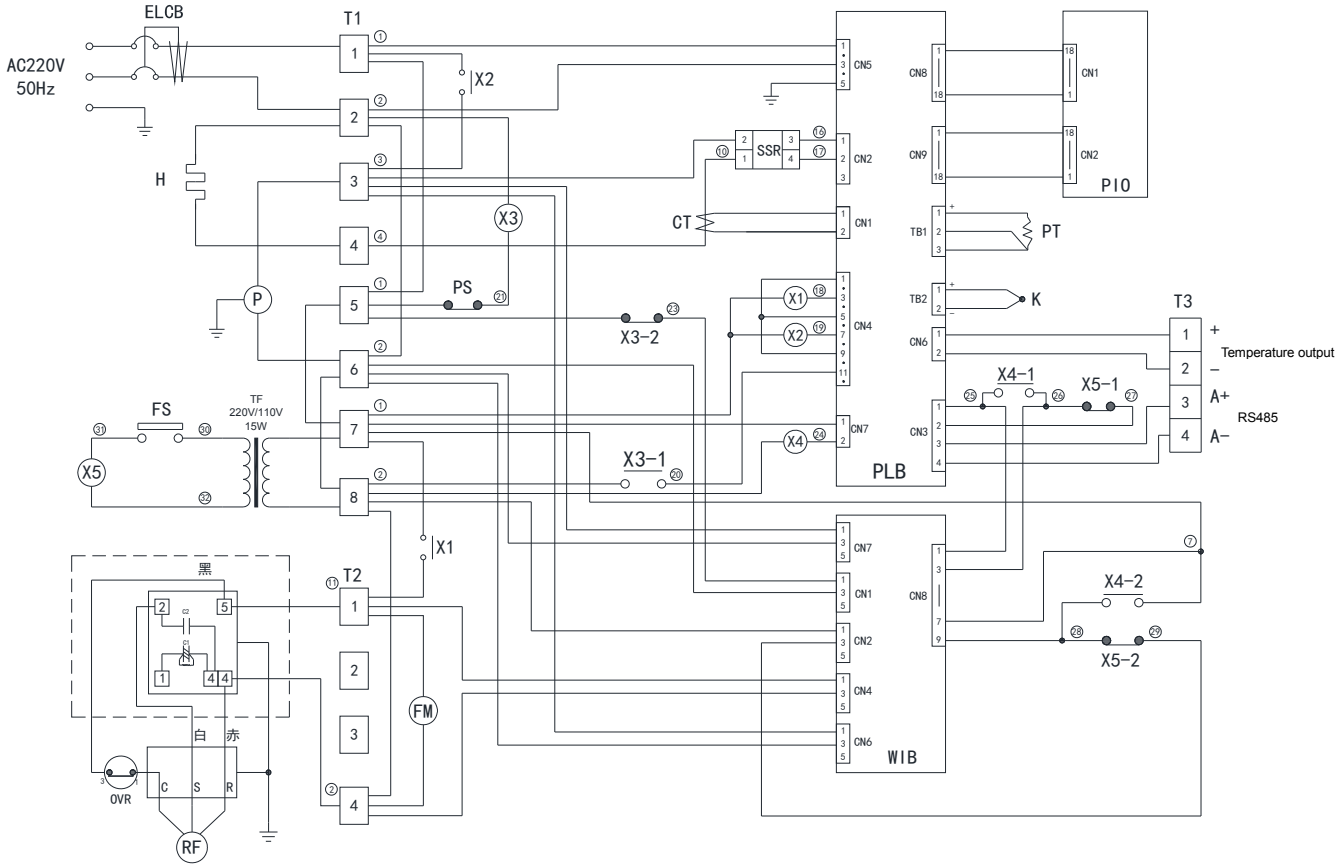
CLH312C/411C



mark	Part name	mark	Part name
ELB	Leakage protection switch	OVR	Overload relay
T1	Terminal block	C1	Run the capacitor
T2	Terminal block	C2	Starting capacitor
T3	Terminal block	X6	Start the relay
H	heater	P	Magnetic pump
SSR	SSR	WIB	Run represents the baseboard
CT	Current sensor	X1	Relays (freezers)
PLB	Control the substrate	X2	Relays（heater）
PIO	Display the baseboard	X3	Relays (refrigerant pressure)
Pt	Temperature Sensor (Pt)	X4	Relays (circulating fluid flow)
K	Temperature Sensor (K)	X5	Relay (alarm)
FM	Fans	PS	Pressure switch
RF	compressor	FS	Flow switch
TF	transformer		

11. Wiring Diagram

CLH610C



mark	Part name	mark	Part name
ELB	Leakage protection switch	OVR	Overload relay
T1	Terminal block	C1	Run the capacitor
T2	Terminal block	C2	Starting capacitor
T3	Terminal block	X6	Start the relay
H	heater	P	Magnetic pump
SSR	SSR	WIB	Run represents the baseboard
CT	Current sensor	X1	Relays (freezers)
PLB	Control the substrate	X2	Relays（heater）
PIO	Display the baseboard	X3	Relays (refrigerant pressure)
Pt	Temperature Sensor (Pt)	X4	Relay (alarm)
K	Temperature sensor（K）	X5	Relays (circulating fluid flow)
FM	Fans	PS	Pressure switch
RF	compressor	FS	Flow switch
TF	transformer		

12. Replacement Parts Table

Common parts

mark	Part name	encode	specification	Manufacturers
WIB	Display the baseboard	B011402010		YSJ
PLB	Control the substrate	B011401009	VS-3P	YSJ
PIO	Display the baseboard	B011402007	VS-3/4	YSJ
-	Flat cable	B011299034	ET-A100-185	YSJ
FS	Flow switch	B011507003	NK-1RAN 1.2L/min	NIKOMU
Pt,K	Temperature sensor	B010504003	Pt&K h=50	YSJ
-	Flow regulating valve	B040407006	BW-9033 PT3/8	ASOU
-	Extraction valve	B040407001	TA295BH-29	TASUKO
-	Drain hydrant	B042202004	TA295BH-31	TASUKO
X3～4	Relays	A011002008	HF13F/A2202Z5D	YSJ
X5	Relays	A011002006	HF13F/A1002Z5D	YSJ
T1	Terminal block	B011301020	MKH-250ABC-8P	YSJ
T2	Terminal block	B011301012	MKH-250ABC-4P	YSJ
T3	Terminal block	A011302066	BHK 3-04-9.52-00F （4P 300V 25A）	YSJ
SSR	SSR	A011006023	KS15/D-38Z25-L	YSJ
TF	transformer	H030101036	220-100V 50W	YSJ

CLH312C

mark	Part name	encode	specification	Manufacturers
P	Magnetic pump	A042102008	MD-20RZ-N AC220V	YSJ
RF	compressor	A030200012	NEK2125GK AC220V	YSJ
FM	Fans	B011603007	SE4-CO41NP	YSJ
X1，2	Relays	A011002008	HF13F/A2202Z5D	YSJ
ELB	Leakage protection switch	A010410007	BV-DN IP+N 10A 30mA	YSJ
H	heater	H030204002	CLH312C_01_02-01	YSJ
-	Power cord	A011208001	3*1mm2 3m	YSJ

CLH411C

mark	Part name	encode	specification	Manufacturers
P	Magnetic pump	A042102008	MD-20RZ-N AC220V	YSJ
RF	compressor	A030200007	NEK2134GK 220V 50HZ	YSJ
FM	Fans	B011603007	SE4-CO41NP	YSJ
X1，2	Relays	A011002008	HF13F/A2202Z5D	YSJ
ELB	Leakage protection switch	A010410007	BV-DN IP+N 10A 30mA	YSJ
H	heater	H030201010	CLH411C_01_02-01	YSJ
-	Power cord	A011208001	3*1mm2 3m	YSJ

12. Replacement Parts Table

CLH610C

mark	Part name	encode	specification	Manufacturers
P	Magnetic pump	A042102015	MD-30RZ-220N	YSJ
RF	compressor	A030200008	NT2178GK(CSIR) 220V 50Hz	YSJ
FM	Fans	A080104030	SJ2206LA2BAT	YSJ
X1，2	Relays	A011002002	HF116F-2/220AL1HSTFW	YSJ
ELB	Leakage protection switch	A010410004	BV-DN IP+N 16A 30mA	YSJ
H	heater	H030205001	CLH610C_01_02-01	YSJ
-	Power cord	A011208002	3*2.5mm2 3m	YSJ

13. List of Dangerous Substances

Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit.

EXPLOSIVE

EXPLOSIVE:	Ethylene glycol dinitrate (nitro glycol), Glycerin trinitrate (nitroglycerine), Cellulose nitrate (nitrocellulose), and other explosive nitrate esters
	Trinitrobenzene, Trinitrotoluene, Trinitrophenol (picric acid), and other explosive nitro compounds
	Acetyl hidroperoxide (peracetic acid), Methyl ethyl ketone peroxide, Benzyl peroxide, and other organic peroxides

FLAMMABLE

IGNITING:	Lithium (metal), Potassium (metal), Sodium (metal), Yellow phosphorus, Phosphorus sulfide, Red phosphorus, Celluloid compounds, Calcium carbide, Lime phosphate, Magnesium (powder), Aluminum (powder), Powder of metals other than magnesium and aluminum, Sodium hydrosulfite
OXIDIZING:	Potassium chlorate, Sodium chlorate, Ammonium chlorate, and other chlorate
	Potassium perchlorate, Sodium perchlorate, Ammonium perchlorate, and other perchlorate
	Potassium peroxide, Sodium peroxide, Barium peroxide, and other inorganic peroxide
	Potassium nitrate, Sodium nitrate, Ammonium nitrate, and other nitrate
	Sodium chlorite and other chlorites
	Calcium hypochlorite and other hypochlorites
INFLAMMABLE LIQUID:	Ethyl ether, Gasoline, Acetaldehyde, Propylene chloride, Carbon disulfide, and other flammable substances having a flash point of lower than -30℃
	Normal hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone, and other flammable substances having a flash point of -30℃ or higher but lower than 0℃
	Methanol, Ethanol, Xylene, Pentyl acetate (amyl acetate), and other flammable substances having a flash point of 0℃ or higher but lower than 30℃
	Kerosene, Light oil (gas oil), Oil of turpentine, Isopentyl alcohol (isoamyl alcohol), Acetic acid, and other flammable substances having a flash point of 30℃ or higher but lower than 65℃
FLAMMABLE GAS:	Hydrogen, Acetylene, Ethylene, Methane, Propane, Butane, and other flammable substances which assume a gaseous state at 15℃ and 1 atm

14. Installation Manual

Install the product according to the following: (Confirm separately for optional items or special specifications)

Model	Serial number	Date	Installation mgr. (company name)	Installation mgr.	Judgment

No.	Item	Implementation method	TOC No. Reference page of the operating instruction manual	Judgment
Specifications				
1	Included items	Check for number of staffs against the included item field	10. Specifications field P. 55	
2	Installation	・Visual check of environmental conditions Caution: Take care for environment	2. Before operating the unit P. 4 ・On the installation site	
		・Securing a space		
		・Fill the water tank Caution:circulation pump pumping	2. Before use P. 8～10 ・Set up a place	
Operation-related matters				
1	Source voltage	・Measure the user side voltage (outlet) with a tester ・Measure voltage during operation (shall meet the standard) Caution: Always use a plug that meets the specification for attaching to the ELB.	2. Before operating the unit ・Be sure to connect the ground wire. P. 4 ・Power supply is …. 10.Specifications ・Specification-power supply P. 6 P. 55	
2	Operation start	・Starts operation Performs fixed value operation, auto stop operation or auto start operation	2. Before operating the unit P. 8～10 ・Installation procedures… P. 15～46 4. Operating procedures	
Description				
1	Operational descriptions	Explain operations of each component according to the operational instructions	4. Operating procedures P. 15～46 ・Operating procedures 1.Safety precautions～ P. 1～ 13. List of dangerous materials P. 61	
2	Error codes	Explain the customer about error codes and procedures for release according to the operational instructions	8. Troubleshooting ～ 9. After sales service and warranty P. 52～54	
3	Maintenance and inspection	Explain operations of each component according to the operational instructions	6. Maintenance procedures ・Daily inspection/ maintenance P. 49	
4	Completion of installation Record items	・Fill in the installation date and the installation mgr. on the nameplate of the main unit ・Fill in necessary information items to the warranty card and hand it over to the customer ・Explanation of the route for after-sales service	9. After sales service and warranty P. 54	

Responsibility

Please follow the instructions in this document when using this unit. Yamato Scientific has no responsibility for the accidents or breakdown of device if it is used with a failure to comply.
Never conduct what this document forbids. Unexpected accidents or breakdown may result in.

Note

- The contents of this document may be changed in future without notice.
- Any books with missing pages or disorderly binding may be replaced.

Instruction Manual
Cooling Water Circulating Device
CLH312C/CLH411/CLH610C
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