Coolnics Circulator

Model CTA401/401S/801/801S
Model CTW401/401S/801/801S

Instruction Manual

First edition

- **Thank you very much for purchasing Yamato Coolnics Circulator, CTA/CTW series.**
- **Please read the "Operating Instructions" and "Warranty" before operating this unit to assure proper operation. After reading these documents, be sure to store them securely together with the "Warranty" at a handy place for future reference.**
- **For how to operate the product, refer to this operation manual and that for the CR 5A-CT Program Controller.**

⚠ Warning: Before operating the unit, be sure to read carefully and fully understand important warnings in the operating instructions.

Yamato Scientific Co., Ltd.

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Table of Contents

1. Safety precautions

Explanation of pictograms

About pictograms

A variety of pictograms are indicated in this operating instruction and on products for safe operation. Possible results from improper operation ignoring them are as follows.
Be sure to fully understand the descriptions below before proceeding to the text.

Warning Indicates a situation which may result in death or serious injury (Note 1.)

Caution Indicates a situation which may result in minor injury (Note 2) and property damages (Note 3.)

（Note 1）Serious injury means a wound, an electrical shock, a bone fracture or intoxication that may leave after effects or require hospitalization or outpatient visits for a long time.

（Note 2）Minor injury means a wound or an electrical shock that does not require hospitalization or outpatient visits for a long time.

（Note 3）Property damage means damage to facilities, devices and buildings or other properties.

Meanings of pictograms

This pictogram indicates a matter that encourages the user to adhere to warning (“caution” included).
Specific description of warning is indicated near this pictogram.

This pictogram indicates prohibitions
Specific prohibition is indicated near this pictogram.

This pictogram indicates matters that the user must perform
Specific instruction is indicated near this pictogram.

1. Safety precautions

List of symbols

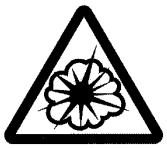
Warning

General warnings

Danger!: High voltage

Danger!: High temperature

Danger!: Moving part



Danger!: Hazard of explosion

Caution

General cautions

Electrical shock!

Burning!

Caution for no liquid heating!

Caution for water leak!

For water only

Poisonous material

Prohibitions

General bans

Fire ban

Do not disassemble

Do not touch

Compulsions

General compulsions

Connect ground wire

Install levelly

Pull out the power plug

Regular inspection

1. Safety precautions

Warning・Cautions

Do not block the radiation ports.

Never operate the unit with the radiations ports on the back and sides of the unit blocked. Temperature on the back and inside the unit will rise and may cause a fire and damages to the unit.

Do not open the panels and the covers.

Do not open the secured panels and covers. Otherwise, an electrical shock or damages to the unit may result.

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

Never operate the unit in a flammable or an explosive atmosphere.
The unit is not explosion-proof and when switching “On” and “Off” and during operation of the unit, which will generate an arc and may cause a fire or an explosion.
For dangerous substances, see the list of dangerous materials (P.94).

Always ground this unit

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

Prohibition of use for error

If a smoke or abnormal smell may be occurred, turn off the ELB of the main unit immediately, and disconnect the power plug. Leaving the failure may cause the fire or electric shock.

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 damage power cord

Do not damage power cord by bending, pulling, or twisting forcedly. It may cause the fire or electric shock. Besides, operating the unit with the something put on the cord may cause overheat, and result in fire.

Never try to disassemble or alter the unit.

Never try to disassemble or alter the unit. A malfunction, a fire or an electrical shock may result.

Do not splash water in the unit.

Do not splash water inside the unit. Take extreme care not to allow water to enter into the back side of the unit and into the radiation ports on the sides. Otherwise, an electrical shock, a fire, or damages to the unit may result.

1. Safety precautions

⚠ Warning

Do not drop any objects on the unit.

This unit contains high precision components. Do not drop any objects on the unit or give shocks to it. Damages to or a malfunction of the unit may result.

Do not attempt to alter the unit.

Do not alter the unit or operate it with any parts other than the original ones installed. Damages to or a malfunction of the unit may result.

Do not attempt any operations not specified in the operation manual.

Do not attempt any operations not specified in the operation manual. Otherwise, unexpected malfunctions or an accident may result.

2. Before operating the unit

Precautions for use

General precautions

When an abnormality occurs.

If an abnormal smoke, heat, or an abnormal noize is generated from the unit, immediately stop operating it, turn the power switch off, and contact your dealer, one of our sales offices, or the general customer service center.

Operate the unit only within its performance.

The unit will not able to control temperature when it is subjected to heat load beyond its power specification. Be sure to check the specification and operate the unit within its performance.

Cautions about circulating liquid

⚠ Cautions

Circulating liquid

Use a relatively low viscosity liquid such as water or mixture of water and ethylene glycol as the circulating liquid.

Also, do not use a highly volatile or permeable liquid.

Do not operate the unit with no liquid.

Do not operate the unit with no liquid. It may cause damages to the pump.

Do not use slurry liquid.

Do not use a liquid that contains powders of metals such as iron or nickel because the pump has strong magnets inside. Also avoid using slurry liquid, which will accelerate wear of internal components of the pump.

Take care for coagulation of circulation liquid.

Take care for coagulation of circulation liquid when you use this unit at a temperature below zero.

Take care for the withstand water pressure.

The withstand water pressure for the circulation system is 0.1Mpa. Too high resistance in the piping system may cause leakage of liquid or damages to the unit.

2. Before operating the unit

Precautions for use

⚠ Cautions

Cautions about radiation water

About radiation water

Use tap water or other clean water as radiation water.
Use radiation water of a temperature in the range of 5°C～30°C.

Required amount of radiation water

Required amount of radiation water is 3～5L/min.

Take care not to exceed the maximum flow of 8L/min. Otherwise the water discharge system may be damaged.

Radiation water pressure

Always keep the inlet side pressure of radiation water at 0.2Mpa or below. If you are going to install a valve for emergency stop, be sure to install it at the radiation water inlet side.

＜NOTES＞

Pressure required to obtain radiation flow of 3～5L/min is 0.03～0.08Mpa for CTW401 and CTW401S and 0.06～0.16Mpa for CTW801 and CTW801S. Increasing the flow beyond this level will not improve performance and, on the contrary, increased flow rate might affect to the pipe materials adversely.

Although up to 0.5Mpa of a shut-off pressure will not cause any harms, which may be caused by a clogging of the outlet side of radiation water, immediately take any necessary measures (P.61 “Safety devices and error codes”) because leaving this status for a long time may damage the unit.

2. Before operating the unit

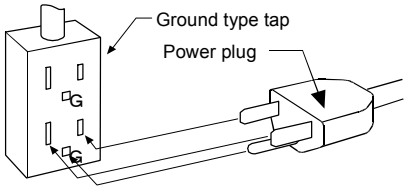
Precautions when installing the unit

⚠ Cautions

Be sure to connect the ground wire

- 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.
- Never use a branching plug, which may cause heating and a dangerous situation.

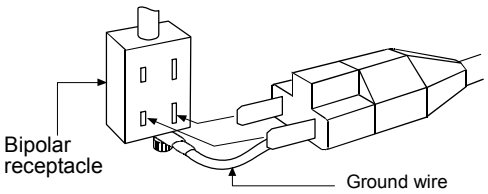
We recommend use of a ground type outlet tap.



When there is no ground terminal.

- In this case, class 3 grounding work is necessary and please consult your dealer or our nearest sales office.

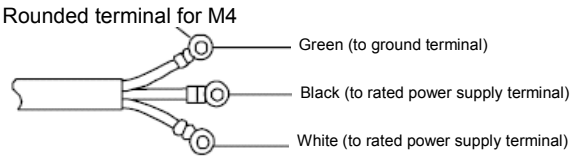
When a bipolar type outlet tap is used



- Insert the ground adaptor included as an option, into a power plug confirming the polarity of the outlet. Connect the grounding wire (green) of the ground adaptor to the ground terminal on the power supply equipment.

- The terminal is of a round type for AC200V specification. (Withstand voltage: 600V)

- The AC100V power cord with a plug is for withstand voltage of 300V and you need replace the power cord if you want to use a power supply of AC200V.



2. Before operating the unit

Precautions when installing the unit

Warning

Install the unit on a level surface.

Install the unit on a level surface. If the bottom surface of the 4 rubber foot does not contact the surface evenly, vibrations or noises may result. This might cause unexpected troubles or malfunctions.

Turn the power switch off.

Be sure to turn the power switch off and remove the power cord before installing or transporting the unit. Otherwise, an electrical shock or damages to the unit may result.

Check the power capacity.

Power capacity in the table below (AC100～240V±10%,50Hz/60Hz) is necessary for the unit. Connect an appropriate power supply cable (200V or more) or a power plug (120V or below).

	100V	120V	200V	220V	240V
CTW401/CTW401S	6	5	3	2.8	2.5
CTW801/CTW801S	10	8.4	5	4.6	4.2
CTA401/CTA401S	5	4.2	2.5	2.3	2.1
CTA801/CTA801S	9	7.5	4.5	4.1	3.8
Power cord	With a plug of rated voltage of 300V		With a round terminal of rated voltage of 600V		

Using a branching plug with too many loads or an extended wire with a cord reel may cause a voltage drop and degradation of freezing capacity or temperature control performance.

Handling of a power cord

- Never use electrical power cords bundled. When these are used bundled, they might overheat causing a fire.。
- Do not convert, forcibly bend, twist or pull the power cord. Otherwise, a fire or an electrical shock may result.
- Do not place the power cord under a desk or a chair, or sand between objects to avoid it from being damaged.
- Otherwise, a fire or an electrical shock may result.
- Do not place the power cord close to a stove or other heat generating device. Sheath of the cord may burn and result in a fire or an electrical shock.
- If the power cord should be damaged (exposure of core wire or disconnection), immediately turn the ELB off, turn the power supply off and ask your dealer to replace the cord. If the unit is operated with a damaged power cord, a fire or an electrical shock may result.
- Connect the power cord to an appropriate wall outlet or distribution board.

2. Before operating the unit

Precautions for installation

⚠ Caution

Precautions for installation

- The unit may topple over and cause a personal injury due to an earthquake or a shock. We recommend taking safety measures including selecting a place with less people passing by.
- When installing the CTW401S/CTA401S, be sure to use the stacking clamps included with the unit because the body of the cooling/heating assembly has not been designed to hold the power control unit.

Cautions after installation

The unit may topple over and cause a personal injury due to an earthquake or a shock. Take appropriate safety measures against toppling over.

Take care for a possible height difference with the water bath.

Take care for a possible height difference with the water bath when installing the unit.
The flow of the circulation pump inside the unit will change according to the lifting height. Consider its installation site referring to the circulation pump capacity (P.76).

About the installation site

Install the unit at a place with the environment that meet the following conditions in order to prevent an electrical shock, a fire, damages to the unit, and a malfunction.

① Indoor (This unit has been designed and manufactured to be used indoors.)
② Environmental temperature: 5°C～35°C (no condensation)
③ Environmental humidity: 35%～85% (no condensation)

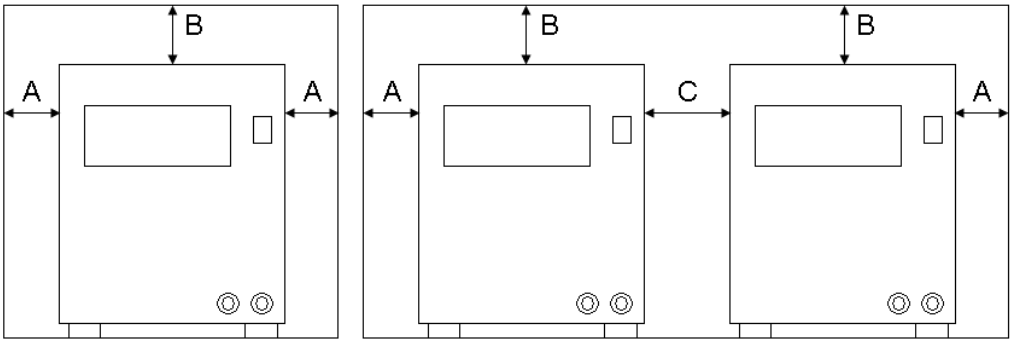
Take special care not to install the unit at a place described below:

① Where flammable gas or corrosive gas exists
② Where subject to direct sunlight
③ Uneven surfaces or dirty surfaces
④ Where winds from a heating appliance or a ventilation port hits directly.
⑤ Where the floor is not firm.
⑥ Unlevel floor.
⑦ In a hermetically closed box where heat will build up.

Installation space

Installation space that allows proper radiation of the unit is shown below.
Note that additional space will be necessary for assure proper wiring and piping works if the space below is not sufficient.

Space above and right/left sides of the unit



Space of front and rear side of the unit

	Integrated type		Separate type		
	Air cooled	Water cooled	Power control assembly	Cooling/heating assembly	
				Air cooled	Water cooled
A	50 mm	50 mm	50 mm	50 mm	50 mm
B	100 mm	100 mm	100 mm	15 mm	15 mm
C	150 mm	150 mm	150 mm	150 mm	150 mm
D	200 mm	100 mm	100 mm	200 mm	100 mm

- The length of radiation water hose included with the water cooled type unit is 3m or less in total for back and forth (both for the supply and discharge sides) and carefully select the intake port of radiation water.

3.Mechanism overview

Description of functions

- This unit is a constant temperature water circulator used for research, development, production, and inspection that require precise temperature control at around the room temperature.
- This unit is available as a constant temperature oven for diversified purposes including keeping temperature of a constant temperature water bath or a sealed system at a constant temperature.
- This unit has an integrated cooling/heating unit using heat semiconductor devices (thermo modules) and an integrated pump.
- This unit has an external communication function using an RS485 interface.
- This unit allows operation at a specific programmed temperature.
- This unit supports an optional external sensor.
- This unit has a self diagnostic function.

⚠ Warning

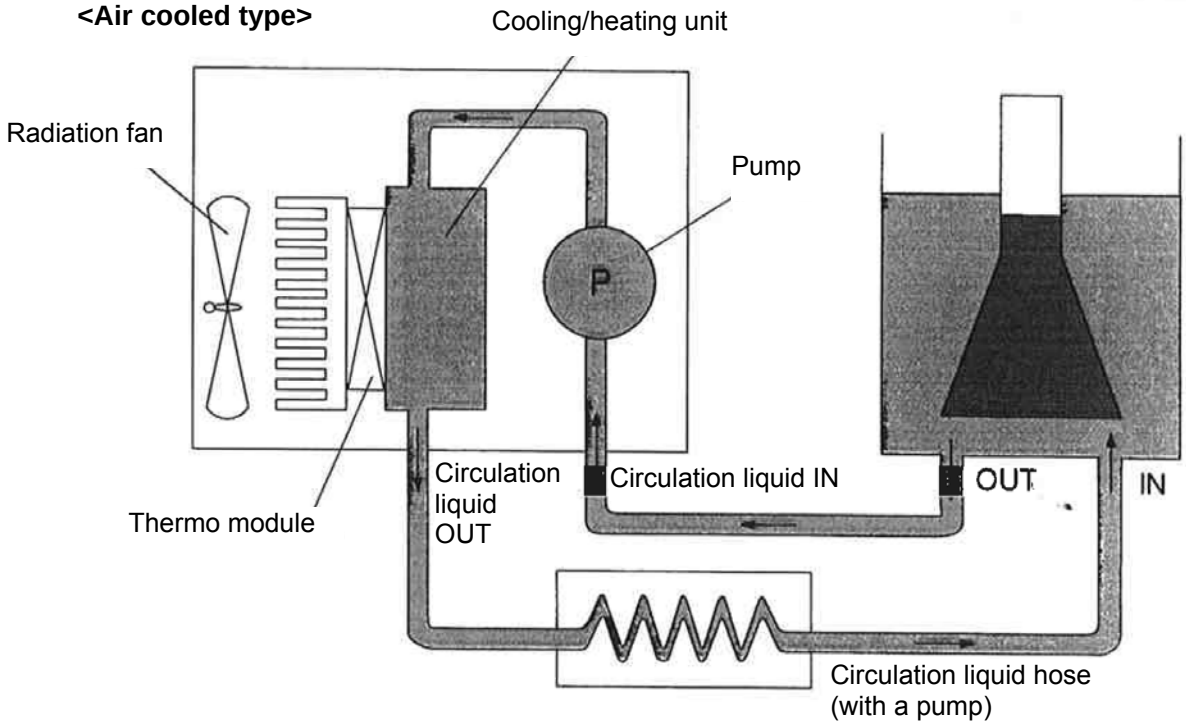
Never use this unit as a device such as for medical devices or for aircraft transportation equipment or other life-support systems. The company assume no responsibility for any claims for monetary damages, lost profits as a result of ignoring this warning or other claims by a third party.

3.Mechanism overview

Conceptual drawing

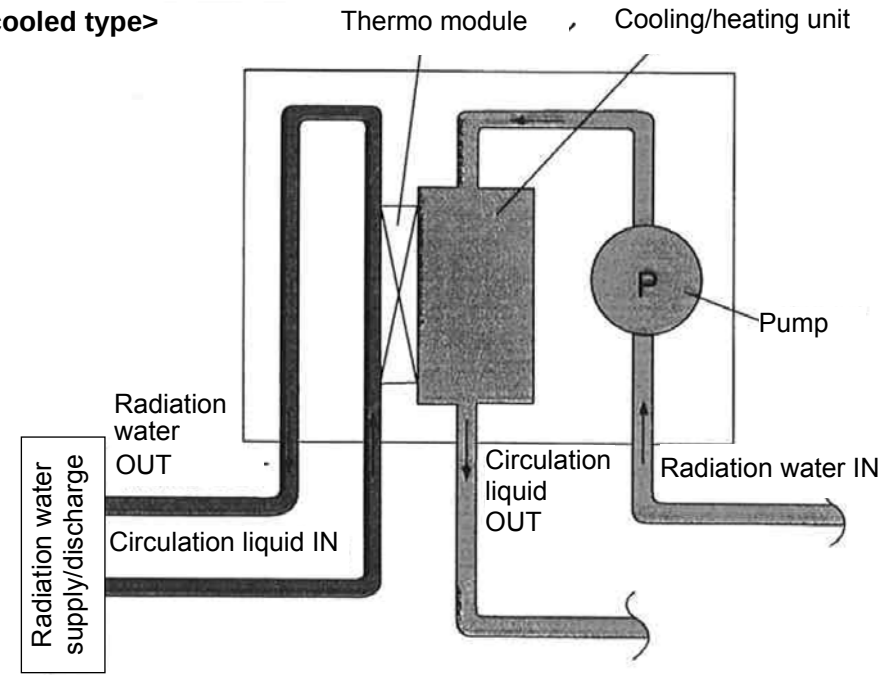
Usage example 1: Controlling an external water bath at a constant temperature

<Air cooled type>



Usage example 2: Controlling a sealed system at a constant temperature

<Water cooled type>



4.Unpacking and checking the contents

1. Unpacking inspection

When you have received you unit, immediately check the following.
If you find any troubles, contact your dealer.

- Whether the model indicated on the unit is exactly the one you ordered.
- Whether there are any damaged parts during transportation.
- Whether all accessories in the list are included.

2. Contents of accessories

Contents and quantities of accessories differ depending on the model you have ordered.
Check that there are no missing accessories referring to the table below.

Integrated type

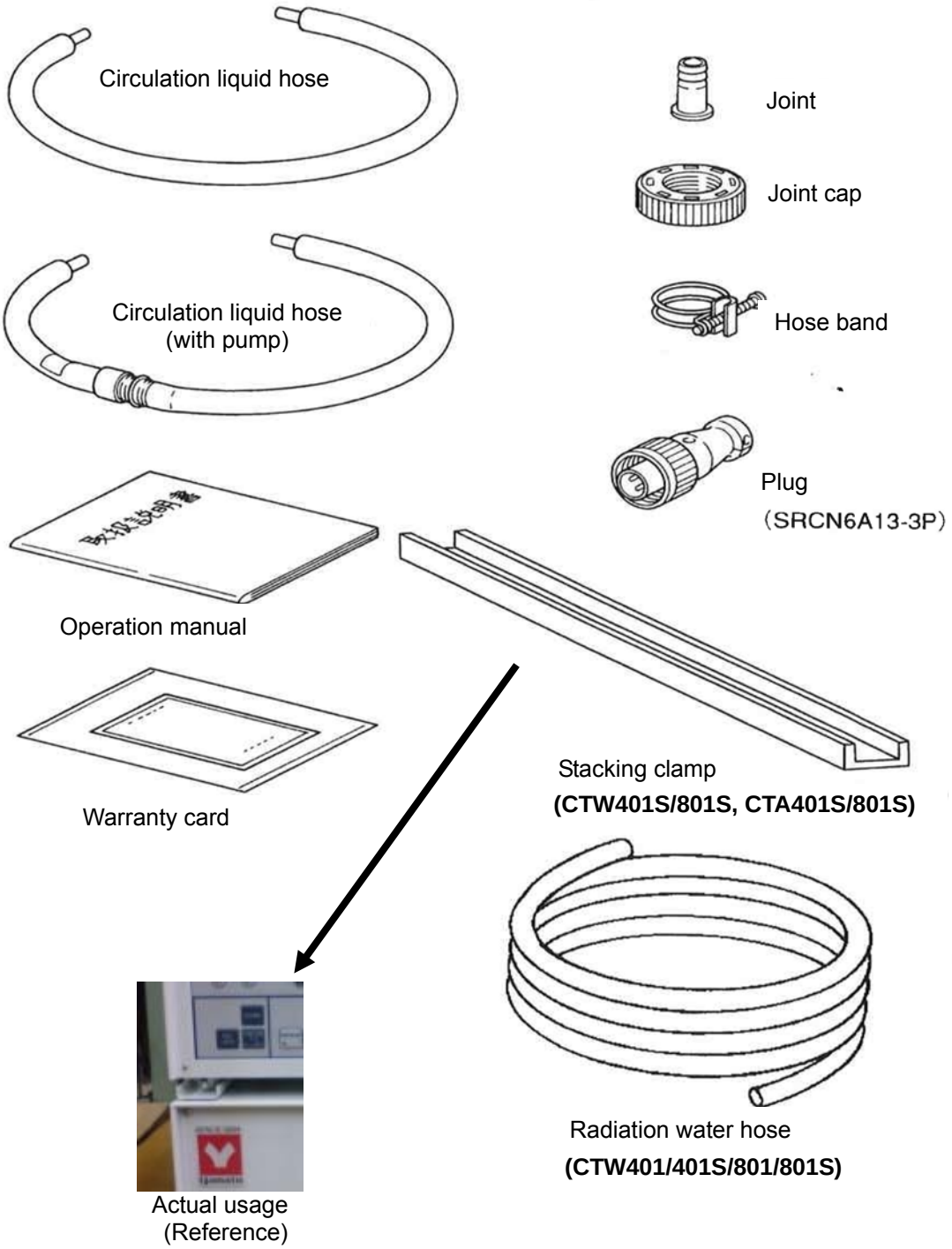
Product code		221601	221602	221603	221604
Model		CTW401	CTW801	CTA401	CTA801
Accessories	Circulation liquid hose	2	2	2	2
	Radiation water hose	1	1	-	-
	PVC joint cap	4	4	2	2
	PVC joint	4	4	2	2
	Hose band	7	7	4	4
	Plug (SRCN6A13-3P)	1	1	1	1
	Stacking clamp	1	1	1	1
	Operation manual	1	1	1	1

Separate type

Product code		221605	221606	221607	221608
Model		CTW401S	CTW801S	CTA401S	CTA801S
Accessories	Circulation liquid hose	2	2	2	2
	Radiation water hose	1	1	-	-
	PVC joint cap	4	4	2	2
	PVC joint	4	4	2	2
	Hose band	7	7	4	4
	Plug (SRCN6A13-3P)	1	1	1	1
	Stacking clamp	2	2	2	2
	Operation manual	1	1	1	1
	Warranty card	1	1	1	1

※For shapes of the accessories, see “3) List of accessories”(P.14).

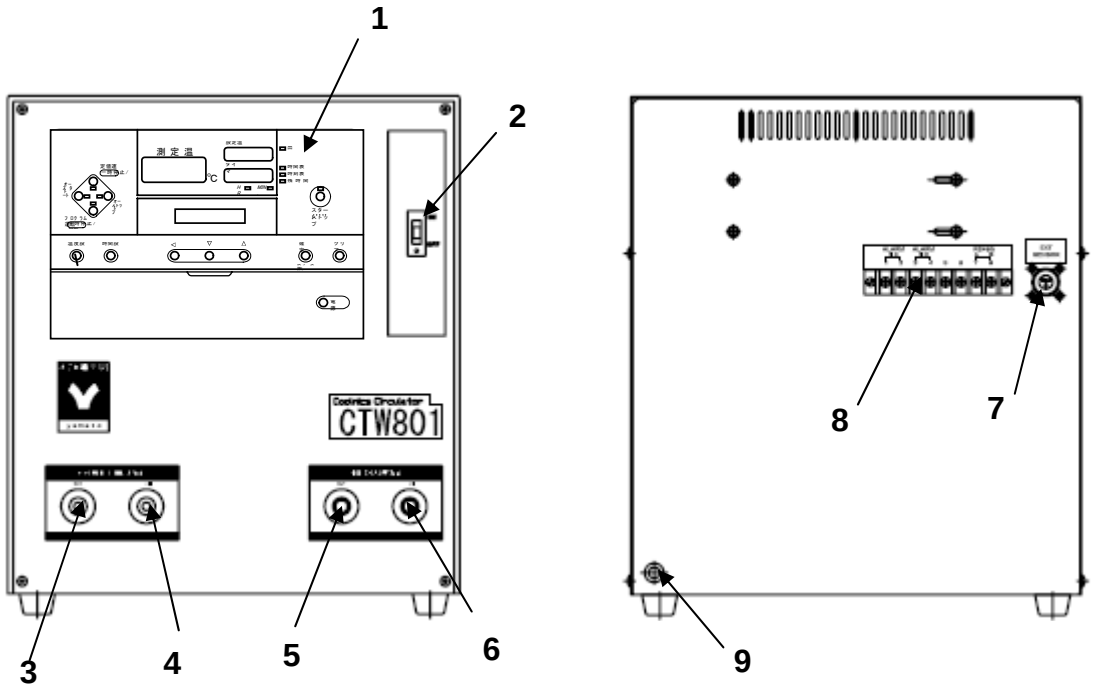
3. List of accessories



5. Names and functions of parts

Integrated type/outer appearance

1. Water cooled type (CTW401/CTW801)



No	Name	Description
1	Operation panel	The panel has buttons for operating the unit and a display that indicates the unit status.
2	Breaker	The breaker used to turn unit power ON/OFF. Turning this breaker “ON” will activated the circulation pump inside the unit.
3	Radiation water joint nipple (OUT)	This is the discharge port of the thermo module radiation water.
4	Radiation water joint nipple (IN)	This is the supply port of the thermo module radiation water.
5	Circulation water joint nipple(OUT)	This is the discharge port of circulation water that circulates between the unit and the constant temperature water bath.
6	Circulation water joint nipple(IN)	This is the supply port of circulation water that circulates between the unit and the constant temperature water bath.
7	Sensor connector	This is a connector (3P) used to connect an external sensor (platinum resistance temperature detector) supplied by the user.
8	Terminal block	The terminal block allows communication with the host with alarm output and the RS485 interface.
9	Power cord	This cord is a three-wire cable with a ground terminal used to supply power to the unit.

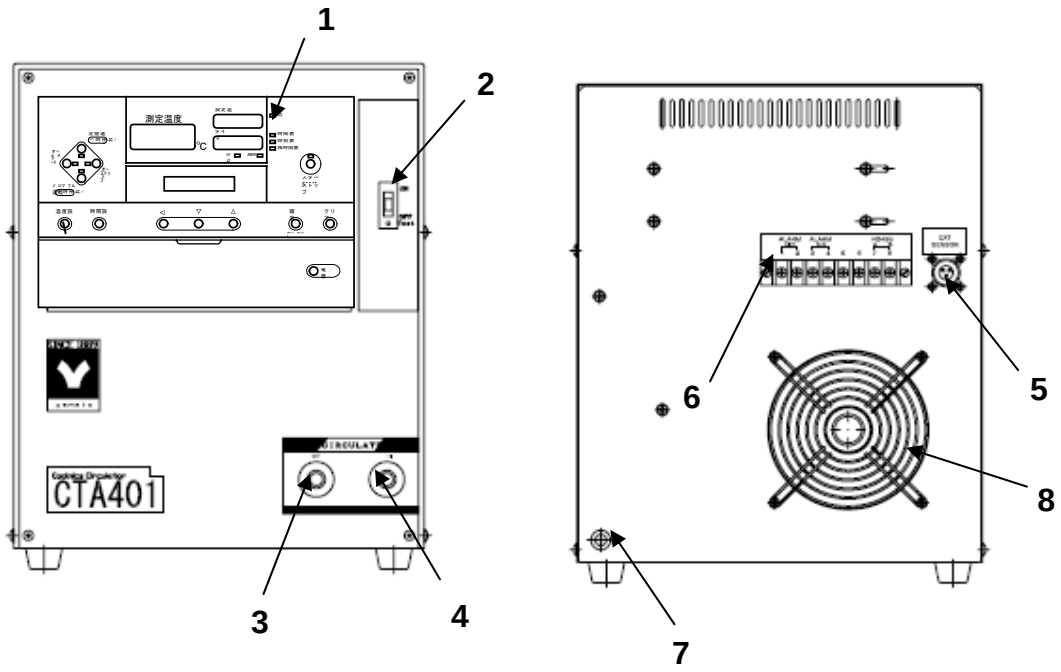
＜Note＞

Expressions in () in the “Name” column are indications printed on the relevant assemblies of the unit.

5. Names and functions of parts

Integrated type/outer appearance

2. Air cooled type (CTA401/CTA801)



No	Name	Description
1	Operation panel	The panel has buttons for operating the unit and a display that indicates the unit status.
2	Breaker	The breaker used to turn unit power ON/OFF. Turning this breaker “ON” will activated the circulation pump inside the unit.
3	Circulation water joint nipple(OUT)	This is the discharge port of circulation water that circulates between the unit and the constant temperature water bath.
4	Circulation water joint nipple(IN)	This is the supply port of circulation water that circulates between the unit and the constant temperature water bath.
5	Sensor connector	This is a connector (3P) used to connect an external sensor (platinum resistance temperature detector) supplied by the user.
6	Terminal block	The terminal block allows communication with the host with alarm output and the RS485 interface.
7	Power cord	This cord is a three-wire cable with a ground terminal used to supply power to the unit.
8	Radiation fan	This is a radiation fan to cool down the cooling/heating device in the unit.

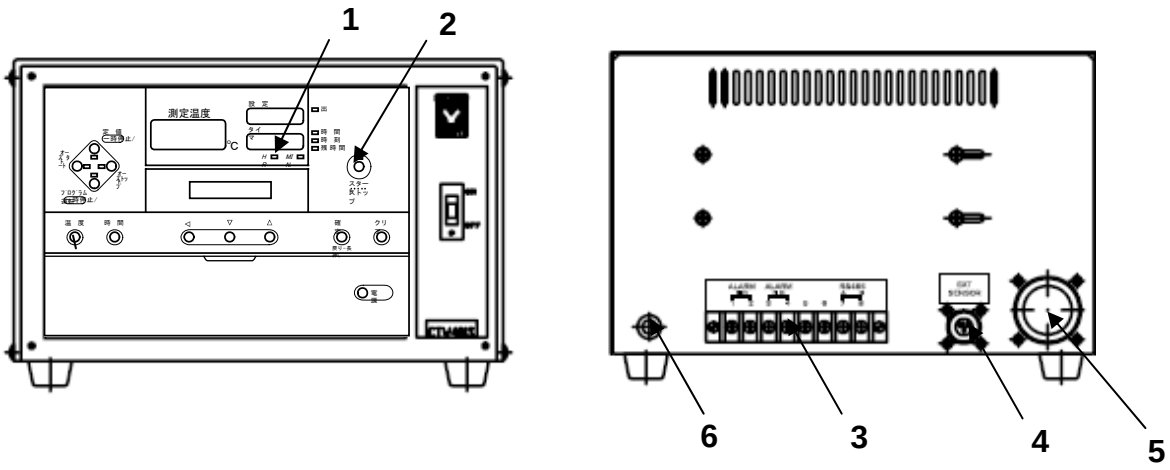
＜Note＞

Expressions in () in the “Name” column are indications printed on the relevant assemblies of the unit.

5. Names and functions of parts

Separate type/outer appearance

3. Water cooled type/air cooled type power control assembly (CTW401S/CTA401S/CTW801S/CTA801S)

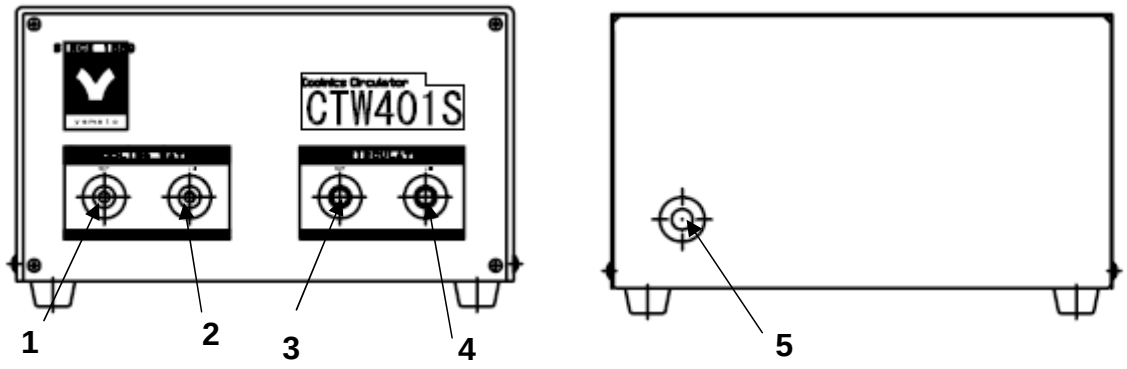


No	Name	Description
1	Operation panel	The panel has buttons for operating the unit and a display that indicates the unit status.
2	Breaker	The breaker used to turn unit power ON/OFF. Turning this breaker “ON” will activated the circulation pump inside the unit.
3	Terminal block	The terminal block allows communication with the host with alarm output and the RS485 interface.
4	Sensor connector	This is a connector (3P) used to connect an external sensor (platinum resistance temperature detector) supplied by the user.
5	Connector	This is a connector used to connect the separate type power supply unit and cooling/heating assembly. Cab tire cable of the cooling/heating assembly is connected to this connector.
6	Power cord	This cord is a three-wire cable with a ground terminal used to supply power to the unit.

＜Note＞

Expressions in (　) in the “Name” column are indications printed on the relevant assemblies of the unit.

4. Water cooled heat exchanging assembly (CTW401S/CTW801S)

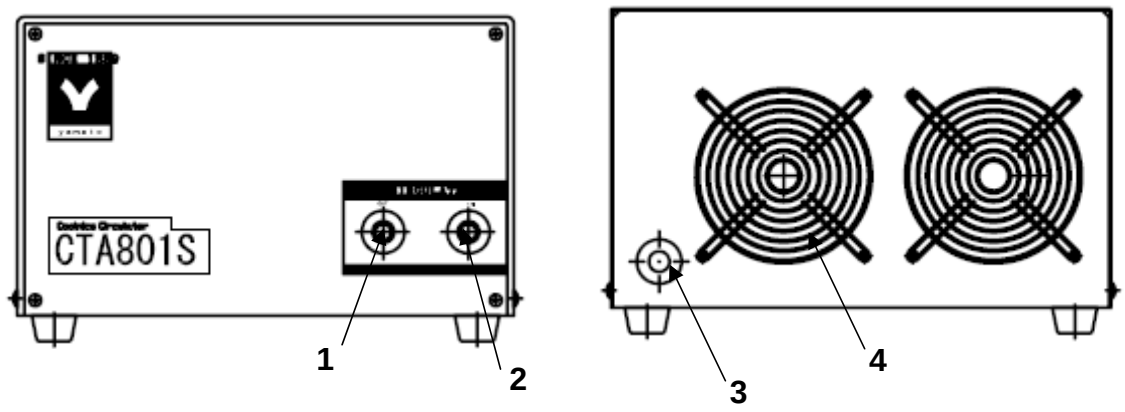


No	Name	Description
1	Radiation water joint nipple (OUT)	This is the discharge port of the thermo module radiation water.
2	Radiation water joint nipple (IN)	This is the supply port of the thermo module radiation water.
3	Circulation water joint nipple(OUT)	This is the discharge port of circulation water that circulates between the unit and the constant temperature water bath.
4	Circulation water joint nipple(IN)	This is the supply port of circulation water that circulates between the unit and the constant temperature water bath.
5	Cab tire cable	This is a cable to connect the separate type power supply unit and the cooling/heating assembly. The cable is connected to the connector at the power supply.

＜Note＞

Expressions in () in the “Name” column are indications printed on the relevant assemblies of the unit.

5. Air cooled heat exchanging assembly (CTA401S/CTA801S)



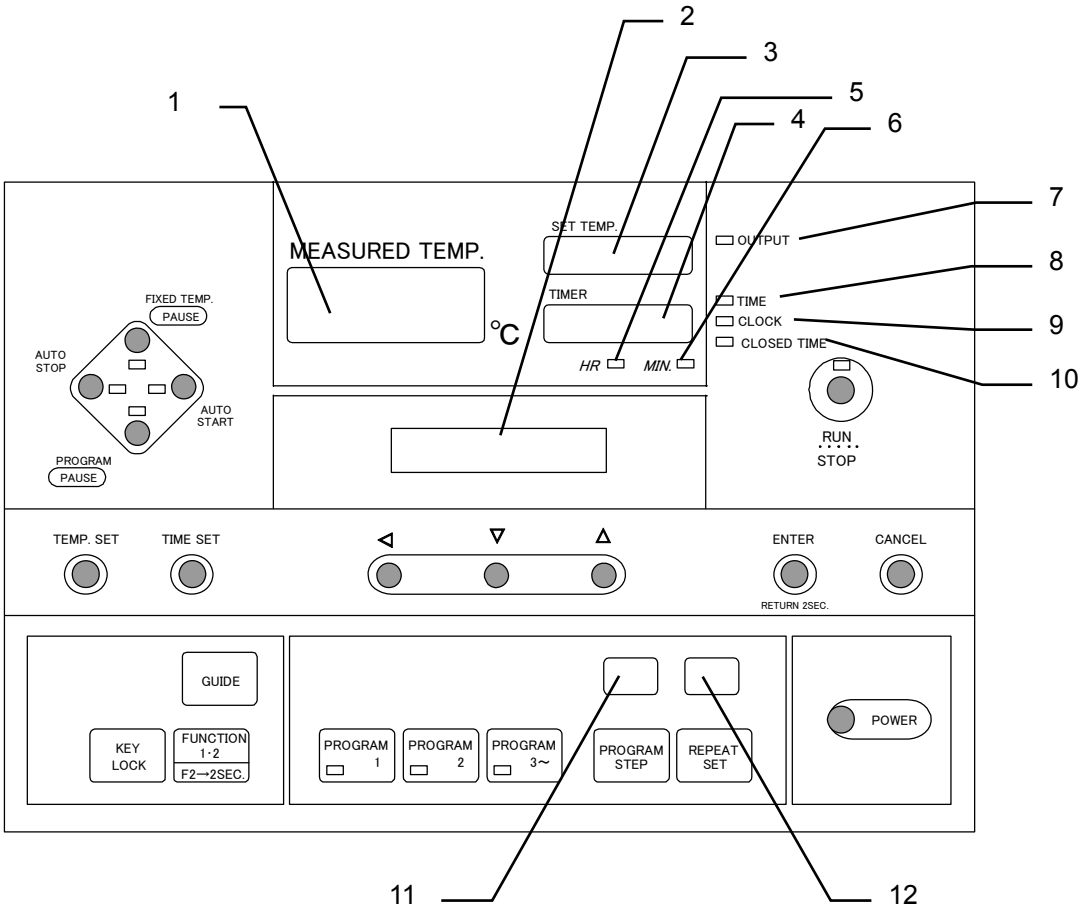
No	Name	Description
1	Radiation water joint nipple (OUT)	This is the discharge port of the thermo module radiation water.
2	Radiation water joint nipple (IN)	This is the supply port of the thermo module radiation water.
3	Cab tire cable	This is a cable to connect the separate type power supply unit and the cooling/heating assembly. The cable is connected to the connector at the power supply.
4	Radiation fan	This is a radiation fan to cool down the cooling/heating device in the unit.

＜Note＞

Expressions in () in the “Name” column are indications printed on the relevant assemblies of the unit.

5. Names and functions of parts

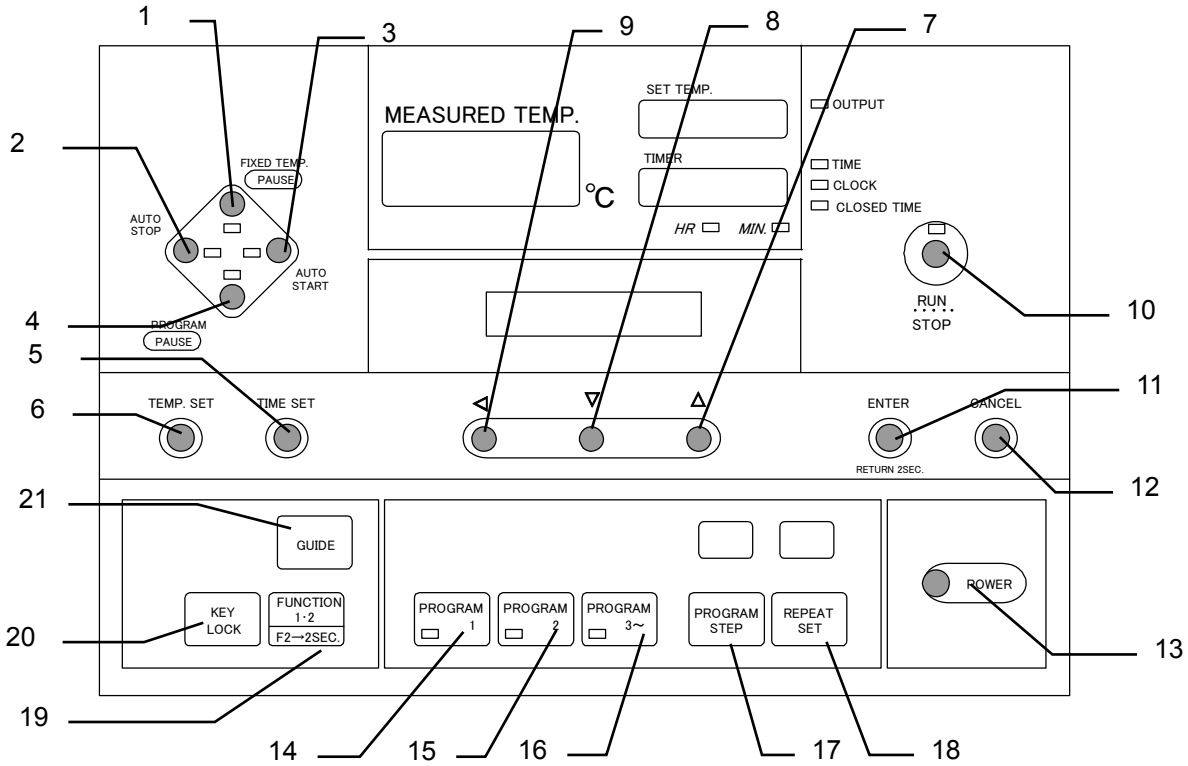
Operation panel



№	Name	Description
1	Measured Temperature Display Screen	This screen indicates measured temperatures and error codes.
2	Operation Guide Screen (fluorescent character display tube)	This screen guides you the present key operation and description of the status using Katakana characters, alphabets, or numeric values.
3	Set Temperature Display Screen	This screen shows a set temperature and parameter settings.
4	Time Display Screen	This screen shows a set period (or set time) or a remaining time.
5	HOUR UNIT lamp	This lamp comes on when the timer setting is in the hours.
6	MINUTE UNIT lamp	This lamp comes on when the timer setting is in the minutes.
6	Repeat Display Screen	The screen displays the No. of step to which repeat operation returns and the number of repetitions.
7	OUTPUT lamp	The lamp comes on during heating.
8	HOUR lamp	The lamp comes on when the timer setting is in the hours.
9	TIME lamp	The lamp comes on when the timer setting is in the time.
10	REMAINING HOUR lamp	The lamp comes on when the timer screen shows the remaining operating time.
11	Step Display Screen	The screen shows the step you selected or the No. of step currently being executed.
12	Repeat Display Screen	The screen displays the No. of step to which repeat operation returns and the number of repetitions.

5. Names and functions of parts

Operation panel



№	Name	Description
1	FIXED TEMP key	This key is used to select the fixed value operation.
2	AUTO STOP key	This key is used to start the auto stop operation during the fixed value operation.
3	AUTO START key	This key is used to select the auto start operation during the fixed value operation or the program operation.
4	PROGRAM key	This key is used to select the program operation.
5	HOURS (TIME) key	This key is used to set or change time for the fixed value operation and the program operation.
6	TEMPERATURE key	This key is used to set or change temperature for the fixed value operation and the program operation.
7	▲ key	This key is used to increment a setting.
8	▼ key	This key is used to decrement a setting.
9	・ key	This key is used to move a digit of a setting.
10	RUN/STOP key	This key is used to start or stop operation of the unit.
11	ENTER key	This key is used to fix (determine) a setting you have entered.
12	CLEAR key	This key is used when you want to cancel a setting you have entered.
13	POWER key	This key is used to turn unit power ON/OFF.
14	PROGRAM 1 key	This key is used to select the program pattern 1 you have entered.
15	PROGRAM 2 key	This key is used to select the program pattern 2 you have entered.
16	PROGRAM 3～ key	This key is used to select the program pattern 3 or later you have entered.
17	STEP key	This key is used to select and set the program step function.
18	REPEAT key	This key is used to set the program repeat function.
19	FUNCTION 1/2 key	This key is used to set various functions of the controller.
20	LOCK key	This key is used to lock key operations or a program pattern.
21	GUIDE key	This key guides you to the appropriate section on the operation manual or a correct page to be proceeded from the current screen when setting operations or operations of the monitor are unclear.

6. Installation procedures

Installation manual

※Install the unit as per the following (Confirm the procedures again for optional parts or special specifications).

Model	Serial #	Date	Installation mgr. (Company name)	Installation mgr.	Judge

No.	Item	Procedures	Relevant column of the operation manual	Judge
Specifications				
1.	Accessories	Check quantity referring to the accessory columns.	4. Unpacking and checking the contents ・Unpacking inspection ・Contents of accessories 11. Specifications	
2.	Installation	Visually check the environmental conditions.	2. Before using the unit ・Installation spaces	
3.	Connecting hoses	Connect the circulation liquid hose. Connect the radiation water hose (for the water cooled type only)	6. Installation procedures ・Connection of the circulation liquid hose ・Connection of the radiation water hose	
Action related matters				
1.	Source voltage	・Measure the customer side voltage (outlet, etc) using a tester. ・Measure the source voltage while the thermo module is active. (shall meet the specifications)	2. Before using the unit ・Be sure to connect the earth wire ・Checking of the power supply capacity 11. Specifications ・Power supply	
2.	Pour circulation water in the external bath	・Pour circulation water in the external circulation bath, release air, and perform inspection before operation. ※Confirm that circulation water is circulating within the specifications. ※Confirm that radiation water is supplied within the specifications.	7. Preparation for operation ・Circulation of liquid ・How to release air ・Inspection before operation 11. Specifications Specifications of circulating liquid & radiation water	
3.	Check the calendar in the controller	・Check whether the date and time currently displayed on the controller are correct (correct only when they are wrong.)	8. How to operate the unit ・Operating procedures ※Refer to separate “Operation manual for the program controller”.	
4.	Operation start (fixed-value operation)	・Perform fixed-value operation. Set the temperature to 20°C and confirm that operation is stable.	7. How to operate the unit ・Operating procedures (Basic steps) ・Turn the ELB on. ※Refer to separate “Operation manual for the program controller” for operational functions.	
5.	Program operation	Perform when necessary.	8. How to operate the unit ・Operating procedures (Example of program registration) ※Refer to separate “Operation manual for the program controller” for operational functions.	
Description				
1.	Description of operation	Explain operations to the customer referring to the operation manual. ※Explanation of cautions and warnings.	1. Safety precautions ～8. How to operate the unit	
2.	Error codes	Explain meanings of error codes and how to reset them to the customer referring to the operation manual.	9. If a trouble occurs ・Safety unit and error codes ・Troubleshooting	
3.	Maintenance & inspection	・Explain daily inspections to the customer referring to the operation manual. Notes : Above all, be sure to explain leak of circulation water or radiation water (water-cooled type), regular level check of the water bath and replacing water, and cleaning of the water bath to the customer	10.Maintenance & inspection ・Daily inspection/maintenance	
4.	Completion of installation Items to note	・Note the date of installation and the manager on the unit nameplate and OK sticker. ・Fill necessary matters in the warranty card and hand it down to the customer. ・Explain the after sales service routes.	16.After sales service and warranty ・When you ask repair.	

6. Installation procedures

Connection of the circulation liquid hose

Use the circulation liquid hose included with the system for connecting the unit and an external water bath. Secure the joint, the joint cap, and the hose bands.
Follow the instructions and secure the hose.

⚠Cautions

Note the following if you want to use a hose prepared by yourself.

- Use a hose that withstands the temperature and the pressure specified for this product.
- Select a soft hose made of rubber or vinyl to allow effective tightening with hose bands.
- Take care for coming off of the hose or leak of liquid when you use a hard hose.

＜Notes＞

●When you are going to prepare a hose by yourself instead of using the attached circulation liquid hose, select a hose having an internal diameter and an outer diameter below.

Hose I.D.: φ11.5～12.0 mm O.D.: φ17.0～17.5 mm

●The O.D. specification above is for when you use the attached hose bands. If you prepare hose bands by yourself, you can use a hose having an O.D. appropriate for them.

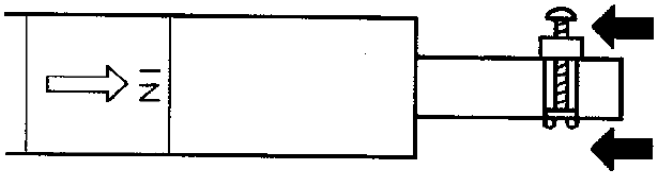
1： Prepare circulation liquid hoses included × 2, joints × 2, joint caps × 2, and hose bands × 2 at hands.

＜Notes＞

Circulation liquid hoses are classified into two types, namely, those with and without a pump.

2： Cut the end of the circulation liquid hose to a length appropriate for the specification application.

3： Run the end of the circulation liquid hose through the hose band. Run the circulation liquid hose with a pump through the IN side.



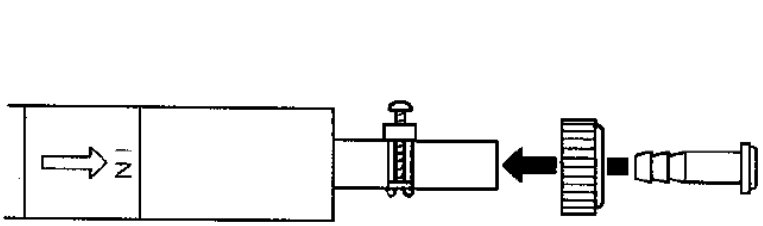
6. Installation procedures

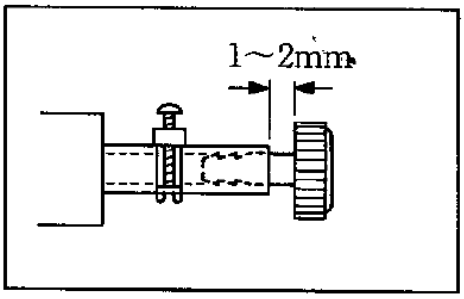
Connecting the circulation liquid hose

4：Install a joint to the joint cap and then insert it into the circulation liquid hose.
Insert the circulation liquid hose with a pump into the IN side.

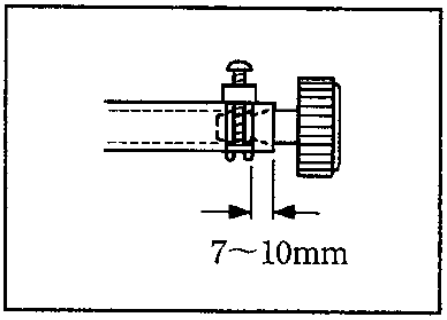
⚠Caution

To avoid leak, be sure to securely insert the hose referring to the illustration below.





5：Move the hose band to the point in the illustration and then fix the hose.



⚠Caution

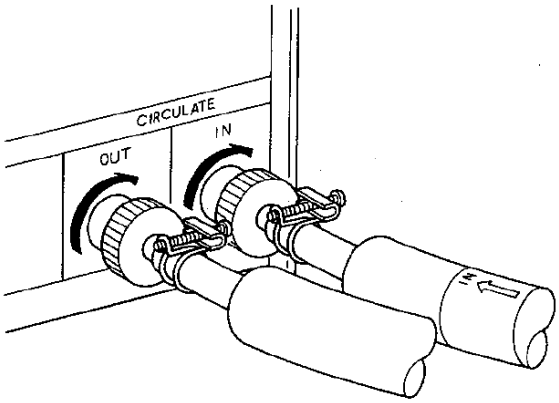
Use a driver to tighten the hose band only with a torque equivalent to that of hand tight. Take care not to deform the joint.

6：Connect the circulation liquid hose (with a pump) to the joint nipple for circulation liquid of the unit (IN) and, the other circulation liquid hose to the joint nipple for circulation liquid (OUT) by twisting their joint caps.

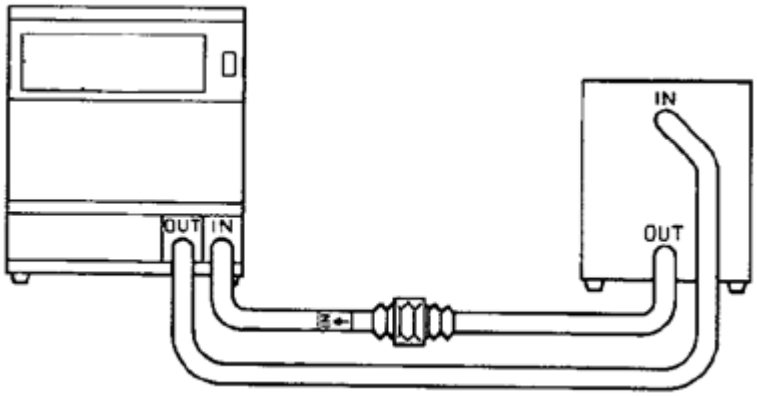
＜Note＞

Securely connect with only a hand tight force (without using a tool).

Connection of the circulation liquid hose



7： Connect other ends of the circulation liquid hoses to IN and OUT of your external water bath.

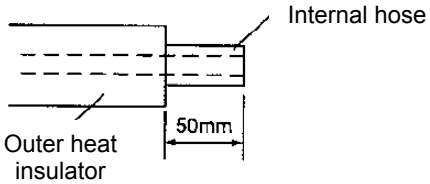


⚠Caution

Check the I.D. and O.D. of the circulation liquid hose and then install it securely with hose bands to prevent leaks.

Do not bend the circulation liquid hose forcibly. Running the circulation liquid hose in a too small angle will prevent proper flow of circulation liquid and may damage the hose.

When you have cut the hose, process the end as shown below.



＜Note＞

- Select circulation liquid having a quality as shown in the “Circulation liquid specification” (P.67) no to give adverse effects to the unit.

6. Installation procedures

Connection of the radiation water hose (for water cooled type only)

When installing a water-cooled unit, use the radiation water hose included with the unit to connect the unit and the supply/discharge port for radiation water. Use the joints, the joint caps, and the hose band (common for circulation liquid hose) to connect the radiation water hose. Follow the instructions to secure the hose.

＜Notes＞

- When you are going to prepare a hose by yourself instead of using the attached radiation water hose, select a hose having an internal diameter and an outer diameter below.
  Hose I.D.: φ11.5～12.0mm　　O.D.: φ17.0～17.5mm
- The O.D. specification above is for when you use the attached hose bands. If you prepare hose bands by yourself, you can use a hose having an O.D. appropriate for them.

⚠Caution

Note the following if you want to use a hose prepared by yourself.

Use a hose that withstands the temperature and the pressure specified for this product.

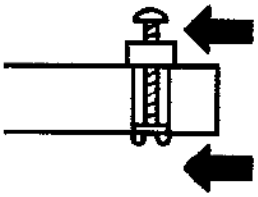
Select a soft hose made of rubber or vinyl to allow effective tightening with hose bands.

Take care for coming off of the hose or leak of liquid when you use a hard hose.

1: Prepare a circulation liquid hoses included (3m), joints × 2, joint caps × 2, and hose bands × 2 at hands.

2: Cut the radiation water hose to a length appropriate for the supply/discharge port position.

3: Run the end of the radiation water hose into the hose band.

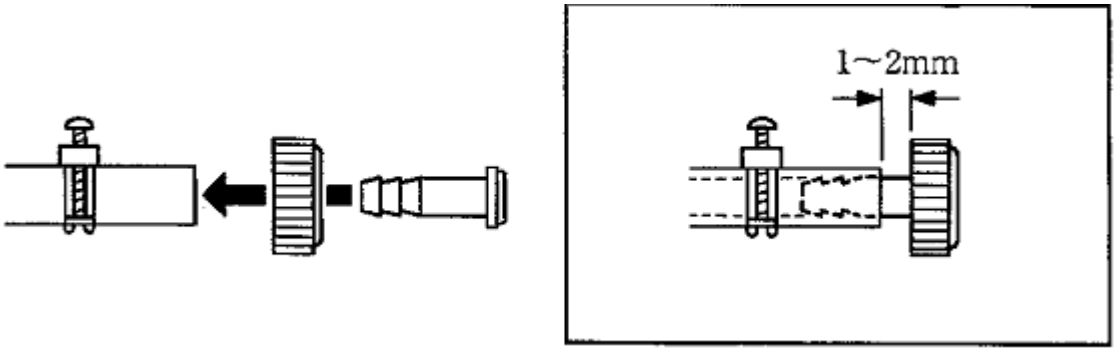


Connection of the radiation water hose (for water-cooled type only)

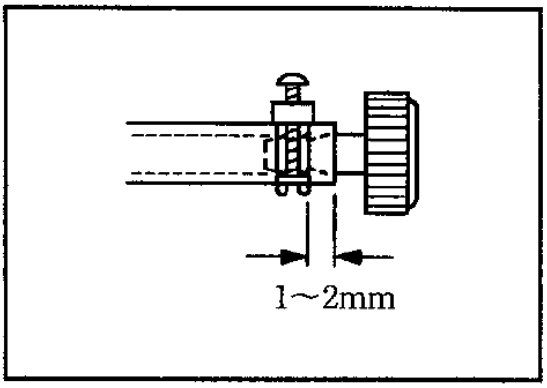
4：Attach the joint to the joint cap and insert the cap into the radiation water hose.

＜Note＞

Securely insert the cap as illustrated to prevent a leak.



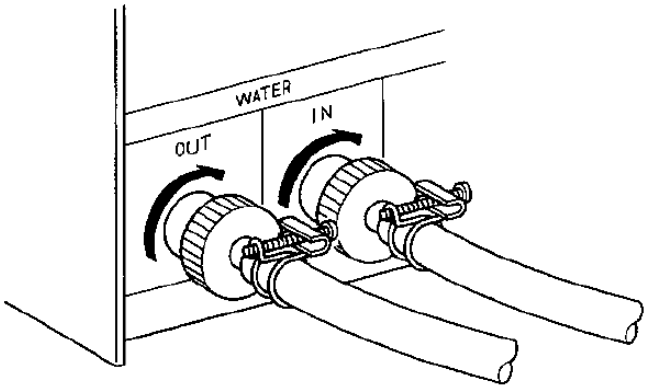
5: Move the hose band to the point in the illustration and then fix the hose.



6: Connect the radiation liquid hose (with a pump) to the supply side (IN) and the discharge side (OUT) joint nipples for radiation water of the unit by twisting their joint caps.

＜Note＞

Securely connect with only a hand tight force (without using a tool).



Connection of the radiation water hose (for water cooled type only)

7: Connect the radiation water hose to the supply/discharge port for radiation water.

⚠Caution

- Check the I.D. and O.D. of the radiation water hose and then install it securely with hose bands to prevent leaks.
- Do not bend the radiation water hose forcibly. Running the radiation water hose in a too small angle will prevent proper flow of radiation water and may damage the hose.
- When you have cut the hose, process the end as shown below.

＜Note＞

●Select radiation water having a quality and at a flow as shown in the “Radiation water liquid specification” (P.67) no to give adverse effects to the unit.

6. Installation procedures

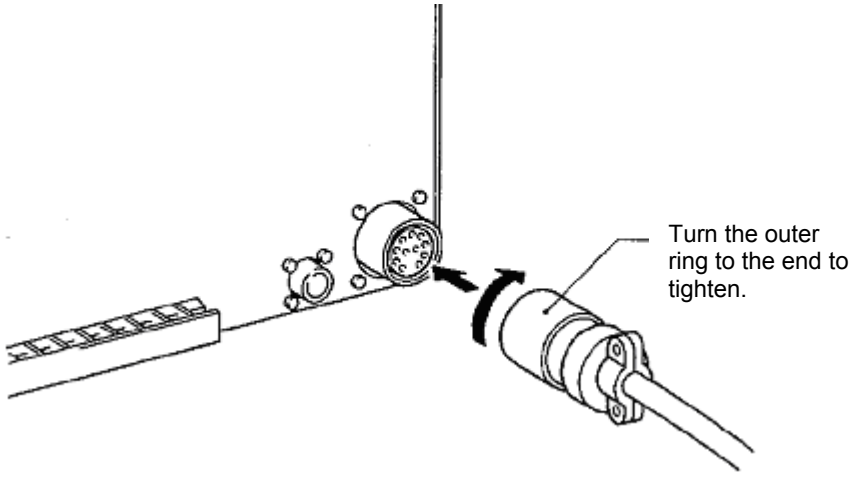
Connection of wires

In this section, how to connect the cab tire cable, an external sensor, an 8P terminal block, RS485, and power code is explained. Carefully read the relevant items and securely connect them.

⚠ Warning

- Do not connect wires with wet hands. It may lead to an electrical shock.
- Connect the power code only after all other wires have been connected. Otherwise, there may be a risk of an electrical shock.

1: Connecting the cab tire cable (for the separate type only)
Connect the cab tire cable from the rear of the cooling/heating assembly to the connector at the power control assembly (11P).



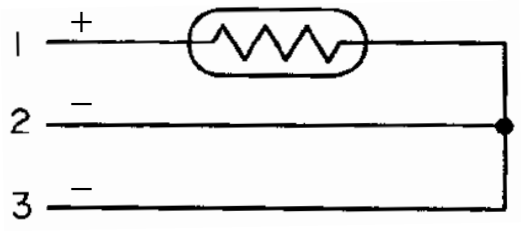
⚠Caution

- When installing the cooling/heating unit by stacking it on the unit, be sure to use the stacking clamps (P13/P14) included with the unit because the body of that assembly has not been designed to hold the power control unit. Otherwise, the unit may be damaged.
- When you stack the separate type unit, be sure to put the power control assembly on the cooling/heating assembly. Stacking them in the inverse order might cause an electrical shock or a fire when water should leak.
- Do not bundle the cab tire cable together with the power cord. A noise may occur and cause a malfunction.

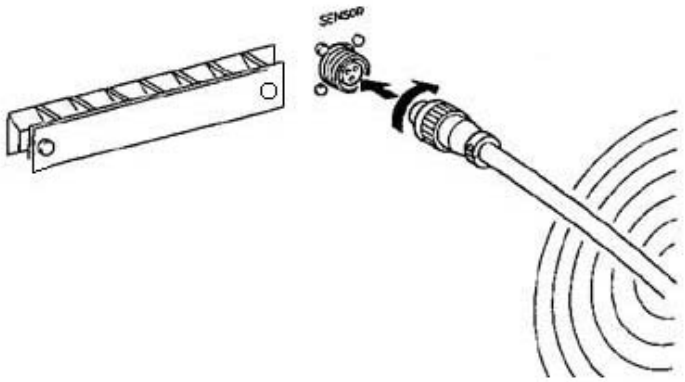
2: Connecting an external sensor connector
Connect an external sensor (platinum resistance temperature detector Pt100) to the sensor connector using the included 3P plug (P13/P14).

＜Notes＞

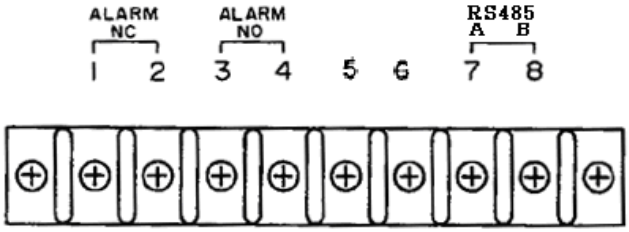
- When you use an external sensor prepared by yourself, switch the external sensor settings in “Function Setting 2” on the temperature controller. (For setting procedures, refer to the separate “Program Controller CR5A-CT operation manual P.51).
- Connect the 3P plug by wiring as shown below.



- No extern sensor is included in the unit. Prepare a sensor that meets the temperature controller specifications (P.66).



3: Connecting the 8P terminal block
The 8P terminal block has two blocks for the alarm/output and for RS485 communication.



・Alarm output signal(ALARM)
When a trouble occurs to the unit due to disconnection of the sensor, stop of DC power supply, or outage of radiation water, the No. 1 and 2 terminals (NC) on the terminal block will become OPEN while No. 3 and 4 (NO) terminals will become CLOSE.
The No. 1 and 2 terminals will be OPEN and No. 3 and 4 terminals will be CLOSE while power is OFF.

⚠ Warning

Contact capacity between terminals is AC125V, 0.5A. Do not flow a current beyond this level. An electrical shock, a fire, or damages to the unit may result.

When wiring has been completed, replace the acrylic cover for the 8P terminal block to the original position before reusing the unit. Otherwise, an electrical shock, a fire, or damages to the unit may result.
Cautions when you use an external sensor.

① When performing heating when the capacity of the water bath is large and set temperature is high (60～70°C), inside of the cooling/heating unit may reach 70°C or more. When operating the unit under such conditions, first use the internal sensor and switch to the external sensor once the set temperature is obtained for safety. (Refer to the separate “Program Controller CR5A-CT operation manual P.51” for how to switch the sensor.)

② Because the sensor position is away from the heat source, response may be slow and temperature control may become inefficient depending on the sensor settings. In such case, you need to change the PID constant. (Refer to the separate “Program Controller CR5A-CT operation manual P.49” for how to change PID constants.)

③ Make sure that circulation liquid is flowing.

4: Connecting the power cord

Connect the power cord with an earth terminal from the rear of the unit (rear of the power supply assembly for the separate type) to the earthed outlet plug. When an earthed outlet plug is not available, use the power cord adaptor included and be sure to ground the earth wire.

⚠ Warning

Never connect the earth wire to a gas pipe. It may cause a fire.

⚠ Caution

The power specification of the unit is AC100～240V±10% 50/60 Hz. Be sure to use an outlet plug (distribution board) that meets the required power capacity. See “11. Specifications” (P.64/65) for current values.

7. Preparations before operation

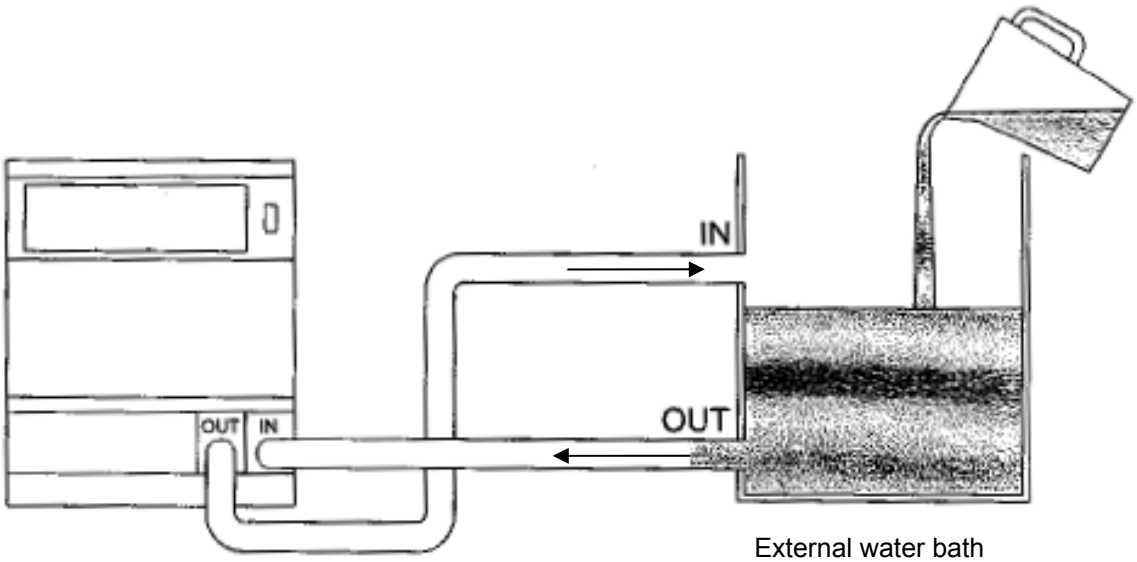
Circulation of liquid

When connection of wires for hoses is completed, pour circulation liquid into the external water bath. At this time, you need to fill the circulation pump in the unit with circulation liquid.
Pour circulation liquid following the procedures below.

1: Pour circulation liquid into the external water bath.

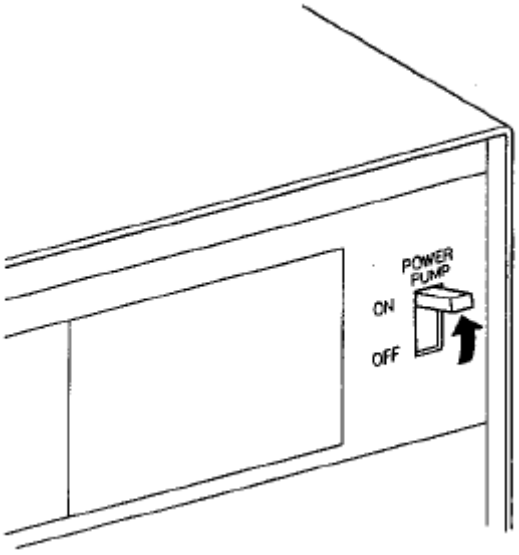
⚠Caution

Pour circulation liquid above the discharge port (OUT) in the external water bath. But do not pour circulation liquid up to the supply port (IN) at first not to prevent proper air releasing.

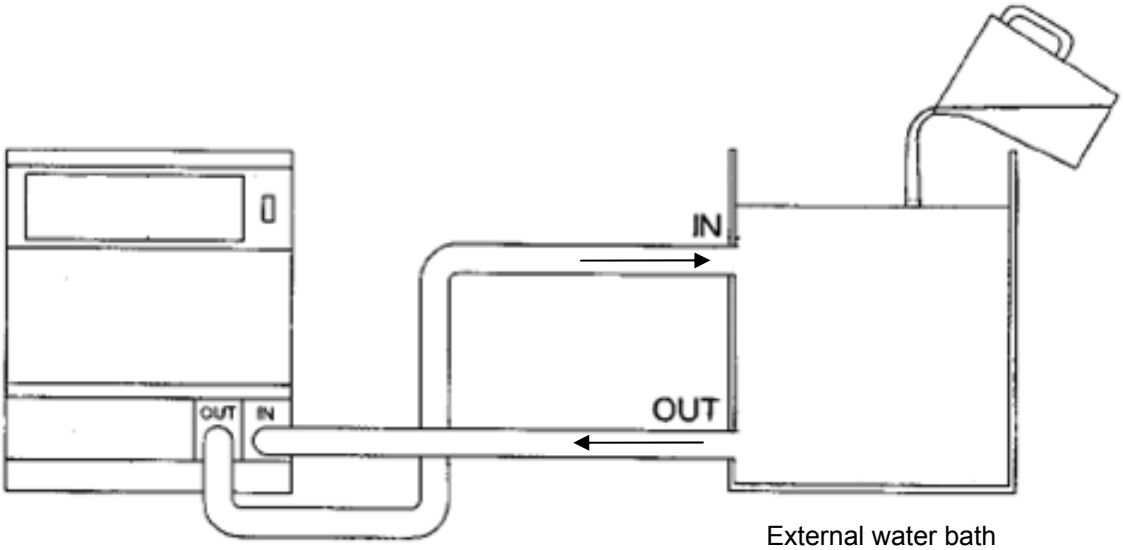


External water bath

2: Turn the unit breaker “ON”.
・The pump will start and circulation liquid starts to circulate.



3: Once circulation liquid starts to circulate, slowly add circulation liquid above the supply port (IN) of the external water bath.



External water bath

⚠Caution

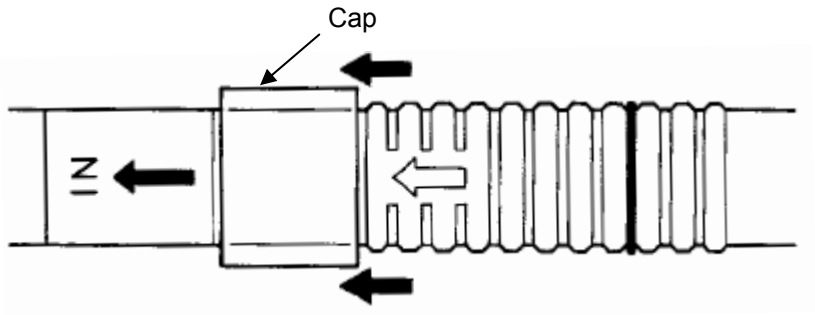
When circulation liquid does not circulate correctly, the circulation pump in the unit may contain air. Release air referring to the next section.

7. Preparations before operation

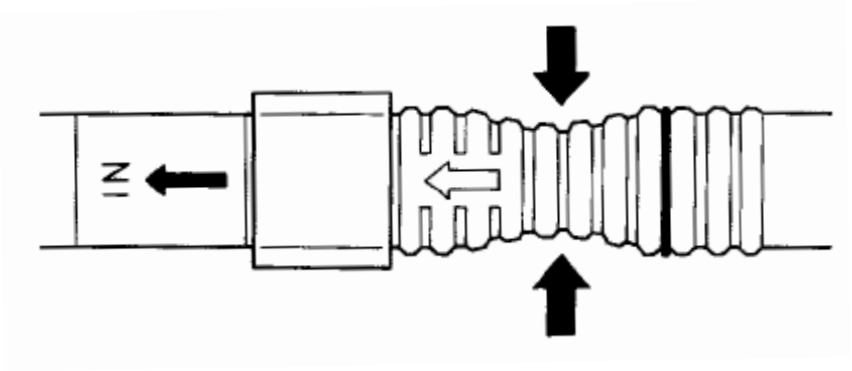
How to release air

When circulation liquid does not circulate correctly, use the circulation liquid hose with a pump to release air from the circulation pump or pipes.

1: Slide the cap at the pump of the circulation liquid hose with a pump.



2: Press the center of the pump several times to release air.
・Air will come out of the supply port (IN) of the external water bath.



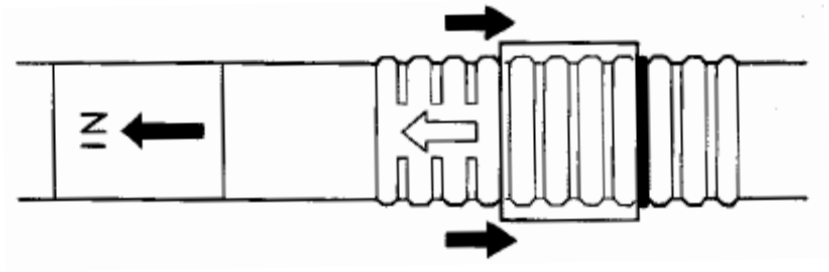
7. Preparations before operation

How to release air

3: When air has been completely released, slide the cap to the original position.

⚠Caution

The cap is used to prevent deform of the pump of the circulation liquid hose with a pomp from suction pressure of the circulation pump in the unit or bend of the hose. When the unit is continuously operated at a higher temperature of 60°C or more, the pump may deform easily. Never forget to place the cap to the pump while the unit is in operation.



Inspection before operation

Inspection the following points before starting operation.

- Check for leak or loosening at connections of pipes for circulation liquid and radiation water.
- Make sure that pipes on the rear of the unit, the power cord, and the earth wire are connected securely.
- For the water-cooled model, make sure that radiation water flow is 3～5 L/min.
  Keep a flow of at least 1L/min even during heating.

8. Operating procedures

Operation modes and lists of functions

There are six operation modes as shown below.
Refer to the separate “Operation Manual for the model CR5A-CT Program Controller” for details

№	Name	Function
1	Fixed Temp. operation	Controls temperature at a constant temperature.
2	Auto Stop operation	Stops operation at a set time.
3	Quick Auto Stop operation	Allows setting auto stop operation during fixed temperature operation.
4	Auto Start operation	Starts operation at a set time.
5	Program operation	Performs program operation.
6	Program Auto Start operation	Starts program operation at a set time.

The function menu shows the following 15 functions.
Refer to the separate “Operation Manual for the model CR5A-CT Program Controller” for details.

№	Name	Function
Functions of FUNCTION 1		
1	Language setting	You can set to Japanese or English.
2	Calendar/Time setting	You can set the dominical year, month, date and the current time.
3	Time/Hour selection	You can select whether timer operation will be set in hours or in time.
4	Buzzer setting	You can turn on or off sound of key operation, time up, operation disabled and door open separately.
5	Output operation level display	The output level in % can be continuously monitored.
6	Electricity/electric power charge display	You can monitor the basic unit for electric power charge calculation, electric power volume and charge for various units from an hour to a year, total electric power charge, electric power volume and charge for one cycle operation.
7	PID constant setting	You can set a proportional band, integration time, and differentiation time.
8	Temperature error detection setting	You can set upper and lower limits of temperature.
Functions of FUNCTION 2		
9	Temperature sensor switching setting	The function is used to switch to an external sensor.
10	Calibration offset setting	The function is used to compensate a calibration offset temperature of main/external sensor.
11	External communication setting	The function is used to set conditions for external communication.
12	Power failure compensation function setting	The function enables you to set whether to continue or hold the operation after recovery from a power failure.
13	Setting of display during operation	You can switch an operation guide display on the screen during operation. You can select from 1: Normal display; 2: Calendar display; 3: Electric energy display; 4: Electric charge display; and 5: Output operation amount display.
14	Accumulated time display	The display allows monitoring of accumulated time of operation of the controller (unit).
15	Warning history display	The display allows monitoring of error information of 20 incidents in the past.

8. Operating procedures

Operation modes and lists of functions

For details, refer to the separate Operation Manual for the Model CR5A-CT Program Controller.

No.	Operations	Corresponding page in the operation manual for the model CR5A-CT Program Controller.
1	**Description of the Control Panel**	P.1
2	Fixed Temperature Operation	P.8
3	Fixed Temperature Auto Stop Operation	P.9
4	Fixed Temperature Quick Auto Stop Operation	P.10
5	Fixed Temperature Auto Start Operation	P.11
6	Program Operation	P.12
7	Registering a Program Operation Pattern	P.12
8	Registering a program	P.15
9	Assign a Created and Registered Program to a Dedicated Key.	P.23
10	Delete the Registered Program	P.25
11	Execute (Run) the Registered Program	P.26
12	Program Operation Function and Setting Procedure	P.27
13	Automatically Start the Registered Program	P.32
14	Program Operation	P.33
15	1. Program Step Change Function	P.33
16	2. Lock Settings	P.38
17	3. Guide Function	P.40
18	4. Suspension Function	P.41
19	Functions of FUNCTION key 1	P.42
20	1. Language select	P.42
21	2. Setting the Calendar Time	P.43
22	3. Hour/Time Setting	P.44
23	4. Buzzer Setting	P.45
24	5. Peltier output operation amount monitor	P.46
25	6. Electric Power Charge Setting	P.47
26	7. Setting a PID constant	P.49
27	8. Temperature error setting	P.50
28	Functions of FUNCTION key 2	P.51
29	1. Setting Temperature Sensor Switching	P.51
30	2. Setting the Calibration Offset	P.52

8. Operating procedures

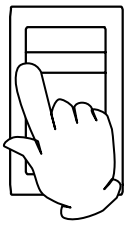
Operation modes and lists of functions

For details, refer to the separate Operation Manual for the Model CR5A-CT Program Controller.

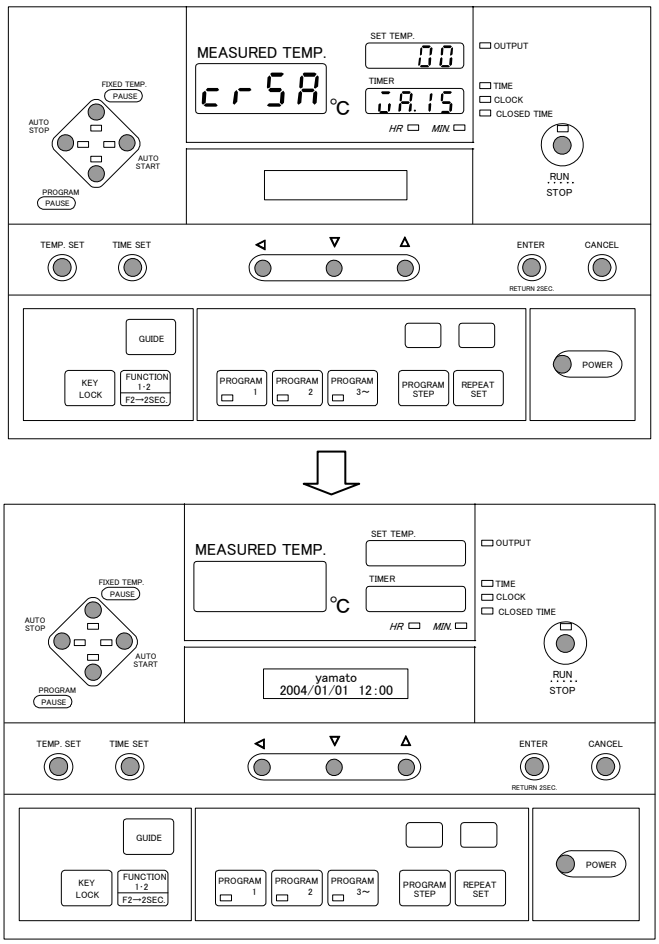
No.	Operations	Corresponding page in the operation manual for the model CR5A-CT Program Controller.
31	3. Setting External Communication	P.53
32	4. Setting Power Failure Compensation Selection	P.55
33	5. Setting Display During Operation	P.56
34	6. Accumulated Time Monitor	P.57
35	7. Warning History Monitor	P.58

1) Turn breaker power on. (Breaker is “ON”.)

- Turn power of the breaker on.
  The controller screen displays the initial display for several seconds and then year, month, day, and the current time will be displayed on the Guide screen



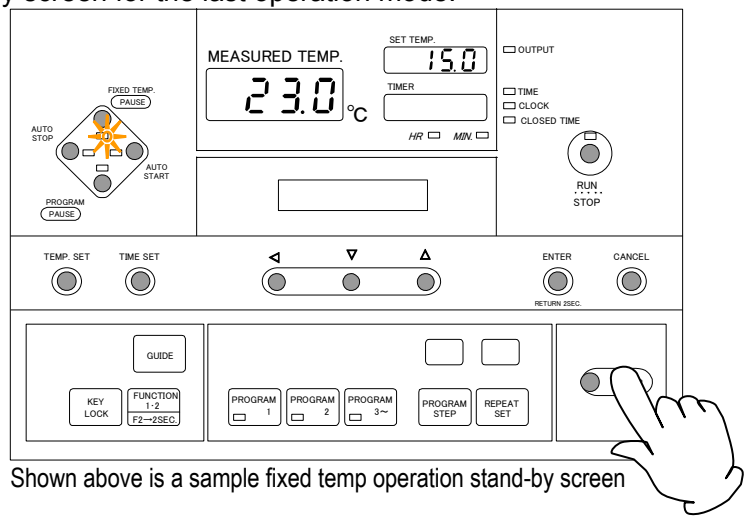
Note:When the Power Failure Compensation function is “ON”, the controller will be activated at a status before power was shut off when breaker power is turned on.
Also refer to the section on FUNCTION 2 “Power Failure Compensation function” in the separate “Operation Manual for the Model CR5A-CT Program Controller”.



Note: Although the calendar has been set at the time of shipping, reset it if the date and the time in the Guide screen are wrong.
For how to set, refer to the section on FUNCTION 1 “Setting the Calendar Time” in the separate “Operation Manual for the Model CR5A-CT Program Controller”.

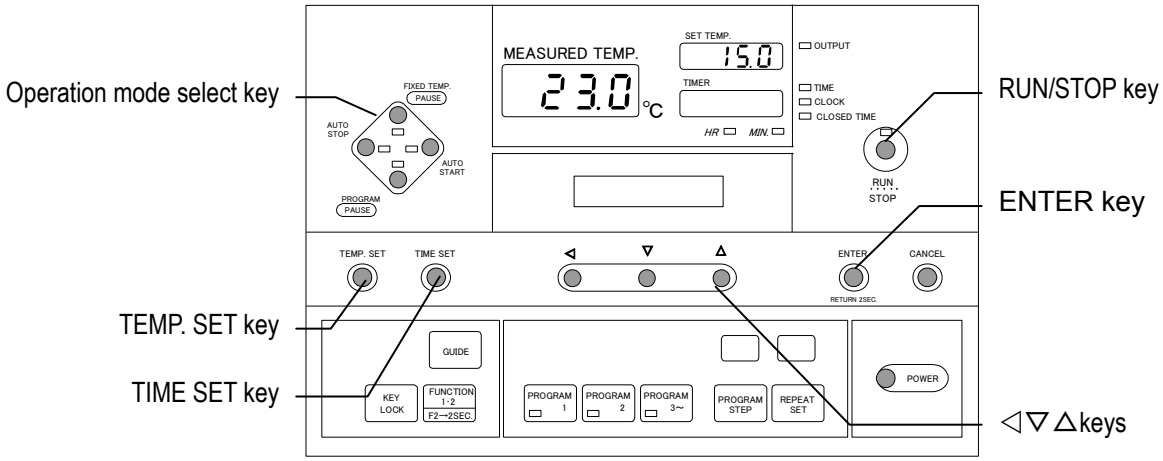
2) Turn controller power on.

■ Press the POWER key of the controller longer (one second).
The screen will switch to the stand-by screen for the last operation mode.



Shown above is a sample fixed temp operation stand-by screen

3) Operating sequence



For detailed operations and function settings, refer to the separate “Operation Manual for the Model CR5A-CT Program Controller”.

■ Select an operation mode you want using the Operation mode select key. If you select a mode the corresponding lamp will come on.

FIXED TEMP. : 3-1) Move to the FIXED TEMP. operation mode.
→ FIXED TEMP. AUTO STOP operation (End time is specified during Fixed Temp. operation)
→ FIXED TEMP. AUTO START operation (Start time is specified during Fixed Temp. operation)

PROGRAM : 3-2) PROGRAM operation mode, 3-3) Move to program settings.
→ PROGRAM AUTO START operation (Start time is specified during Program operation)

3-1) FIXED TEMP. operation mode

1. Select the Fixed Temp. key with the Operation Mode Select key.
2. Select the TEMP. SET key.
   The lowest one digit will flash in the Set Temp. Screen.
3. ・Enter a set temperature you want with the ▽△ keys.
   ・Shift the digit with the appropriate key and set a figure for the flashing digit with the □□ keys.
4. Press the ENTER key to determine the set temperature.
   Pressing the ENTER key ends flashing on the Set Temp.Screen and the set temperature is determined.

If you do not use FIXED TEMP. AUTO STOP operation or FIXED TEMP. AUTO START operation, move to Step 7.

5. Select the TIME SET key.
   (Only when FIXED TEMP. AUTO STOP operation or FIXED TEMP. AUTO START operation is set.)
   The lowest one digit will flash in the Timer screen.
5. ・Enter a time (clock time) you want with the ▽△ keys.
   ・Shift the digit with the appropriate key and set a time (clock time) for the flashing digit with the ▽△ keys.
6. Press the ENTER key to determine the set time.
   Pressing the ENTER key ends flashing on the Timer screen and the set time is determined.
7. Start operation.
   In the FIXED TEMP. operation stand-by status, press the RUN/STOP key to start operation.
   The lamp on the RUN/STOP key will come on.
8. Stop operation.
   In the FIXED TEMP. operation mode, press the RUN/STOP key to stop operation.
   The lamp on the RUN/STOP key will go off.
9. Pause operation of the unit.
   Pressing the FIXED TEMP key during FIXED TEMP. operation pauses the unit.
   Pressing the FIXED TEMP key again recovers from pause and the unit resumes operation.

3-2) PROGRAM operation mode

You need to register a program beforehand to select the PROGRAM operation. For registration of programs, refer to the section “PROGRAM operation” in the separate “Operation Manual for the model CR5A-CT Program Controller".

1. Select the PROGRAM key.
   Allow a program to be loaded into the existing PROGRAM key. Select a PROGRAM key and press it longer. The number of digits in the SET TEMP. screen will change to four and the lowest digit will flash.
2. ・ Allow the program you want to be loaded using the ▽△ keys.
   ・ Shift the digit with an appropriate key, set a program number from ”0001～0099” for the flashing digits with the ▽△ keys. When you select a program number, “Program number”, “Registration status” and “Name” will be displayed on the Guide screen. Confirm whether it is the program that you want to set or change and then press the ENTER key to determine.

Move to step 6. If you do not use PROGRAM AUTO START operation.

3. Select the TIME SET key.
   (Only when PROGRAM AUTO START operation is set)
   The lowest digit in the TIMER screen will flash.
4. ・Enter a time (clock time) you want with the ▽△ keys.
   ・Shift the digit with an appropriate key, set a figure (time) for the flashing digit with the □□ keys.
5. Press the ENTER key to determine the set time.
   Pressing the ENTER key ends flashing in the TIMER screen and determines the set time.
6. Start PROGRAM operation.
   In the PROGRAM operation stand by status, press the RUN/STOP key to start operation.
   The lamp on the RUN/STOP key will come on.
8. Stop PROGRAM operation.
   In the PROGRAM operation mode, press the RUN/STOP key to stop operation.
   The lamp on the RUN/STOP key will go off.
9. Pause operation of the unit.
   Pressing the PROGRAM key during PROGRAM operation pauses the unit.
   Pressing the PROGRAM key again recovers from pause and the unit resumes operation.

3-3) Program setting

For registration of programs, refer to the section “PROGRAM operation” in the separate “Operation Manual for the model CR5A-CT Program Controller".

1. Select the PROGRAM key.
   Allow the number of a program for set to be loaded in the PROGRAM key. Select the PROGRAM key with a program loaded and press it longer. The number of figures in the SET TEMP. screen will change to four and the lowest digit will flash. Select a number from “0001～0099”.
2. ・Allow the program you want to be loaded using the ▽△ keys.
   ・Shift the digit with an appropriate key, set a program number from ”0001～0099” for the flashing digits with the ▽△ keys. When you select a program number, “Program number”, “Registration status” and “Name” will be displayed on the Guide screen. Confirm whether it is the program that you want to set or change and then press the ENTER key to determine.
3. Set a program.
   Press the ENTER key again. As shown in the name “・・・・・・・・・” in the GUIDE screen, an under bar flashes under a character. The character with a flashing under bar may be converted.
4. Change the name as necessary.
   Move the flashing under bar of the name using the “◁” key, select characters with the ▽△ keys to change the name. When finished, press the ENTER key.

5. Set the number of steps.
   Then enter the number of steps. Enter a number of steps you want. When finished, press the ENTER key.
   ※Take steps for heating or cooling into consideration beforehand. Set “TEMP.” you want to “1 min”. The setting “1 min” for the timer parameter means you can move to the next step only after the unit has reached the temperature you want at the maximum power. So set the time parameter for heating or cooling steps to “1 min”.
6. Set a step temperature.
   The SET TEMP. screen flashes and the mode switches to the temperature setting mode. Select a temperature you want with the ▽△ keys to change to it. When finished, press the ENTER key.
7. Set the step time.
   The TIMER screen flashes and the mode switches to the time setting mode. Select a time you want with the ▽△ keys to change to it. When finished entering, press the ENTER key.
   ※For heating/cooling steps →”1 min"
   For holding step →”Time you want to hold”
8. Set each of steps.
   Repeat steps 7.～8. to set each step to the temperature and time you want.
9. END setting
   The CR5A-CT controller has a function that allows selecting end operations from below. Make selection below during the program setting phase. The number of digits in the SET TEMP. screen changes to four and the lowest digit flashes.
   Select any of “0000 : OFF”, “0001 : Hold”, “0002 : Fixed temp.” with the ▽△ keys and press the ENTER key. Now program setting has completed.
   0 : OFF Terminates program operation and brings the unit into the standby state.
   1 : HLD An alarm notifies the end of program operation, counts the elapsed time since end and control operation is completed.
   2 : ST After completion of the final step, the unit automatically switches to the Fixed Temp. operation mode and continues operation.

Make changes following the program setting steps above.

8. Operating procedures

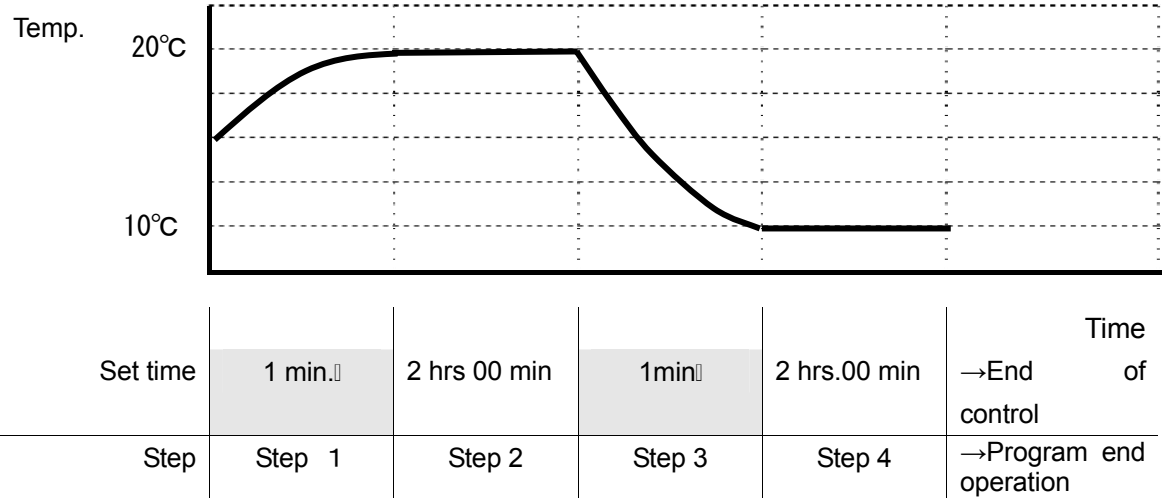
Operating sequence (Example of program registration)

・Program registration example

Program No.	Program 01
Name	20°C 2　10°C 2
Program	Step 1：Heating to 20°C→Step 2：Hold at 20°C for 2hrs.→ Step 3：Cooling to 10°C→Step 4：Hold at 10°C for 2 hrs.→ End of program

・Description of operation

	Operation	Set temp.	Set time
Step 1	Heating to 20°C	20°C	00 hr 01min.
Step 2	Hold at 20°C for 2 hrs	20°C	2 hrs 00min.
Step 3	Cooling to 10°C	10°C	00 hr 01min.
Step 4	Hold at 10°C for 2 hrs	10°C	2hrs 00min.



※The set time of 1 min for the step 1 and 3 is designed to maximize the heating and cooling capacity in order to hold the temperature during the next step.

※ Although the sample program above has been set as the most typical settings. Adjust time, temperature and number of steps as appropriate depending on the specific purpose and application.

8. Operating procedures

Operating sequence (Example of program registration)

1. Register a name “20°C 2　10°C 2”.
   Perform steps 1.～4. on P.41”, section 3-3) , then perform step 5. and enter “20°C 2　10°C 2”.

   PROGRAM01 EXIST
   NAME　(20°C 2　10°C 2)

2. Enter the number of steps.
   Set "4" as the number of steps.
   (Settings for step 1～step 4.)

   STEP in PGM01
   SET:**　REMAIN:**

3. Step 1：Heating to 20°C and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP. screen to 20.0°C with the △▽ keys. Press the ENTER key to determine the temperature.

   PROGRAM01 Step 01
   TEMP SET

4. Step 1：Heating to 20°C and then set the time parameter.
   Change the time flashing in the TIMER screen to 00:01 with the △▽ keys. Press the ENTER key to determine the temperature.

   PROGRAM01 Step 01
   TIME SET

5. Step 2：Hold at 20°C for 2 hrs and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP. screen to 20.0°C with the △▽ keys. Press the ENTER key to determine the temperature.

   PROGRAM01 Step 02
   TEMP SET

6. Step 2：Hold at 20°C for 2 hrs, and then set the time parameter.
   Change the time flashing in the TIMER screen to 2：00 with the △▽ keys. Press the ENTER key to determine the temperature.

   PROGRAM01 Step 02
   TIME SET

7. Step 3：Heating to 10°C and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP screen to 10.0°C with the △▽ keys. Press the ENTER key to determine the temperature.

   PROGRAM01 Step 03
   TEMP SET

8. Step 3：Heating to 10°C and then set the time parameter.
   Change the time flashing in the TIMER screen to 00：01 with the △▽ keys. Press the ENTER key to determine the temperature.

   PROGRAM
   01 Step 03
   TIME SET

9. Step 4：Hold at 10°C for 2 hrs and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP. screen to 10.0°C with the ▽△ keys. Press the ENTER key to determine the temperature.

   PROGRAM 01 Step 04
   TEMP SET

10. Step 4：Hold at 10°C for 2 hrs and then set the time parameter.
    Change the time flashing in the TIMER screen to 2：00 with the △▽ keys. Then press the ENTER key to determine the temperature.

    PROGRAM 01 Step 04
    TIME SET

11. Set the program end operation.
    In the previous section, pressing the ENTER key will change the screen to the Program End operation screen. Set the value in the SET TEMP. screen to “0001” and press the ENTER key. Now setting has been completed.

    PGM01 END SET
    0：OFF　1：HLD　2：ST

    PROGRAM 01 EXIST
    Name　(20°C 2　10°C 2)

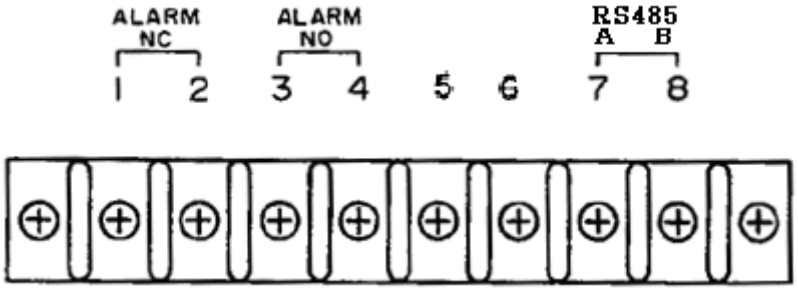
Before operating the unit

❗	Be sure to follow instructions in this manual for operating the product. Operations other than those specified in this manual may cause a trouble. Also take care that the warranty may be void if any operation other than those specified in this manual is performed.

⚠ CAUTION

❗	1. Be sure to turn the breaker OFF before making any connections.
	2. Be sure to use the unit within the rated capacity when you use the alarm output.
	3. Make any connection secure with the screws attached to the terminal block.

Connecting procedures



Connecting terminals

Specifications

Alarm output	Alarm output signal(ALARM) When a trouble occurs to the unit due to disconnection of the sensor, stop of DC power supply, or outage of radiation water, the No. 1 and 2 terminals (NC) on the terminal block will become OPEN while No. 3 and 4 (NO) terminals will become CLOSE. • The No. 1 and 2 terminals will be OPEN and No. 3 and 4 terminals will be CLOSE while power is OFF. • Contact capacity：AC125V　0.5A (resistance load) • Connection：With an M4 screw to the terminal block

1. Communication settings

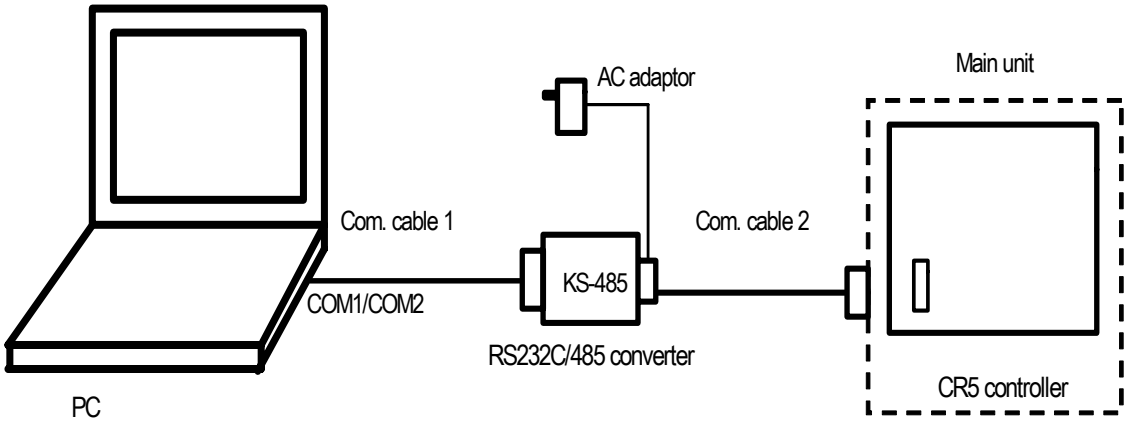
1.1 Communication settings

Make communication parameter settings on the PC side before starting communication with the CR5A-CT controller (hereafter, “this Unit”)

	Item	Communication settings
1	Data length	8 bits
2	Stop bit length	2 bits
3	Parity	None
4	BCC check	Enabled
5	Communication rate	4800BPS
6	Response delay time	0msec

1.2 Connection for communication

- PC
  - ・One RS485C interface channel (COM1/COM2 port) is used.
- RS232C／RS485 converter
  - ・We recommend a converter KS-485 of System Sacom.
  - ・ By purchasing our non-standard accessory “external communication adaptor (RS485-232C) ODK18”, you can make following connection. (PC unit is excluded.)
  - ・Sample program can be viewed in our home page.
    http://www.yamato-net.co.jp/support/program/index.htm
- Connection communication cable



Note 1) Configuration of the non-standard accessory, “external communication adaptor (RS485-232C) ODK18” is as follows.

① Com cable 1: PC side connector (for connecting IBM9 pin device) RS-485 cable 1m, KS-485 side connector (Dsub25 pin, male) System Sacom CBL16

② Com cable 2: KS-485 side connector (Dsub9 pin, male) UL2464TASB 2-core AWG20 cable 3m, with a Y-terminal on the device side (with terminal resistance of 100Ω)

③ RS-485□KS-485 converter unit: System Sacom KS-485, with an AC adaptor

2. Data transmission system

Item	Specifications
Communication standard	EIA standard RS-485 compliant
Synchronization system	Asynchronous system
Communication system	Half-duplex communication
Transmission code	ASCII code
Communication rate	1200／2400／[4800]／9600BPS
Communication dist.	Max.500m (depends on environmental influences)
Network	Multi-drop system (Max. 1:31 stations)
Signal wire	Two wires: transmission/reception
Stop bit length	1／[2bits]
Data length	7／[8bits]
Parity	[None]／Odd／Even
BCC check	[Enabled]／Disabled
Response delay time	[0]～250 msec
Communication address	[1]～99 stations (Max. 1:31 stations)
Communication mode select	RO／[RW]

Note) Settings indicated in [ ] are the initial settings of the Unit.

3. Transmission control characters

Symbol	Name	Code	Description
STX	Start of text	02H	Indicates the beginning of a text
ETX	End of text	03H	Indicates the end of a text
R	Read	52H	Command to read a request
W	Write	57H	Command to write a request
ACK	Acknowledge Character	06H	Transmission of acknowledgement of proper reception
NAK	Negative Acknowledge	15H	Transmission of reply of reception error

Note) R : Read (Command to read settings or measurements)
W : Write (Command to write settings)
R command can be always available for communication in any mode.
W command is available for communication only in the normal mode and its specific parameters that can be communicated differ depending on the operating status (during operation). See “7. List of identifiers/commands”.

4. Transmission control procedures

4.1 Communication procedures

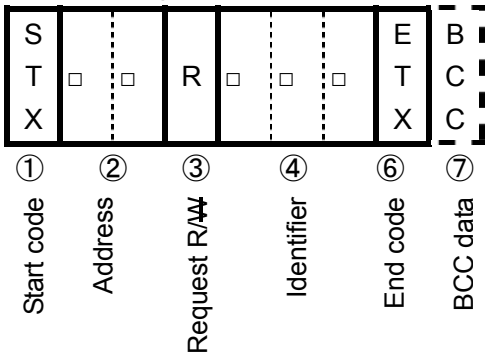
- The Unit returns “reply message” in response to a “request message” from a host PC. Thus, the Unit will never start transmission.
- The Unit does not make any communication for about four seconds after power on (no reply). Set some delay before start of communication after power on.

4.2 Message types

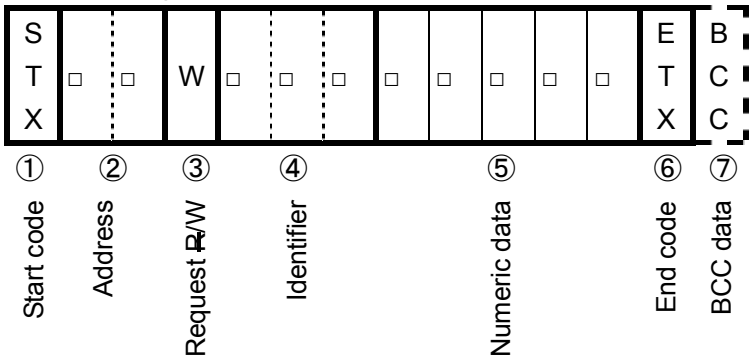
- Types of messages include the transmission request message from a host PC and the transmission reply message from the Unit.
- All code (excluding BCC) including STX, address, request content, identifier, and ETX are expressed in ASCII codes.

4.3 Configuration of the request message (Transmission from a host PC to the Unit)

4.3.1 Configuration of the read request message

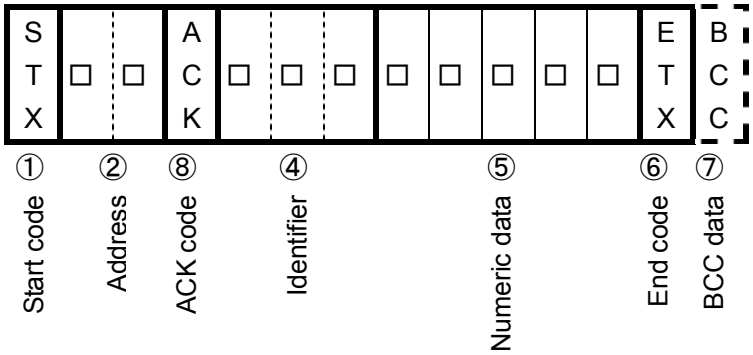


4.3.2 Configuration of the write request message

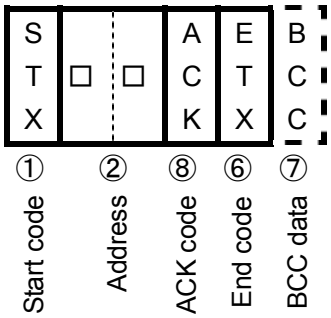


4.4 Configuration of the reply message

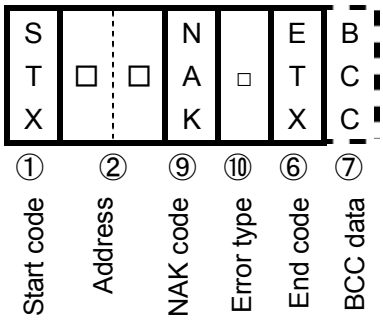
4.4.1 Reply message in response to the read request message



4.4.2 Reply message in response to the write request/store request messages



4.4.3 Reply message when an error occurs



4.5 Description of codes

- Codes below from ①STX, ②Address .･･･ ⑩Error type are expressed in ASCII codes.
- For ASCII codes, see “8.ASCII code list”.
- For conversion to ASCII codes, see “5.Communication example”.

① STX

This code is necessary for the receiving side to detect the beginning of a message. This is prefixed to the beginning of the character string to be transmitted.

② Address

This is the address of the counterpart (the Unit) for communication with a host PC. The address within a reply message from the Unit indicates the transmission source of the reply message.

③ Request

Indicate R or W symbol.

R：When data is read out from the Unit

W：When data is written into the Unit or stored in the Unit.

④ Identifier

This is a classification symbol (identifier) for data to be read out or written and is expressed in a three-digit ASCII code. See “7. Identifier／command list”.

⑤ Numeric data

This is data to be read out or written all of which are expressed in a five-digit number irrespective of their type.

Minus data：The “－” symbol is indicated at the first digit.

Decimal point position ：A five-digit data does not contain a decimal point.

Example) Five-digit numeric data ０ ０ １ ０ １ has the following meanings:

Example		Meaning
Set temp. (SV1)	When temp. sensor is a thermocouple	→ 101°C
	When temp. sensor is of platinum	→ 10.1°C
Set time (TIM)		→ 1 hr 1min

⑥ ETX

This is a code necessary for the receiving side to detect the end of a message. This is suffixed to the end of a character string to be transmitted. (Excluding BCC)

⑦ BCC

This is a check code for error detection and is an exclusive OR (EX-OR) of all characters from STX to ETX. This code (BCC) will not be embedded in a reply message when the item BCC check for communication setting is set to “None”.

⑧ ACK

This is an acknowledgement code and is returned embedded in a “reply message” from the Unit when the message received with the Unit contains no error.

⑨ NAK

This is a negative acknowledgement code and is returned embedded in a “reply message” from the Unit when the “request message” received with the Unit contains an error.

⑩ ERR type

When a “request message” received with the Unit contains an error, its description is embedded after “□NAK” in the “reply message” from the Unit.

This is a communication error and its detailed expression is omitted here.

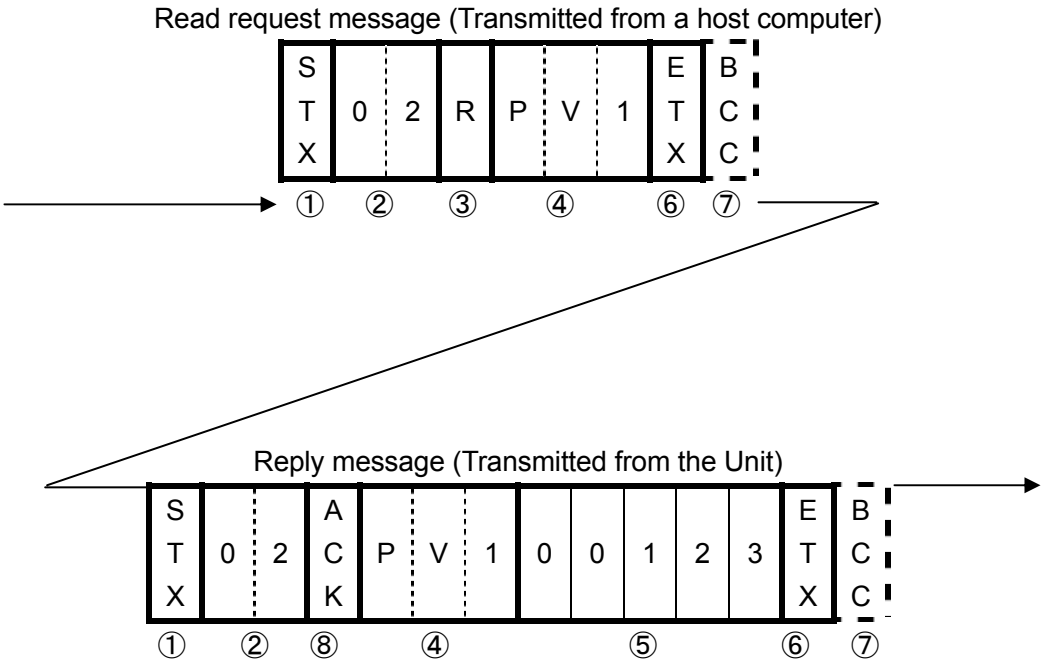
Reception timeout means a case STX is not sent from the Unit after some response wait time after a host PC has sent BCC.

5. Communication example

5.1 Communication example to be read out

Example) Request message: This message requests read-out of PV to the Unit addressed to address02.

Reply message from the Unit to this: PV data (00123) is returned.



Code	Symbol/data	ASCII code note 2)
① Start code	STX	02H
② Address	02	30H 32H
③ Request (Read)	R	52H
④ Identifier note 1)	PV1	50H 56H 31H
⑤ Numeric data	00123	30H 30H 31H 32H 33H
⑥ End code	ETX	03H
⑦ BCC data Request		61H
Reply		02H
⑧ Acknowledgement code	ACK	06H

Note 1) See “7. Identifier/command list”.

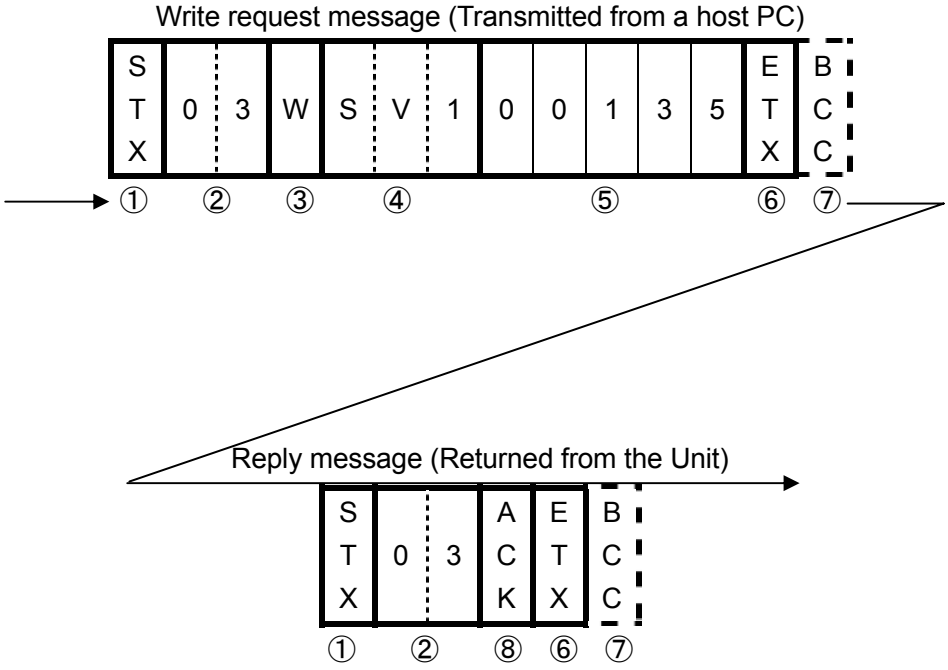
Note 2) For ASCII codes, see “8. ASCII code list”.

5.2 Example of write communication

Example) Request message: This message requests the Unit addressed to address03 to set “SV setting to 135” (write 135).

Reply message from the Unit to this: Returns acknowledgement that the request message was received.

☆Check that the message has been correctly written by separately reading out the data.



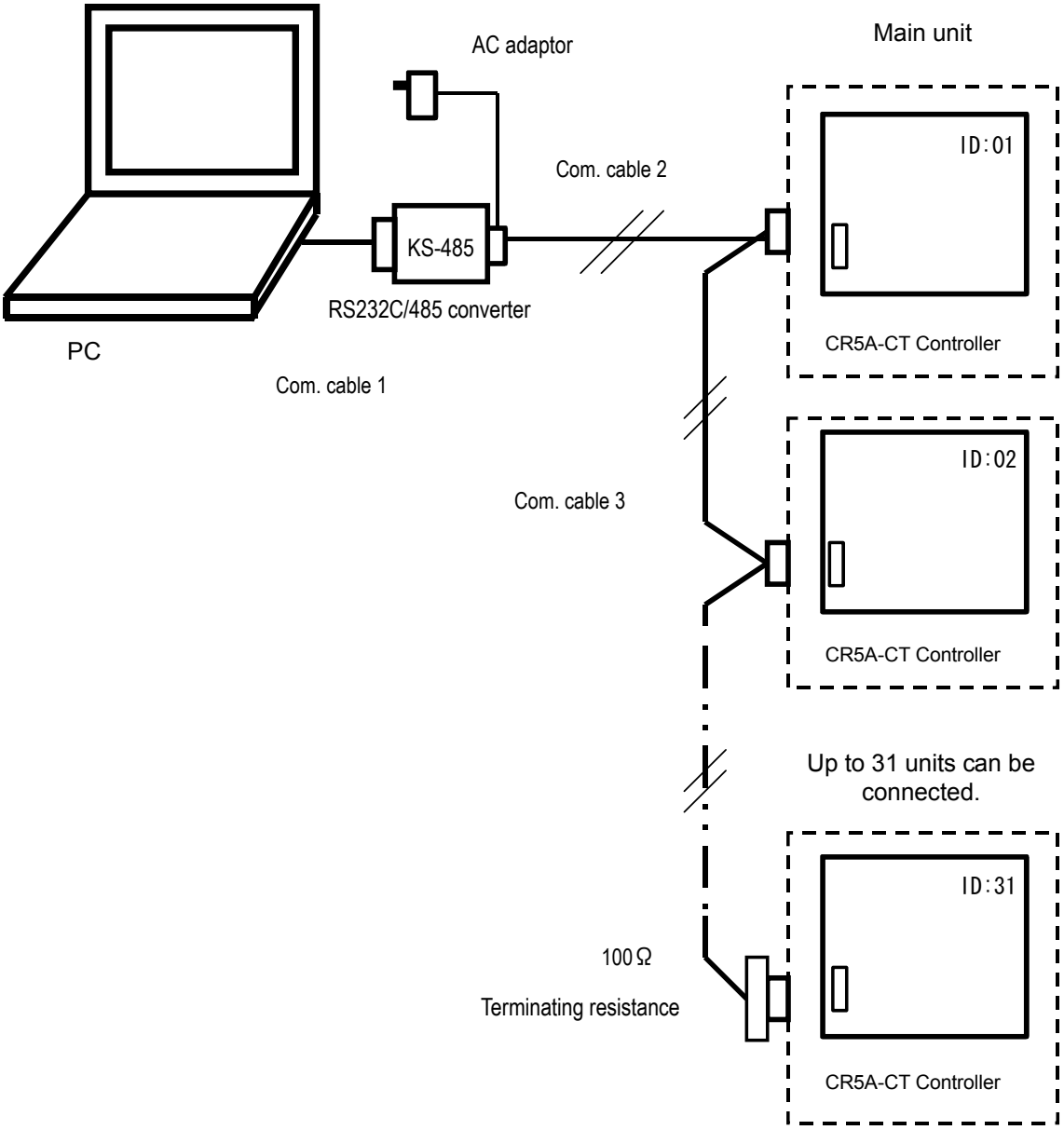
Code	Symbol・data	ASCII code note2)
① Start code	STX	02H
② Address	03	30H 33H
③ Request (Write)	W	57H
④ Identifier note 1)	SV1	53H 56H 31H
⑤ Numeric data	00135	30H 30H 31H 33H 35H
⑥ End code	ETX	03H
⑦ BCC data Request		56H
Reply		04H
⑧ Acknowledgement code	ACK	06H

Note 1) See “7. Identifier/command list”.

Note 2) For ASCII codes, see “8. ASCII code list”.

6. Wire connection

Shown below is an example of the multi drop connection.



Note1) Com. cable 1: PC side connector (for connecting IBM9 pin device) RS-485 cable 1m, KS-485 side connector (Dsub25 pin, male) System Sacom CBL16

Note2) Com cables 2, 3: These must be separately ordered.

Note3) Terminating resistance: This must be separately ordered. If the customer prepares this, be sure to connect a fixed resistor of at least 100Ω1/4W to the final cable device terminal block.

7. Identifier／command list

＜About identifiers and settings＞

*1 : When the time exceeds 100 hours, setting unit will be one hour.

*2 : __ indicates a space.

*3 : Parameters for which W command is effective during each operation mode. (This is effective during start phase in the normal mode.)

Fixed Temp. operation parameters

Name	Identifier	Command	Setting
Temp. setting	SV1	R/W/*/*	SLL～SLH : Lower limiter ～ upper limiter°C *3

Program operation parameters

Name	Identifier	Command	Setting
Temp. setting	S01～S99	R/W/*/*	SLL～SLH : Upper limiter ～ lower limiter *1*2
Time setting	T01～T99	R/W/*/*	00000～09959 : 0 hr 0 min ～ 99 hrs 59 min H0000～H9999 : 100 hrs ～ 9999 hrs
Repeat dest in. setting	R01～R99	R/W/*/*	00001～00099 : Steps 1 ～ 99
Repeat number setting	C01～C99	R/W/*/*	00000 : None 00001～00099 : 1 ～ 99 times 00100 : No restriction
End operation setting	O01～O99	R/W/*/*	00000 : END status 00001 : HLD status 00100 : FT status
Pattern № setting	PSN	R/W/*/*	00001 ～ 00099 : Programs 1～99
No of step setting	STC	R/W/*/*	00000 : No steps (unregistered) 00001 ～ 00099 : Steps 1～99
Program № select	PSP	R/W/*/*	00000 : Program 1 00001 : Program 2 00100 : Program 3
Step № select	STN	R/W/*/*	00001 ～ 00099 : Steps 1 ～ 99

Auto Start operation parameter

Name	Identifier	Command	Setting
Auto Start time setting	SST	R/W/*/*	When time control is selected 00000 ~ 09959 : 0 hr 0 min ~ 99 hr 59 min *1 H0100 ~ H9999 : 100 hrs ~ 9999 hrs When time control is selected 00000 ~ 02359 : 0 hr 0 min~23 hrs 59 min

Auto Stop operation parameter

Name	Identifier	Command	Setting
Auto Stop time setting	SPT	R/W/*/*	When time control is selected 00000 ~ 09959 : 0 hr 0 min~99 hr 59 min *1 H0100 ~ H9999 : 100 hrs~9999 hrs When time control is selected 00000~02359 : 0 hr 0 min~23 hrs 59 min

Other parameters

Name	Identifier	Command	Setting
Dominical year setting	YAR	R/W/*/*	00000 ~ 00099 : 0 ~ 99 years
Month setting	MON	R/W/*/*	00001 ~ 00012 : 1 ~ 12 month
Day setting	DAY	R/W/*/*	00000 ~ 00031 : 1 ~ 31 day
Hour setting	HOU	R/W/*/*	00001 ~ 00012 : 0 ~ 23 hour
Minute setting	MIN	R/W/*/*	00001 ~ 00012 : 0 ~ 59 minute
Power ON/OFF	POW	R/W/*/*	00000 : Power OFF *3 00001 : Power ON
Run/stop	RUN	R/W/*/*	00000 : Stop *3 00001 : Run
Operation mode selection	OKS	R/W/*/*	00000 : Fixed Temp. operation select 00001 : Program operation selection

Other parameters

Name	Identifier	Command	Setting
Timer operation select	TOS	R/W/*/*	00000 : No timer operation 00001 : Auto Start operation 00002 : Auto Stop operation
Remaining time monitor	_TI	R/*/*/*	00000 : Timer up or operation stop *2 00001 ~ 09959 : 0 hr 1 min ~ 99 hrs 59 min H0100 ~ H9999 : 100 hrs ~ 9999 hrs
Program № monitor	_MN	R/*/*/*	00000 : Program 1 select *2 00001 : Program 2 select H0100 : Program 3 select
Step № monitor	_ST	R/*/*/*	00000 : Timer up or operation stop *2 00001 ~ 00099 : Steps 1 ~ 99
Key lock	KLC	R/W/*/*	00000 : Key lock release 00001 : key lock
Output monitor 1	OM1	R/*/*/*	00000 : 1st digit = Not used 2nd digit = Not used 3rd digit = Main output 4th digit = Alarm output 5th digit = Buzzer output Output status 0 = Output OFF 1 = Output ON
Output monitor 2	OM2	R/*/*/*	00000 : 1st digit = Event 1 output 2nd digit = Event 2 output 3rd digit = Event 3 output or operation output 4th digit = Event 4 output or timer up output 5th digit = Not used Output status 0 = Output OFF 1 = Output ON
Error monitor 1	ER1	R/*/*/*	00000 : 1st digit = Sensor error 2nd digit = Not used 3rd digit = Not used 4th digit = Stand-alone overheat prevention function error 5th digit = Not used Error status 0 = No error 1 = Error
Error monitor 2	ER2	R/*/*/*	00000 : 1st digit = Memory error 2nd digit = AT error 3rd digit = Internal com. error 4th digit = Peltier error 5th digit = Power source error Error status 0 = No error 1 = Error

Other parameters

Name	Identifier	Command	Setting
Error monitor3	ER3	R/*/*/*	00000 : 1st digit = Temp. upper limit error 2nd digit = Temp. lower limit error 3rd digit = Not used 4th digit = Not used 5th digit = Not used Error status 0 = No error 1 = Error
Main measured temperature monitor External measured temperature monitor	PV1 PV2	R/*/*/*	When input to a thermocouple (Ex) 00100 : 100°C When input to platinum (Ex) 01000 : 100.0°C When input to both of a thermocouple and platinum HHHHH : Measured temp. over scale LLLLL : Measured temp. under scale

8. ASCII code list

ASCII code	02H	03H	06H	15H						
Symbols used	STX	ETX	ACK	NAK						

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

ASCII code	2DH	20H								
Figures used	— Minus	SP Space								

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

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

ASCII code	55H	56H	57H	58H	59H	5AH	20H			
Char. used	U	V	W	X	Y	Z	SP Space			

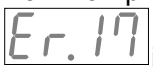
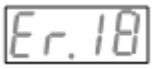
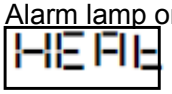
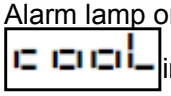
9. Troubleshooting

Safety device and error codes

The unit has the self diagnostic function with a controller and a separate safety device.
Table below shows possible causes and measures when the safety device is triggered.

[Error codes]

When a functional or mechanical abnormality occurs, the alarm lamp will illuminate on the control panel, an error code will be displayed on the control panel and the alarm buzzer will sound. When an abnormality occurs, confirm the error code and immediately stop operation.

Safety device	Symptom	Possible causes and measures
Sensor error	Alarm lamp on  indication	● Error in the temperature input circuit ● Disconnection or other errors in the temperature sensor ● Measured temperature is outside the displayable range: Contact our customer service center. ● When the external sensor switch setting is different: Check the temperature sensor switch setting and make settings again.
Independent temperature overrise error	Alarm lamp on  indication	● When circulation water temperature/radiation water temperature exceeds the upper limiter setting: Reset power supply once, and check the temperature in the bath and the set temperature of the overheat preventive device. If above procedure does not recover the unit, contact the general customer service center.
Power supply error	Alarm lamp on  indication	● When power output is stopped tentatively due to overheat protection, over voltage, over current protective action for the switching power supply that supplies power to the Peltier (thermo module), reset power supply once, and contact the general customer service center if above procedure does not recover the unit.
Memory error	Alarm lamp on  indication	● Wrong memory setting: Contact the general customer service center.
Internal communication error	Alarm lamp on  indication	● Communication error between the control board and the display board: Contact the general customer service center.
Peltier error	Alarm lamp on  indication	● Peltier (thermo module) error occurred Contact the general customer service center.
Upper limit temperature error	Alarm lamp on  indication	● When a measured temperature will be higher than the set temperature by 5°C or more after the set temperature is reached. This error is automatically recovers when the measured temperature returns to within the set temperature +5°C.
Lower limit temperature error	Alarm lamp on  indication	● When a measured temperature will be lower than the set temperature by 5°C or more after the set temperature is reached. This error is automatically recovers when the measured temperature returns to within the set temperature -5°C.

9. Troubleshooting

When a malfunction is suspected

If any of the symptoms below occurs

Symptom	Check
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 occurring..
An error code (Er.) is displayed	● Check the error code. Check the error code in “Safety device and error codes” on P.61.
The refrigerator does not start	● Refrigerator is overloaded. Turn the ELB off immediately and make check in the column “Temperature does not go down” below, wait for a while and turn the breaker on again.
Temperature does not rise.	● If the set temperature is below that in the bath. ● If the power supply voltage has declined. ● If the ambient temperature is outside the usable environmental temperature range. ● If cooling load for inside the bath is large.
Temperature does not go down	● If the set temperature is higher than that in the bath. ● If supply voltage is low. ● If the environmental temperature is high. ● If heat load in the bath is large. ● If the ventilation port is covered.
Temperature fluctuates during operation.	● If the set temperature is appropriate. ● If the power supply voltage has declined. ● IF fluctuation of the environmental temperature has become large. ● If load for inside the bath is large.
Displayed temperature differs from the measurement.	● If the calibration offset setting is other than “0”. Set it to “0.” Confirm the settings described in the separate “Operation Manual for Model CR5A-CT Program Controller Manual”.

If power outage occurs

When the power is applied again after the unit has stopped due to power outage, the unit will automatically return to the status immediately before the power outage and resumes operation. To manually recover, follow the procedures in FUNCTION 2 “Power failure compensation setting” in the “Operation Manual for the Model CR5A-CT Program Controller”.
Turn the ELB off if you do not want to resume operation by automatic recovery.

◆If the symptom does not match any of the above, immediately turn the ELB on the main unit off, pull out the power cord from the power supply and contact your dealer or one of our customer service center.

10. Maintenance and inspection

Daily inspection/maintenance

Regularly perform the following maintenance and inspection below to use the unit comfortably and safely at all times, .

Warning

Never disassemble this product to perform maintenance or inspection. An electrical shock or damages to the unit may result.

Be sure to turn the power switch off and remove the power cord before maintenance and inspection.
Otherwise, an electrical shock may result.

Caution

Wiping the unit with benzene or thinner may damage plastic products or finishing. Remove dirt with a cloth slightly moistened with mild detergent solution and then completely wipe dry.

If outer surface of the unit or connections of pipes are dirty with chemicals, remove dirt with a cloth slightly moistened with mild detergent solution and then completely wipe dry. Above all, there are a lot of electric components inside the unit and accumulated dusts or dirts might cause a fire or a malfunction.

If circulation liquid is contaminated with stain or scale, its circulation efficiency will be compromised and may degrade performance or cause a malfunction. Regularly replace circulation liquid.

In a water cooled model, water stain or scale may generate in radiation water routes during long time of operation degrading water flow efficiency and may compromise the performance. In such a case, the water routes must be cleaned and you need to call a service staff.

When you are not going to use the unit for an extended period of time or before transportation, discharge circulation water and radiation water from the unit and let the inside of the unit dry. Otherwise, water stain or scale may be produced.

The unit has a pump and a fan motor inside as consumable components. Although it depends on the actual operating status of the unit, regularly replace them after 10,000 hours of operation of the pump and 20,000 hours of operation of the fan motor as a rough standard. Contact our service staff for replacement.

If you want to wash the cooling water routes inside the unit, contact your dealer, or one of our sales offices, or the general customer service center.

11. Specifications

Integrated type

Product code		221601	221602	221603	221604
Model		CTW401	CTW801	CTA401	CTA801
Performance	Operating temperature range Depends on conditions	-10°C (※1)～+70°C		0°C (※2)～+70°C	
	Temperature control precision	±0.1°C (When the water bath is CTE-3A, 6A, 12A, or 24A)			
	Cooling capacity(※3)	Approx. 145 J/s (Approx. 125 Kcal/h)	Approx. 291 J/s (Approx. 250 Kcal/h)	Approx. 93 J/s (Approx. 80 Kcal/h)	Approx. 186 J/s (Approx. 160 Kcal/h)
Configuration	Temperature controller	PID control with a PC			
	Sensor	Platinum resistance temperature detector (Pt100Ω)			
	Temperature setting system	Digital setting			
	Temperature display system	Digital display			
	Thermo module driving system	Switching power supply			
	Thermo module	KSP-3036 x 4	KSP-3036 x 8	KSP-3036 x 4	KSP-3036 x 8
	Material of heat exchanger liquid contact assembly	Stainless steel (SUS304)			
	Radiation system	Water cooled type (Withstand water pressure:5 Kgf/cm^2)		Air cooled type (fan motor)	
	Self diagnostic function	Buzzer alarm, relay contact output, and an error item will be indicated for the eight errors: ①Sensor error ②Overheat error ③Power supply error ④Memory error ⑤Internal communication error ⑥Peltier error ⑦Temperature upper limit error ⑧Temperature lower limit error. Power supply to the thermo module will be stopped for items: ①, ②, ③, ④, ⑤, and ⑥.			
Standards	External dimensions: W×D×H	291×360×360	331×480×380	391×380×360	371×440×380
	Power supply (50/60 Hz) 100V	6A	10A	5A	9A
	120V	5A	8.4A	4.2A	7.5A
	200V	3A	5A	2.5A	4.5A
	220V	2.8A	4.6A	2.3A	4.1A
	240V	2.5A	4.2A	2.1A	3.8A
	Weight	Approx. 19.5 kg	Approx. 29.5 kg	Approx. 24 kg	Approx. 36 kg
Accessories	Heat insulation hose for circulation water I.D. : 11.5 mm Length : 1m	2			
	Heat insulation hose for radiation water I.D. : 12 mm Length : 3m	1		-	

※1. -10°C is when radiation water temperature is 15°C ; no load.

※2. 0°C is when the environmental temperature is 10°C ; no load.

※3. Set temperature: 20°C; environmental temperature: 20°C; radiation water temperature: 20°C

11. Specifications

Separate type

Product code			221605	221606	221607	221608
Model			CTW401S	CTW801S	CTA401S	CTA801S
Performance	Operating temperature range Depends on conditions		-10°C (※1)～+70°C		0°C (※2)～+70°C	
	Temperature control precision		±0.1°C (When the water bath is CTB-3A, 6A, 12A, or 24A)			
	Cooling capacity(※3)		Approx. 145 J/s (Approx. 125 Kcal/h)	Approx. 291 J/s (Approx. 250 Kcal/h)	Approx. 93 J/s (Approx. 80 Kcal/h)	Approx. 186 J/s (Approx. 160 Kcal/h)
Configuration	Temperature controller		PID control with a PC			
	Sensor		Platinum resistance temperature detector (Pt100Ω)			
	Temperature setting system		Digital setting			
	Temperature display system		Digital display			
	Thermo module driving system		Switching power supply			
	Thermo module		KSP-3036 x 4	KSP-3036 x 8	KSP-3036 x 4	KSP-3036 x 8
	Material of heat exchanger liquid contact assembly		Stainless steel (SUS304)			
	Radiation system		Water cooled type (Withstand water pressure:5 Kgf/cm^2)		Air cooled type(fan motor)	
	Self diagnostic function		Buzzer alarm, relay contact output, and an error item will be indicated for the eight errors: ①Sensor error ②Overheat error ③Power supply error ④Memory error ⑤Internal communication error ⑥Peltier error ⑦Temperature upper limit error ⑧Temperature lower limit error. Power supply to the thermo module will be stopped for items: ①, ②, ③, ④, ⑤, and ⑥.			
Standards	External dimensions: W×D×H	Heat exchange assembly	291×380×175	311×480×202	291×380×190	361×410×260
		Power control assembly	291×342×195			
	Power supply (50/60 Hz)	100V	6A	10A	5A	9A
		120V	5A	8.4A	4.2A	7.5A
		200V	3A	5A	2.5A	4.5A
		220V	2.8A	4.6A	2.3A	4.1A
		240V	2.5A	4.2A	2.1A	3.8A
	Weight	Heat exchange assembly	Approx. 12.5 kg	Approx. 20 kg	Approx. 16 kg	Approx. 30 kg
		Power control assembly	Approx. 9 kg	Approx. 10 kg	Approx. 9 kg	Approx. 10 kg
Accessories	Heat insulation hose for circulation water I.D. : 11.5 mm Length : 1m		2			
	Heat insulation hose for radiation water I.D. : 12 mm Length : 3m		1		-	
	Stacking clamp		2			

※1. -10°C is when radiation water temperature is 15°C; no load.

※2. 0°C is when the environmental temperature is 10°C; no load.

※3. Set temperature: 20°C; environmental temperature: 20°C; radiation water temperature: 20°C

11. Specification

Specifications for temperature controller

Sensor	Platinum resistance temperature detector Pt100[Ω]3-wire (JIS C1604-1989)
Displayed temperature	-20.0～+80.0[°C]
Set temperature range	-15.0～+75.0[°C]
Display error	±0.1[°C]
Environmental temperature range	0～+60[°C]
Control system	Digital calculation PID control
Self diagnostic function	① Sensor error ② Overheat error ③ Power supply error ④ Memory error ⑤ Internal communication error ⑥ Peltier error ⑦ Temperature upper limit error ⑧ Temperature lower limit error
External communication function	RS485 Equipped as standard
Fixed value operation function	Continuously controls at a certain temperature.
Program operation function	Performs temperature control in the temperature increase and decrease gradient as per registered step temperatures and timings.
Auto start/auto stop function	Starts or stops operation in the range of 0～99 hours 59 minutes using the timer function.
Power outage compensation function	When a power outage occurred during the fixed value operation or the program operation, returns to the status at the time of power outage. (Power outage compensation operations can be selected, the initial setting is automatic recovery)

11. Specifications

Specifications for circulation liquid and radiation water

Specifications for circulation liquid

Temperature	-10°C～70°C
Pressure	0.1MPa (1 kgf/cm^2) or less
Viscosity	30 cP (when specific gravity is 1.0) or less
Specific gravity	1.0 (when viscosity is 1 cP) or less
Liquid suited for circulation liquid	Tap water, mixture of water and ethylene glycol or other liquid with relatively lower viscosity
Liquid not suited for circulation liquid	●Liquid with higher volatility and permeability ●Liquid with extreme viscosity ●Liquid that contains iron, nickel or other iron powder ●Slurry liquid ●Liquid corrosive to the materials below: ・Hard vinyl chloride ・Ethylene propylene rubber ・Polyethylene ・Alumina ・Special Fluorine resin ・SUS304

＜Note＞

- The figures in the circulation liquid specification table show temperature ranges that will no give adverse effects to the unit for operation and do not guarantee actual attainable or controllable temperatures.
  Actual attainable or controllable temperatures will differ depending on the model you use or operating conditions.

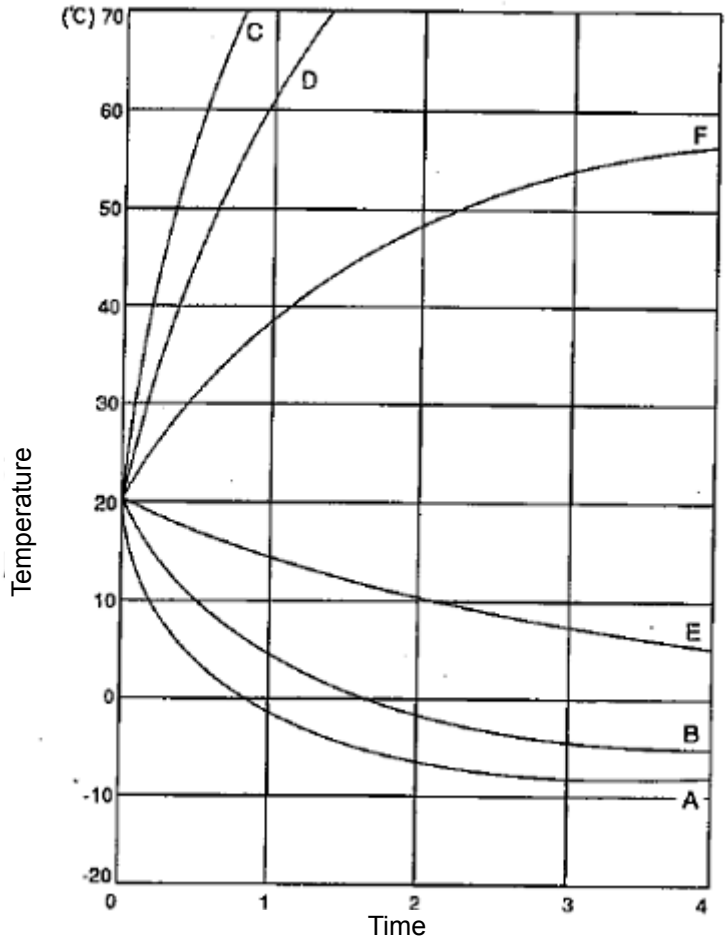
Specifications for radiation water

Flow	3～5 L/min
Ordinary pressure	0.2 MPa(2 kgf/cm^2) or less
Temperature	5～30°C
Liquid suited for radiation water	Tap water (clean water)
Liquid not suited for radiation water	●Flammable liquid ●Liquid with volatility or permeability higher than water ●Liquid corrosive to the materials below: ・Hard vinyl chloride ・Polypropylene ・Polyethylene ・Aluminum(with alumite) ・SUS304

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTW401・CTW401S**
  Cooling and heating characteristics



	A・C	B・D	E・F
Container	CTB-3A	CTB-6A	CTB-24A
Liquid	Ethylene glycol + water (1:1)		
Liquid amount	3L	6L	20L
Environmental temperature	20°C		
Radiation water temperature	20°C		
Radiation water amount	5 L/min		

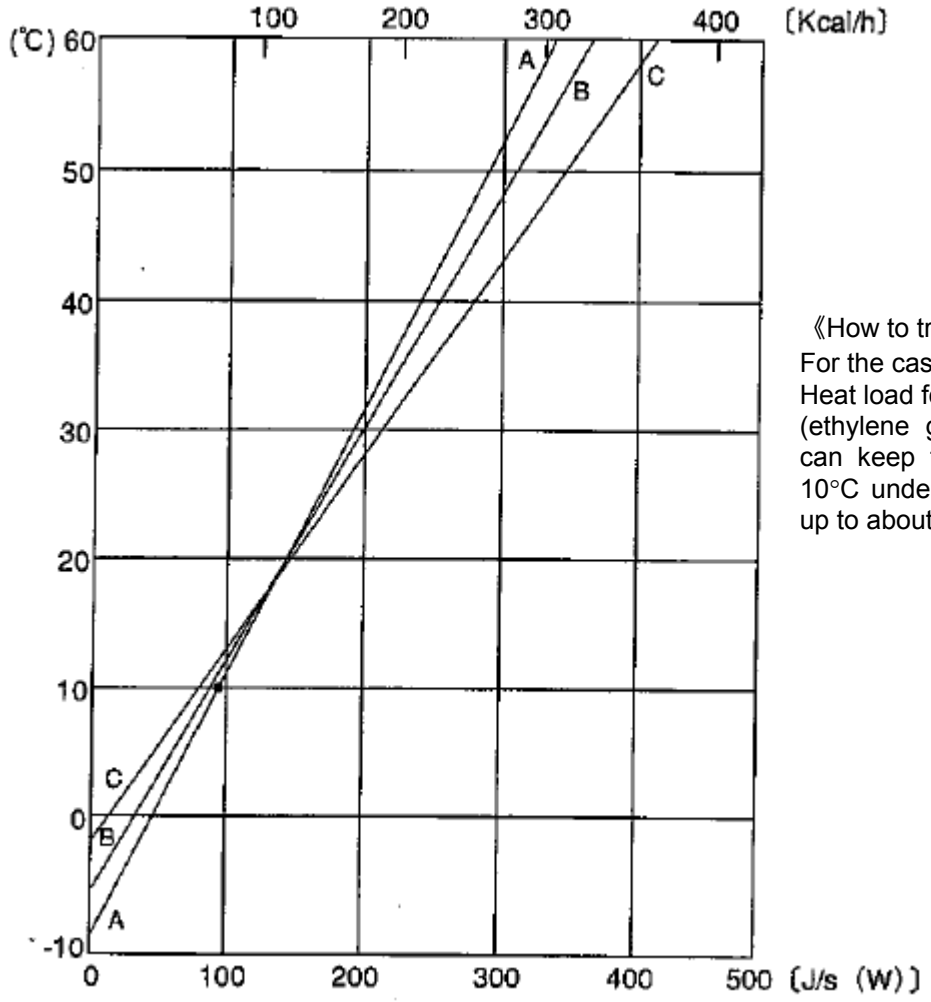
111. Specifications

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTW401・CTW401S**

Heat load characteristics



Heat load

《How to translate the graph》
For the case of "・" in the graph;
Heat load for CTB-3A and 3L of liquid (ethylene glycol + water- 1:1) that can keep the liquid temperature at 10°C under the conditions shown is up to about 90W.

	A・C	B・D	E・F
Container	CTB-3A	CTB-6A	CTB-24A
Liquid	Ethylene glycol + water (1:1)		
Liquid amount	3L	6L	20L
Environmental temperature	20°C		
Radiation water temperature	20°C		
Radiation water amount	5 L/min		

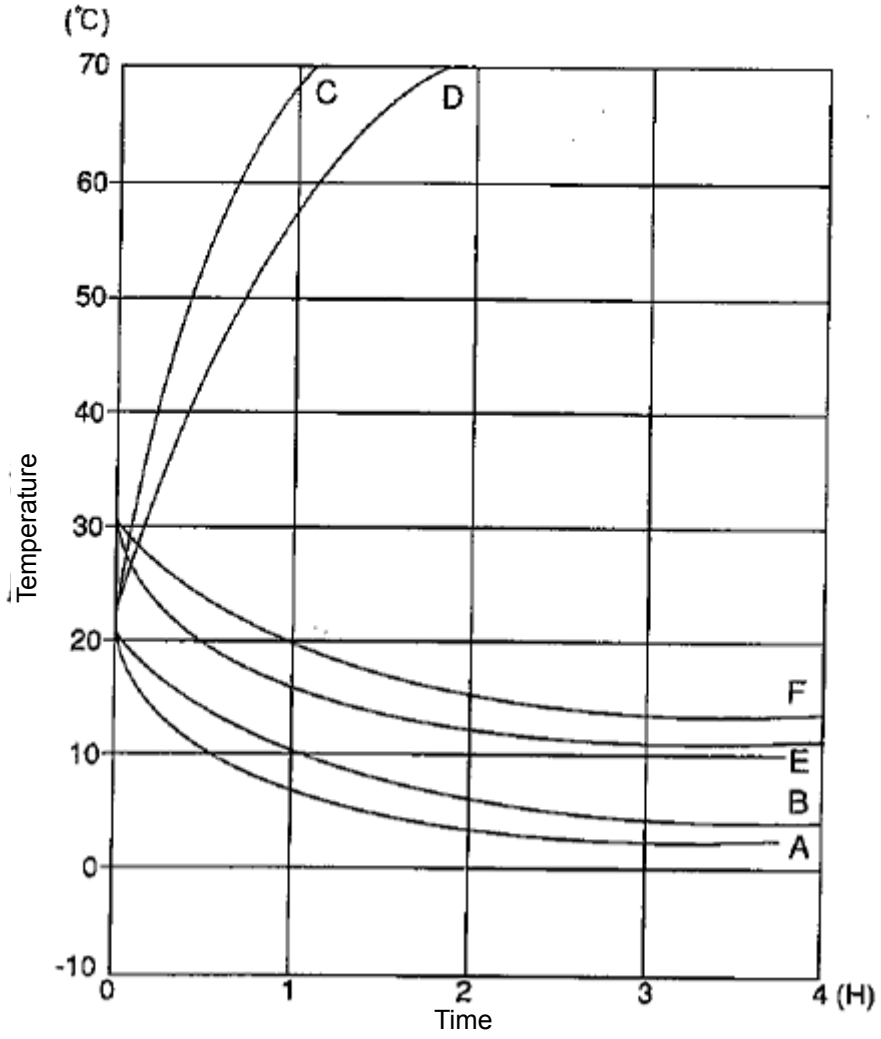
11. Specifications

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTA401・CTA401S**

Cooling/heating characteristics



	A・C	B・D	E	F
Container	CTB-3A	CTB-6A	CTB-3A	CTB-6A
Liquid	Ethylene glycol + water (1:1)			
Liquid amount	3L	6L	3L	6L
Environmental temperature	20°C		30°C	

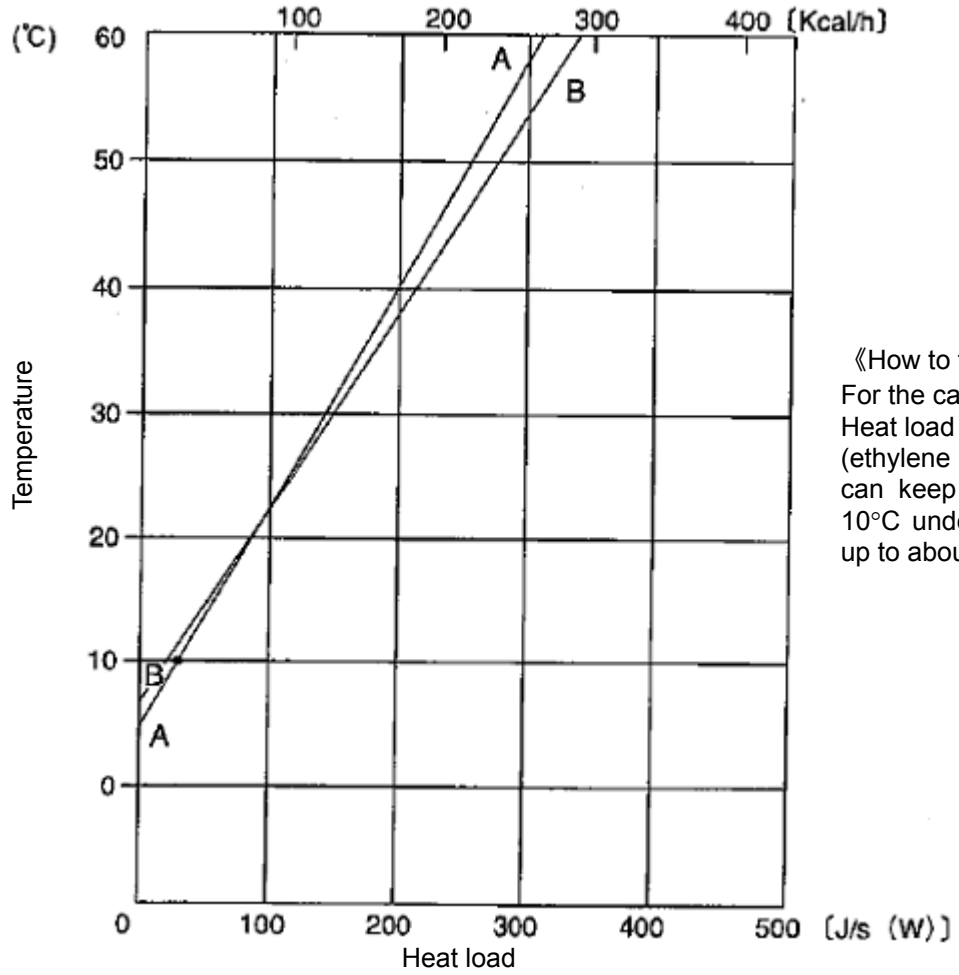
11. Specifications

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTA401・CTA401S**

Heat load characteristics



《How to translate the graph》
For the case of "・" in the graph;
Heat load for CTB-3A and 3L of liquid (ethylene glycol + water- 1:1) that can keep the liquid temperature at 10°C under the conditions shown is up to about 30W.

	A	B
Container	CTB-3A	CTB-6A
Liquid	Ethylene glycol + water (1:1)	
Liquid amount	3L	6L
Environmental temperature	20°C	

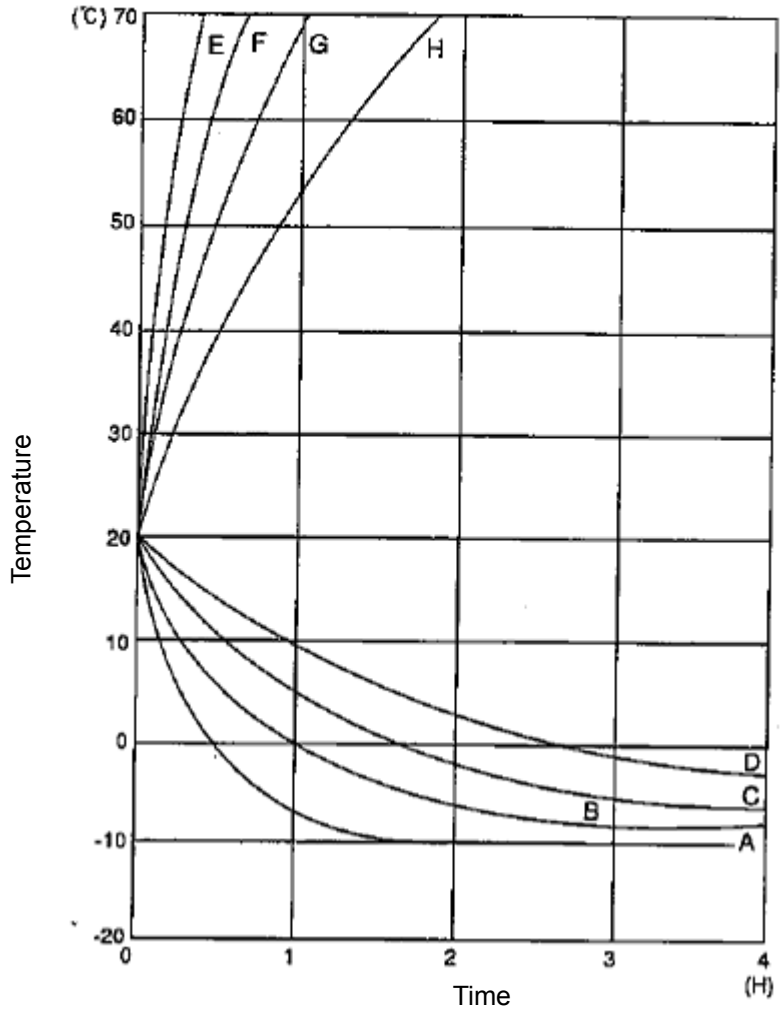
11. Specifications

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTW801・CTW801S**

Cooling/heating characteristics



	A・E	B・F	C・G	D・H
Container	CTB-3A	CTB-6A	CTB-12A	CTB-24A
Liquid	Ethylene glycol + water (1:1)			
Liquid amount	3L	6L	12L	20L
Environmental temperature	20°C			
Radiation water temperature	20°C			
Radiation water amount	5 L/min			

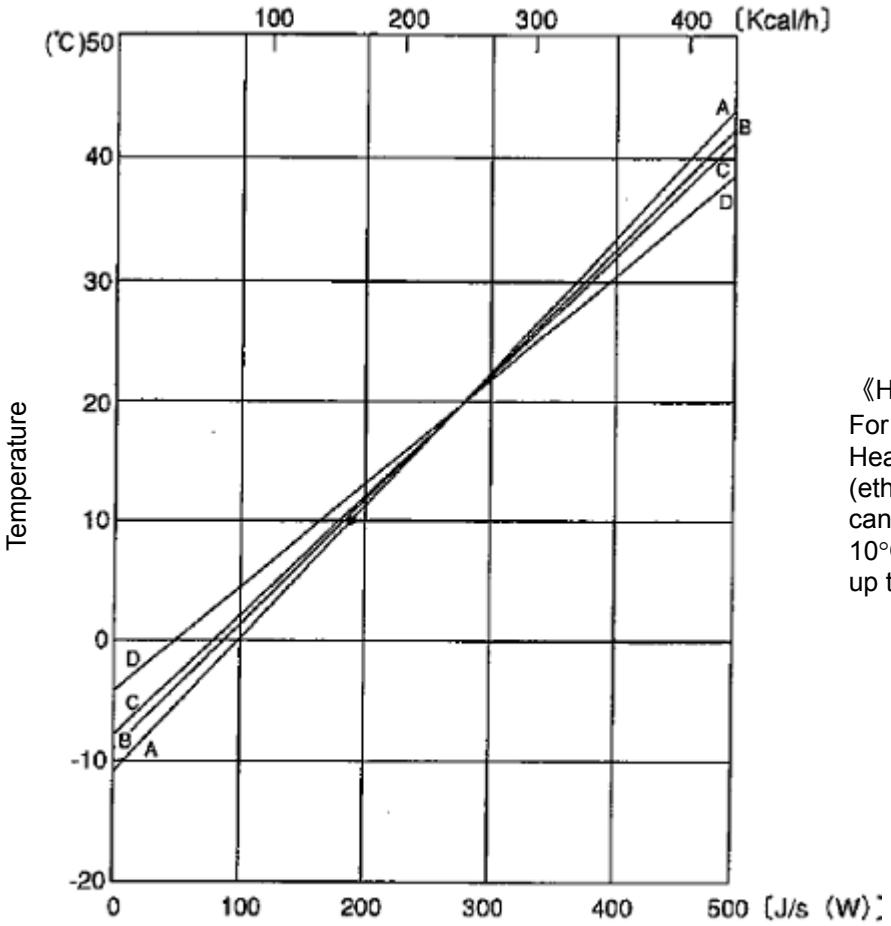
11. Specifications

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTW801・CTW801S**

Heat load characteristics



Heat load

《How to translate the graph》
For the case of "・" in the graph;
Heat load for CTB-3A and 3L of liquid (ethylene glycol + water- 1:1) that can keep the liquid temperature at 10°C under the conditions shown is up to about180W.

	A・E	B・F	C・G	D・H
Container	CTB-3A	CTB-6A	CTB-12A	CTB-24A
Liquid	Ethylene glycol + water (1:1)			
Liquid amount	3L	6L	12L	20L
Environmental temperature	20°C			
Radiation water temperature	20°C			
Radiation water amount	5 L/min			

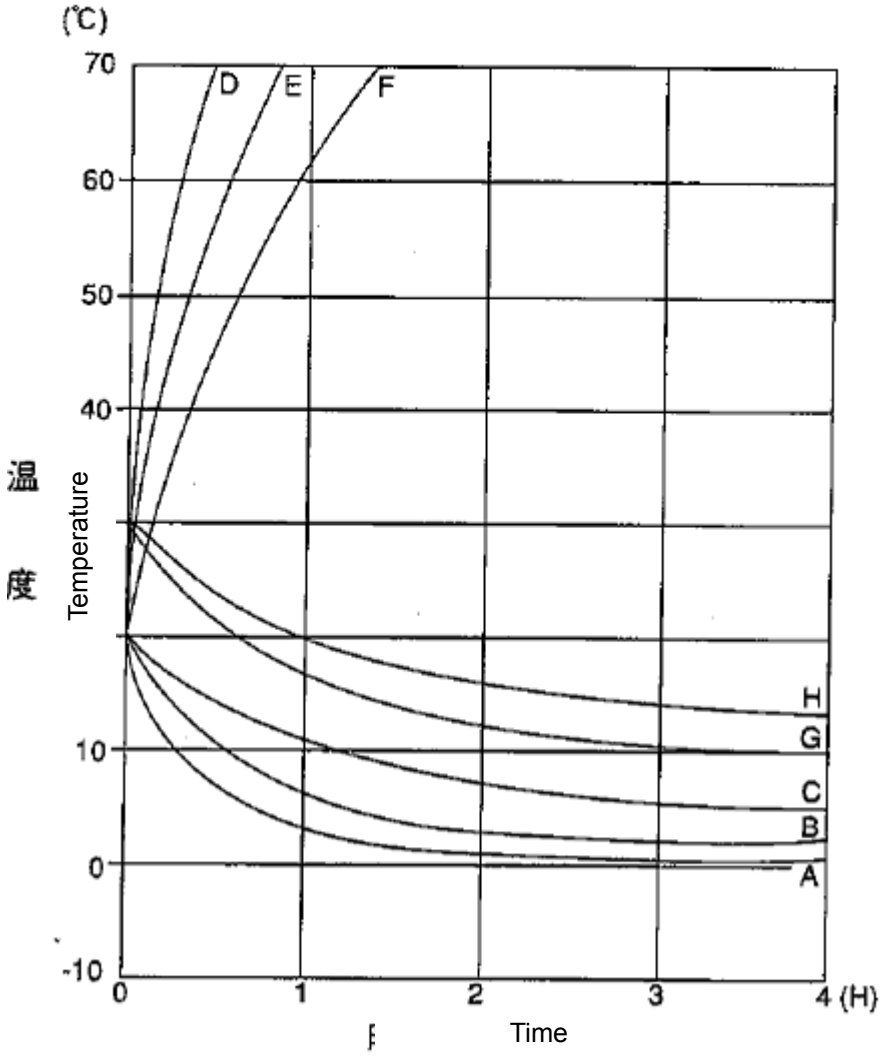
11. Specifications

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTA801・CTA801S**

Cooling/heating characteristics



	A・D	B・E	C・F	G	H
Container	CTB-3A	CTB-6A	CTB-12A	CTB-6A	CTB-12A
Liquid	Ethylene glycol + water (1:1)				
Liquid amount	3L	6L	12L	6L	12L
Environmental temperature	20°C			30°C	

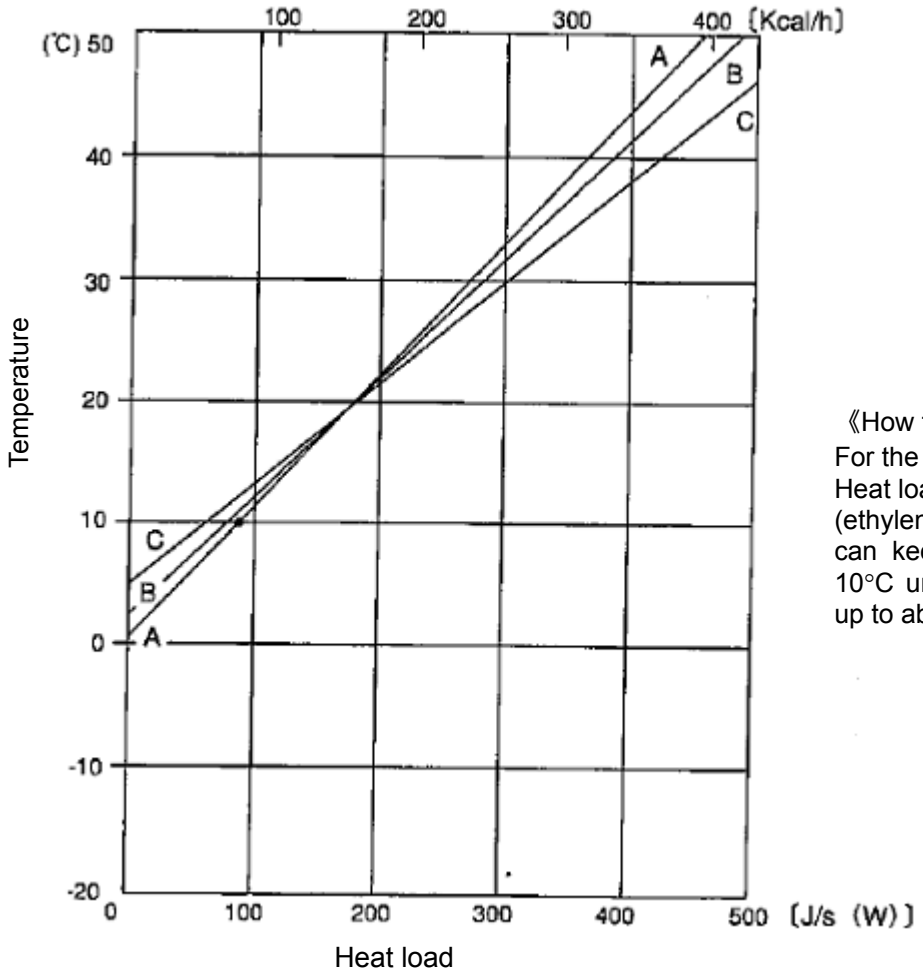
11. Specifications

＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Containers in the table are the Yamato CTB series test baths.

- **CTA801・CTA801S**

Heat load characteristics



《How to translate the graph》
For the case of "・" in the graph;
Heat load for CTB-3A and 3L of liquid (ethylene glycol + water- 1:1) that can keep the liquid temperature at 10°C under the conditions shown is up to about 85W.

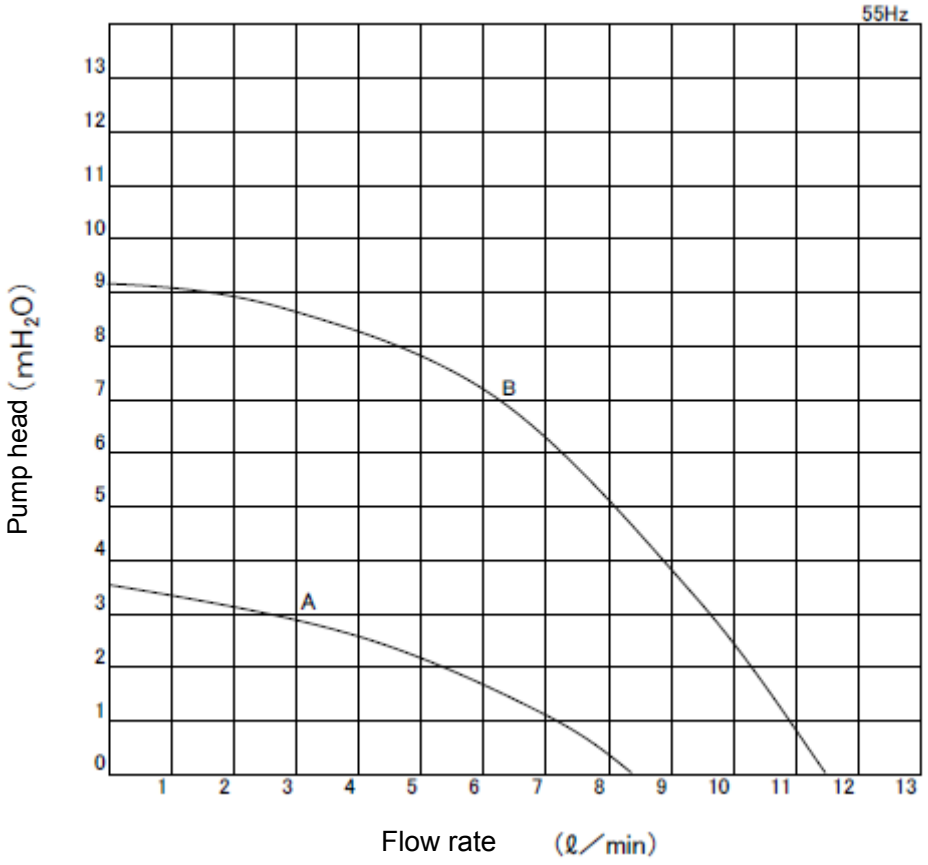
	A	B	C
Container	CTB-3A	CTB-6A	CTB-12A
Liquid	Ethylene glycol + water (1:1)		
Liquid amount	3L	6L	12L
Environmental temperature	20°C		

11. Specifications

Capacity of the circulation pump

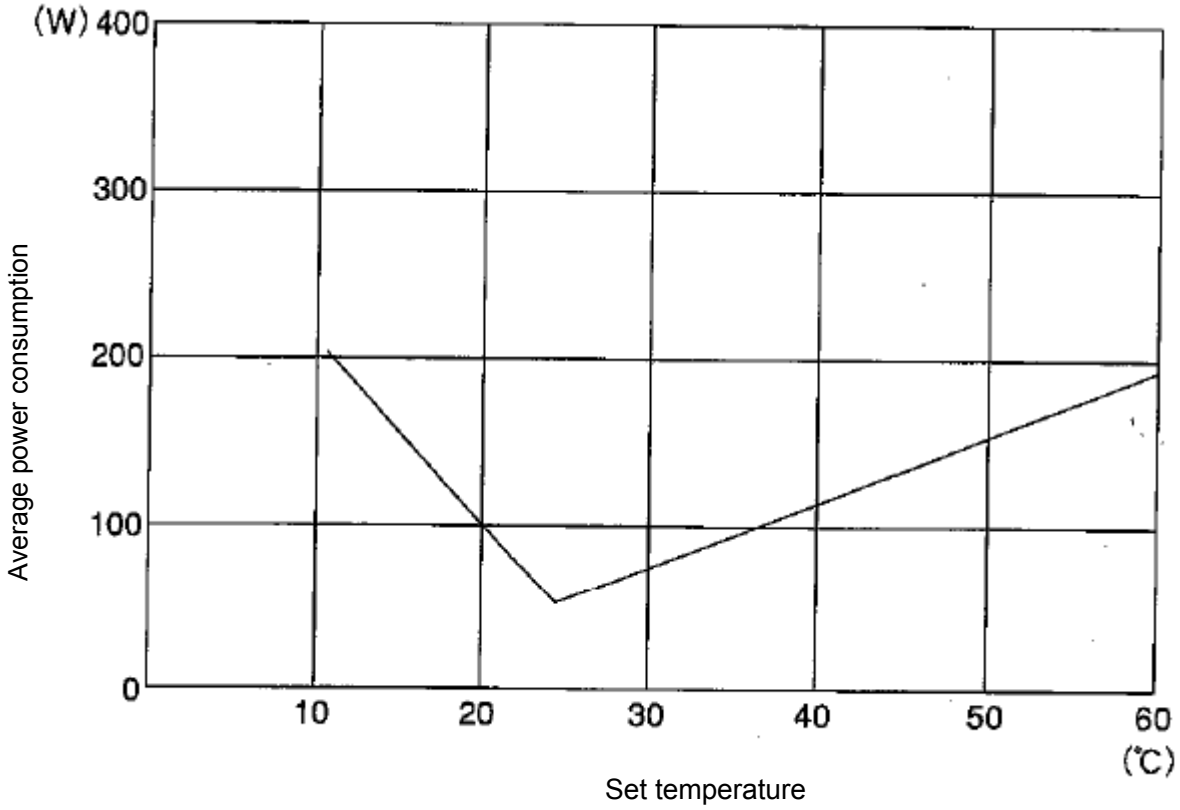
＜Notes＞

- The performance lines in the table are standard values in our tests, not guaranteed values for the products.
- Figures in the table are those obtained when operating with a 55 Hz power supply.
  Because a DC-AC inverter was used for the driving power supply for the circulation pump (output: AC100V, 55 Hz), the maximum flow and the maximum lifting will be the same when it is operated with a 50/60 Hz power supply.
  Flow-lifting curves
  A:CTW401・CTA401・CTW401S・CTA401S
  B:CTW801・CTA801・CTW801S・CTA801S



Average power consumption

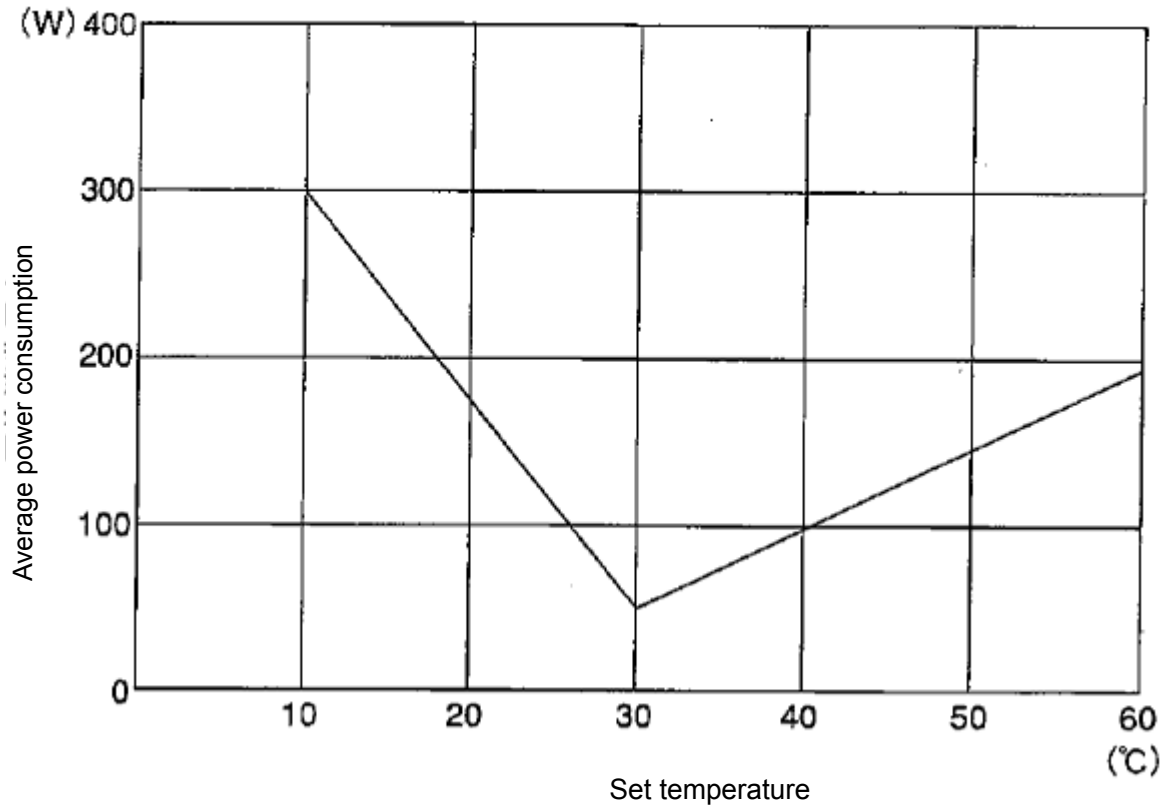
●**CTW401, CTW401S**



Container	CTB-6A
Liquid	Water
Liquid amount	6
Environmental temperature	25°C
Radiation water temperature	20°C

11. Specifications

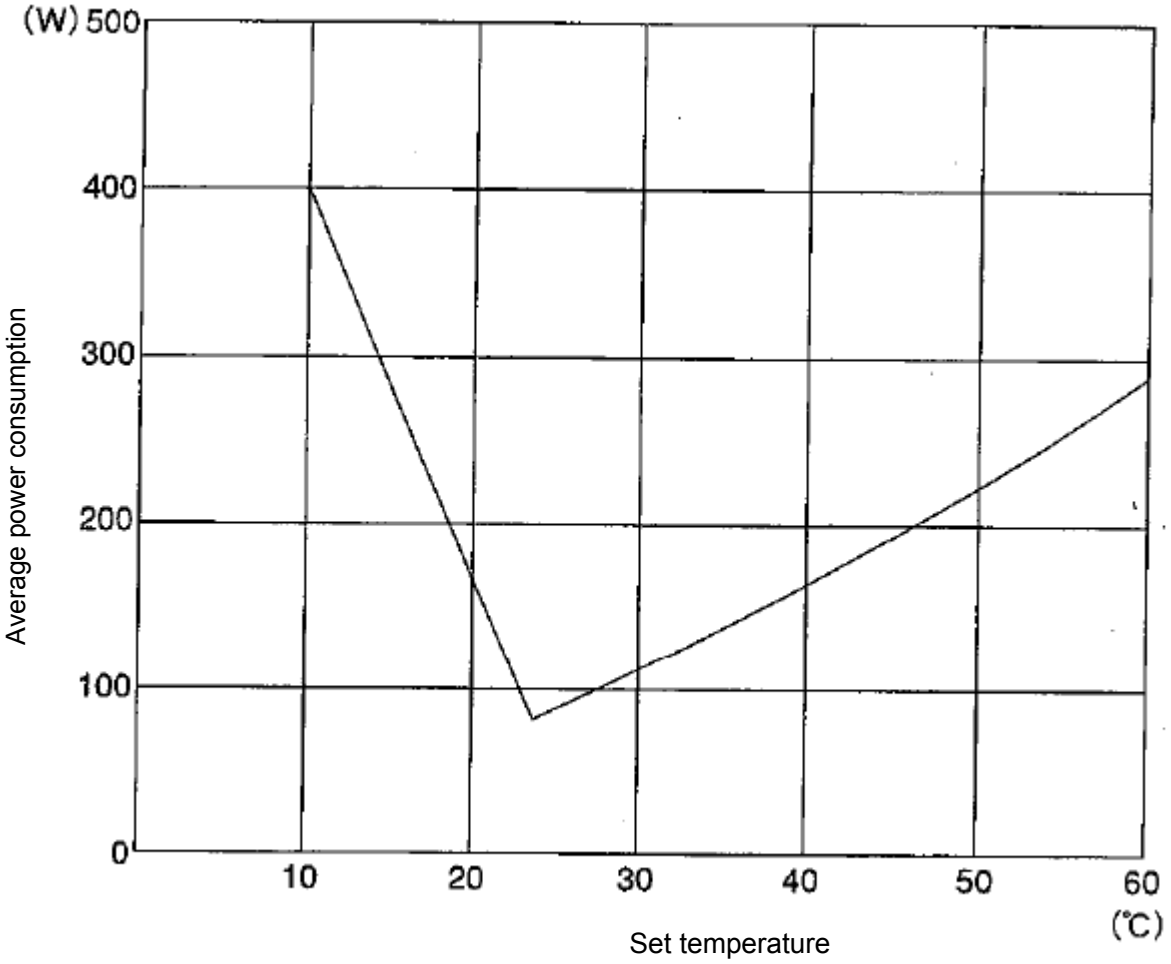
●CTA401, CTA401S



Container	CTB-6A
Liquid	Water
Liquid amount	6
Environmental temperature	20°C

11. Specifications

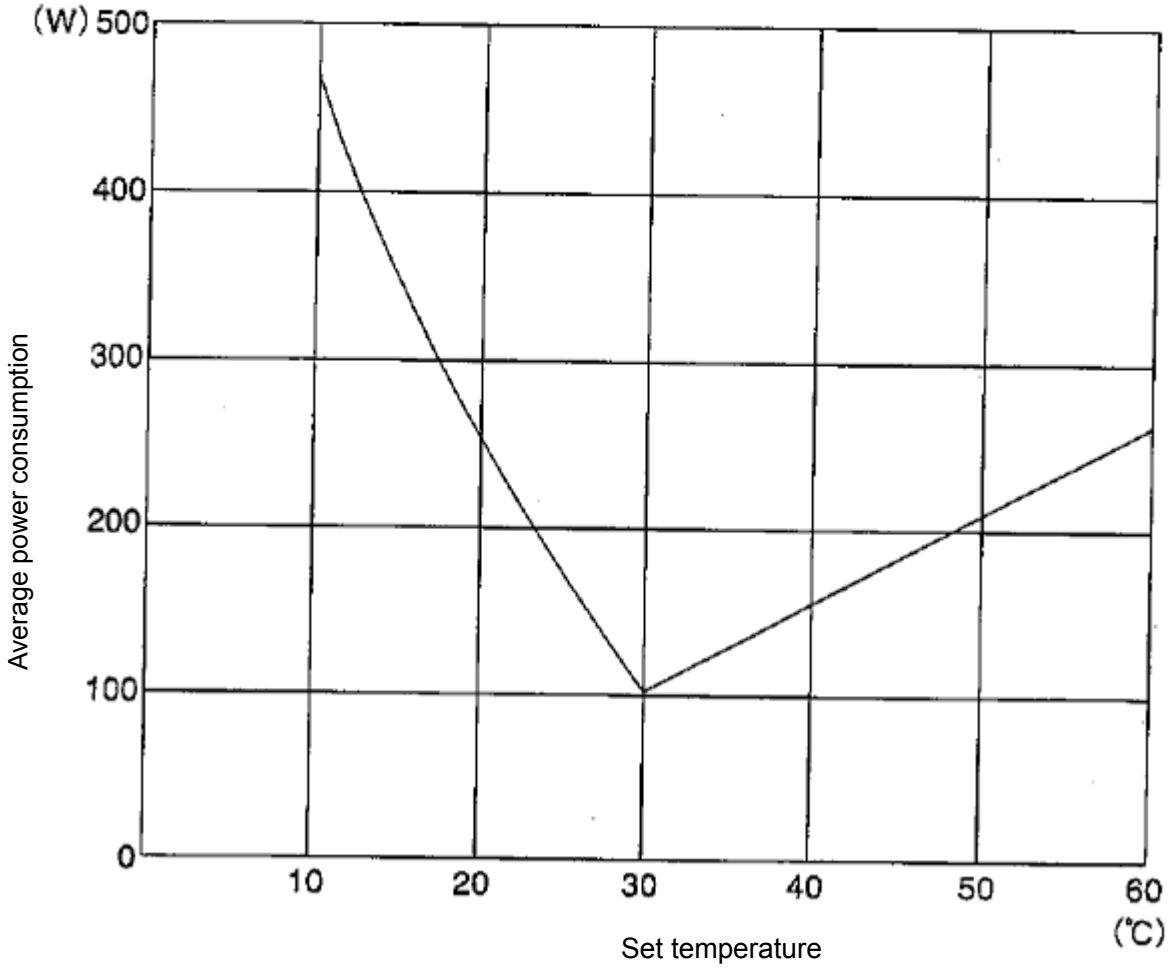
●CTW801, CTW801S



Container	CTB-6A
Liquid	Water
Liquid amount	6
Environmental temperature	25°C
Radiation water temperature	20°C

11. Specifications

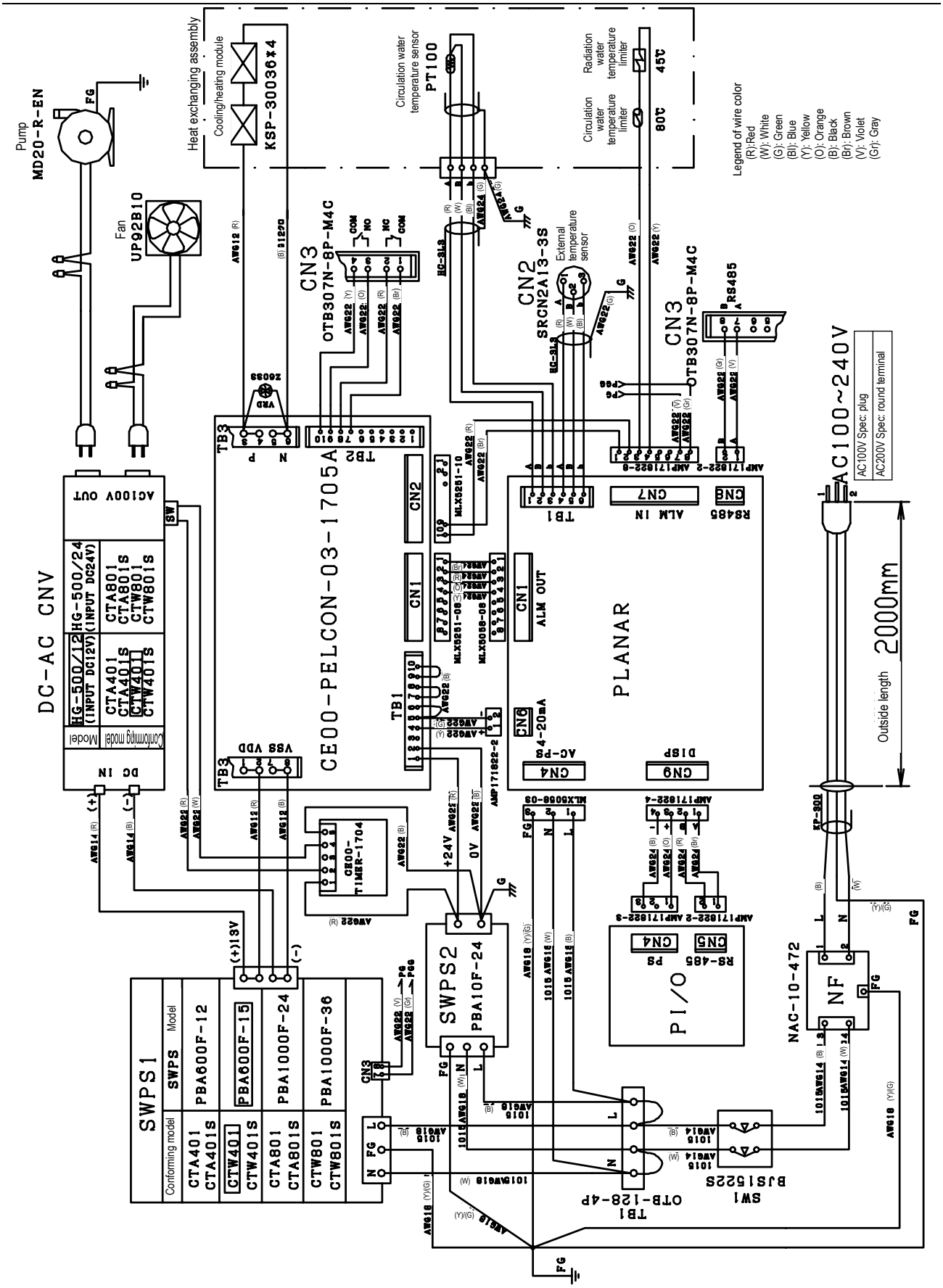
●CTA801, CTW801S



Container	CTB-6A
Liquid	Water
Liquid amount	6
Environmental temperature	25°C

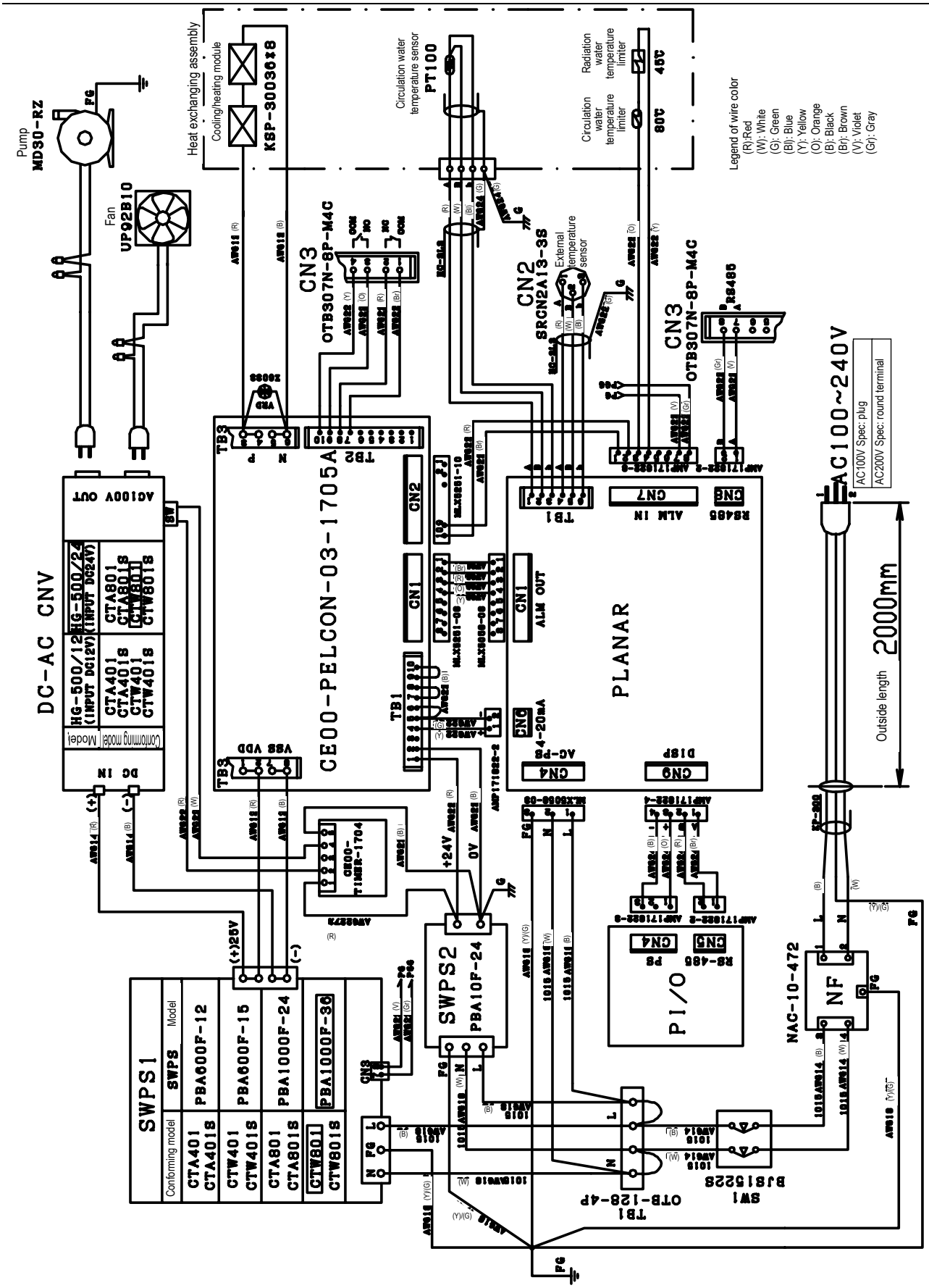
12. Wiring diagram

CTW401



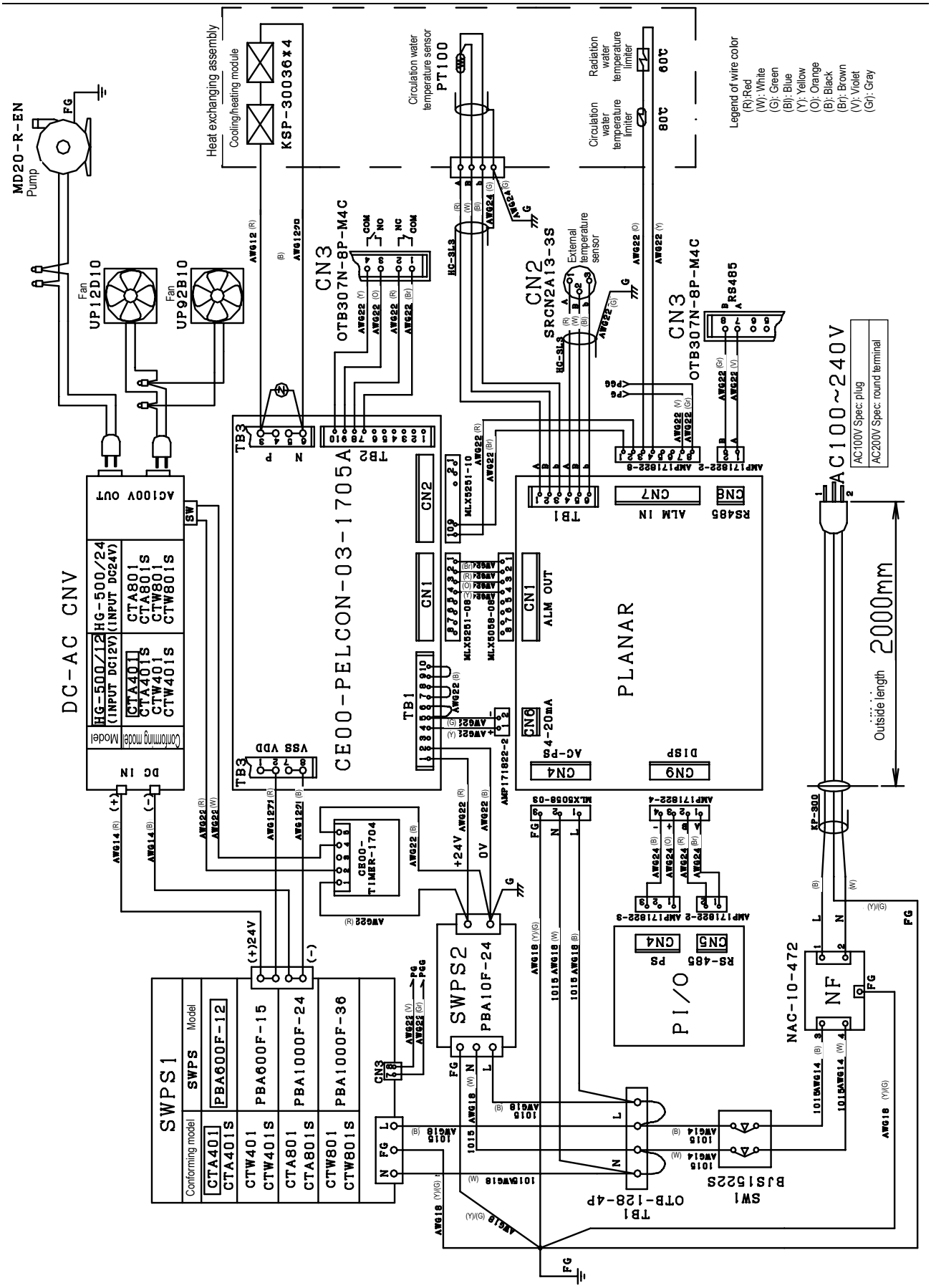
12. Wiring diagram

CTW801



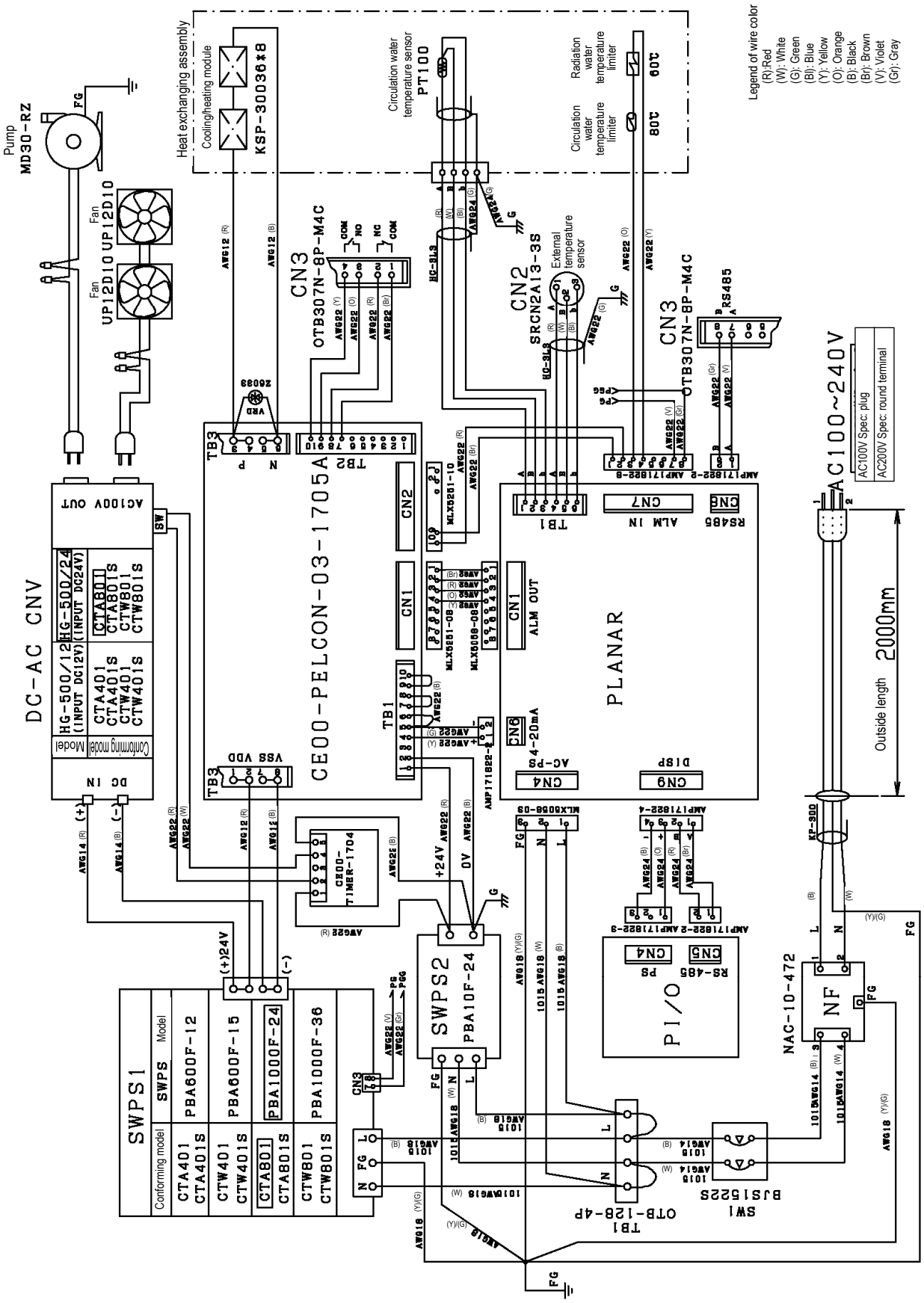
12. Wiring diagram

CTA401



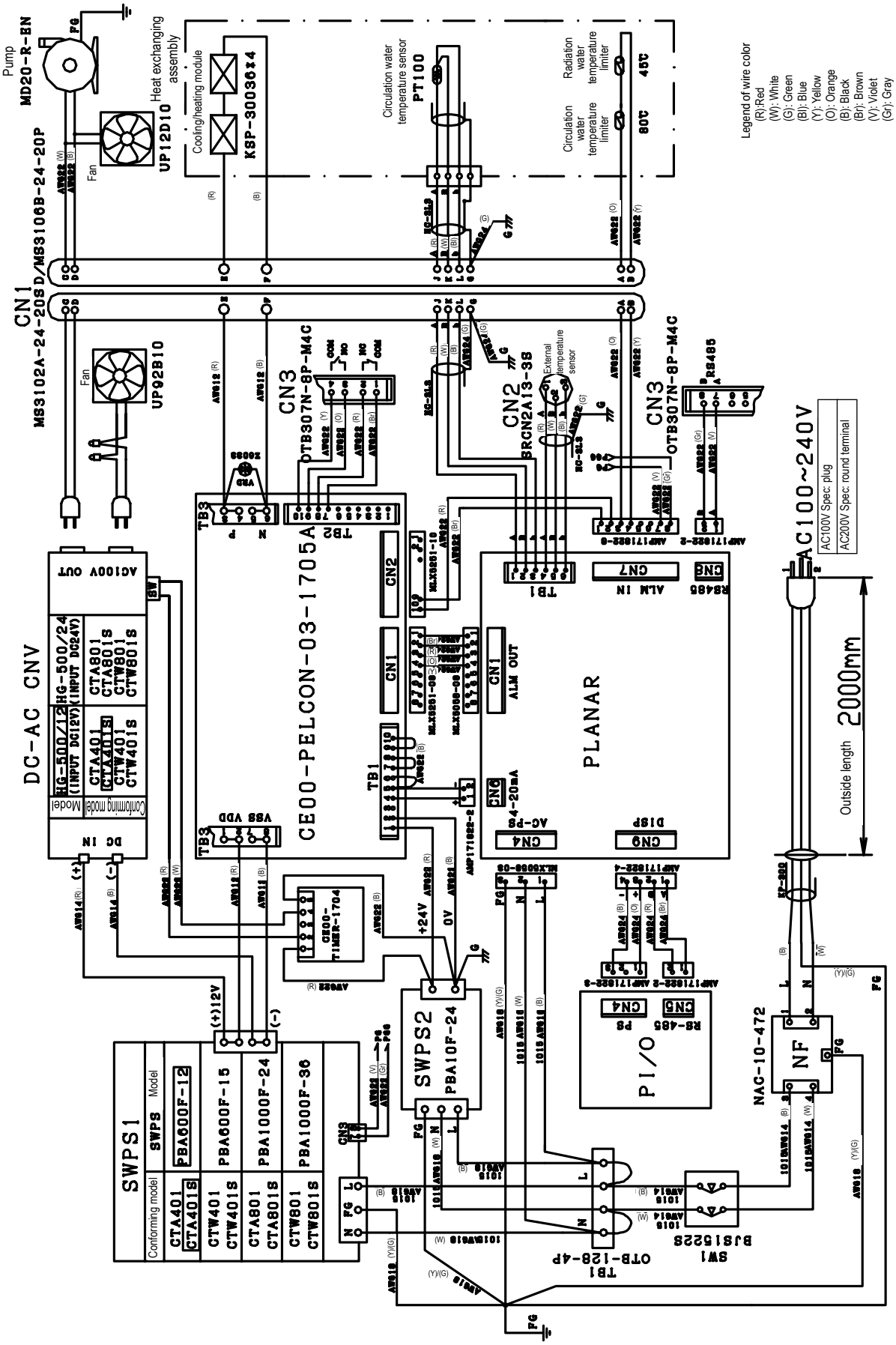
12. Wiring diagram

CTA801



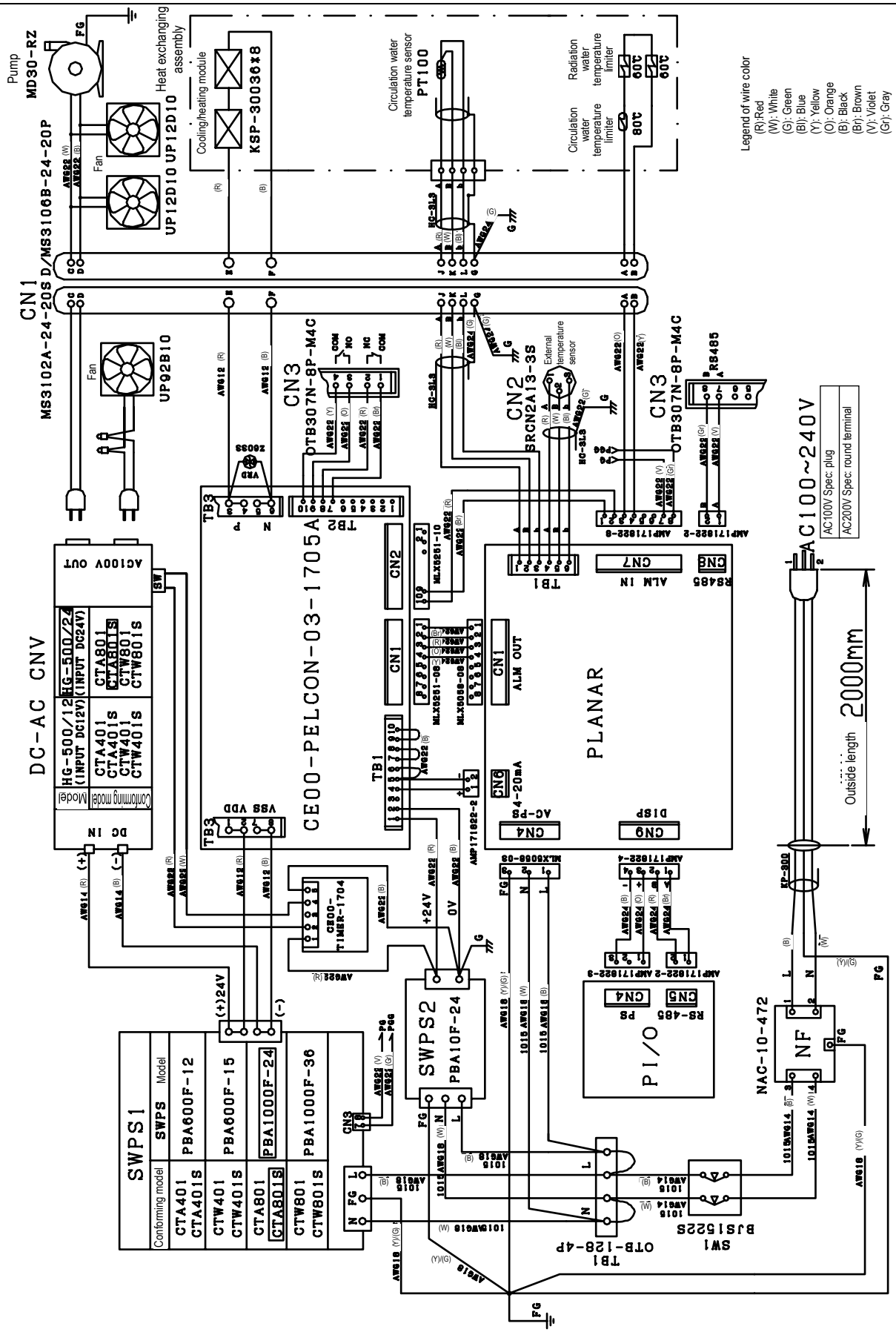
12. Wiring diagram

CTA401S



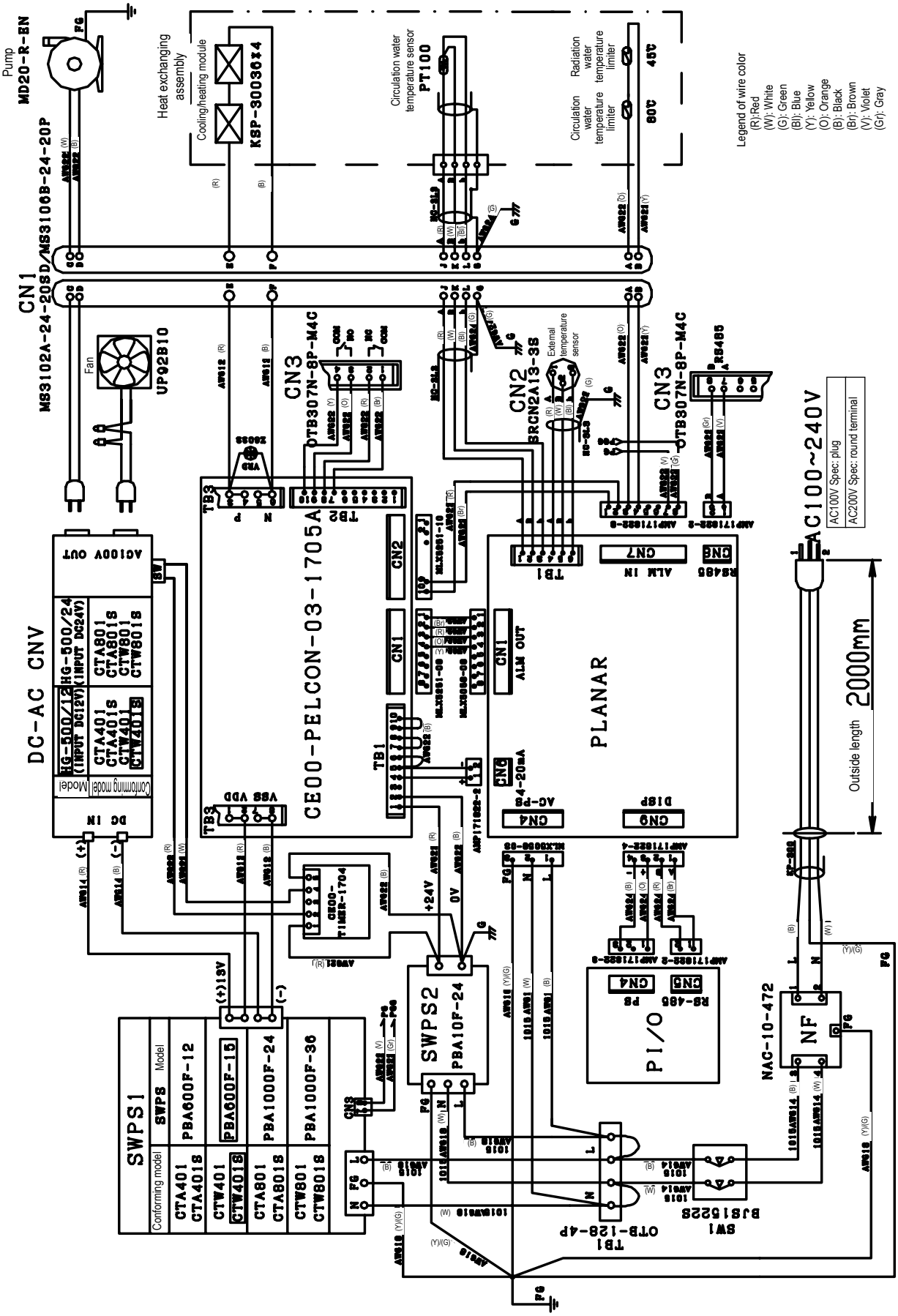
12. Wiring diagram

CTA801S



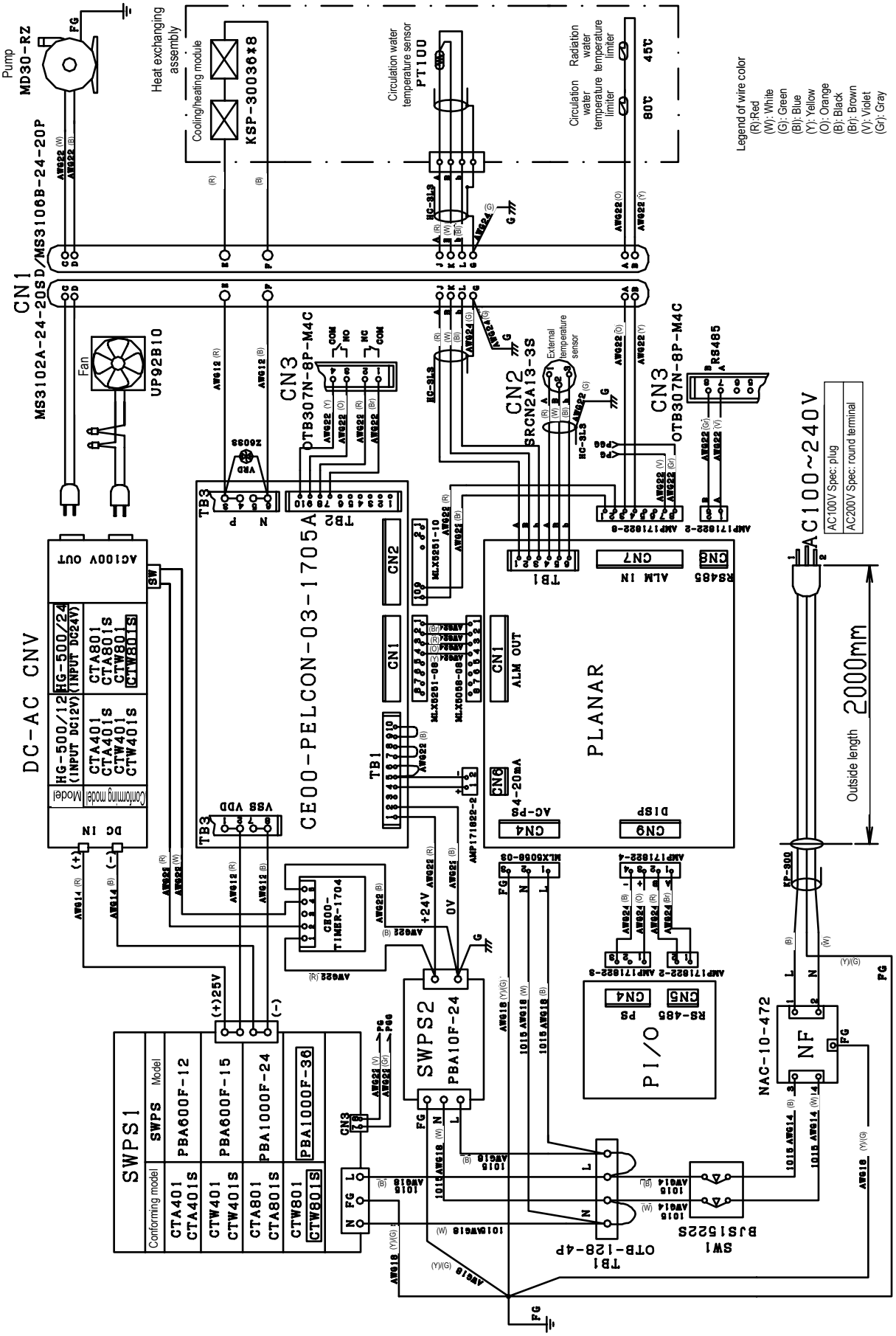
12. Wiring diagram

CTW401S



12. Wiring diagram

CTW801S



13. Replacement parts list

Common parts

Part name	Code №.	Specifications	Maker
Temperature controller	LT00026531	CR5A-CT	Yamato
Display board	LT00009411	CR5A	Yamato
External platinumresistance sensor	A401211250-1	Pt100Ω	COPER
Noise filter	R080255NF01	NAC-10-472	COSEL
Peltier control board	R080255CT01	CE00-PELCON-03-1705B	COPER
Timer board	R080255TM01	CE00-TIMER-1704	COPER
Electric leakage breaker	DEE0000007-1	BJS1522S	Matsushita
Switching power supply	A1501611021-1	PBA10F-24	COSEL
Priming pump	BAGA000700	002-B4-096-1	COPER
Joint nipple 13	CTW0021401	402-21-5150-1	COPER
Joint 13ASSY	BAUB211160	402-21-1160-1	COPER
Joint cap	CTW002160	402-21-5160-1	COPER
Wire clamp dia.19	DMJ0000020	Φ9	COPER
Heat insulation hose for circulation water	BAHA000100	Ⅲtype(1m)	COPER
Heat insulation hose for circulation water	BAHA001100	Ⅴ type(with pump,1m)	COPER
DC/AC converter (CTA401/CTA401S/CTW401/CTW401S)	R080255DDC01	HG-500-12(Yamato SPEC)	COPER
DC/AC converter (CTA801/CTA801S/CTW801/CTW801S)	R080255DDC02	HG-500-24(Yamato SPEC)	COPER
Cooling Fan	RO8255092FAN	UP92B10	STYLE Electronics

13. Replacement parts list

CTW401/401S

Part name	Code number	Specification	Maker
Switching power supply	CED601100-1	PBA600F-15	COSEL
Circulation pump	DEB0000012	MD-20R-EN	Iwaki
Fan motor (for heat exchanger)	R080255600FAN	FAN-PB6	COPER
Heat exchanger unit CTW401	A41121137100-1	With a C-401W sensor	COPER
Heat exchanger unit CTW401S	A411211F7000-1	With a C-401WS sensor	COPER

CTA401/401S

Part name	Code number	Specification	Maker
Switching power supply	CED601200-1	PBA600F-12	COSEL
Circulation pump	DEB0000012	MD-20R-EN	Iwaki
Fan motor (for heat exchanger)	R080255600FAN	FAN-PB6	COPER
Heat exchanger unit CTA401	DEA0000022	UP12D10	COPER
Heat exchanger unit CTA401S	A41121138100-1	With a C-401A sensor	COPER
Switching power supply	A411211F8000-1	With a C-401AS sensor	COPER

CTW801/801S

Part name	Code number	Specification	Maker
Switching power supply	CED611100-1	PBA1000F-36	COSEL
Circulation pump	DEB0000018	MD-30RZ-EN	Iwaki
Fan motor (for heat exchanger)	R082551000FAN	FAN-PB10	COPER
Heat exchanger unit CTW801	BAEA00230000-1	With a C-801W sensor	COPER
Heat exchanger unit CTW801S	BAEA00270000-1	With a C-801WS sensor	COPER

CTA801/801S

Part name	Code number	Specification	Maker
Switching power supply	CED611200-1	PBA1000F-24	COSEL
Circulation pump	DEB0000018	MD-30RZ-EN	Iwaki
Fan motor (for heat exchanger)	R082551000FAN	FAN-PB10	COPER
Heat exchanger unit CTA801	DEA0000022	UP12D10	COPER
Heat exchanger unit CTA801S	BAEA00250000-1	With a C-801A sensor	COPER
Switching power supply	BAEA00260000-1	With a C-801AS sensor	COPER

14. Appendix (Temperature control program sheet)

This sheet is for recording program steps. Make duplicates as necessary.

Program name ____________ Programmed date ____ / ____ / ____ Programmer ____________

____________ Remarks : ____________

Temp.

Time →
Step
Repeat 1
Repeat 2

Step	Operation (BUZZER)		Set temp.	Set time	Repeat step	No of repetitions	Jump to
			°C	:			
			°C	:			
			°C	:			
			°C	:			
			°C	:			
			°C	:			
			°C	:			
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			°C	:			
			°C	:			
			°C	:			
			°C	:			

15. When the unit is not to be used for a long time or when disposing

When the unit is not to be used for a long time or when disposing

⚠ Warning	⚠ Caution
When the unit is not going to be used for a long time ●Turn the ELB to off and pull out the power cord.	When you want to dispose of the unit ● Never leave it in a place where children may play. ● Remove all the driving assembly. ● Dispose of the unit as a bulky trash.

Notes about disposition

Always pay attention to the preservation of the global environment.

We highly recommend taking the unit apart as far as possible for separation or recycling to contribute to the preservation of the global environment. Major components and materials for the unit are as follows:

Major parts names	Material
Major components of the main body	
Exterior	Stainless steel plate
Interior	PET resin film
Rubber feet	Chloroprene rubber
Major components of the interior	
Cooling unit	Stainless steel SUS304, aluminum (with alumite), etc.
Major components of the electric system	
Switching power supply	Composite material of resin, steel, and others
Transformers	Composite material of resin, steel, and others
Switches and connectors	Composite material of resin, cupper, and others
Substrates	Composite material of glass fiber and others
Fan	Composite material of resin, steel, and others
Pump	Composite material of resin, steel, and others
Power cord	Composite material of synthesized rubber sheath, cupper, nickel, and others
Major components of piping system	
Hoses	Ethylene polygene rubber, polyethylene
Connector	Polypropylene
Hose clamp	Iron
Circulation port	Hard vinyl chloride
Optional accessories	
Testing bath	Hard vinyl chloride, ethylene propylene, aluminum

16. After sales 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

See the warranty card or the nameplate on the unit.
See the section “Names and functions of parts” on pages 15 to 21.

- 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.

17. List of dangerous materials

Never use an explosive substance a flammable substance or a substance containing them for this device.

Explosive substance	Explosive substance	①Nitroglycol, glycerine trinitrate, cellulose nitrate and other explosive nitrate esters
		②Trinitrobenzen, trinitrotoluene, picric acid and other explosive nitro compounds
		③Acetyl hydroperoxide, methyl ethyl ketone peroxide, benzoyl peroxide and other organic peroxides
Flammable substances	Explosive substances	Metal “lithium”, metal “potassium”, metal “natrium”, yellow phosphorus, phosphorus sulfide, red phosphorus, celluloids, calcium carbide (a.k.a, carbide), lime phosphide, magnesium powder, aluminum powder, metal powder other than magnesium and aluminum powder, sodium dithionous acid (a.k.a., hydrosulphite)
	Oxidizing substances	①Potassium chlorate, sodium chlorate, ammonium chlorate, and other chlorates
		② Potassium perchlorate, sodium perchlorate, ammonium perchlorate, and other perchlorates
		③ Potassium peroxide, sodium peroxide, barium peroxide, and other inorganic peroxides
		④Potassium nitrate, sodium nitrate, ammonium nitrate, and other nitrates
		⑤Sodium chlorite and other chlorites
		⑥Calcium hypochlorite and other hypochlorites
	Flammable substances	①Ethyl ether, gasoline, acetaldehyde, propylene chloride, carbon disulfide, and other substances with ignition point at a degree 30 or more degrees below zero.
		② n-hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone and other substances with ignition point between 30 degrees below zero and less than zero.
		③Methanol, ethanol, xylene, pentyl acetate, (a.k.a.amyl acetate) and other substances with ignition point between zero and less than 30 degrees.
		④Kerosene, light oil, terebinth oil, isopenthyl alcohol(a.k.a. isoamyl alcohol), acetic acid and other substances with ignition point between 30 degrees and less than 65 degrees.
	Combustible gas	Hydrogen, acetylene, ethylene, methane, ethane, propane, butane and other gases combustible at 15°C at one air pressure.

(Quoted from the separate table 1 in Article 6, the enforcement order of the Industrial Safety and Health Law)

Limited liability

Be sure to use the unit strictly following the handling and operating instructions in this operating instruction.
Yamato Scientific Co., Ltd. assumes no responsibility for an accident or a malfunction caused by use of this product in any way not specified in this operating instruction.
Never attempt to perform matters prohibited in this operation instruction.
Otherwise, an unexpected accident may result.

Notice

- **Descriptions in this operating instruction are subject to change without notice.**
- **We will replace a manual with a missing page or paging disorder.**

Instruction Manual
Coolnics Circulator
CTA401/401S/801/801S
CTW401/401S/801/801S
First edition Mar. 17, 2009
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