Programmable Low Temperature Constant-Temperature Chamber

Model IL702

Instruction Manual

First edition

- **Thank you very much for purchasing this Yamato IL702 programmable low temperature constant-temperature chamber.**
- **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 5 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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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

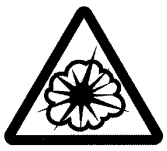
Warning

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

⚠ Warning

Never operate the unit in an atmosphere containing flammable or explosive gas

Never operate the unit in an atmosphere containing flammable or explosive gas.
Otherwise, an explosion or a fire may result since the unit is not explosion-proof.
See section “13. List of dangerous materials” on page 53.

Be sure to connect the ground wire.

Be sure to connect the ground wire correctly. Otherwise, electrical leak may result and cause an electrical shock or a fire.

Ban on operation when an abnormality occurs

When a smoke or an unusual odor is seen or sensed, immediately turn the ELB on the main unit off and pull out the power plug. A fire or an electrical shock may result.

Never use electrical power cords bundled.

When these are used bundled, they might overheat causing a fire.

Take care not to damage electrical power cords.

Avoid tightly bend, pull with a strong force or twist to prevent electrical power cords from damaging. A fire or an electrical shock may result.

Never use an explosive or a flammable material with this unit.

Never use an explosive material, a flammable material or a material containing them. An explosion or an electrical shock may result.
See section “13. List of dangerous materials” on page 53.

Never try to touch a hot part.

Some parts of the unit are hot during and immediately after operation. Take special care for possible burning.

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.

⚠ Caution

When a thunder is heard.

When a thunder is heard, turn the main power off immediately. A malfunction, fire or an electrical shock may result.

2. Before operating the unit

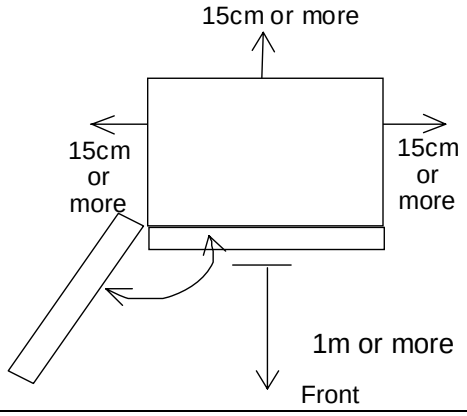
Precautions when installing the unit

1. Carefully select an installation site.

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

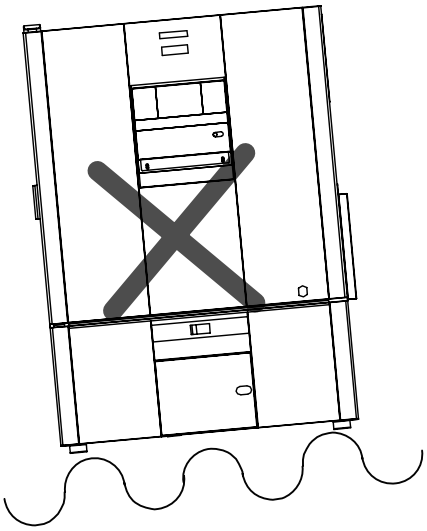
- Uneven surfaces or dirty surfaces
- Where flammable gas or corrosive gas exists
- Where the ambient temperature is 35℃ or more
- Where temperature changes severely
- Where humidity is high
- Where subject to direct sunlight
- Where vibration is severe

Install this unit at a place with spaces shown below.



2. Install the unit on a level surface.

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



The unit weight is approx. 90 kg.
When lifting the unit for transportation and installation, carefully handle it by at least two people.

3. Installation

The unit might fall down or move by an earthquake or an impact resulting a personal injury. We recommend making safety measures such as to avoid installing the unit at a place other than busy places.

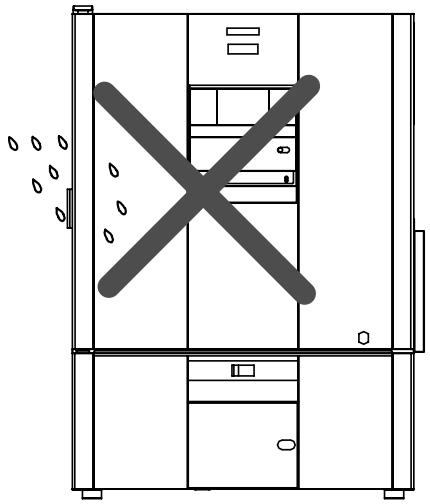
2. Before operating the unit

4. Secure sufficient ventilation for the unit.

Do not operate the unit when its side panels and vent holes are blocked.
Internal temperature of the unit will rise degrading the performance and an accident, a malfunction or a fire may result.

5. Do not operate the unit at such a place that may subject to splash.

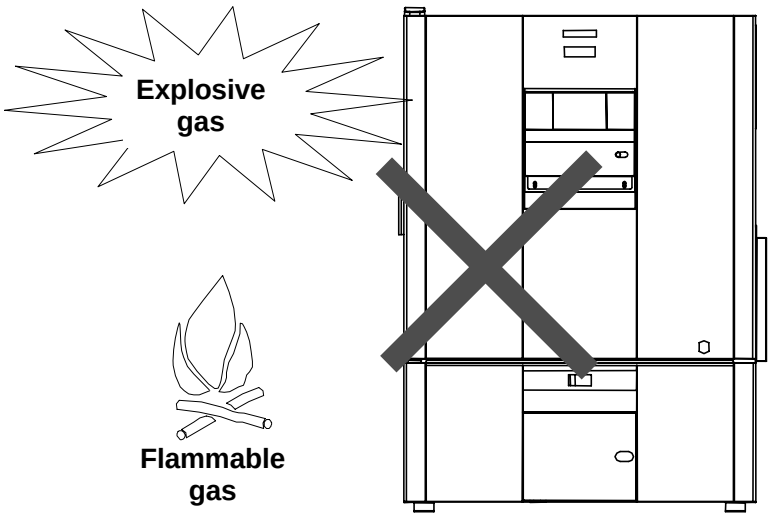
Do not operate the unit at such a place that may subject to splash. Liquid entering the inside may cause an accident, a malfunction, an electrical shock or a fire.



6. Never operate the unit in an atmosphere containing flammable or explosive gas.

Never operate the unit in an atmosphere containing flammable or explosive gas. Since the unit is not explosion-proof, an arc is discharged when switching the ELB “ON” and “OFF” and during operation and a fire or an explosion may result.

See the section “13. List of dangerous materials” on page 53 for flammable and explosive gases.



2. Before operating the unit

Precautions when installing the unit

7. Be sure to connect the power plug to the dedicated power distribution panel or a wall outlet.

Use a power distribution panel or a wall outlet that meets the electrical capacity of the unit.

Electrical capacity: IL702 AC100V 13A

* When the unit will not start even when you turn the Electric Leakage Breaker to “ON”, check for low main voltage or if the unit is connected to the same power supply line as other devices and connect it to another line if necessary.

Avoid connecting too many devices using a branching outlet or extending a wire with a cord reel or refrigerating function and temperature controlling function may degrade due to voltage drop.

Do not connect the unit to any parts or lines other than a correct power supply line such as a gas pipe, a water pipe or a telephone line.
Otherwise, an accident or a malfunction may result.

8. 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.

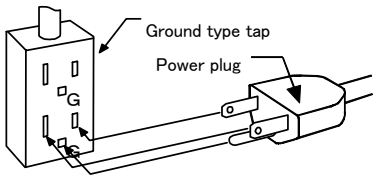
If the power cord should be damaged (exposure of core wire or disconnection), immediately turn the ELB off, turn the power supply off and ask your dealer to replace the cord. If the unit is operated with a damaged power cord, a fire or an electrical shock may result.

Connect the power cord to an appropriate wall outlet.

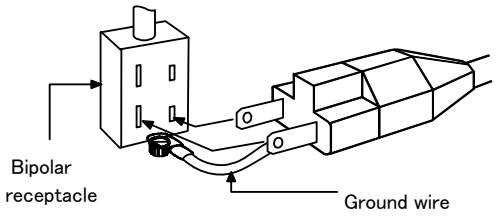
9. Be sure to connect the ground wire.

- When the unit has no ground terminal, class D grounding work is necessary and please consult your dealer or our nearest sales office.
- Securely connect to an outlet.

<u>We recommend use of a ground type outlet tap.</u>



<u>When a bipolar type outlet tap is used</u>



<u>When there is no ground terminal.</u>
In this case, class D grounding work is necessary and please consult your dealer or our nearest sales office.

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.

Do not connect the grounding wire to any parts or lines other than a correct grounding terminal such as a gas pipe, a water pipe or a telephone line.
Otherwise, an accident or a malfunction may result.

2. Before operating the unit

Installation procedures/precautions

(1) Transporting the product

・Two or more people are required for lifting and transporting the IL702 unit.
※Take care for protrusions on the unit when transporting it.

(2) Installing the drain system

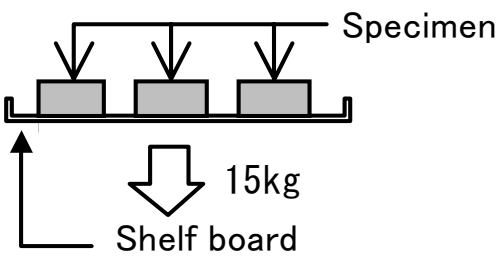
・Drain water generated from defrosting is stored in the drain pan at the left lower side on the main unit to allow natural evaporation.
・The drain pan may not accept all water generated from defrosting, if too much frost has generated during operation without defrosting. When frost to remove seems to be too much, prepare a separate larger pan.
・Be sure to stop the unit before attaching or removing the drain pan.
・Be sure to empty the drain pan before moving the unit.

(3) Attaching the manual holder

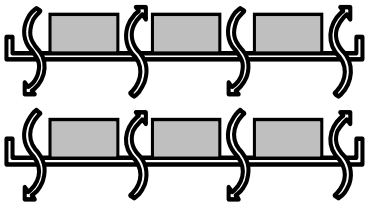
・Attach the manual holder included with the unit as shown in the picture.
Hook the key hole shaped openings on the holder onto the knurled screws on the right side panel of the unit.
Store this operation manual and the manual for CR5 Program Controller in this holder.

(4) Install shelf boards.

・Install shelf pegs at heights you want on the right and left shelf posts in the internal bath of the main body.
・Completely push shelf boards by sliding to the end.
*Take care to put each shelf board on correct pairs of right and left shelf pegs.
・Make sure that shelf boards will not fall nor rattle.
・Withstand load of each shelf board is 15 kg in even loading. When putting specimens, arrange them as dispersed as possible.



・Put specimens with appropriate spaces between them. Too many specimens may prevent proper temperature control. To assure proper temperature control, put specimens with a space at least 30% of the shelf board area.



Assure at least 30% of space

(5) Do not put an specimen on the bottom of the internal bath.

・Operating the unit with a specimen directly put on the bottom of the internal bath might degrade its temperature characteristics. This also may cause corrosion, damage or rust of the internal bath. Never put any specimen on the bottom surface.

・When putting specimens, take care not to allow them touching the wall on which the heater, the sensor or other devices are installed. Put specimens on the shelf board included with the unit.

(6) Take special care for specimens including:

①Specimen that contains a flammable or explosive component.

・This unit is not explosion-proof. Never attempt to dry or process a specimen that contains a flammable or explosive component.

②Corrosive specimen

・Take care for handling a corrosive specimen. Although SUS304 stainless steel is used for major components of this unit, they might corrode if they are subject to strong acid. Also note that packing may corrode with acid, alkaline substances, oil, or organic solvent.

③Specimen that contains much moisture

・While operating the unit at a lower temperature, cooling capacity of the evaporator may be degraded and the set temperature may not be maintained due to too much frost on the evaporator. When frost is confirmed through the frost observation window at the bottom of the bath in the unit, perform defrosting.

④Operation with devices of higher heat load introduced

・By leading a power cable from the cable port, you can operated devices in the unit. Note, however, that operation of devices with higher heat load will increase temperature in the unit.

(7) About two-tier stacking

・Use the special optional accessory to stack two units. Consult your dealer or one of our sales offices for details.

(8) Handling the controller

・Using optional “remote control communication cable (product code:281397)”, “remote control power unit (product code:281399)”, you can remove the control panel off the main unit and remotely control an IL series controller.

・A “remote control panel stand (product code: 281398)” is also available for removed panel. This stand is useful when the main unit is installed in a draft chamber or a clean room, or when remotely controlling the main unit.

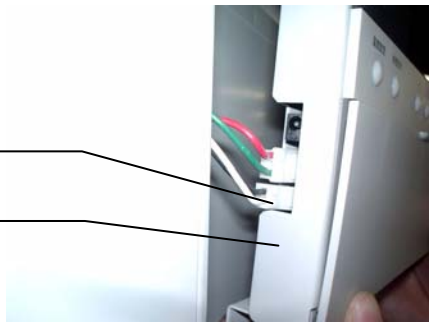
【Removing the control panel】

1) Make sure that the breaker is at [OFF].
2) Remove the knurled screws that secure the control panel to the main unit. (Two points at the lower part)

3) Slowly slide the control panel upward.

4) Slowly remove the cable that connects between the main unit and the control panel off the cable jack. The cable is two-forked and has two jacks.

※Excess length of the cable is only about 10 cm from the main unit.



Insert the optional communication cable and the remote operation power cable to the appropriate connectors.

Refer to the section “Remote Control Connection of the Control Panel” of the “Operation manual for the model CR5 Program Controller”.

2. Before operating the unit

Installation procedures/precautions

【How to install the control panel】

1) Make sure that the breaker is at [OFF].
2) Insert the cable from the main unit into one of the jacks on the left side of the control panel. The jacks on the panel are for DC5V remote operation power, DC5V power 3 pin jack, and internal communication 2 pin jack beginning from the top.
   ※Excess length of the cable is only about 10 cm from the main unit.

3) Hook the control panel to the brackets on the main unit, then slowly slide the panel downward until it stops.

4) After making sure that the control panel is securely attached to the hooking brackets and connectors are securely connected, install the knurled screws.
   Make sure that the control panel has been completely secured.

⚠ Cautions

- Use of the panel as a remote commander is an optional function and remove the control panel only necessary.
- The weight of the control panel is about 1 kg. Take care not to drop it.
- Do not put the removed control panel with the front side down or do not put anything on the panel.
- The control panel is a high precision device. Take extreme care for handling.
- Take care not to lose the removed knurled screws.

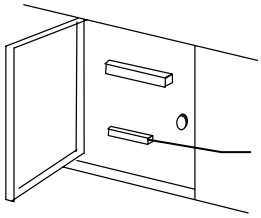
2. Before operating the unit

Installation procedures/precautions

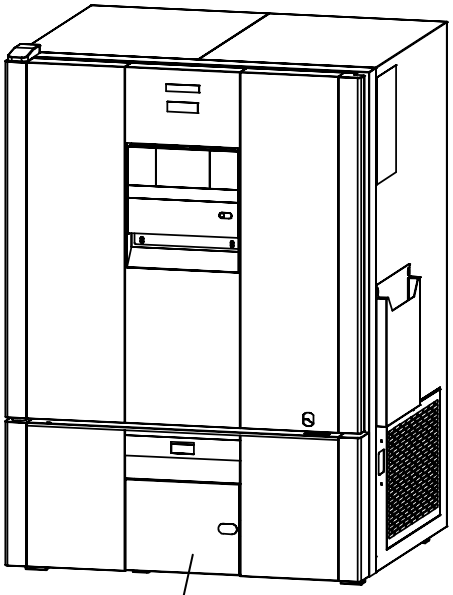
【How to connect remote control-related devices】

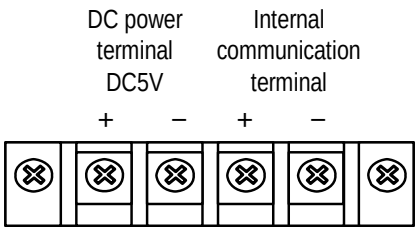
Optional accessories below will be necessary for remote control.

Connection to the main unit is made from the external output connector box on the front of the main unit.



Terminal block for remote control





External output connector box

【Combinations of options】

Option settings differ depending on the distance for remote control you want. See the list below and consult one of our sales offices.

1）When the panel is installed on the unit （Control is not made remotely.）

No option settings are necessary.

2）Remote control is made with a cable of 5m or less in length.

Item name	Spec.	Remarks
Remote operation communication cable	5m	Product code：281397

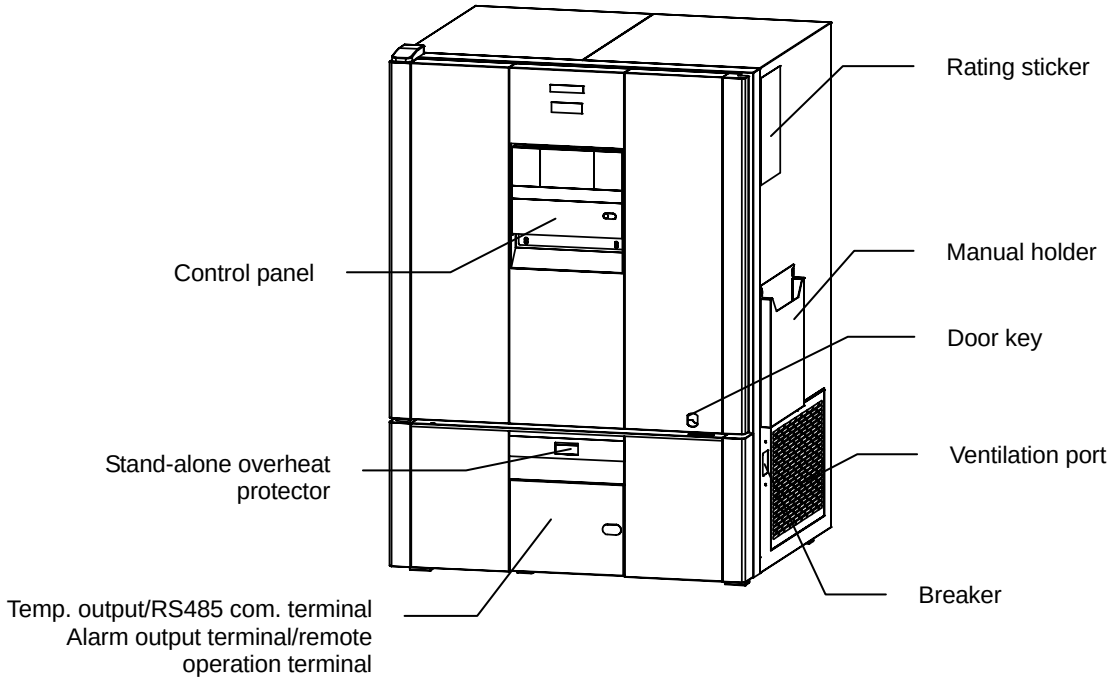
3）Remote control is made with a cable of 5m or more in length.

Item name	Spec.	Remarks
Remote operation communication cable	Required length (m)	Contact our sales office.
Remote operation power supply	DC5V	Product code：281399

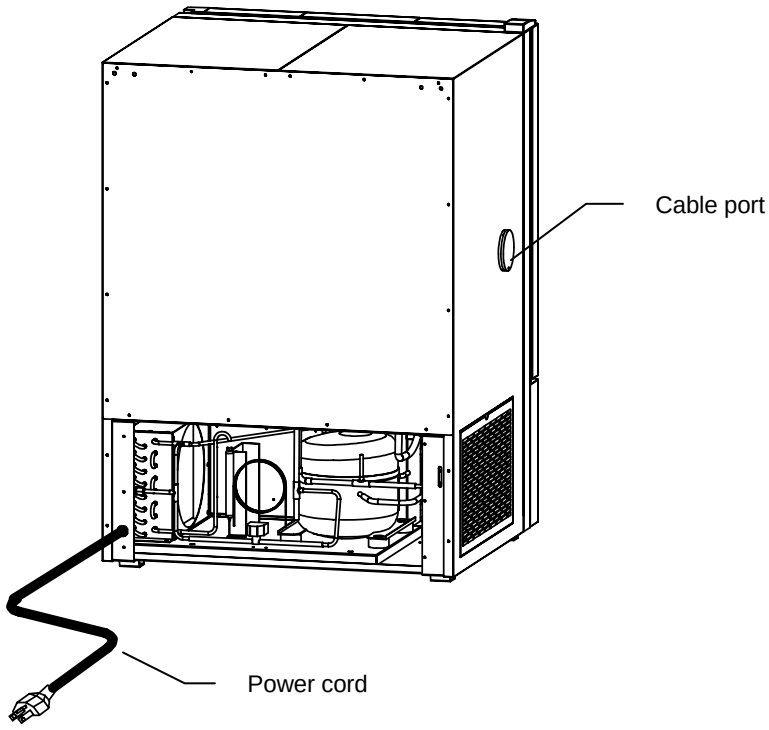
3. Names and functions of parts

Main unit

Front of IL702

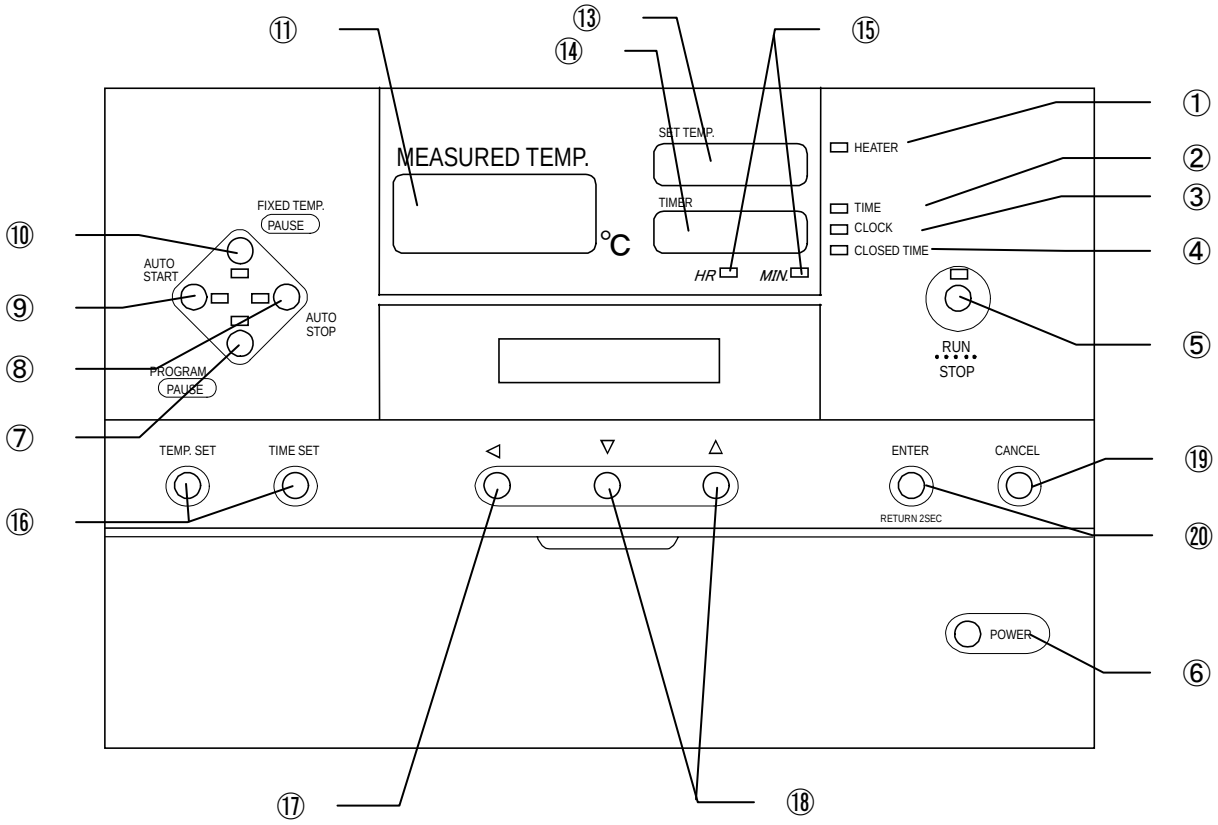


Rear of IL702



3. Names and functions of parts

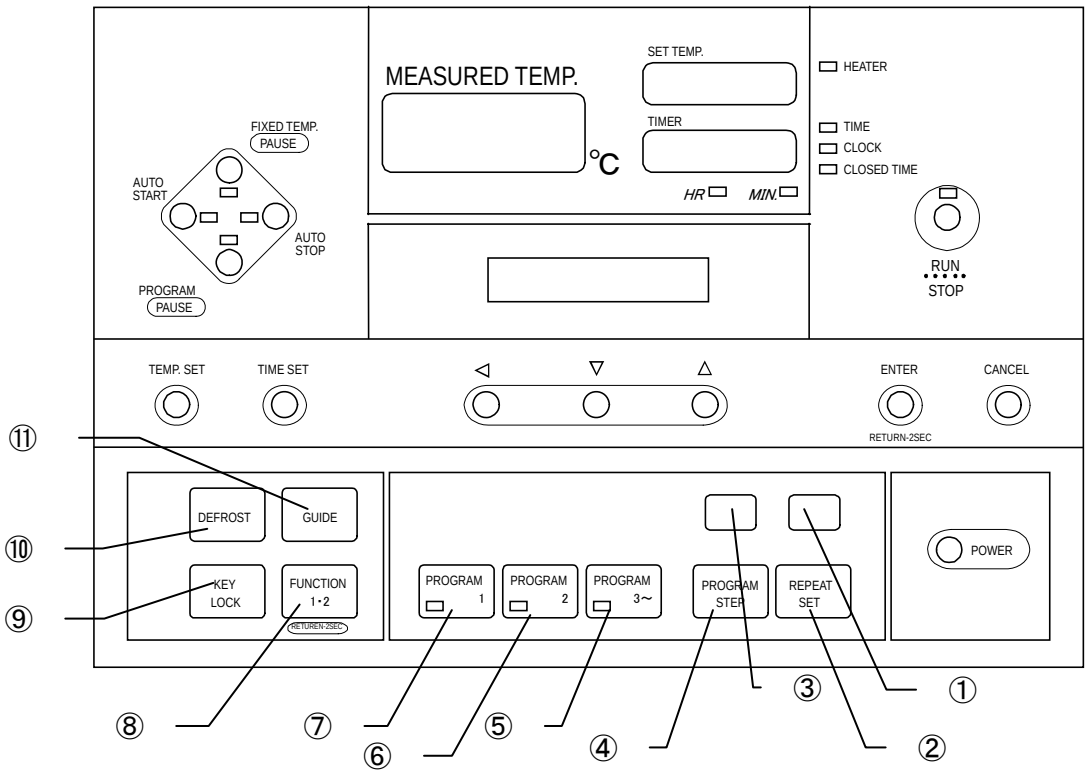
Operation panel



No.	Name	Operation／action
①	HEATER lamp	Lights when the heater is turned on.
②	HOUR lamp	Lights when the timer is set in hours.
③	TIME lamp	Lights when the timer is set in clock time.
④	REMAINING HOUR lamp	Lights when the Timer screen displays the remaining operation time.
⑤	RUN/STOP key	The key is used to start/stop specific operation.
⑥	POWER key	The key is used to turn on or off the power to the controller.
⑦	PROGRAM key	The key is used to select program operation.
⑧	AUTO STOP key	The key is used to select auto stop operation.
⑨	AUTO START key	The key is used to select auto start operation.
⑩	FIXED TEMP key	The key is used to select fixed temperature operation.
⑪	Measured Temperature Display Screen	The screen displays the measured temperature and error numbers.
⑫	Operation Guide Screen	The screen describes status.
⑬	Set Temperature Display Screen	The screen displays the set temperature and parameter settings.
⑭	Timer Display Screen	The screen displays the set time and the remaining hours.
⑮	HOUR UNIT/MIN UNIT lamps	One of these comes on when the time setting is the hour or minute.
⑯	TEMP. SET/TIME SET(time)keys	The keys are used to set or change temperature and time for the fixed temperature operation or program operation.
⑰	DIGIT SHIFT key	The key is used to shift a digit during setting.
⑱	▼▲ keys	The keys are used to increase/decrease settings.
⑲	CANCEL key	The key is used to go back to the previous parameter item or to clear parameter settings.
⑳	ENTER key	The key is used to advance to the next parameter item or to determine a parameter setting.

3. Names and functions of parts

Control panel



No.	Name	Operation／action
①	Repeat Display Screen	The screen displays repeat setting and the number of repetitions.
②	REPEAT SET key	The key is used to set repeat during program operation.
③	Step Display Screen	The screen displays the selected step and steps to be executed.
④	STEP key	The key is used to set steps for program operation.
⑤	PROGRAM 3 key	The key is used to select program 3.
⑥	PROGRAM 2 key	The key is used to select program 2.
⑦	PROGRAM 1 key	The key is used to select program 1.
⑧	FUNCTION 1/2 key	The key is used to set various functions of the controller.
⑨	LOCK key	The key is used to lock settings.
⑩	DEFROST key	The key is used for manual defrosting.
⑪	GUIDE key	The key is used to show guidance on the Operation Guide screen.

4. 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 CR5 Program Controller” for details.

No.	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 16 functions (including when optional devices are installed).

Refer to the separate “Operation Manual for the model CR5 Program Controller” for details.

No.	Name	Function
Functions of FUNCTION 1		
1	Calendar/Time setting	You can set the dominical year, month, date and the current time.
2	Time/Hour selection	You can select whether timer operation will be set in hours or in time.
3	Buzzer setting	You can turn on or off sound of key operation, time up, operation disabled and door open separately.
4	Heater output operation level display	The heater output level in % can be continuously monitored.
5	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.
Functions of FUNCTION 2		
6	Event output setting	The function is used to set the event output function during program operation for each step.
7	Motor output setting	The function is used to set the pump power during operation.
8	Refrigerator output setting	The function is used to set the output of the refrigerator during operation.
9	Temperature sensor switching setting	The function is used to switch between the internal sensor and an external sensor when an external circulating unit is used.
10	Calibration offset setting	The function is used to compensate a calibration offset temperature.
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	Wait function setting	The function is used to set a wait zone and a wait time. This setting may not be different among different steps.
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.
16	Refrigerator operation setting	The function is used to switch from continuous operation to ON/OFF operation to improve defrosting performance.

4. Operating procedures

Operation modes and lists of functions

Defrosting function is built-in in this chamber as special function.
For details, refer to the separate Operation Manual for the Model CR5 Program Controller.

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Defrost function</td><td>While operating the unit at a lower temperature, cooling capacity of the evaporator may be degraded and the set temperature may not be maintained due to too much frost on the evaporator.
The IL unit has an observation window to allow check how much frost is on the evaporator. The speed in which frost is generated will differ depending on specific conditions.
(1) Operating temp.:
Operation at a lower temperature is likely to cause frost.
(2) External temp./humidity:
Frost is likely to occur at a higher temperature and humidity.
(3) Inside the bath:
Frost is likely to occur when the humidity inside the bath is high.
(Such as when the specimen used contains much moisture.)
The IL unit allows selecting from the following operation modes to prevent frosting depending on the use conditions.
This function can be enabled even during fixed temperature operation by pressing the [Defrost] key.

 
Although it depends on use conditions, take care since the temperature in the bath will rise compared to the set temperature during defrost operation, which might influence on specimens. In which case, the displayed temperature may rise by 10℃ or more.
(Increased margin of temperature will differ depending on the set temperature, the specimen or the external temperature.)
※Reference data: Temperature increase is within about 4℃ at the set temperature of 37 ℃ and the external temperature of 20℃.</td></tr>
</table>

4. Operating procedures

Operation modes and lists of functions

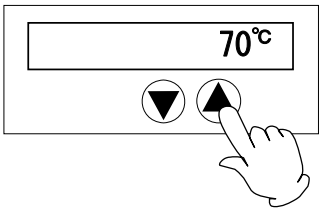
Refer to the separate “Operation Manual for the Model CR5 Program Controller” for details of operations.

No.	Operations	Corresponding page in the operation manual for the model CR5 Program Controller.
1	Description of the Control Panel	P.1
2	Remote Control Connection of the Control Panel	P.4
3	Fixed Temperature Operation	P.10
4	Fixed Temperature Auto Stop Operation	P.11
5	Fixed Temperature Quick Auto Stop Operation	P.12
6	Fixed Temperature Auto Start Operation	P.13
7	Program Operation	P.14
8	Program Auto Start Operation	P.34
9	Program Step change Function	P.35
10	Lock Settings	P.40
11	Guide Function	P.42
12	Suspension Function	P.43
13	Program Pattern Registration Function	P.28
14	Program Pattern Assignment Function	P.25
15	Settings of FUNCTION 1	P.44
16	Settings of FUNCTION 2	P.50
17	Defrost Function	P.62

4. Operating procedures

Operating sequence (Overheat protector settings)

The stand-alone overheat protector consists of a temperature measurement circuit, CPU, sensors, and the output circuit separate from the controller. When the protector is activated, the unit will stop and will not recover until the earth leakage breaker is turned on again. (Manual recovery)

Temperature setting for the stand-alone overheat protector 	① Set the temperature with the ▼▲ keys.

About the stand-alone overheat protector

When the difference in the set temperatures between the stand-alone overheat protector and the controller is small, the protector may be activated and operation may be stopped. Set the temperature for the protector at least 5℃ higher than that for the controller. Note that the protector is not available for the purpose of protecting specimens.
The temperature is set at 70℃ at the time of shipping.

If you want to operate the stand-alone overheat protector at a temperature you want, first operate the unit with the temperature in the bath at that setting until operation becomes stable, then gradually lower the protector setting and make sure that it operates reliably at the temperature setting you want. It takes about five seconds before it starts operation for which time you have to wait before checking. When the protector is triggered, it displays Er07 and operation stops. Since the activation temperature for the sensor of the protector differs depending on overshoot at the time of heating or specimen status, set it at as high temperature as possible.

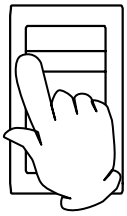
Also, when the protector set temperature has been changed, wait for about five seconds until that temperature is recorded before turning power off.

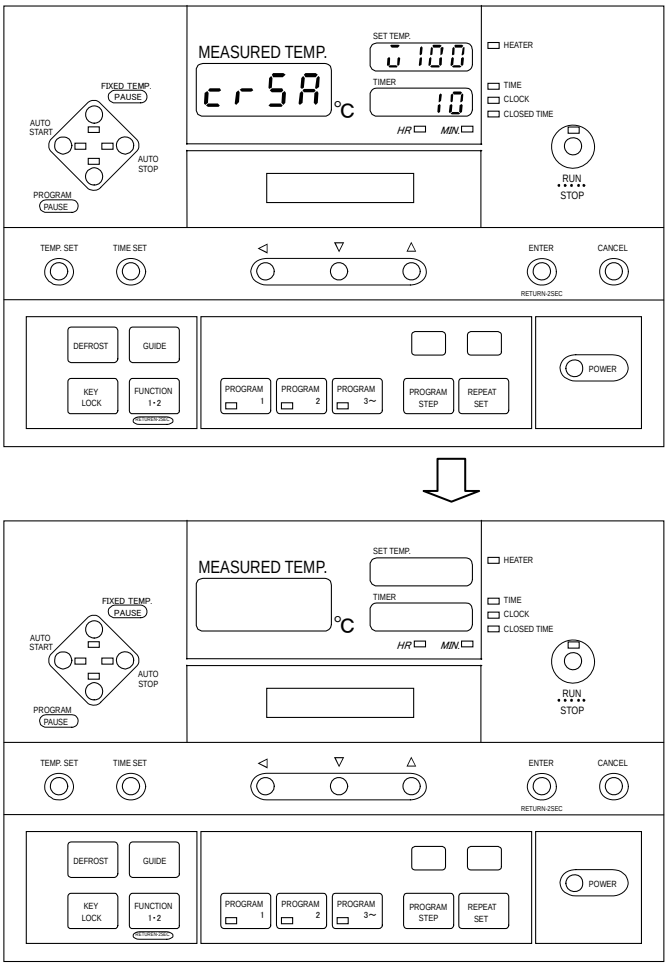
4. Operating procedures

Operating sequence (Basic operation)

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 CR5 Program Controller”.

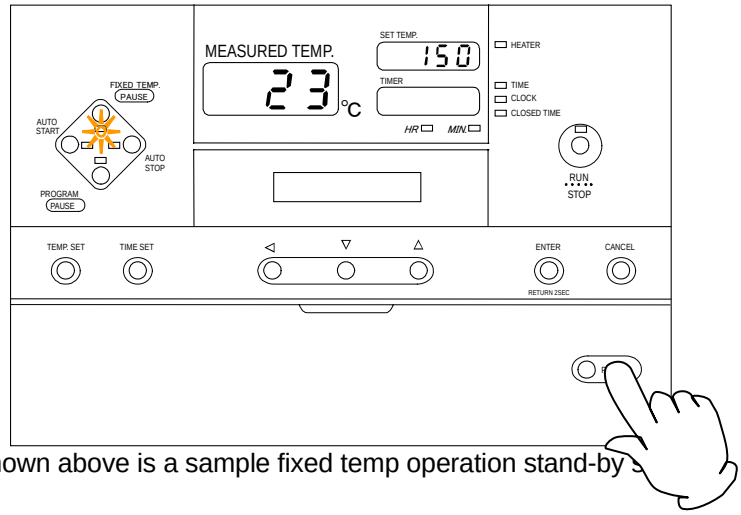
Note: Although the calendar has been set at the time of shipping, reset it if the date and the time in the Guide screen are wrong.
For how to set, refer to the section on FUNCTION 1 “Setting the Calendar Time” in the separate “Operation Manual for the Model CR5 Program Controller”.

4. Operating procedures

Operating sequence (Basic operation)

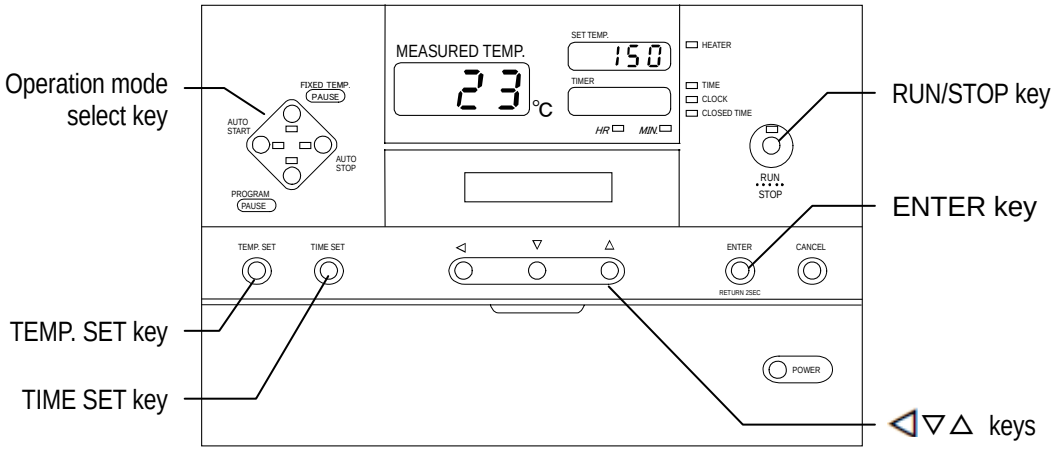
2) Turn controller power on.

■ 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 s

3) Operating sequence



For detailed operations and function settings, refer to the separate “Operation Manual for the Model CR5 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）

4. Operating procedures

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 CR5 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 CR5 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 CR5 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, display END, and control operation is completed at once.Also, the elapsed counts is displayed since control end.
   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.

4. Operating procedures

Operating sequence (Example of program registration)

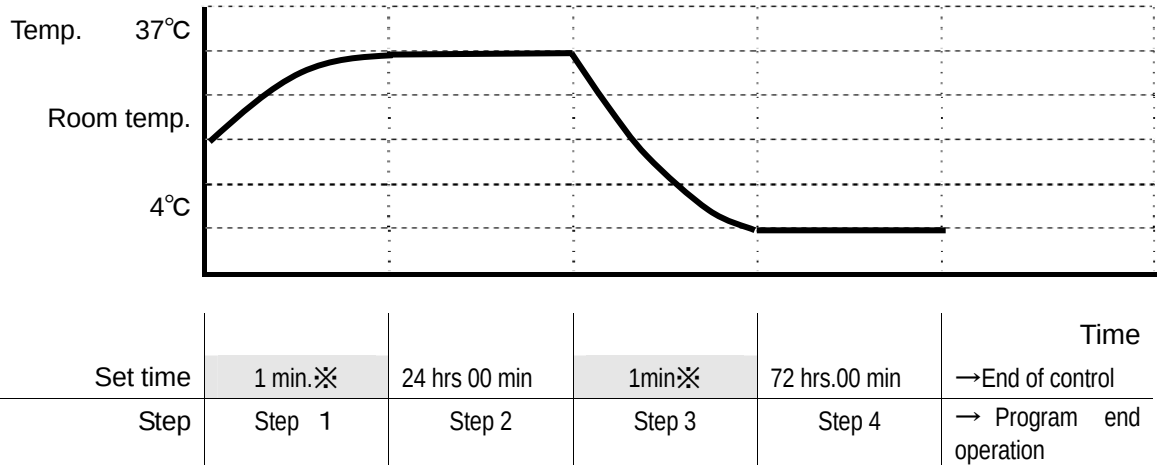
The unit has the following programs registered at “PROGRAM 1 key” at the time of shipping from the factory.
Temperature and time have been set as follows and you can change them as necessary before starting operating the unit.

・Description of registration

Program No.	Program 01
Name	37℃24　4℃72
Program	Step 1：Heating to 37℃→Step 2：Hold at 37℃ for 24hrs.→ Step 3：Cooling to 4℃→Step 4：Hold at 4℃ for 72 hrs.→ End of program

・Description of operation

	Operation	Set temp.	Set time
Step 1	Heating to 37℃	37℃	00 hr 01min.
Step 2	Hold at 37℃ for 24 hrs（1 day）	37℃	24 hrs 00min.
Step 3	Cooling to 4℃	4℃	00 hr 01min.
Step 4	Hold at 4℃ for 72 hrs（3 days）	4℃	72hrs 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.

Program has been set to 1: HLD at the time of shipping. When the program ends, alarm is triggered (when alarm setting is ON); "End" appears in the MEASURED TEMP. screen, indication in the TIMER screen changes to the time elapsed since end of the program and control operation is complete. To turn off alarm sound, press the CANCEL key. Also, press the RUN/STOP key to complete the program ending operation.

※Although the sample program above has been set at incubation at 37℃ for 24 hrs (1 day)→Hold at 4℃ for 72 hrs（3 days） as the settings most typical for the purpose of life science, which time and temperature are not the ones that guarantee proper incubation or storage of specimens. Adjust time, temperature and number of steps as appropriate depending on the specific purpose and application.

4. Operating procedures

Operating sequence (Example of program registration)

1. Register a name “37℃24　4℃72”.
   Perform steps 1.～4. on P.21”, section 3-3）, then perform step 5. and enter “37℃24　4℃72”.

PROGRAM01 EXIST NAME　(37℃24　4℃72)

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 37℃ and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP. screen to 37.0℃ with the △▽ keys. Press the ENTER key to determine the temperature.

PROGRAM01 Step 01 TEMP SET

4. Step 1：Heating to 37℃ 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 37℃ for 24 hrs and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP. screen to 37.0℃ with the △▽ keys. Press the ENTER key to determine the temperature.

PROGRAM01 Step 02 TEMP SET

6. Step 2：Hold at 37℃ for 24 hrs, and then set the time time parameter.
   Change the time flashing in the TIMER screen to 24：00 with the △▽ keys. Press the ENTER key to determine the temperature.

PROGRAM01 Step 02 TIME SET

7. Step 3：Heating to 4℃ and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP screen to 4.0℃ with the △▽ keys. Press the ENTER key to determine the temperature.

PROGRAM01 Step 03 TEMP SET

8. Step 3：Heating to 4℃ 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 4℃ for 72 hrs and then set the temperature parameter.
   Change the temperature flashing in the SET TEMP. screen to 4.0℃ with the ▽△ keys. Press the ENTER key to determine the temperature.

PROGRAM 01 Step 04 TEMP SET

10. Step 4：Hold at 4℃ for 72 hrs and then set the time parameter.
    Change the time flashing in the TIMER screen to 72：00 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：FT

PROGRAM 01 EXIST Name　（37℃24　4℃72）

4. Operating procedures

Before operating the unit

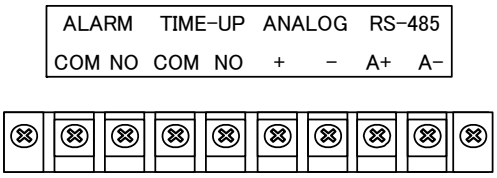
❗	Be sure to follow instructions in this manual for operating the product. Operations other than those specified in this manual may cause a trouble. Also take care that the warranty may be void if any operation other than those specified in this manual is performed.

⚠ CAUTION

❗	1. Be sure to turn the breaker OFF before making any connections.
	2. Do not connect anything to the temperature output terminal other than a recorder with input impedance of 600Ω or less.
	3. Make any connection secure with the screws attached to the terminal block.

Connecting procedures

❗	Securely connect to the terminal to be used.
	When temperature output is used, use a shielded cable to prevent noises.



Connecting terminals

Specifications

Temperature output （ANALOG）	• Outputs a voltage (DC) according to the measured temperature • Output temperature range: IL702 -5～65℃ • Output voltage: DC1～5V • Resolution : 0.1℃ • Connection : M4 screw terminal block
Alarm output （ALARM）	• Outputs when an abnormality is detected (For description of abnormalities, see “Safety device and error codes” on P. 47.) • A-contact (relay contact) • Contact capacity AC250V 3A (resistance load) DC30V 3A (resistance load) • Connection : M4 screw terminal block
Time up output （TIME UP）	• Outputs on time-up of AUTO STOP, AUTO START or QUICK AUTO STOP or at program end. • A-contact（relay contact） • Contact capacity: AC250V 3A（resistance load） DC30V 3A（resistance load） • Connection : M4 screw terminal block

IL702

Temperature（℃）	Output voltage（V）
-5	1.00
5	1.57
15	2.14
25	2.71
35	3.29
45	3.86
55	4.43
65	5.00

4. Operating procedures

Useful functions (RS485 communication function)

1. Communication settings

1.1 Communication settings

Make communication parameter settings on the PC side before starting communication with the CR5 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 RS232C interface channel (COM1/COM2 port) is used.

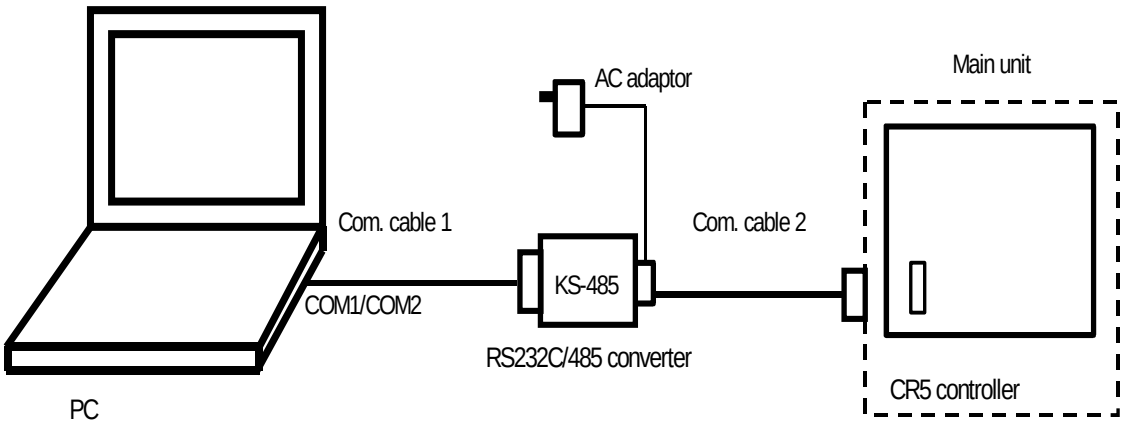
■ RS232C／RS485 converter

・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-232C 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-232C⇔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]～250msec
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

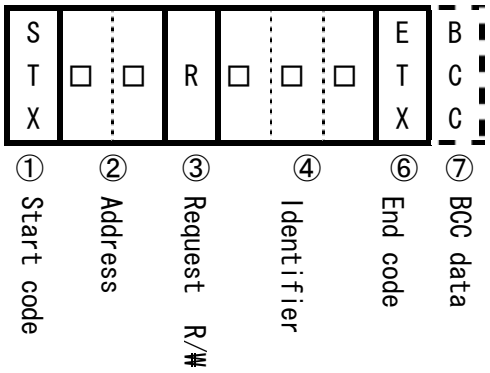
- The Unit returns “reply message” in response to a “request message” from a host PC. Thus, the Unit will never start transmission.
- The Unit does not make any communication for about four seconds after power on (no reply). Set some delay before start of communication after power on.

4.2 Message types

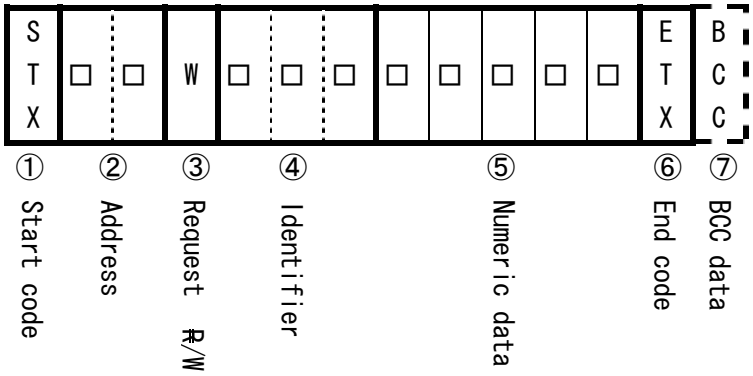
- Types of messages include the transmission request message from a host PC and the transmission reply message from the Unit.
- All code (excluding BCC) including STX, address, request content, identifier, and ETX are expressed in ASCII codes.

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

4.3.1 Configuration of the read request message

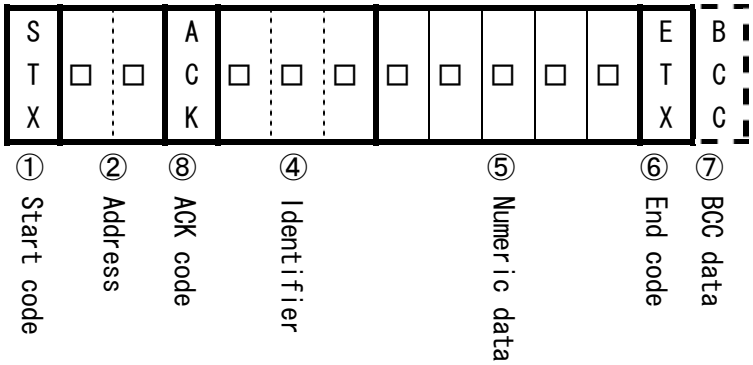


4.3.2 Configuration of the write request message

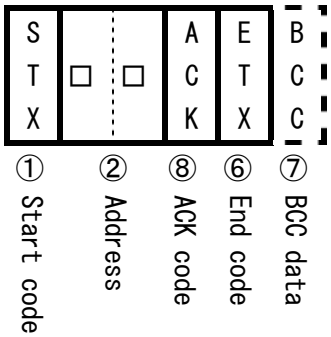


4.4 Configuration of the reply message

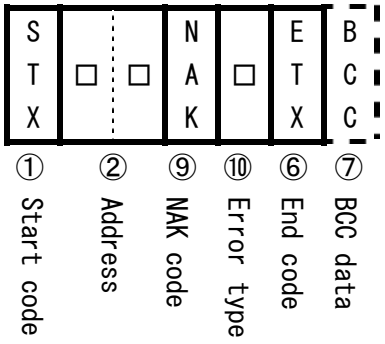
4.4.1 Reply message in response to the read request message



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℃
	When temp. sensor is of platinum	→ 10.1℃
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 “⑨NAK” in the “reply message” from the Unit.

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

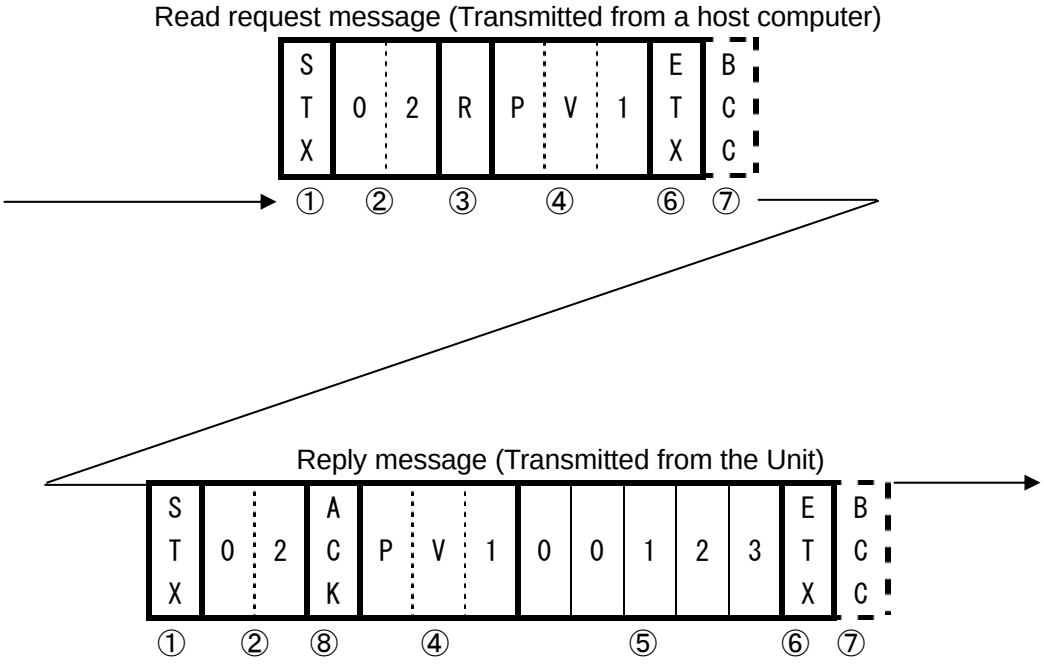
Reception timeout means a case STX is not sent from the Unit after some response wait time after a host PC has sent BCC.

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”.

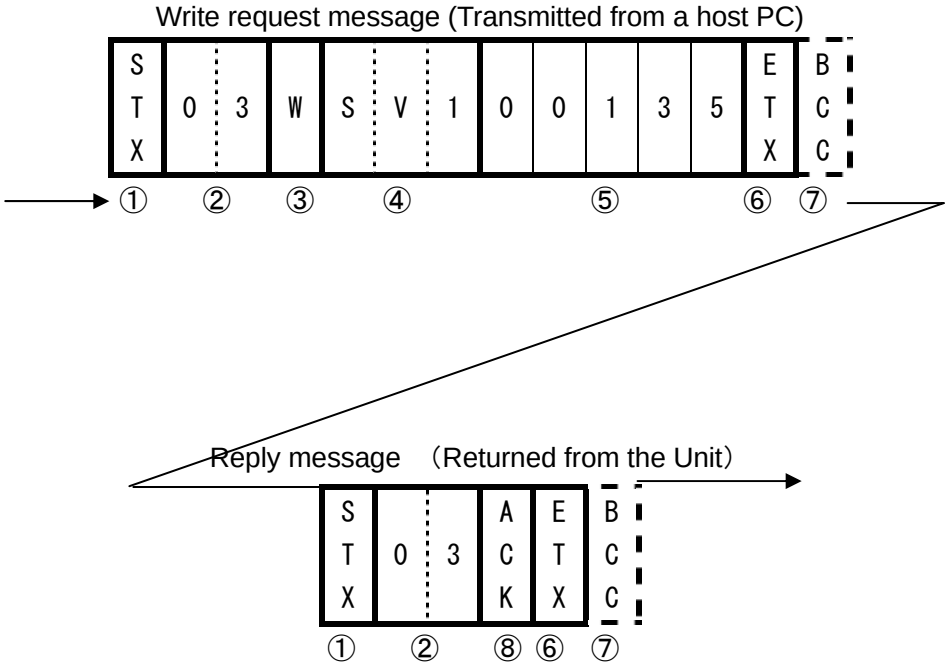
Note 2) For ASCII codes, see “8.ASCII code list”.

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.



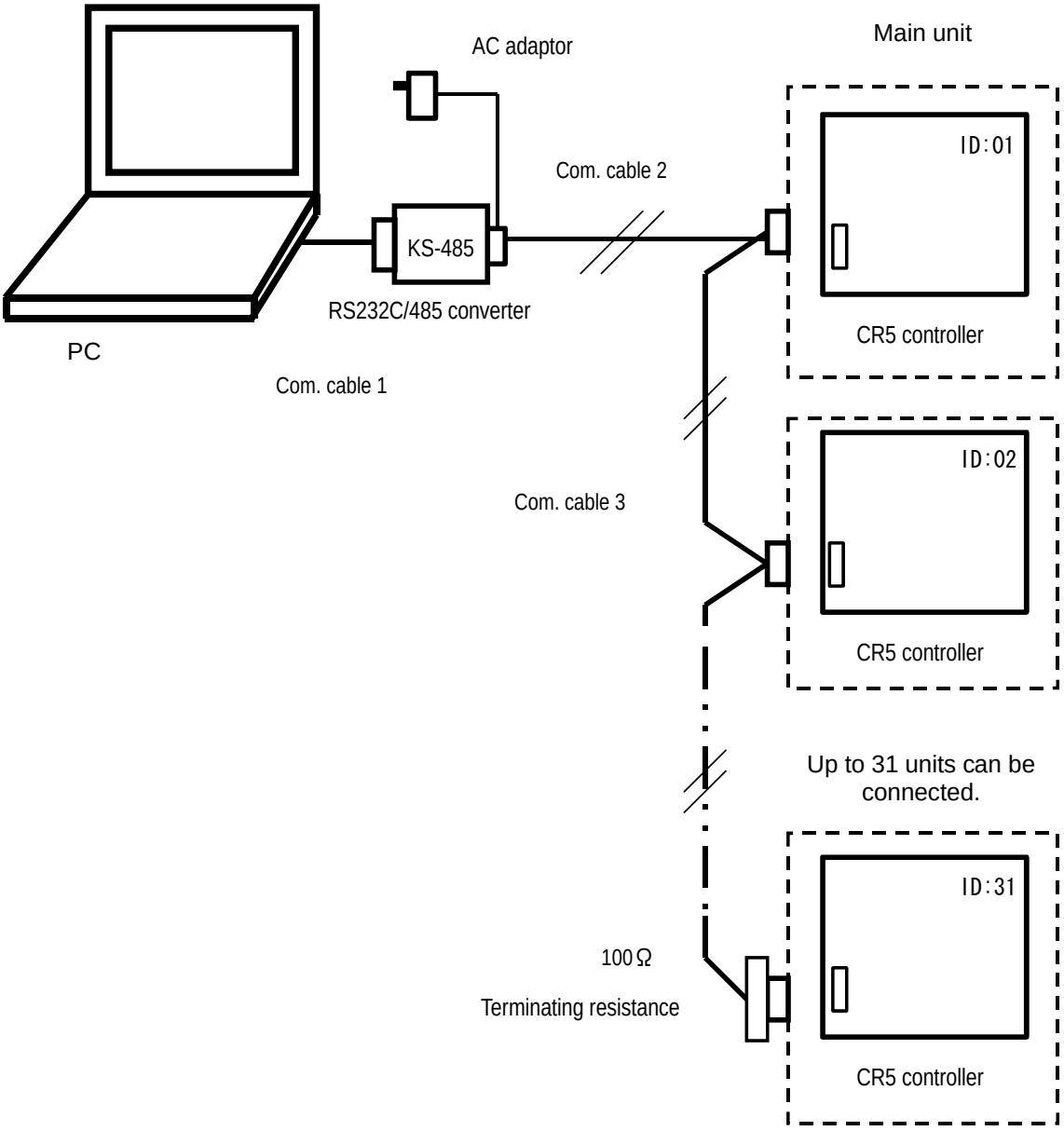
Code	Symbol・data	ASCII code note2)
① Start code	STX	02H
② Address	03	30H 33H
③ Request（Write）	W	57H
④ Identifier note 1)	SV1	53H 56H 31H
⑤ Numeric data	00135	30H 30H 31H 33H 35H
⑥ End code	ETX	03H
⑦ BCC data Request		56H
Reply		04H
⑧ Acknowledgement code	ACK	06H

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-232C 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
Event output setting	EVE	R/W/*/*	00000 : Event output OFF 00001～00015 : 1～15 patterns
Motor output setting	FAN	R/W/*/*	For motor output operation selection, When ON/OFF control is selected 00000 : Motor control disabled 00001 : Motor control enabled When level control is selected 00000 : Motor control disabled 00001～00010 : Levels 1～10
Refrigerator output setting	LEI	R/W/*/*	00000 : Refrigerator control disabled 00001 : Refrigerator control enabled（normal operation） 00002 : Refrigerator control enabled（forced operation）

Program operation parameters

Name	Identifier	Command	Setting
Temp. setting	S01～S99	R/W/*/*	SLL～SLH : Upper limiter～lower limiter°C *1*2
Time setting	T01～T99	R/W/*/*	00000～09959 : 0hr 0min～99 hrs 59min H0000～H9999 : 100hrs ～9999hrs
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 No. 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 No. select	PSP	R/W/*/*	00000 : Program 1 00001 : Program 2 00100 : Program 3

Useful functions (RS485 communication function)

Program operation parameters

Name	Identifier	Command	Setting
Step №. select	STN	R/W/*/*	00001～00099 : Steps 1～99
Motor output	F01～F99	R/W/*/*	In motor output operation selection, When ON/OFF control is selected 00000 : Motor control disabled 00001 : Motor control enabled When level control is selected 00000 : Motor control disabled 00001～00010 : Levels 1～10

Auto Start operation parameter

Name	Identifier	Command	Setting
Auto Start time setting	SST	R/W/*/*	When time control is selected 00000～09959 : 0hr 0min～99hr 59min *1 H0100～H9999 : 100hrs～9999hrs When time control is selected 00000～02359 : hr 0min～23hrs59min

Auto Stop operation parameter

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

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 : 0hr 1min～99hrs 59min H0100～H9999 : 100hrs～9999hrs
Program No. monitor	_MN	R/*/*/*	00000 : Program 1 select *2 00001 : Program 2 select H0100 : Program 3 select
Step No. 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=Heater output 2nd digit=Refrigerator output 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=Motor relay output ※ Output status 0=Output OFF 1=Output ON
Error monitor 1	ER1	R/*/*/*	00000 : 1st digit=Sensor error 2nd digit=Heater short-circuit error 3rd digit=Heater disconnection error 4th digit=Stand-alone overheat prevention function error 5th digit=Refrigerator error ※ 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=No-load heating error 5th digit=Door open ※ Error status 0=No error 1=Error

Other parameters

Name	Identifier	Command	Setting
Main measured temperature monitor External measured temperature monitor	PV1 PV2	R/*/*/*	When input to a thermocouple （Ex）00100 : 100℃ When input to platinum （Ex (Ex）01000 : 100.0℃ 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			

5. Cautions on handling

⚠ Warning

1. About handling of flammable or combustible solution

The unit is not explosion proof. Take special care for handling specimens that contain on which explosive materials, combustible materials. Flammable or combustible solution will evaporate when left at a room temperature (or at a lower temperature for some types of solutions) and may be ignited and explode from switches, lights and other ignitable sources. Be sure to assure sufficient ventilation when using these materials.
See section “13. List of dangerous materials” on page 53.

2. Ban on use/countermeasures when an error occurs

If smoke is emerges on the unit or an odd odor is felt, immediately turn the ELB on the main unit off, turn the power supply off and contact your dealer or a Yamato sales office for inspection. Otherwise, a fire or an electrical shock may result. The user shall never attempt to repair the unit to avoid any possible dangers.

3. Secure sufficient ventilation for the unit.

Do not operate the unit when its side panels and vent holes are blocked.
Internal temperature of the unit will rise degrading the performance and an accident, a malfunction or a fire may result.

4. Do not allow liquid to spill over the unit.

Do not allow liquid to spill over the unit. Pay special attention not to allow liquid to enter into the vent holes in the side and rear panel of the unit. If liquid is spilt over or into the unit, do not try to operate it any further. Otherwise, an accident, a malfunction, a fire or an electrical shock may result.

5. Do not allow a metal piece to fall into the unit.

Do not allow a clip, a staple, a screw or other metal pieces to fall into the unit.
Stop operating the unit if a metal piece has dropped into the unit.
Otherwise, an accident, a malfunction, a fire or an electrical shock may result.

6. Do not open the cabinet.

Do not open panels or covers fixed on the unit, or do not operate the unit with any of those open. Other wise, an accident, a malfunction, or an electrical shock may result.

7. Do not attempt to operate the unit without the vent hole filter.

Do not attempt to operate the unit without the vent hole filter.
Otherwise, an accident, a malfunction, or an electrical shock may result.

8. Do not attempt to modify the unit.

The user shall never try to modify the unit; other wise, an accident, a malfunction, a fire or an electrical shock may result.

5. Cautions on handling

⚠ Caution

1. Do not step on the unit.

Do not step on the unit. Otherwise, the unit may trip over or be damaged resulting a personal injury or a malfunction.

2. Do not put or drop an object on the unit.

Do not put or drop an object on the unit. Since the unit contains high precision devices, vibrations or shock may cause a malfunction.

3. When a thunder is heard.

When a thunder is heard, turn the ELB on the main unit off then turn the main power off immediately. Otherwise, a lightning strike may result and cause a fire.

4. During night and not to be operated for a long period of time.

During the night and when you want to stop the unit for a longer period of time, turn the ELB to “off” and pull out the power cord from the power supply.

5. About recovery from power outage.

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.

If you do not want to resume operation by automatic recovery, refer to FUNCTION 2 “Power failure compensation setting” in the “Operation Manual for the Model CR5 Program Controller”.

6. When opening or closing the door

When opening or closing the door, do not put your hand or face close to the area the door moves (space).

7. Do not operate the unit with the door open.

When the unit is operated with the door open, proper temperature control is not possible and the heater may overheat causing a possible danger. Be sure to operate the unit with the door closed.

8. About installation of shelf boards and specimens

Correctly place shelf boards and specimens according to section “Installation procedures/precautions” on page 7. If these are not placed correctly, the unit will be unable to perform correctly as well as an accident or a malfunction may result.

9. Do not attempt to do anything other than specified in this operation manual.

Do not attempt to do anything other than specified in this operation manual. Otherwise, an unexpected accident may result.

6. Maintenance procedures

Daily inspection/maintenance

Be sure to perform daily inspection and maintenance to assure reliable operation of the unit.

⚠ Warning

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

⚠ Caution

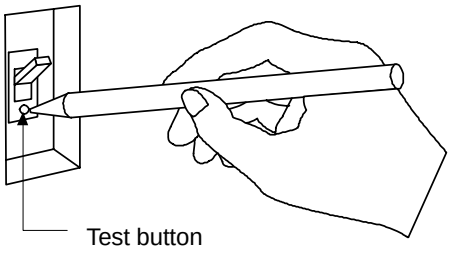
- Wipe off any dirt with a tightly wrung soft cloth. Never try to clean the unit with benzene, thinner or scouring powder, or rub with a scrubbing brush. Deformation, degradation or discoloration may result.

Every month

Inspect the functions of the ELB.

Test shall be performed with the power cord connected and power is being supplied to the unit.

- First turn the ELB to “off.”
- Then, turn the ELB “on” and press the test button on the device with a ball-point pen to check whether it is turned off to indicate that it is in the normal state.



Maintenance of the internal bath

Stop operation and turn the ELB to OFF. Pull out the power cord off the distribution board and the wall outlet. Confirm the temperature in the device and remove shelf boards and clamps.

The internal bath, shelf boards and shelf clamps are made of SUS304 stainless steel, glass boarad for inner door and reinforced glass is used for the frost observation window. To clean these items, thoroughly wipe with a cloth moistened with cleaning alcohol then wipe gently with a dry cloth.

Never use acid detergent, alkaline detergent, oil or organic solvent, which may cause corrosion or damage to the products.

⚠ **There are sharp protrusions inside the internal bath, shelf boards and shelf pillars and shall be handled with special care to avoid personal injury. Be sure to wear gloves since handling with bare hands may present danger.**

About defrosting of the refrigerator

Too much frost may degrade cooling performance of the refrigerator and may be unable to maintain the set temperature.

There is a frost observation window in the bath to check frost to the evaporator. When frosting is confirmed, perform defrosting.

Refer to the section of defrost setting in the separate “Operation manual for the model CR5 Program Controller”.

6. Maintenance procedures

Maintenance of the filter

A clogged filter will degrade cooling performance. It may also cause a refrigerator malfunction. The extent and speed of clogging depends on the environment and operation period. Regularly clean the filter according to the specific operating conditions.

Pull the filter attaching plate on the right side of the unit toward you. The plate is fixed with magnets so you can remove simply by pulling it.

Remove the filter on the filter attaching plate and wash or remove dusts with an electric cleaner.

There are condenser fins behind the ventilation port plate.
Never touch them with bare hands to avoid injury.
After cleaning, install it by performing the procedures above in the reversed order.

◆If you have questions, immediately contact your dealer or one of Yamato sales offices.

7. 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

⚠ 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.

⚠ Warning

When disposing the unit

●The Unit employs substitutive CFC.
Ask disposal to a professional company.

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:

Names of major parts	Major materials
Major components of the outer finish	
Outer finish	Bonderized steel sheet, melamine resin baking finish
Internal bath	SUS304 stainless steel
Packing	Vinyl chloride
Nameplate	Polyethylene（PET）resin film
Major electric parts	
Switches and relays	Resin, copper
Board	Fiber glass
Heater	Chrome iron
Power cord	Synthetic rubber coating, copper, nickel
Refrigerator	Iron, copper
Major piping parts	
Hoses	Silicon
Drain hose	Silicon
Hose clamp	66 nylon
Piping heat insulation hose	Polyurethane sponge
Piping parts	SUS304
Condenser	Iron, copper, aluminum
Refrigerator encapsulated refrigerant	
Refrigerant	HFC-R134a

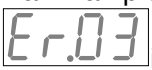
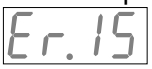
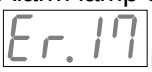
8. Troubleshooting

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 busser 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 service department.
SSR short circuit	Alarm lamp on  indication	● SSR short circuit Contact our service department.
Detection of heater disconnection	Alarm lamp on  indication	● Heater disconnection Contact our service department.
Overheat	Alarm lamp on  indication	● Activation of overheat protector First reset the power supply and check the temperature in the bath and the set temperature for the overheat protector. If the unit does not reset, contact our service department.
Memory error	Alarm lamp on  appears	● Memory setting error Contact our service department
Internal communication error	Alarm lamp on  indication	● Communication error between the control board and the display board Contact our service department.

8. 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. 47.
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. ●If the condenser filter is dirty. ●If the condenser fins are clogged.
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 “Opeation Manual for Model CR5 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 CR5 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 sales offices.

9. 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 “3. Names and functions of parts” on page 12.

- Description of trouble (as in detail as possible)

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

Warranty card (attached separately)

●Warranty card is given by your dealer or one of our sales offices and please fill in your dealer, date of purchase and other information and store securely.

●Warranty period is one full year from the date of purchase. Repair service for free is available according to the conditions written on the warranty card.

●For repairs after the warranty period consult your dealer or one of our sales offices. Paid repair service is available on your request when the product’s functionality can be maintained by repair.

Minimum holding period of repair parts

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

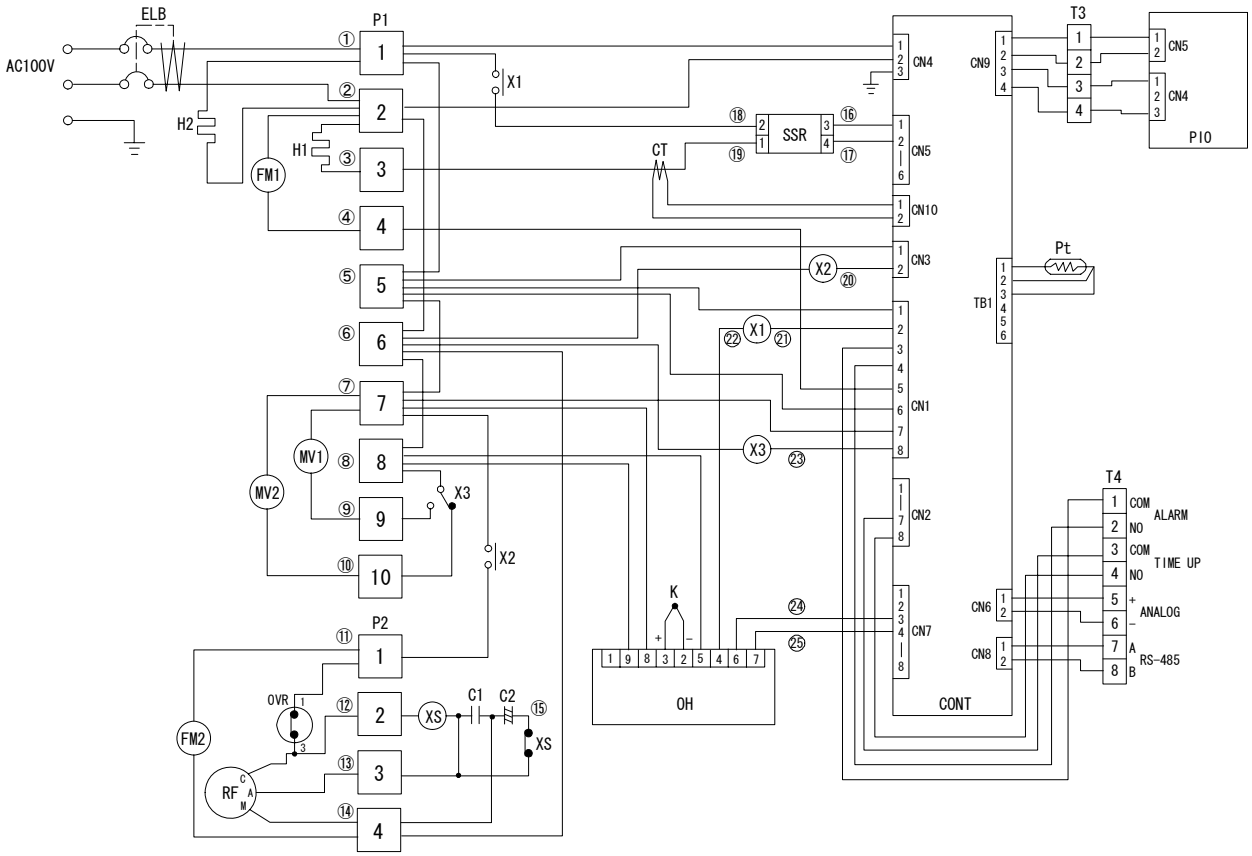
10. Specifications

Product name		Program low temperature constant-temperature chamber
Model		IL702
System		Natural convection with air jacket
Performance	Operating temp. range	0℃～60℃
	Set temp. range	-5℃～65℃
	Temp. adjustment precision ※1	During continuous operation of refrigerator ±0.3℃（Set at 37℃, no load） During ON/OFF operation of refrigerator ±1.0℃（Set at 37℃, no load）
	Temperature distribution precision※1	During continuous operation of refrigerator ±1.0℃（Set at 37℃, no load）
	Refrigerator operating range	Below set temp.44.0℃:ON; 44.1℃ or above: OFF
Configuration	Internal finish material	SUS304 stainless steel
	Frost observation window	Frost observation window: transparent acrylic plate
	Inner door	Reinforced glass:5 ㎜
	Temp. control	PID control with a micro computer
	Sensor	Pt100Ω（for temp. control）＋ K-thermocouple（for overheat protection）
	Temperature set/display	Digital setting/digital indication
	Heater	Chrome iron wire heater:800W
	Refrigerator	Air-cooled fully closed compressor:300W（reciprocal type）
	Refrigerant/amount	HFC R134a 280g
	Defrosting mechanism	Hot gas bypass system
	Cable port	I.D.50 ㎜ Left side on the main unit
Safety functions		Over-current ELB, overheat protector, delay timer for refrigerator protection, refrigerator overload relay circuit, self-diagnosis function（sensor error, heater disconnection, SSR short circuit, automatic overheat protection）
Other functions		Key lock function, calibration offset function, temperature output terminal, RS485 communication function, alarm output terminal, condenser filter
Standard	Internal dimensions (w×d×h mm)	600×530×500
	Outer dimensions※2 (w×d×h mm)	710×645×1008
	Number of steps for shelf boards/ withstand load	12 steps 15 kg/board
	Shelf peg pitch	30 mm
	Capacity	159λ
	Power（50/60Hz）	AC100V 13A
	Weight	Approx. 90 kg
Accessories		Shelf boards:3, shelf peg:3 sets, door key:2, Holder for the operation manual:1, operation manual, operation manual for the model CR5 Program Controller, warranty card

※1 Temperature adjustment precision and temperature distribution precision are possible values at the environmental temperature 23℃±5℃.

※2 Outer dimensions do not include protrusions.

11. Wiring diagram



Symbol	Part name	Symbol	Part name
ELB	Electric Leakage Breaker	Pt/K	Temp. sensor
T1～4	Terminal block	OH	Stand-alone overheat protector
H1	Heater（in the unit）	SSR	Solid state relay
H2	Heater（door）	CONT	Planar board
FM1	Fan motor（in the unit）	PIO	Display board
FM2	Fan motor（refrigerator）	CT	Current sensor
MV1	Solenoid valve（defrost）	OVR	Overload relay
MV2	Solenoid valve（return tube）	C1	Operation condenser
X1	Relay（heater in the unit）	C2	Start condenser
X2	Relay（refrigerator）	XS	Start relay
X3	Relay（alarm output）	RF1	Refrigerator

12. Replacement parts list

Replacement parts

Symbol	Part name	Code №.	Specifications	Maker
PIO	Display board	LT00009411	CR5A 型	Yamato Scientific
CONT	Planar board	LT00009410	CR5A 型	Yamato Scientific
Pt	Temp. sensor	LT00009705	Pt100Ω	Yamato Scientific
K	Temp. sensor	LT00009502	K 熱電対	Yamato Scientific
RF	Refrigerator	LT00009463	AA134C24TA00-A0FS 300W	Panasonic
FM1	Fan motor	2-15-027-0001	FM-05035-AAB	Royal
FM2	Fan motor	3-01-006-0006	SE4-C041NP	Sanyo
H1	Heater	IL72S-40100	100V 800W	Yamato Scientific
H2	Heater	IN81S-40480	100V 54W	Yamato Scientific
MV1	Solenoid valve	3-02-006-0002	SEV-502BXF	Saginomiya
MV2	Solenoid valve	3-02-006-0003	NEV-603DXF	Saginomiya
X3	Relay	2-05-000-0060	G2R-1-T AC100V	Omron
SSR	SSR	2-16-000-0035	TRS5225	Toho Denshi
CT	Current sensor	2-17-001-0005	CTL-6-S-4-H	URD
OH	Stand-alone overheat protector	2-10-011-0002	PAS3K1-0Y0B0Y	Fuji
T1	Terminal block	LT00031665	TFD250ABC-10P	Terminal
T2	Terminal block	LT00031661	TFD250ABC-4P	Terminal
T3	Terminal block	LT00005450	MF10-4AX 4P with cover	Toyo Giken
T4	Terminal block	2-07-023-0008	MF10-4AX 8P with cover	Toyo Giken
―	Power cord	LT00008924	T2-3C 3m	Yamato Scientific
ELB	Breaker	LT00029774	NV-L22GR 15A/30mA	Mitsubishi
X1	Relay	LT00012708	G4B-112T1	Omron
X2	Relay	2-05-000-0030	JR1a-TM AC100V	Omron

13. 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℃ at one air pressure.

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

14. Standard installation manual

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

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

No.	Item	Implementation method	TOC No. Reference page of the operating instruction manual	Judgment
Specifications				
1	Accessories	Check for number of accessories on the basis of the column for accessories.	10. Specifications field P.50	
2	Installation	・Visual check of environmental conditions Caution: Take care for environment	2. Before operating the unit ・On the installation site P.4	
		・Securing a space		
		・Placement of shelf boards and specimens	2.Before operating the unit ・Installation procedure P.7～10	
Operation-related matters				
1	Source voltage	・Measure the user side voltage (outlet) with a tester ・Measure voltage during operation (shall meet the specifications) Caution: Always use a plug that meets the specification for attaching to the ELB.	2. Before operating the unit ・Be sure to connect the ground wire. P.6 ・Power supply is …. P.6 10.Specifications ・Specification-power supply P. 50	
2	Operation start	・Start operation. Set to a temperature about five to 5℃ lower than the room temperature and check that cooling time and temperature is stable at the setting.	Refer to the separate “Operation manual for the model CR5 Program Controller”.	
Description				
1	Operational descriptions	Explain operations of each component according to the operational instructions	4. Operating procedures ・Operating procedures 1. Safety precautions ～13. List of dangerous materials Refer to separate manual. P. 1 ～P.53	
2	Error codes	Explain the customer about error codes and procedures for release according to the operational instructions	8. Troubleshooting ～9. After sales service and warranty P.47～49	
3	Maintenance and inspection	Explain operations of each component according to the operational instructions	6. Maintenance procedures ・Daily inspection/ maintenance P. 44	
4	Completion of installation Entries	・Fill in the installation date and the installation mgr. on the nameplate of the main unit ・Fill in necessary information to the warranty card and hand it over to the customer ・Explanation of the route for after-sales service	9. After sales service and warranty P. 49	

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
Programmable Low Temperature Constant-Temperature Chamber
IL702
First edition Sep.30, 2004
Revised Mar.1, 2012

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