User's Manual

Temperature and Humidity Cabinet & Low Temperature Cabinet

LH-113, LHL-113,
LHU-113, LU-113

4101204000442

⚠
- Read this manual carefully before using the equipment.
- Familiarize yourself with all safety precautions before using the equipment.
- Keep this manual handy for future reference.

ESPEC CORP.

Liability

ESPEC CORP. assumes NO responsibility whatsoever for accidents or equipment trouble arising from the failure to observe handling instructions contained herein. Do not perform any operation or handle the equipment in any way or form that is not described in this user's manual or which is herein specifically prohibited. Careless usage of the sort may result in unexpected damage to the equipment or accident.

Introduction

This manual has been written for users of Temperature (and Humidity) Cabinet (LH, LHL, LHU, LU) and particularly for technicians. Read it thoroughly to obtain the maximum performance from the cabinet.

Safety Symbols

The following safety symbols are used throughout this manual.

Degree of DANGER

⚠ **VERY DANGEROUS**	**This mark means extremely dangerous consequences may arise, with the possibility of death or serious injury to the user, if the equipment is handled incorrectly.**
⚠ **DANGER**	**This mark means dangerous consequences may arise, with the possibility of death or serious injury to the user, if the equipment is handled incorrectly.**
⚠ **CAUTION**	**This mark means dangerous consequences may arise, with the possibility of somewhat serious injury to the user and/or damage to equipment and facilities, if the equipment is handled incorrectly.**

Keywords

The following keywords are used in this manual.

Note : Provides information necessary for gaining full performance from the cabinet or to prevent damage to equipment.

Procedure : Explains how to operate the cabinet on a step-by-step basis.

Reference : Offers supplementary information.

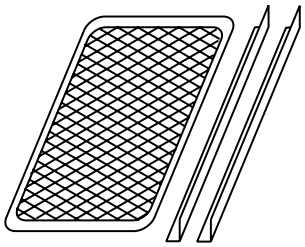
Document Composition

The user's manual composition that came with your cabinet contains the following reference materials. Use them as necessary.

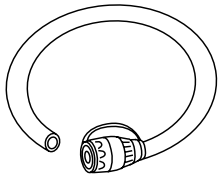
Manual	Content
Temperature (and Humidity) Cabinet (LH, LHL, LHU, LU)	Explains the basics of Temperature (and Humidity) Cabinet (LH, LHL, LHU, LU) as well as how to effectively use features and some of the options.
Quick Reference	Reorganizes operation from the instrumentation panel into a simple, handy digest.
Options • **Communication Function**	Explains how to use the communication function options. This manual shall always have priority of the above reference materials when found in disagreement.

Accessories & Spare Parts

Ð Shelf and shelf brackets

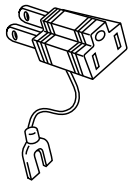


Ð Water supply/drain hose (Ø9 mm ID with snap-on socket head)

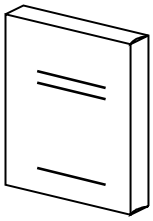


ð Brush (For cleaning the humidifying tray)

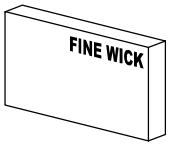
ñ Socket adapter



ò User's Manual



Ó Wet-bulb wick



Check the following accessories and spare parts have been included with your cabinet and in the specified quantity.

No.	Accessory/Part	Use	Qty.	Check if included
Ð	Shelf and shelf brackets	Holds specimens inside the cabinet.	Self 2 sets Self brackets 2 sets	
Ð	Water tank supply/drain hose	Ø9 mm ID with snap-on socket head. Connect to the cabinet to supply and drain water. (not included with LU cabinets)	1	
ð	Brush	Use to clean the humidifying tray. (not included with LU cabinets)	1	
ñ	Socket adapter	Adapter for converting 3P power cable plug to 2P. (100V AC, 115V AC specification only)	1	
ò	User's Manual	Literature necessary for proper cabinet use.	1 set	
Ó	Wet-bulb wick	Box of 24 wet-bulb wicks and 1 filler (not included with LU cabinets)	1	

* 115/220/230V AC specification (option) cabinets also come with one glass tube fuse (LH ı 5A / LHL, LHU,LU ı 10A).

Contents

Chapter 5 Getting More Out of Your Cabinet

Chapter 6 Checks and Maintenance

Chapter 7 Troubleshooting

Appendix

Chapter 1 Precautions in Usage

⚠ Read this section before using the equipment.

This chapter explains safety precautions you should observe to operate the equipment safely. Be sure to read it carefully and follow instructions to the letter so as to prevent harm to yourself, anyone else, specimens or the equipment.

1.1 Substances Which Should Not Be Placed inside the Equipment

⚠ DANGER

DO NOT introduce the following explosives, combustibles or substances which contain them into the equipment. Moreover, keep these substances away from the equipment and immediate area.
When exposed to excessive heat, these substances may cause fires and/or explosions.

Explosive Substances

Explosive Substances

- Nitroglycol, nitroglycerine, nitrocellulose, and other explosive ester nitrates.
- Trinitro-benzene, trinitrotoluene, picric acid, and other explosive nitrocompounds.
- Peracetic acid, methyl ethyl ketone peroxides, benzoyl peroxide, and other organic peroxides.

Inflammable Substances

Combustible Substances

Metal lithium, metal potassium, metal sodium, yellow phosphor, phosphor sulfide, red phosphor, celluloids, calcium carbonate (also called carbide), calcium phosphate, magnesium powder, aluminum powder, metal powders other than magnesium powder and aluminum powder, hydrosulfite.

Cont.

⚠ DANGER

Cont.

Oxides

- Potassium chlorate, sodium chlorate, ammonium chlorate, and other chlorates.
- Potassium perchlorate, sodium perchlorate, ammonium- perchlorate, and other perchlorates.
- Potassium peroxide, sodium peroxide, barium peroxide, and other inorganic peroxides.
- Potassium nitrate, sodium nitrate, ammonium nitrate, and other nitrates.
- Sodium chlorite and other chlorites.
- Calcium hypochlorite and other hypochlorites.

Ignitable Substances

- Ethyl ether, gasoline, acetaldehyde, propylene oxide, carbon disulfide and other substances with an ignition point of -30°C (-22°F).
- Normal hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone and other substances with an ignition point above -30°C (-22°F) and below 0°C (32°F).
- Methanol, ethanol, xylene, pentyl acetate amylacetate and other substances with an ignition point above 0°C (32°F) and below 30°C (85°F).
- Kerosene, light oil, turpentine oil, isopentyl alcohol (also called isoamyl alcohol), acetic acid and other substances with an ignition point above 30°C (85°F) and below 65°C (150°F).

Combustible Gases

Hydrogen, acetylene, ethylene, methane, ethane, propane, butane, and other combustible substances that are in a gaseous state at a temperature of 15°C (60°F) and at a pressure of 1 atmosphere.

⚠ CAUTION

- **DO NOT introduce corrosive substances into the equipment.**
  Humidifying water or specimens which generate substances that corrode stainless steel, copper or silicon rubber can drastically shorten service-life of internal parts, including the refrigerator, and packing.
  Corrosive substances include but are not limited to chlorine, chlorides and acids. Though apparently harmless at ambient temperature, these substances can readily corrode circuit boards and other parts when the equipment is run at high temperature and humidity.

1.2 Specimen Protection (Safety Devices)

> **⚠ CAUTION**
>
> - **Set safety devices according to test conditions and the type of specimens.**
> Unless properly set, specimens could be damaged in the event something goes wrong in testing.

The cabinet is controlled to a user-set target temperature and humidity by a temperature (and humidity) controller, but temperature and humidity * can get out of control for various reasons. Therefore, to protect specimens against thermal and humidity damage, the cabinet comes with hardware and software protection against overheating.
* The LU is without humidity control.

Table 1.1 Hardware/Software safety devices

Safety device			Trip point (Set to satisfy below conditions.)	Equipment response when tripped	Remarks
Overheat protector			• Set roughly 20°C higher than target temperature. • Set below specimen's maximum allowed temperature.	• Alarm displayed • Buzzer sounded • Heater shut OFF • Humidifier shut OFF (Not applicable to LU cabinets) • Refrigerator shut OFF (Not applicable to LH cabinets) • Air circulator shut OFF • Specimen power supply control terminal interrupted (option)	
Build into temperature (and humidity) controller	Temperature alarms	Absolute high limit	• Set roughly +15 to +20°C higher than target temperature. • Set below specimen's maximum allowed temperature. • Max. 95°C		
		Absolute low limit	' Set higher than the cabinet's lowest allowed temperature. LH : Min.0°C LHL : Min.0°C LHU : Min.-25°C LU : Min.-25°C • Set a minimum 5°C lower than target temperature. • Set above specimen's minimum allowed temperature.		
		Upper deviation limit	Set roughly 10°C higher than target temperature.	• Alarm displayed • Buzzer sounded *1 • Heater shut OFF	When temperature returns within range limits, alarms are automatically cleared.
	Humidity alarms (Not included on LU cabinets)	Absolute high limit	Set at least 10%RH higher than target humidity. Set below specimen's maximum allowed humidity.	• Alarm displayed • Buzzer sounded *1 • Humidifier shut OFF	
		Absolute low limit	• Set at least 10%RH lower than target humidity. Set above specimen's minimum allowed humidity.	• Alarm displayed • Buzzer sounded *1	

*1 : Can be turned ON/OFF.

Ŭ Absolute high/low limit temperature (& humidity) alarms and upper deviation limit temperature alarm

The absolute high/low limit alarms are completely independent of the target temperature (& humidity). They do not change when target temperature (or humidity) has been changed.

On the other hand, the upper deviation limit alarm is relative to the target temperature.

If the target temperature is changed, the deviation alarm temperature changes in proportion.

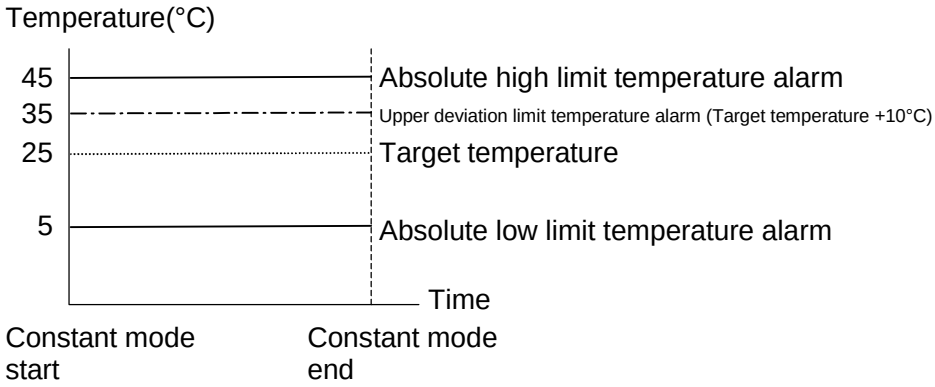


Fig. 1.1 Temperature alarm settings

Safety Device Setting Example

ŬHigh limit temperature

In this example, the target temperature is 60°C and the maximum allowed temperature of the specimens is 80°C. Safety devices are set as follows.

Table 1.2 Setting example for overheat protector and high limit temperature alarms

Overheat protector		+80°C	・Set 20°C higher than target temperature. ・Set to specimen's maximum allowed temperature.
Temperature (and Humidity) controller	**Absolute high limit**	+75°C	・Set 15°C higher than target temperature. ・Set 5°C lower than specimen's maximum allowed temperature.
	Upper deviation limit	+10°C	Will trip at 70°C.

With the settings in Table 1.2, the safety devices will trip in the succession shown in Fig. 1.2 as temperature inside the cabinet rises beyond the target temperature. The first to trip will be the upper deviation limit alarm, followed by the absolute high limit alarm and then the overheat protector. Because the cabinet is equipped with multiple safety devices, abnormal temperatures cannot escape detection even if one of the devices is not working.

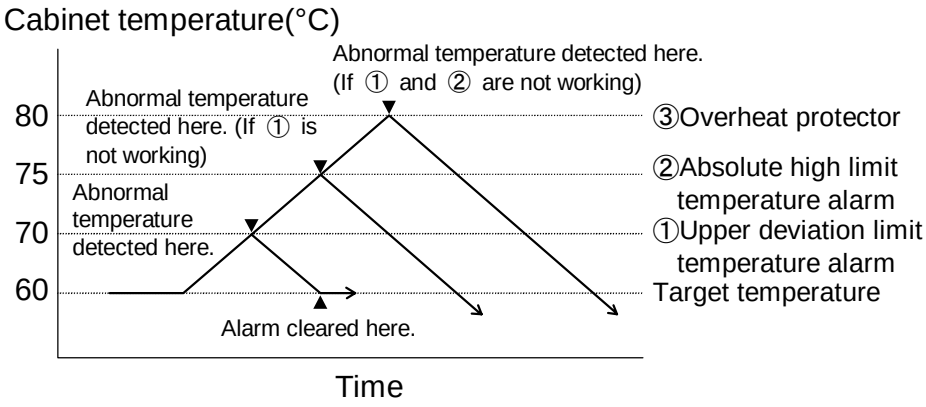


Fig. 1.2 Temperature alarm trigger conditions

1.3 Disposing of the Cabinet

⚠ DANGER

- **TRAPPED INSIDE! Before disposing of the cabinet, take the door off its hinges.**
- **HEAVY DOOR! Have someone hold the door when detaching it from the hinges.**
  The door is heavy and can injure you if it falls on top of you.

Procedure

1. Remove the bolts that lock the hinges (x 2) to the door. Use an 8 mm wrench. Support the door to prevent it from falling.

2. Lift the door upward slightly and then pull it toward you to detach.

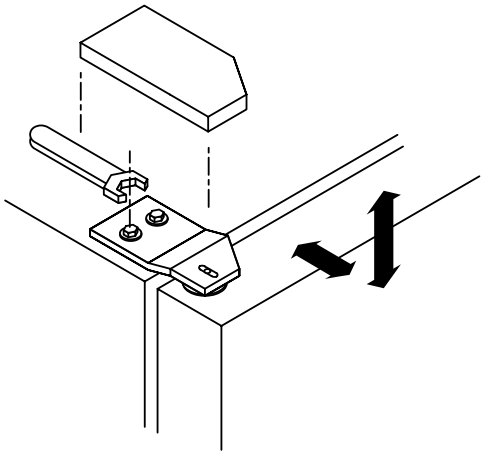


Fig. 1.3 Door hinge

1.4 Other Precautions

⚠ DANGER

- **Ground the equipment WITHOUT FAIL.**
  ELECTRIC SHOCK! Unless the equipment is grounded, the leakage breaker will not trip in the event current leaks, possibly resulting in electric shock. For details on grounding, see "3.3 Power Supply Work".
- **BEFORE using the equipment, test the leakage breaker and make sure it is working properly.**
  ELECTRIC SHOCK! If the breaker is not working properly, shut OFF the primary power supply and contact the place of purchase or ESPEC CORP. Using the equipment in anything but good working condition could result in electric shock. For an explanation on how to test the breaker, see "6.2 Checks".
- **Use only the specimen power supply control terminal (option) to apply voltage to specimens.**
  Specimens generate heat as they are charged. The specimen power supply control terminals are interlocked with the cabinet control circuit, so power to specimens is turned OFF when the cabinet is not running. Using other means to charge specimens leaves the specimens charged in the event of cabinet trouble. This can drive up temperature inside the cabinet which can damage specimens and, in worse cases, result in fire. For more information, see "How to Charge Specimens" in "4.1 Test Preparations".

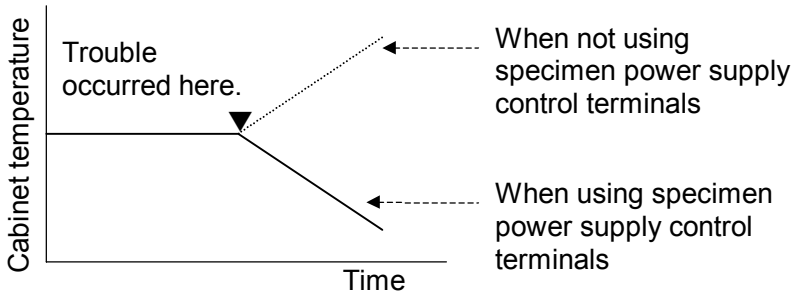


Fig. 1.4 Temperature and specimen power supply control terminals(Option)

- **Do not use or leave the equipment outdoors.**
  Not only can outdoor environments adversely affect performance and functioning, but also electrical parts contact with water can lead to short-circuit, fire, electric shock and breakdown.
- **Do not disassemble, remodel or service the equipment.**
  Unauthorized handling can lead to malfunction, fire, electric shock, personal injury and breakdown. For servicing, contact the place of purchase or ESPEC ENGINEERING CORP.

⚠ CAUTION

- **HOT AIR BLAST WHEN OPEN! Use caution when opening the door during and shortly after operation at high temperature.**
  HOT air is blown from inside the cabinet when opened.
- **HOT ON THE INSIDE! During and shortly after operation above 55°C, the cabinet is HOT on the inside (specimens, shelves, door gasket, test area walls).**
  Direct contact may result in burns. Wear heat resistant gloves.
- **COLD ON THE INSIDE! During and shortly after operation below 0°C, the cabinet is COLD on the inside (specimens, shelves, door gasket, test area walls).**
  Direct contact may result in cold burns. Wear cold resistant gloves. (Not necessary with LH cabinet)
- **When opening the door during or immediately after operation, be careful of dewing.**
  Dew formed inside the test area can drip onto the floor. Be mindful of dewing also when loading specimens which contain moisture into the cabinet.
- **DO NOT turn the refrigerator ON within 5 minutes of turning it OFF, or vice-versa.**
  Failure to observe the above precautions can seriously shorten refrigerator service-life. (Not necessary with LH cabinet)
- **DO NOT introduce electrically conductive specimens which might easily be thrown about by air currents inside the cabinet.**
  Specimens of the sort can cause current leaks in the heater if they infiltrate the air conditioner.
- **Do not stack cabinets on top of one another.**
- **Keep objects off the cabinet top.**

Note

- Blot up moisture from wet specimens before introducing them into the cabinet.
- The withstand load of the included shelf is 5 kg evenly distributed. Spread specimens across the entire shelf without bunching them in any one place.

1.5 Warning Labels

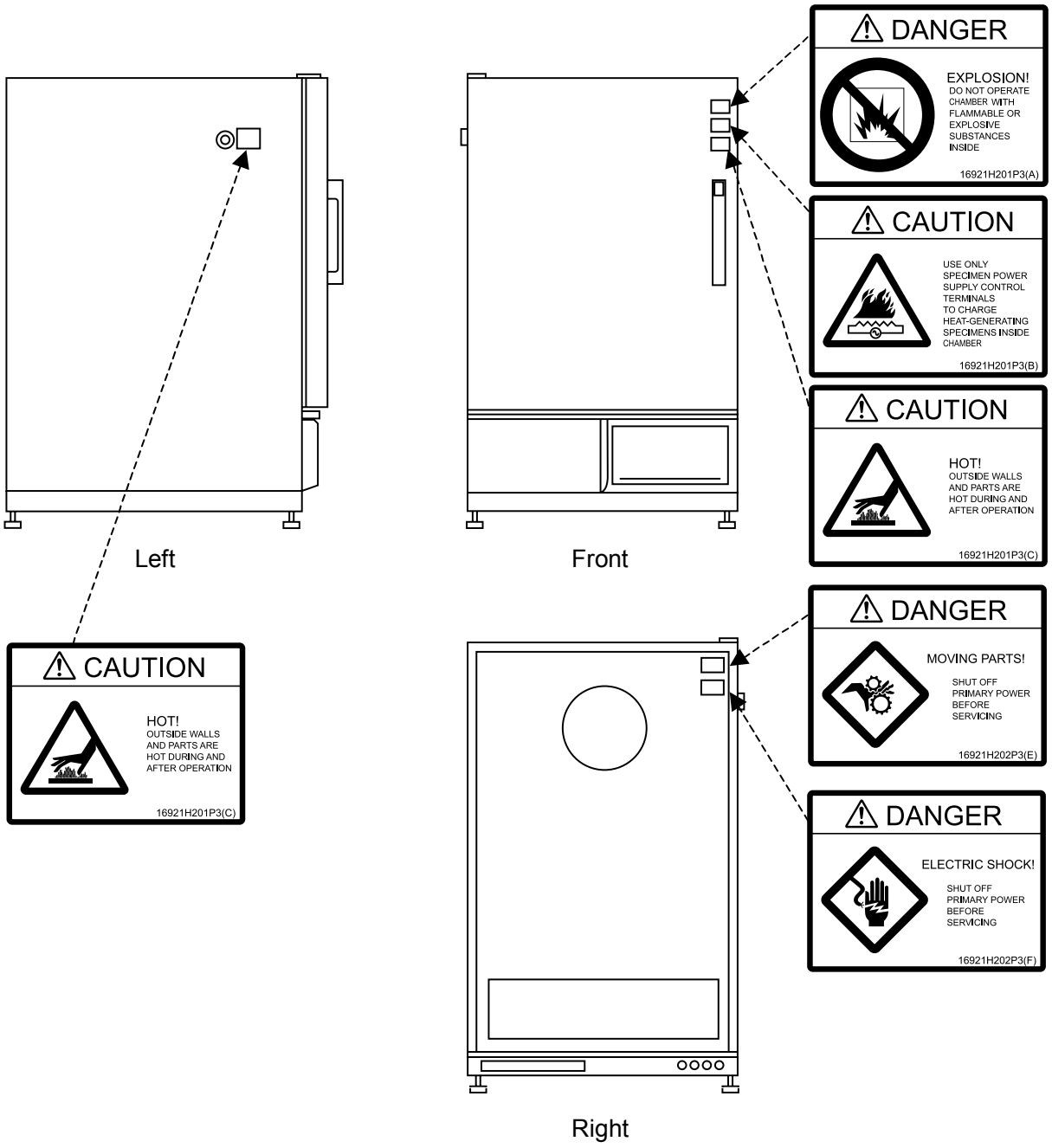


Fig. 1.5 Warning label location

For Additional Labels

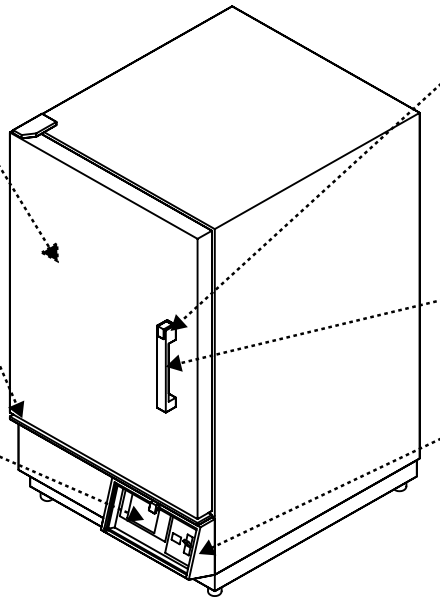
If labels are damaged, lost or become otherwise illegible, contact the place of purchase or ESPEC CORP. for replacements. (Replacements subject to billing.)

Chapter 2 Names and Functions of Parts

This chapter explains cabinet, test area, instrumentation panel and water circuit (heat exhaust) compartment parts by name and function. Return to this chapter any time you are not sure where the part being referred to is.

2.1 Cabinet

Front and Right



Cabinet door
Open for specimen loading/unloading.

Dew tray
Collects and drains condensation running off of the cabinet door.

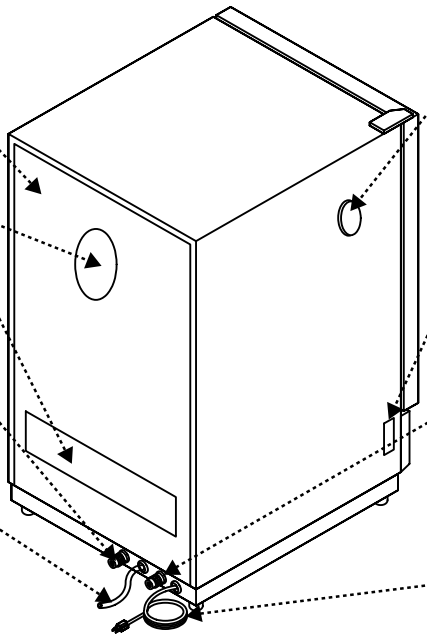
Instrumentation panel
Contains the temperature (and humidity) controller, overheat protector and main power switch.

Push button
Press this button and pull on the handle to open the door. (Not applicable when equipped with an optional inner door)

Door handle
Pull to open the cabinet door.

Instrumentation frame and cover
Protect the instrumentation panel against condensation dripping from the cabinet door. Except when operating the cabinet, keep the cover closed.

Rear and Left



Water circuit (heat exhaust) compartment panel

Rear exhaust port
Exhausts heat from the condenser and air circulator.

Water tank nipple
Connect a hose here to fill or drain the water tank.

Drain hose
Drains water from the test area, including overflow from the humidifying tray and condensation from dew tray.

Cable port
Feed cables, such as to charge specimens, into the test area from here.

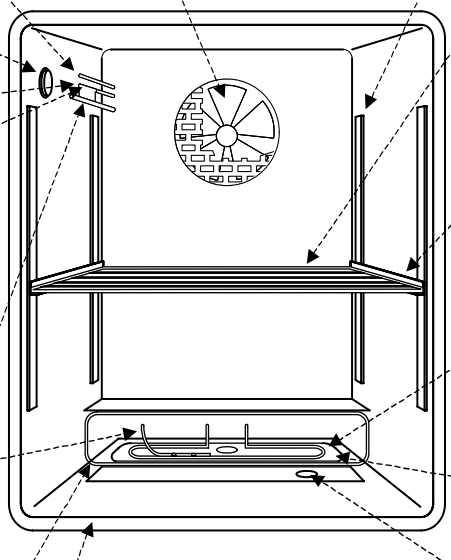
Specimen power supply control terminals (Option)
Terminal for applying voltage to specimens.

Humidifying tray nipple
Connect a hose here to drain the humidifying tray during temperature tests or humidifier cleaning.

Power cable
3-pole plug with grounding pole

Fig. 2.1 Front, right, rear and left side parts (Stands are available as an option.)

Test Area



Dry-bulb temperature sensor
Detects dry-bulb(test area) temperature.

Cable port

Wet-bulb temperature sensor ∗
Detects wet-bulb temperature (test area humidity).

Wet bulb wick ∗
Used in detecting wet-bulb temperature (test area humidity). There are two holes for the wet-bulb temperature sensor. Insert it into the top hole.

Wick pan ∗
Supplies water to the wet-bulb wick.

Boil-dry protector ∗
Prevents the humidifying heater from overheating when humidifying water is low.

Protective grille
Prevents direct contact with the humidifying heater.

Air circulator
Circulates air in the test area.

Door packing
Seals the test area to prevent outside air penetration and inside air leaks.

Support
Supports shelf brackets, shelf and specimens.

Shelf
Shelf for holding specimens.
Withstand load: 5 kg evenly distributed
Installation pitch: 50mm

Shelf bracket
Holds shelves. Move the shelf bracket to adjust the clearance from the ceiling or other shelves.

Humidifying heater ∗
Evaporates water in the humidifying tray.

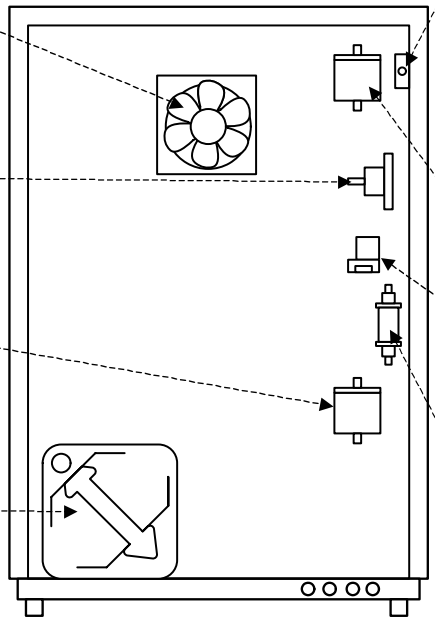
Humidifying tray ∗
Holds humidifying water.

Drain port
Releases internal pressure buildup and drains overflow from the humidifying tray to the outside.

: Not provided on LU cabinets

Fig. 2.2 Test area parts

Water Circuit (Heat Exhaust *) Compartment



Ventilation fan
Exhausts condenser and air circulator heat from the rear of the cabinet.

Boil-dry protecter ∗
Prevents the humidifying heater from overheating when humidifying water is low.

Humidifying tray water level regulator ∗
Keeps water in the humidifying tray to a constant level

Water tank ∗
Supplies water to the water circuit.

Door switch
Trips the main power switch when detecting the water circuit (heat exhaust) compartment panel in the open position. (115/220/230V AC specification only)

Wick pan water supplier ∗
Supplies water to the wick pan.

Solenoid valve ∗
Regulates water flow rate to the humidifying tray.

Electromagnetic pump ∗
Supplies water to the wick pan water supplier and humidifying tray.

: Not provided on LU cabinets

Fig. 2.3. Water Circuit (Heat Exhaust*) Compartment parts

2.2 Instrumentation Panel

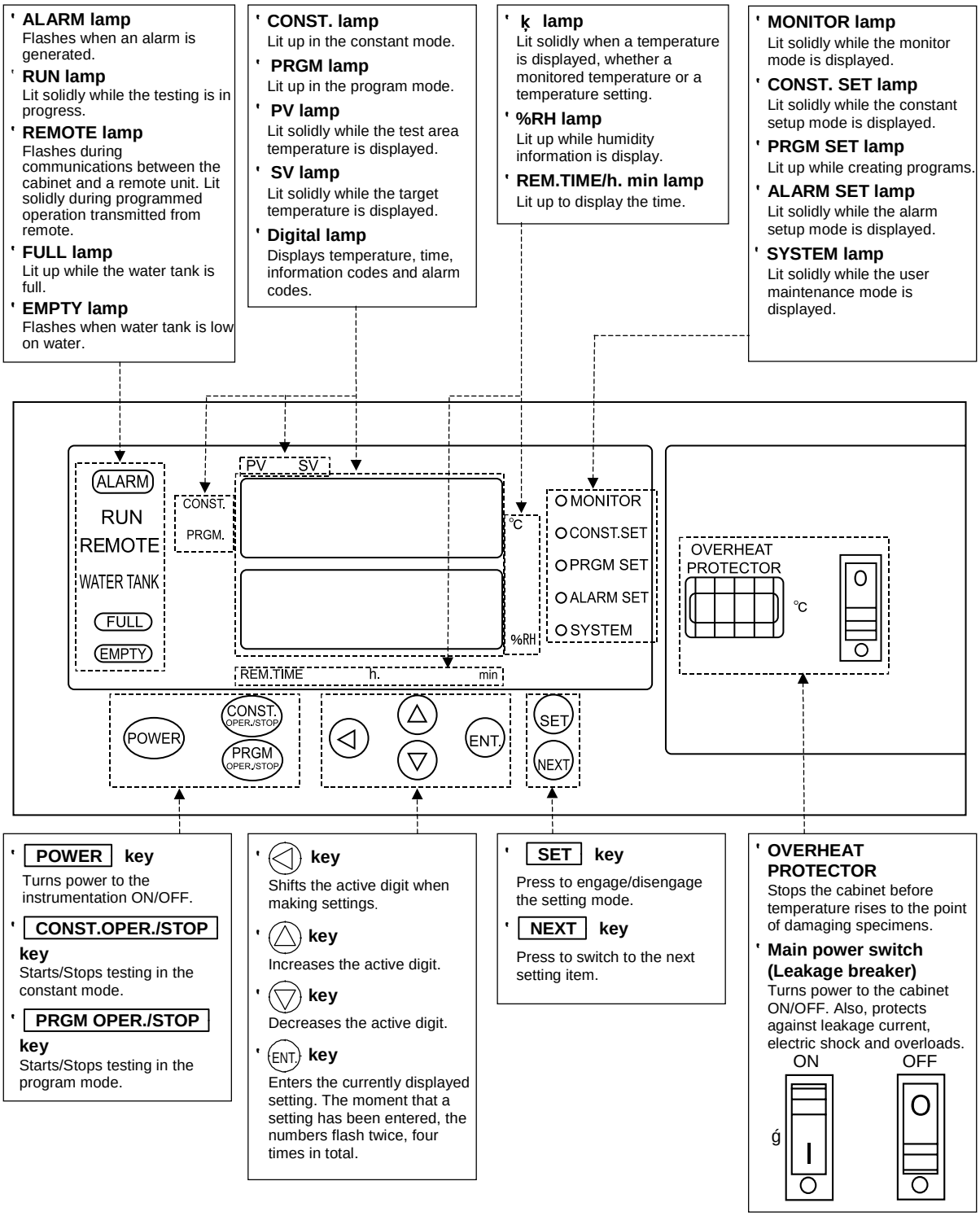


Fig. 2.4 Instrumentation panel

Chapter 3 Installation

This chapter explains how to install the cabinet and prepare for tests. Be sure to read the parts on installation even if having the cabinet installed by the place of purchase or ESPEC CORP. Also, refer to this chapter whenever relocating the cabinet.

3.1 Installation

Installation Site Check

This section describes installation site and space requirements.

Ü Installation site

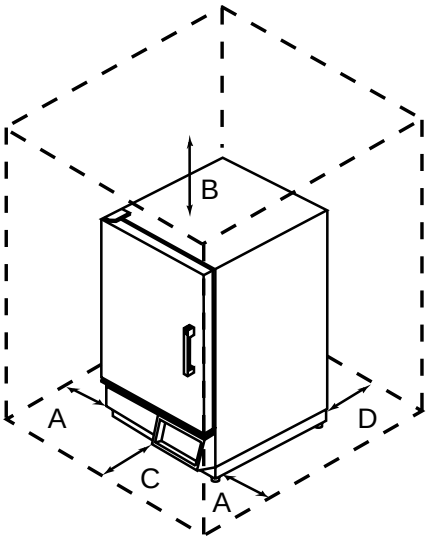
Install the cabinet in a place which satisfies the following conditions.

- On a flat, level floor which is strong even to bear the weight of the equipment.
- Where subjected to only minimal mechanical vibrations
- Where not exposed to direct sunlight but which is well-ventilated
- Where ambient temperature is +5 ~ +35°C and free of sharp temperature fluctuations
- In a dust-free room
- Which is not exceptionally wet or humid
- Away from flammables and explosives
- Where not exposed to combustible or corrosive gases
- Near to power, water and drainage utilities
- Not directly underneath or near to fire alarms

Note Cabinet working temperature range is 0 ~ 40°C. Using the cabinet outside of this range will lead to equipment trouble.

Ŭ Installation space

The cabinet requires maintenance space on the left and right sides, plus space on the rear to connect the drain hoses and vent hot air exhaust. It must be also be a safe distance from objects on the front side so that the door can be opened. It must also be a safe distance from objects on the front side so that the door can be opened.



A: Min 300 mm
B: Min 300 mm
C: Min 650 mm
D: Min 300 mm

∗ A specimen power supply control terminal (option) can be installed on the left side of the cabinet. Ensure sufficient access space to the terminals if wanting to use them.

Cabinet size
W650 × H1090 × D805（mm）

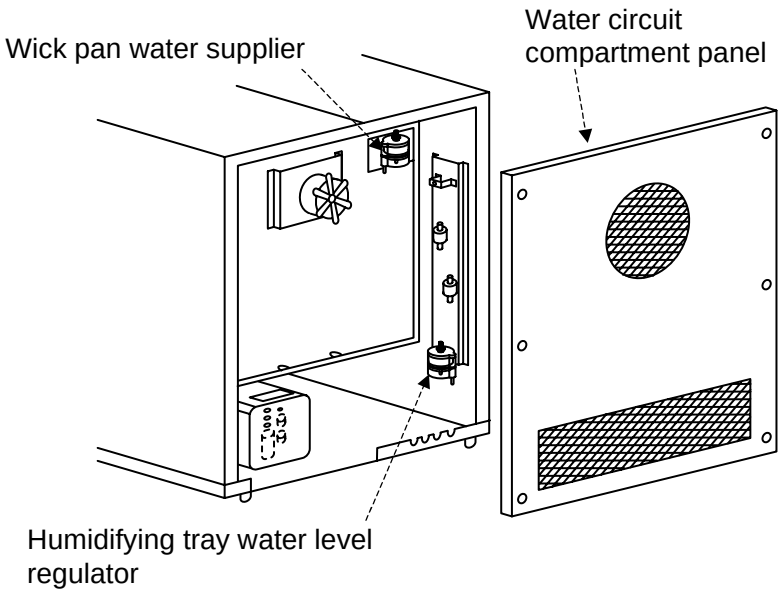
Fig. 3.1 Installation space

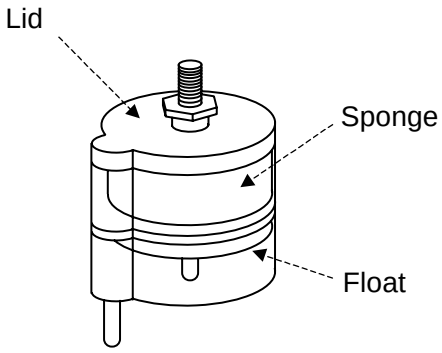
3.2 Removing Shipping Protection (LU cabinets excluded)

The cabinet is shipped with protective sponges inside the wick pan water supplier and humidifying tray water level regulator. These sponges prevent the floats from being damaged during transport. Before performing power supply work, remove the sponges. If left inside the cabinet, they can absorb water and moisture and provoke leaks.

Procedure

1. Detach the water circuit compartment panel.
2. Carefully open the lids to the wick pan water supplier and humidifying tray water level regulator. Then, remove the sponges inside.





3.3 Drainage Work
(Not necessary with LU cabinet)

Drainage work is needed to drain water from the humidifying tray and condensation formed in the test area out of the cabinet.

⚠ CAUTION

- **If collecting drainage in a container, check water level to make sure it does not overflow.**
- **To prevent backflow into the cabinet, do not share the drainage line with other equipment. Also, leave the water tank supply/drain hose and drain hose ends open to the atmosphere.**
- **If the water tank supply/drain hose and drain pipe are raised more than 100mm off the ground, drainage will flow back into the test area.**

Note Gravity drainage is used with temperature (and humidity) cabinets, so keep the drain hoses sloped downward to prevent pockets from forming in the line and run them into a pit.

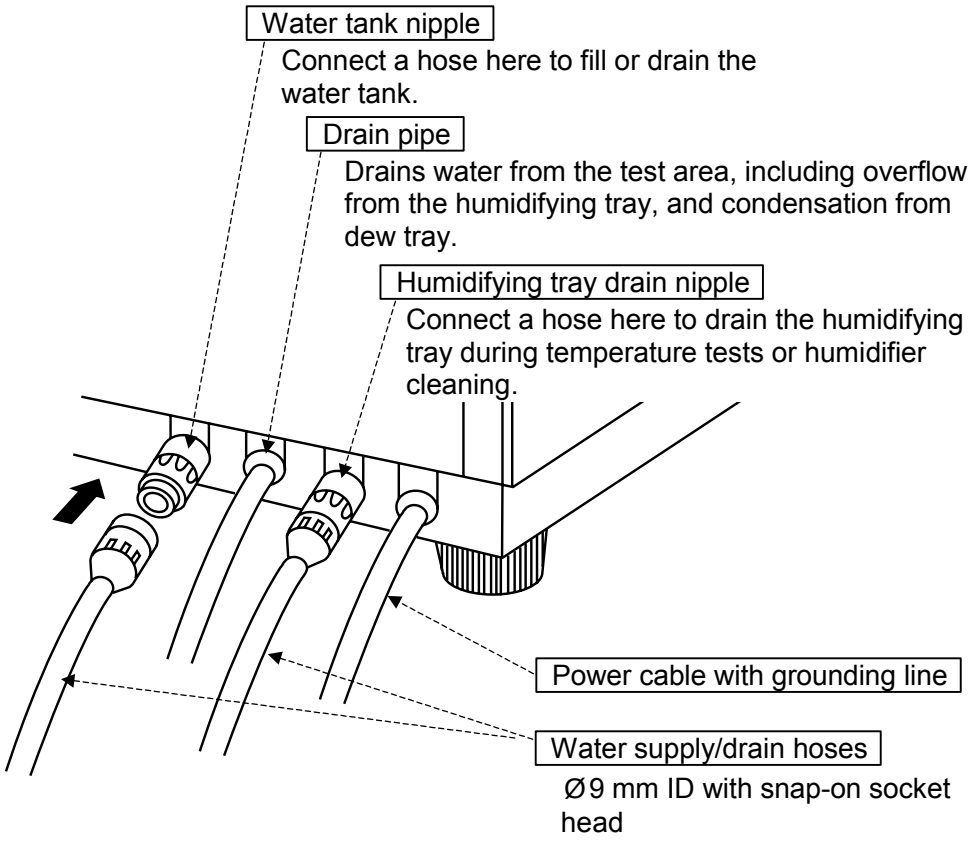


Fig. 3.2 Cabinet rear connections

3.4 Power Supply Work

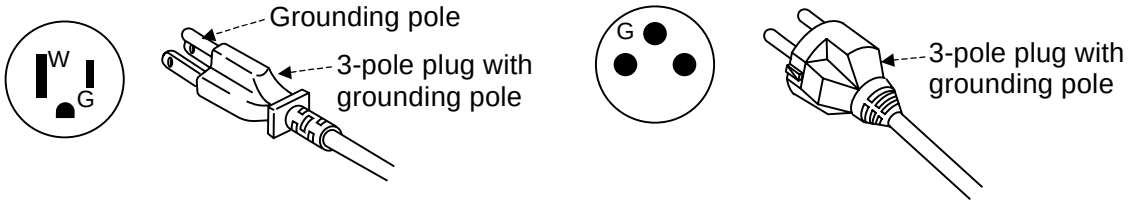
⚠ DANGER

- **Ground the equipment WITHOUT FAIL.**
  ELECTRIC SHOCK! Unless the equipment is grounded, the leakage breaker will not trip in the event current leaks, possibly resulting in electric shock.

The power cable has a 3-pole plug with grounding pole. Plug it directly into an electrical outlet with ground.

■ **For electrical outlet with ground**

' The cabinet is grounded through the power cable when plugged into the electrical outlet, so separate grounding work is not needed.



For 100V AC/15 A, 115V AC/13 A and higher power supplies

For 220V AC/7 A, 230V AC/6.5 A and higher power supplies

Fig. 3.3 Electrical outlet with ground and power cable plug

Ŭ **For electrical outlets without ground (100V AC/15 A, 115V AC/13 A and higher power supplies)**

Though it preferred that an electrical outlet with ground be used, the included socket adapter can be used temporarily until a better outlet can be secured. With the adapter, ground the cabinet on a nearby grounding terminal from the green grounding wire on the adapter. If a grounding terminal is not available, ensure a max. 100 Â resistance against ground or otherwise as local building codes specify.

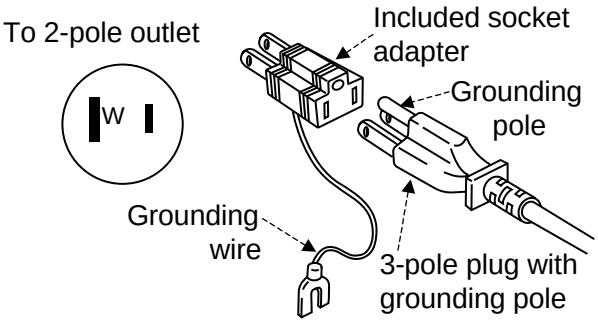


Fig. 3.4 Groundless outlet and adapter

⚠ CAUTION

- **Do not use extension cords, power strips, or other similar products.**
  One blade of the plug is 6.3 mm wide while the other is 8 mm wide. Depending on the type, commercially sold extension cords will not fit the plug. Also, extension cords are generally less reliable and less safe than fixed electrical outlets, therefore you should avoid using them.

3.5 Water Level Check (Not necessary with LU cabinet)

Water is supplied from the water tank to the humidifying tray. For proper cabinet operation, water level in the tray must be checked.

Note

- Use distilled water of a 0.1 to 10 µS/cm conductivity. Using water with a high impurity content, such as tap water, will shorten service-life of the humidifying heater and wet-bulb wick.
- Do not tilt the tank when full. Water will spill out.

To Fill the Water Tank

The water tank is filled by hand. This water is subsequently supplied to the humidifying tray.
Press the POWER key and run the cabinet at 30ºC and 40%RH. For details, see “Chapter 4 Operation”.

Procedure

1. Prepare a water source a minimum of 500 mm higher than the water tank nipple on the cabinet rear.

2. Connect the included snap-on water supply/drain hose (Ø9mm ID) to the water tank nipple. See “3.3 Drainage Work”.

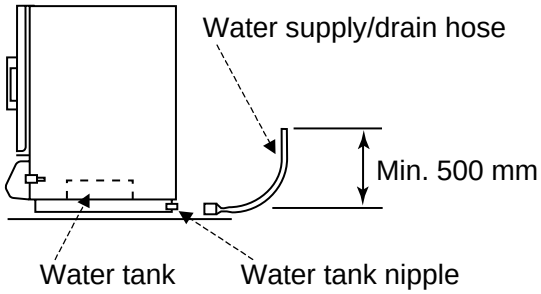


Fig. 3.5 Setup for adding water

3. Start water supply.
   When the water tank becomes full (approx. 20L), the FULL lamp (green) will light up. Stop water supply at that point.
   Also, if wanting to leave the cabinet running unmanned for 2 to 3 days, fill the water tank with distilled water in advance.

Water Consumption Rate

Ŭ When the FULL lamp is lit

When the FULL lamp is lit, you can use about 14L of water. Though consumption rate will vary according to conditions of use, the below table gives a yardstick of water consumption.

Table 3.1 Water consumption rate

Temperature/Humidity	Water consumption rate	Continuous hours (days) of operation
60 ķ 95 RH	70 40mL/h	Approx. 200 350 hr (approx. 8 14 days)
85 ķ 95 RH	100 130mL/h	Approx. 100 160 hr (approx. 5 6 days)

Ŭ When the EMPTY lamp flashes

When the water tank gets low on water, “AL-26” will flash on the display. If water level drops to about 3L, the EMPTY lamp will start flashing. In such case, add water. The cabinet can run for another 20 hours from when the EMPTY first starts flashing until it shuts down completely.

Checking Water Level in the Humidifying Tray

Check water in the humidifying tray is high enough.

Procedure

- Check that the humidifying heater is completely under water and that water is not overflowing from the humidifying tray. An inappropriate water level will destabilize temperature and humidity control.

Reference

When either the humidifying heater is not completely under water or water is overflowing from the humidifying tray, it is possible that the cabinet is not level or that the water level in the humidifying tray water level regulator is too low/high.
If the cabinet is not level, level it. If water level in the humidifying tray water level regulator is too low/high, regulate it as explained under "Reference" on the following page.

To Check Water Level in the Humidifying Tray Water Level Regulator

Water level in the humidifying tray will depend on the water level in the humidifying tray water level regulator.

Note

The air circulator in the water circuit (heat exhaust) compartment panel is dangerous. Before opening the compartment panel, set the main power switch in the OFF position.

Procedure

1. Detach the water circuit (heat exhaust) compartment panel.
2. Check water level in the humidifying tray water level regulator is above the WATER LEVEL FOR HUMIDIFIER mark.

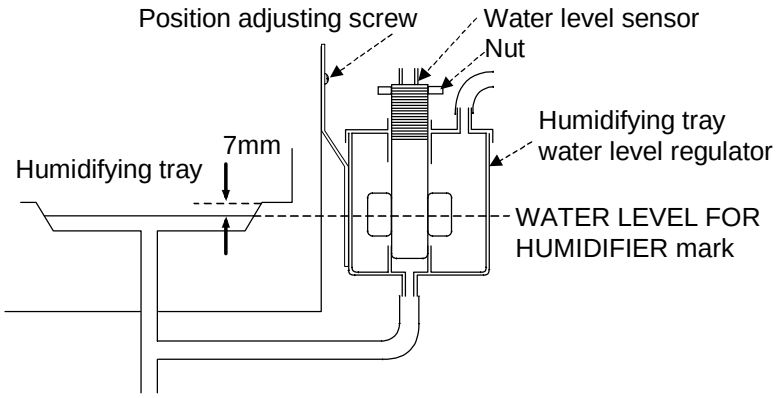


Fig. 3.6 Water level check

3. Reattach the water circuit (heat exhaust) compartment panel.

Reference

If water level in the humidifying tray water level regulator is low or high, regulate it as follows.

1. Loosen the position adjusting screw and raise/lower the humidifying tray water level regulator.
2. If water level cannot be regulated in step 1, loosen the nut and turn the water level sensor clockwise (seen from above) to lower water level, or counter-clockwise to raise it. Then, retighten the nut.
3. Reattach the water circuit (heat exhaust) compartment panel and set the main power switch in the ON position.
4. Press the POWER key.
5. Run the cabinet at 30 ķ and 40%RH.
6. Check water is the proper level.
   If water level is okay, the cabinet is ready for use. If not, set the main power switch in the OFF position and repeat steps 1 ~ 6.

Chapter 4 Operation

This chapter explains test preparations and preliminary checks, test startup and ending of the temperature (and humidity) cabinets. Perform the work described in this chapter before every test.

4.1 Test Preparations

How to Arrange Specimens

Note

- The withstand load of each included shelf is 5 kg evenly distributed. Remember to spread specimens out across the entire shelf without crowding them in any one place.
- Space specimens apart and away from walls so as not to block air circulation inside the test area.
- Temperature(& humidity) uniformity drops if air cannot flow freely, which will throw off test results.
- You may freely change the position of the shelves to suit specimen size and quantity. Arrange specimens so as not to obstruct air currents inside the test area.

Setting Shelves and Shelf Bracket

Procedure

1. Attach the shelf brackets in the order of the numbers shown below. Ensure sufficient clearance from the ceiling or other shelves. Supports have hooks spaced every 50 mm apart.

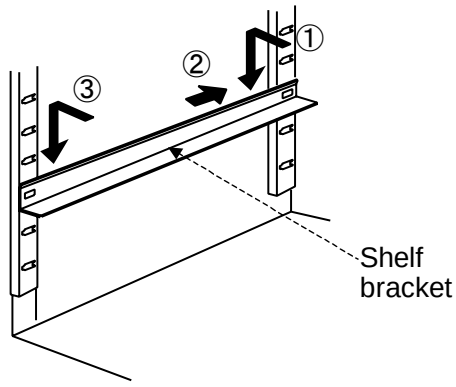


Fig. 4.1 How to install shelf bracket

2. Slide the shelf onto the shelf brackets.
   The hook should be to the rear. When sliding the shelf in, make sure the shelf and hooks clamp the brackets.

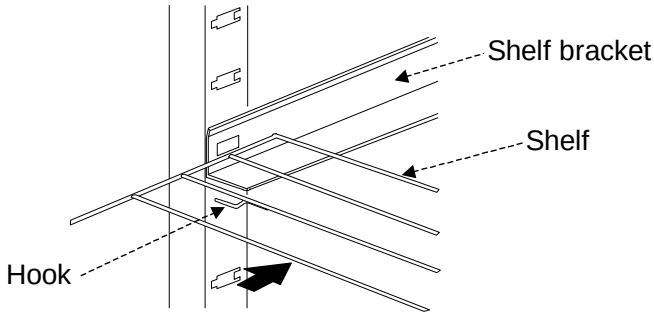


Fig. 4.2 How to install shelves

How to Charge Specimens (Use only when needed.)

Use the specimen power supply control terminal (option) to charge specimens. The rated electric capacity of these terminals is 250V AC, 1 A. A suitable diameter cable would be 0.3 to 2 mm^2.

⚠ DANGER

- **Use only the specimen power supply control terminals to apply voltage to specimens.**
  Using other means to charge specimens can drive up temperature inside the cabinet as specimens generate heat. This can damage specimens and, in worse cases, result in fire.
- **Always shut OFF power to specimens at the source before unplugging the specimen power supply control terminal plug from the connector.**
  Disconnecting the plug with power ON can result in electric shock.

⚠ CAUTION

- **Droop cables below and up to specimens as shown in Fig. 4.3.**
  If cables are taut, dew can run down the cables and damage specimens.

Ů To charge specimens with less than 1 A of power

Be sure to fit the line with a suitable capacity fuse.

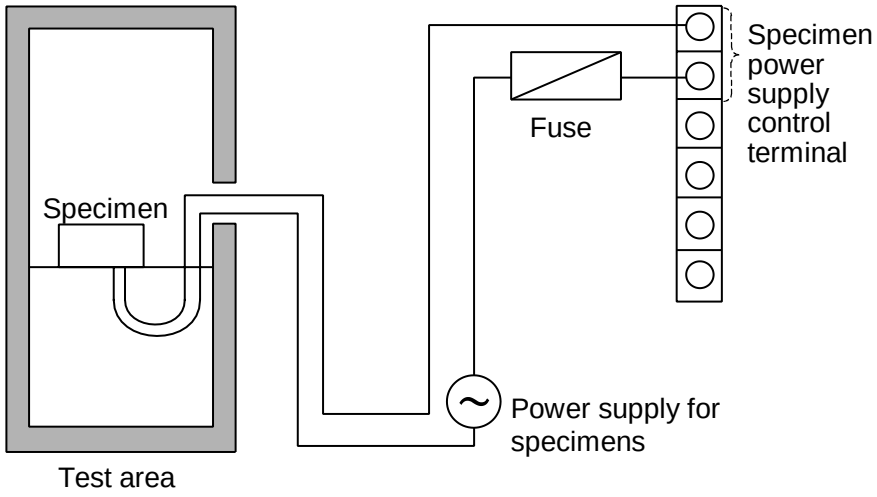


Fig. 4.3 Wiring to specimens
<To charge specimens with less than 1 A of power>

Ů To charge specimens with 1 A or more power

Be sure to fit the line with a suitable capacity contactor and fuse.

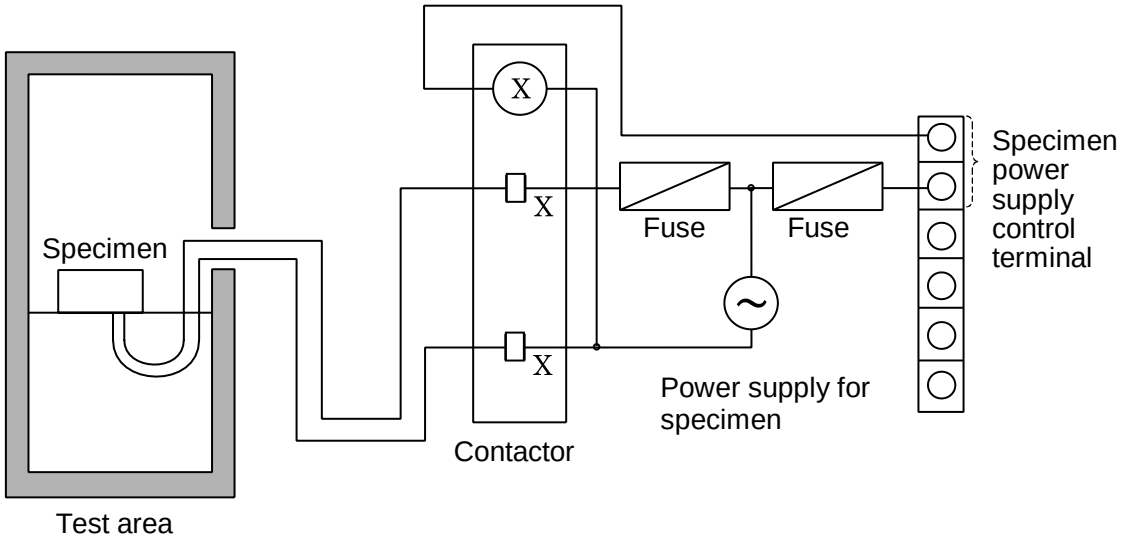


Fig. 4.4 Wiring to specimens
< To charge specimens with 1 A or more power>

Procedure

1. Remove the cap from the cable port.

2. Feed the cable from the specimens through the cable port and then cover the port with the included rubber plug.

3. Disconnect the terminal plug from the connector on the right side of the cabinet.

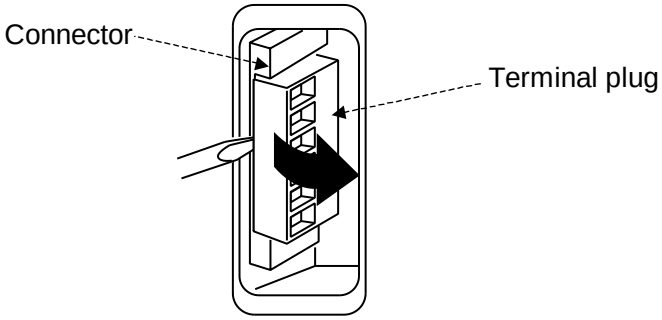


Fig. 4.5 Disconnecting the terminal plug

4. Wire a power supply to the specimen power supply control terminals. Insert the wire leads into the top 2 slots on the terminal plug and tighten the screw with a slotted head screwdriver.

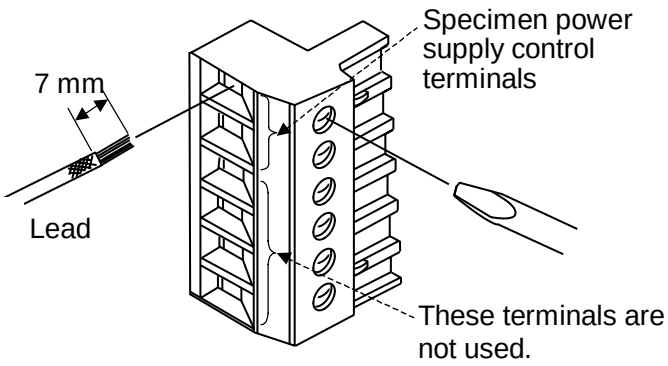


Fig. 4.6 Wiring power supply to the specimen power supply control terminals

5. Plug the terminal plug into the connector on the cabinet.

Reference

- After feeding the specimen cable through the cable port, cover the port with the included rubber plug. Without the plug, outside air will infiltrate the test area, which can keep temperature (humidity) from reaching the target setting. Cut a notch the size of the cable in the plug and fit the cable in the notch.

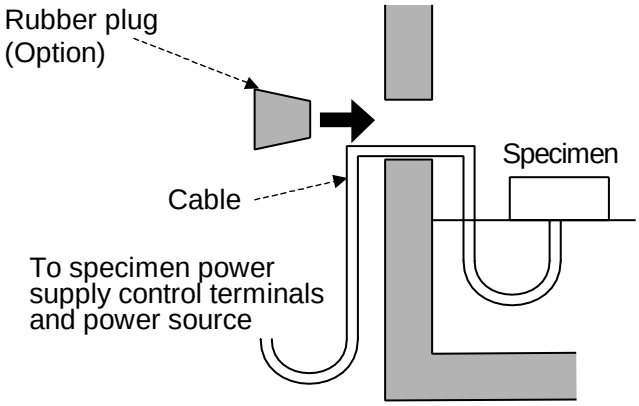


Fig. 4.7 Feeding specimen cables through the cable port

Use a specimen cable that can withstand test conditions. Refer to the following table for possible cable types.

Table 4.1 Cable type and withstand temperature

Cable type	Withstand temperature
Vinyl cable	55°C
Heat-proof vinyl cable	100°C
Styrene-butadiene cabtyre cable	70°C
Electron crosslinked heat-proof plastic cable	100°C
Glass-braid silicon shielded cable	200°C

- When not using the cable port, cover it with the rubber plug from the inside and the cap from the outside.

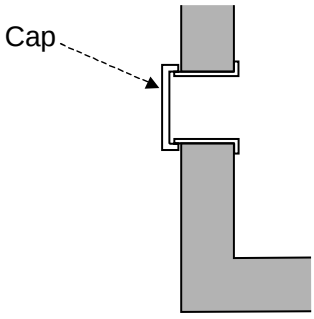


Fig. 4.8 When not using the cable port

Wet-bulb Wick Check (Not necessary with LU cabinet)

Note

- The wet-bulb wick (included) must be installed in order to run humidity tests. If already in place, check whether it is wet or dry before starting. If dry, change it.
- Bacteria adhering to the wet-bulb wick can proliferate during tests and block water supply. Wash hands with soap and water before handling the wick.
- Make sure the edge of the wet-bulb wick is aligned with the tip of the wet-bulb temperature sensor. Humidity control can be destabilized if the sensor is overly exposed or if the sensor is out of position. Feed the wet-bulb temperature sensor through the top hole and the wick pan through the bottom hole.

Reference

- Remove the wet-bulb wick for temperature-only tests, especially if running the cabinet above ambient temperature. Should the wick dry out, it will be harder to supply it with water, which will throw off humidity measurements the next time a humidity test is run.

Procedure

1. Wipe the wet-bulb temperature sensor clean with clean gauze or cloth.

2. Remove the wet-bulb wick from its bag.

3. Drape the wet-bulb wick over the wet-bulb temperature sensor. Make sure the edge of the wet-bulb wick is aligned with the tip of the wet-bulb temperature sensor.

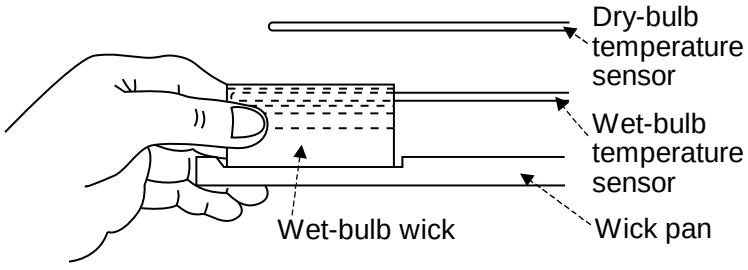
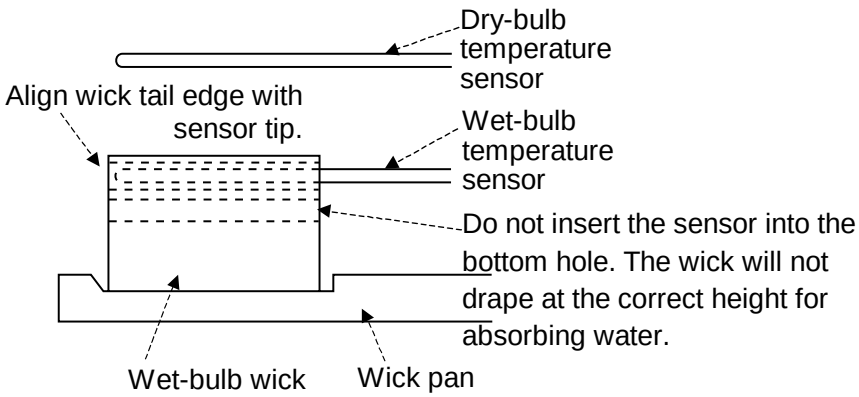


Fig. 4.9 How to set the wet-bulb wick 1

4. Lay the ends of the wet-bulb wick in the wick pan.



4.10 How to set the wet-bulb wick 2

Wick Pan Water Level Check (Not necessary with LU cabinet)

Procedure

1. Check water in the wick pan is at the level shown in the below figure.

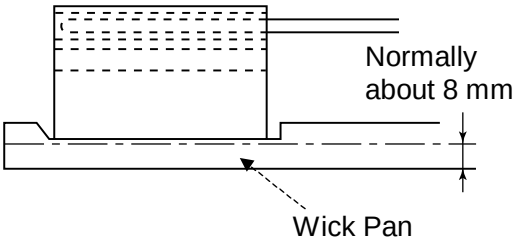


Fig. 4.11 Wick pan water level

2. It takes time to fill the wick pan with water.

3. If water level is low (high), slightly reposition the wick pan water supplier higher (lower) on the back wall of the water circuit compartment.

Water Tank Water Level Check (Not necessary with LU cabinet)

Check water level in the water tank. If low, add water as explained in "3.4 Water Level Check".

4.2 Software Interface

The software installed in cabinets gives you finger-tip control over power ON/OFF, operating mode selection, test starting/stopping, test setup and monitoring. A function tree showing available modes and setup/monitor items is given in Figs. 4.12 and 4.13. The sequence in which modes and items are displayed can be checked in “Instrumentation Displays” in the Appendix. The monitor mode is the default mode when control power is activated from the POWER key. You can move to other modes by pressing the SET key.

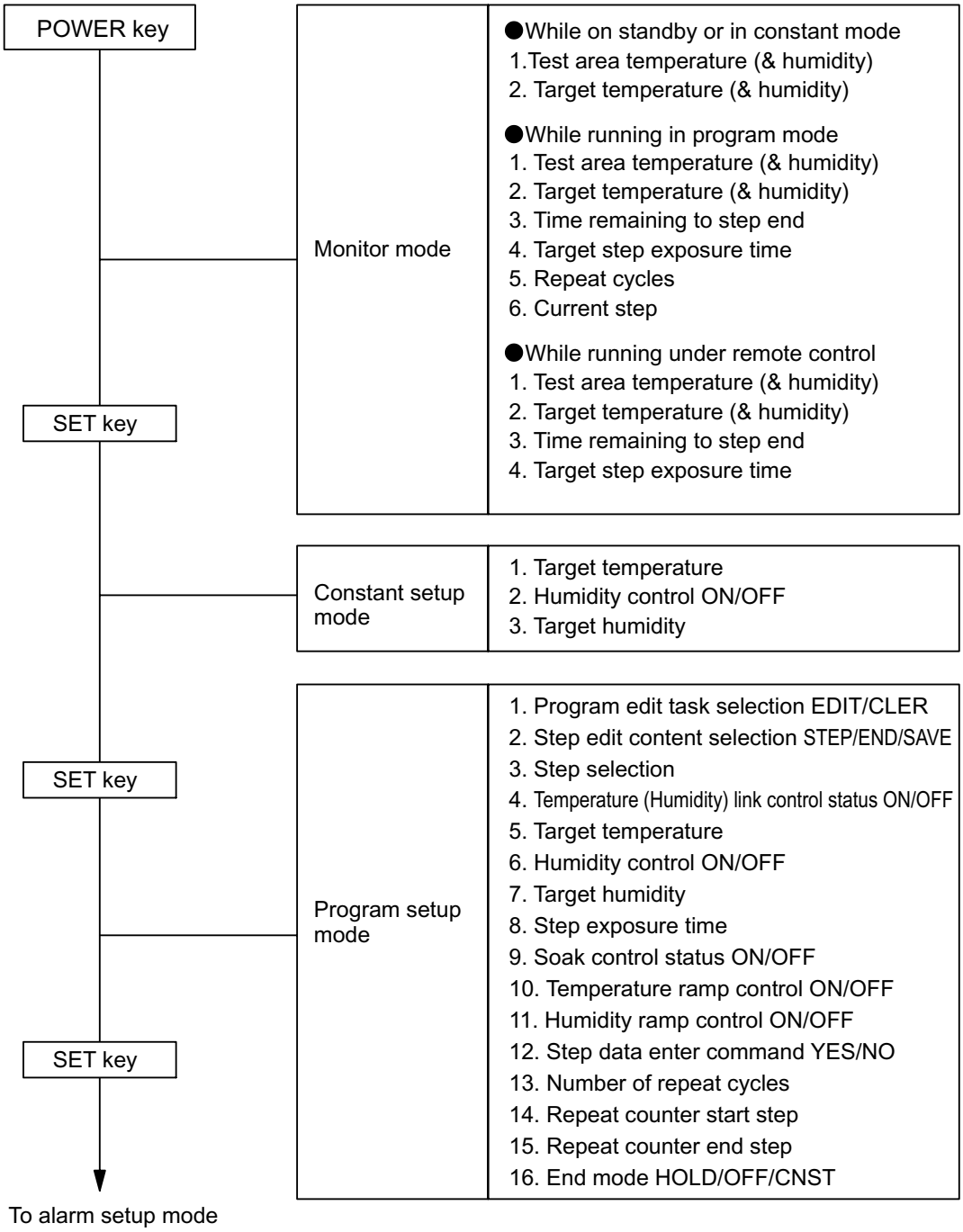
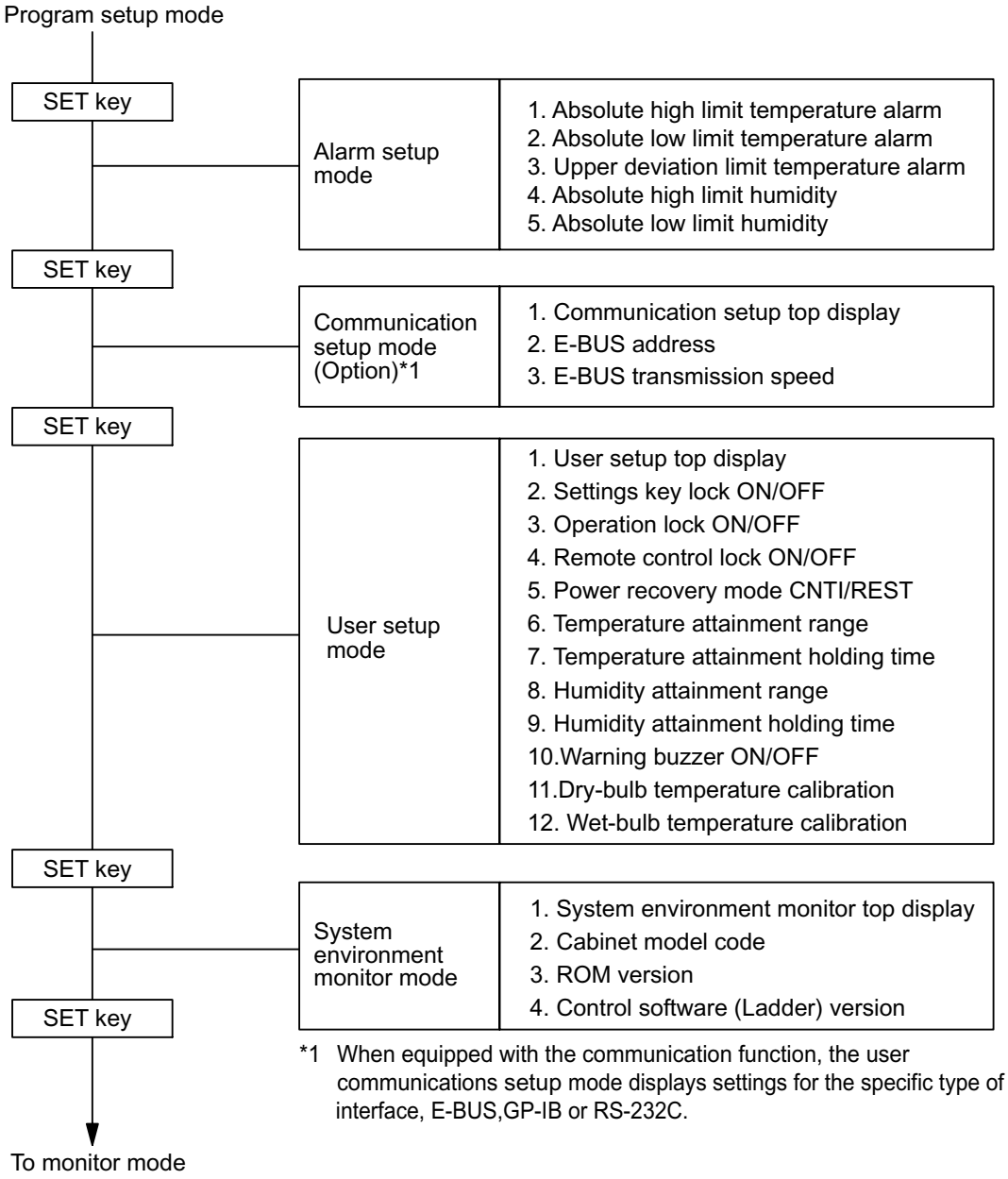


Fig. 4.12 Modes and functions 1



*1 When equipped with the communication function, the user communications setup mode displays settings for the specific type of interface, E-BUS,GP-IB or RS-232C.

Fig. 4.13 Modes and functions 2

4.3 Specimen Safety Device Setup

Overheat Protector

⚠ CAUTION

- **Always set the overheat protector BEFORE beginning tests. Set it according to the type of specimens and test conditions.**
  Unless properly set, the overheat protector will not trip in the event of cabinet trouble, which could lead to specimen damage. For details on the overheat protector setting, see "1.2 Specimen Protection (Safety Devices)".

Procedure Turn the dials until a suitable temperature is displayed.

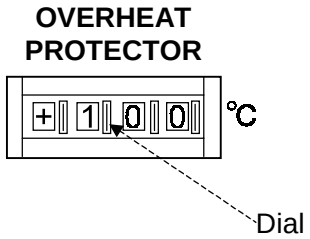


Fig. 4.14 Overheat protector

Absolute High/Low Limit Temperature (Humidity) Alarms

⚠ CAUTION

- **Always set the absolute high/low limit temperature (humidity) alarms BEFORE beginning tests. Set alarms according to the type of specimens and test conditions.**
  Unless properly set, the absolute high/low limit temperature (humidity) alarms will not be triggered in the event of cabinet trouble, which could lead to specimen damage. For details on alarm settings, see "1.2 Specimen Protection (Safety Devices)".

Alarm Setup Mode

This section explains how to set the temperature alarms that are built into the temperature controller. Alarms available for setting are the absolute high limit temperature, absolute low limit temperature (& humidity) and upper deviation limit temperature alarms.
The absolute high and low limit temperature (& humidity) alarms are

triggered by test area temperature (& humidity). Alarms will trip as follows.

- When the test area temperature rises above the absolute high limit temperature, the absolute high limit temperature alarm trips.
- When the test area temperature drops below the absolute low limit temperature, the absolute low limit temperature alarm trips.
- When the test area humidity rises above the absolute high limit humidity, the absolute high limit humidity alarm trips.
- When the test area humidity drops below the absolute low limit humidity, the absolute low limit humidity alarm trips.

The upper deviation limit temperature alarm is triggered by the set deviation from the test area temperature. The alarm will trip as follows.

- When the test area temperature rises above the target temperature + the upper deviation limit temperature, the upper deviation limit temperature alarm trips.

* For details on alarm settings, see "1.2 Specimen Protection (Safety Devices)".

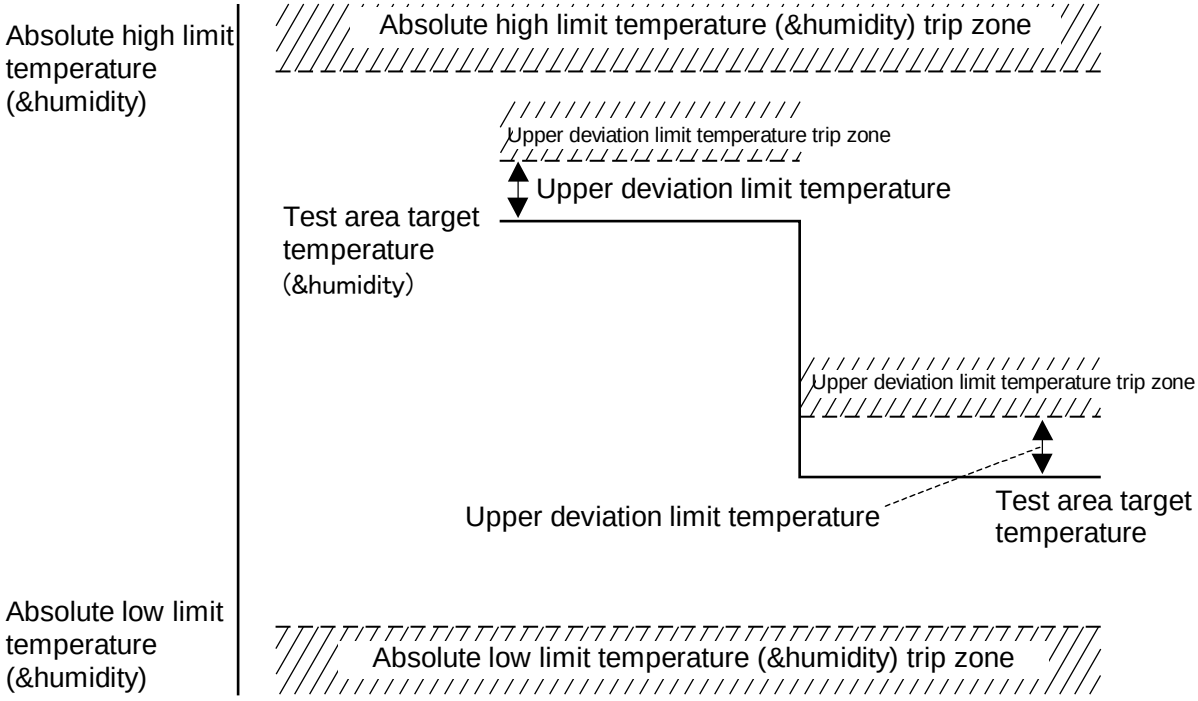


Fig. 4.15 Absolute high / low limit temperature (humidity) and upper deviation limit temperature alarms

Ů Getting the alarm setup mode

Set the main power switch in the ON position and press the POWER key. With the temperature (humidity) monitor on the display, press the SET key 3 times. The absolute high limit temperature alarm setting will appear on the display.

Ŭ Operation

△ ▽ Selects and inputs settings.

◁ Selects the digit.

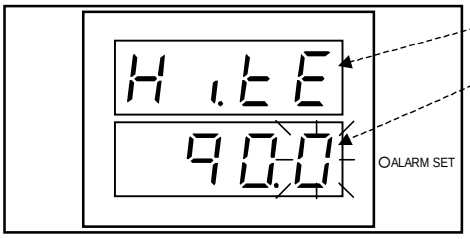
ENT. Enters changes to settings.

* Unless the ENT. key is pressed, changes you make to settings will not be updated.

NEXT Moves to the next setting.

In this manual, indicates a flashing digit.

1. Absolute high limit temperature alarm



Stands for "Absolute High Limit Temperature Alarm"

Currently set absolute high limit temperature

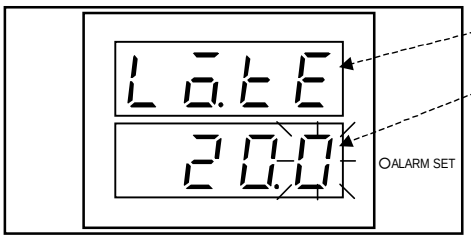
△ ▽ : Changes the value. ◁ : Selects the digit.

ENT. : Enter changes.

* Setting range : Target temperature ≦ Absolute high limit temperature ≦ Highest settable temperature

Press the NEXT key and move to the next setting.

2. Absolute low limit temperature alarm



Stands for "Absolute Low Limit Temperature Alarm"

Currently set absolute low limit temperature

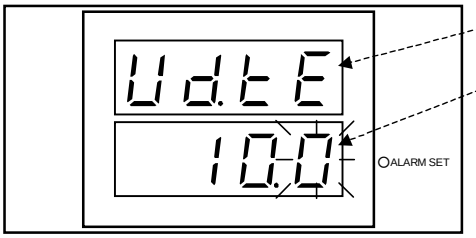
△ ▽ : Changes the value. ◁ : Selects the digit.

ENT. : Enter changes.

* Setting range : Lowest settable temperature ≦ Absolute low limit temperature ≦ Target temperature

Press the NEXT key and move to the next setting.

3. Upper deviation limit temperature alarm



Stands for "Upper Deviation Limit Temperature Alarm"

Currently set upper deviation limit temperature

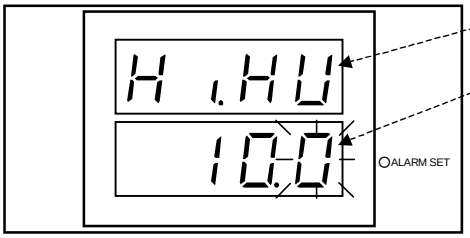
△ ▽ : Changes the value. ◁ : Selects the digit.

ENT. : Enter changes.

* Setting range : 5.0 ≦ Upper deviation limit temperature ≦ 50.0

Press the NEXT key and move to the next setting.

4. Absolute high limit humidity alarm (Not necessary for LU cabinet)



Stands for "Absolute High Limit Humidity Alarm"

Absolute high limit humidity

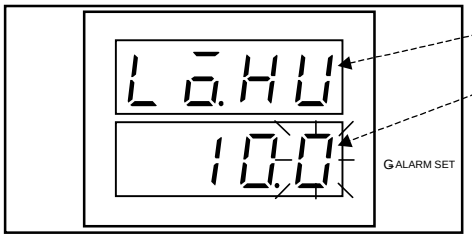
△ ▽ : Changes the value. ◁ : Selects the digit.

ENT. : Enter changes.

* Setting range : Target humidity ≦ Absolute high limit humidity ≦ 100%RH

Press the NEXT key and move to the next setting.

5. Absolute low limit humidity alarm (Not necessary for LU cabinet)



Stands for ħ Absolute Low Limit Humidity Alarm Ĩ

Absolute low limit humidity

△ ▽ Changes the value. ◁ Selects the digit.

ENT. Enter changes.

* Setting range : 0%RH ź Absolute low limit humidity ź Target humidity

Press the NEXT key and return to the absolute high limit temperature alarm setting.

1. Absolute high limit temperature alarm

4.4 Target Temperature/Humidity Setup

Constant Setup Mode

In the constant mode, you set the temperature and humidity.

Ü Getting constant setup mode

Set the main power switch in the ON position and press the POWER key.

With the temperature monitor on the display, press the SET key 1 time.

The target temperature (step 1 in the below procedure) setting will appear on the display.

Ü Operation

△ ▽ Selects and inputs settings.

◁ Selects the digit.

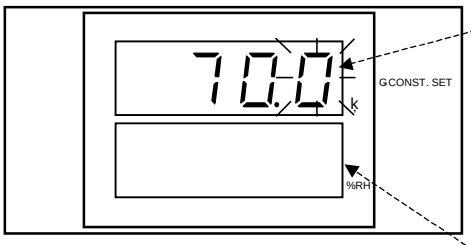
ENT. Enters changes to settings.

* Unless the ENT. key is pressed, changes you make to settings will not be updated.

NEXT Moves to the next setting.

In this manual, indicates a flashing digit.

1. Target temperature



Target temperature

△ ▽ Changes the value. ◁ Selects the digit.

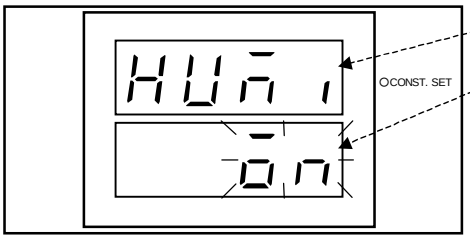
ENT. Enter changes.

* Setting range : Absolute low limit temperature ź Target temperature ź Absolute high limit temperature

The last set humidity target appears here.

Press the NEXT key and move to the next setting.

2. Humidity control ON/OFF (Not necessary for LU cabinet)



Stands for "Humidity".

Humidity control status

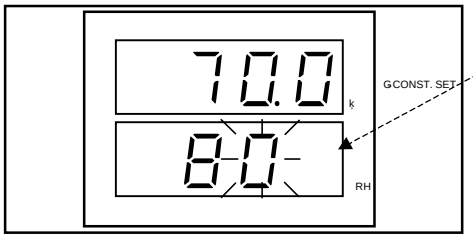
▲ ▽ : ON Turns humidity control ON. Go to the target humidity setting (step 3 in this procedure).

OFF Turns humidity control OFF. Return to the target temperature setting (step 1 in this procedure).

ENT. : Enters the selection.

Press the NEXT key and move to the next setting.

3. Target humidity (Not necessary for LU cabinet)



Target humidity

▲ ▽ Changes the value. ◁ Selects the digit.

ENT. Enter changes.

* Setting range : Absolute low limit humidity ź Target humidity ź Absolute high limit humidity

Press the NEXT key and return to the target temperature setting.

1. Target temperature

Program Setup Mode

The program changes the target temperature (humidity) as dictated by a program that you create in advance. Each program is a test pattern of multiple steps. Each step contains a target temperature (humidity) and exposure time. Only one program of a maximum 9 steps and a maximum 99 repeated steps can be stored in memory at a time.

Program setup flow

The basic program setup flow is shown here below.

Get the program edit task selection.

' Select “EDIT”

Input the test pattern.

' Set up individual steps. (Max. 9 steps)

Make the setting.
⋮
Enter the setting. } Step 1 setup
Œ
Make the setting.
⋮
Enter the setting. } Step 2 setup

Step Settings and Selections
No., temperature (humidity) link control ON/OFF, target temperature, humidity control ON/OFF, target humidity, step exposure time, soak control ON/OFF, temperature ramp control ON/OFF, humidity ramp control ON/OFF, step setup entry

Input settings as needed for step 3 and after.

Make the setting. ő Select “END” and press the ENT. key.

Set the number of repeat cycles and end mode.

' Set the number of repeat cycles. (0 99)
Number of repeat cycles
⋮
Repeat counter end step
Œ
' Set the end mode. (HOLD/OFF/CNST)
End mode

Save the program.

' End program editing.
Select the step edit content selection. ő Select “SAVE” and press the ENT. key.

Ů Getting program setup

Set the main power switch in the ON position and press the POWER key. With the temperature (humidity) monitor on the display, press the SET key 2 times. The program edit task selection will appear on the display.

Ů Operation

△ ▽ Selects and inputs settings.

◁ Selects the digit.

ENT. Enters changes to settings.

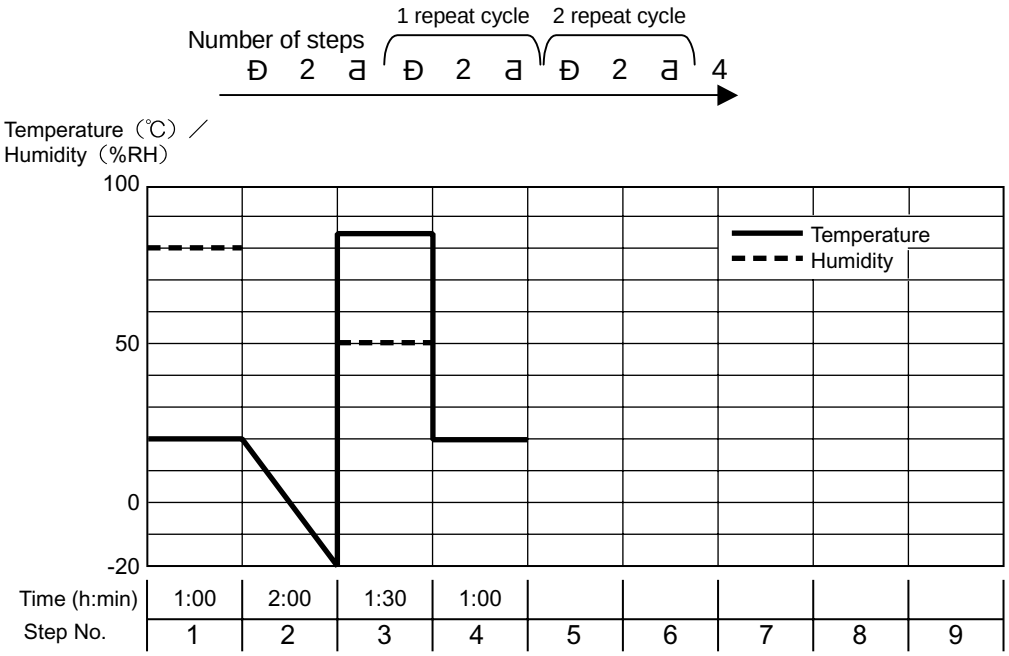
* Unless the ENT. key is pressed, changes you make to settings will not be updated.

NEXT Moves to the next setting.

In this manual, indicates a flashing digit.

The following program is used as an example to help you with program setup. In it, steps 1 ~ 3 are run three times (repeated twice), then step 4 is run and power is shut OFF at program end. When actually creating programs, use the Program Sheet in Appendix G. It is wise to create your programs on paper before trying to input them at the cabinet .

Step 1	Temperature	20 ķ	Humidity	80%RH	1 h	Repeated twice
Step 2	Temperature	-20 ķ	Humidity	control OFF	2 h	Ramp control ON
Step 3	Temperature	85 ķ	Humidity	50%RH	1.5 h	
Step 4	Temperature	20 ķ	Humidity	control OFF	1 h	Soak control ON



Step No.	1	2	3	4	5	6	7	8	9
Temperature and humidity link control	ON	ON	ON	ON					
Target temperature	20	-20	85	20					
Humidity control ON/OFF	ON	OFF	ON	OFF					
Target humidity	80	—	50	—					
Step exposure time	1:00	2:00	1:30	1:00					
Soak control	OFF	OFF	OFF	ON					
Temperature ramp control	OFF	ON	OFF	—					
Humidity ramp control ON/OFF	OFF	—	OFF	—					

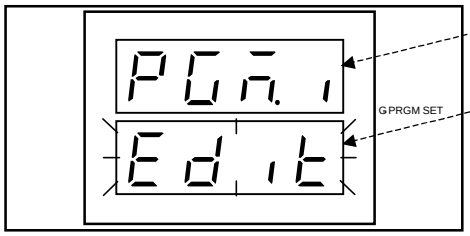
—: No setting made

Repeat setup	Number of repeat cycles (2) Start step (1) → End step (3)
End mode setting	○ HOLD ● OFF ○ CNST

First of all, select “CLER” for the program edit task and press the (ENT.) key to erase the existing program. However, if wanting only to edit part of the existing program, follow the below procedure without erasing the entire program.

1. Program edit task selection EDIT/CLER

Select “EDIT” and press the (ENT.) key.



Stands for ħ Program Input Ĩ

Program edit task selection

(△) (▽) EDIT Sets the program for editing.
CLER Clears the entire program.

(ENT.) Enters the selection.

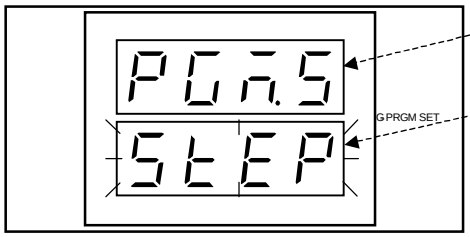
Reference

- To register a new program, first clear the old program and then set up the new program.

Select “EDIT” and press the (ENT.) key. Then, go to the step edit content selection (step 2 in this procedure).

2. Step edit content selection STEP/END/SAVE

Select “STEP” and press the (ENT.) key.



Stands for ħ Program Set Ĩ

Step edit content selection

(△) (▽) STEP Selects step input.
END Moves to number of repeat cycles setting (and end mode setting).
SAVE Saves the program.

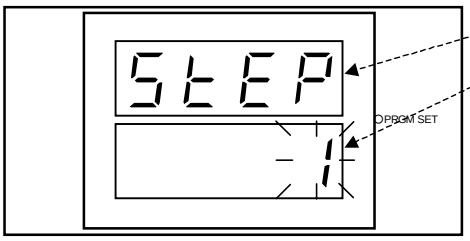
(ENT.) Enters the selection.

Select “STEP” and press the (ENT.) key. Then, go to the step selection (step 3 in this procedure).
Select “END” and press the (ENT.) key. Then, go to the repeat cycle setting (step 13 in this procedure).

Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Step 1 Setup Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ

3. Step selection

Input “1” as the step No. and press the (ENT.) key. Then, press the (NEXT) key.



Stands for “Step”

Step No.

(△) (▽) : Changes the value.

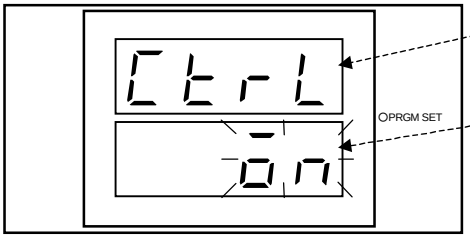
(ENT.) : Enters the selection.

* Setting range : 1 ≦ Step number ≦ 9

Press the (NEXT) key and move to the next setting.

4 Temperature (Humidity) link control status ON/OFF

Select “ON” and press the (ENT.) key. Then, press the (NEXT) key.



Stands for “Control”

Temperature (humidity) link control status

(△) (▽) : ON Turns temperature (humidity) link control ON. Go to the target temperature setting (step 5 in this procedure).

OFF Turns temperature (humidity) link control OFF. Go to the exposure time setting (step 8 in this procedure).

(ENT.) : Enters the selection.

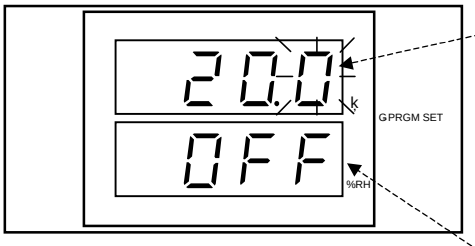
Reference

- Turning temperature (humidity) control OFF means basing that step entirely on the set exposure time. When the time set for that step elapses, the cabinet will advance the program to the next step, therefore this feature can be used as a timer.

Press the (NEXT) key and move to the next setting.

5. Target temperature

Input “20.0” and press the (ENT.) key. Then, press the (NEXT) key.



Target temperature

(△)(▽) Changes the value. (◁) Selects the digit.

(ENT.) Enter changes.

Setting range : Absolute low limit temperature ź Target temperature ź Absolute high limit temperature

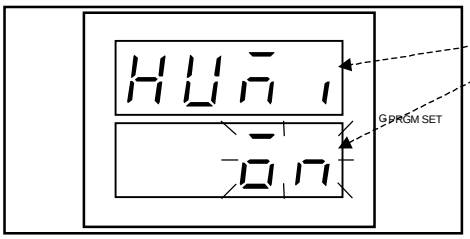
The humidity target appears here.

When humidity control is OFF, “OFF” is displayed.

Press the (NEXT) key and move to the next setting.

6. Humidity control ON/OFF (Not necessary for LU cabinet)

Select “ON” and press the (ENT.) key. Then, press the (NEXT) key.



Stands for ħ Humidity Ĩ

Humidity control status

(△)(▽) ON Turns humidity control ON. Go to the target humidity setting (step 7 in this procedure).

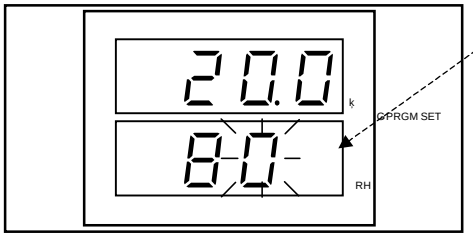
OFF Turns humidity control OFF. Go to the exposure time setting (step 8 in this procedure).

(ENT.) Enters the selection.

Press the (NEXT) key and move to the next setting.

7. Target humidity (Not necessary for LU cabinet)

Input “80” and press the (ENT.) key. Then, press the (NEXT) key.



Target humidity

(△)(▽) Changes the value. (◁) Selects the digit.

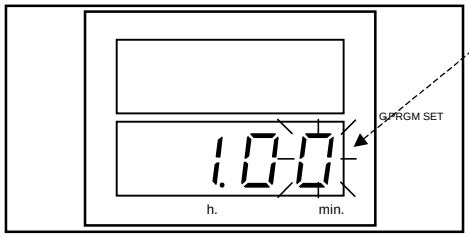
(ENT.) Enter changes.

* Setting range : Absolute low limit humidity ź Target humidity ź Absolute high limit humidity

Press the (NEXT) key and move to the next setting.

8. Step exposure time

Input “1.00” and press the (ENT.) key. Then, press the (NEXT) key.



Step exposure time

(△) (▽) Change the value. (◁) Selects the digit.

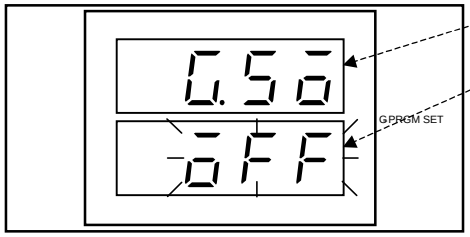
(ENT.) Enters the selection.

* Exposure time can be set between 00 (h): 00 (min) and 99 (h): 59 (min), or between 100 and 999 hours.

Press the (NEXT) key and move to the next setting.

9. Soak control status ON/OFF

Select “OFF” and press the (ENT.) key. Then, press the (NEXT) key.



Stands for “Guaranteed Soak”.

Soak control status

(△) (▽) ON Turns soak control ON. Go to the step data enter command (step 12 in this procedure).
* In soak control, the exposure time for a given step is counted down only while the temperature (humidity) is within the set attainment range for the set holding time. So, the time specimens are exposed to the target temperature will equal the time set in step 8 above. See “5.2 User Setup and Safety Device Options Setup”.

OFF Turns soak control OFF. Go to the temperature ramp control setting (step 10 in this procedure).
* The exposure timer will start at the same time the step does and will continue counting without stopping.

(ENT.) Enters the selection.

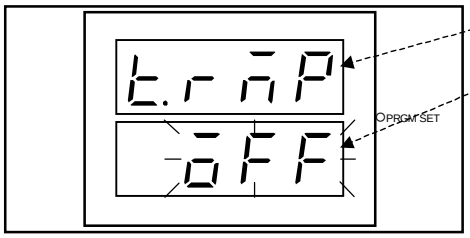
* Soak control cannot be used when either temperature or humidity ramp control is used.

Press the (NEXT) key and move to the next setting.

10. Temperature ramp control ON/OFF

Select “OFF” and press the (ENT.) key. Then, press the (NEXT) key.

In ramp control, temperature rise or fall from the setting in the previous step to that of this step is controlled at a constant rate, or ramp.



Stands for “Temperature Ramp”.

Temperature ramp control status

(△) (▽) : ON Turns temperature ramp control ON.

OFF Turns temperature ramp control OFF.

(ENT.) : Enters the selection.

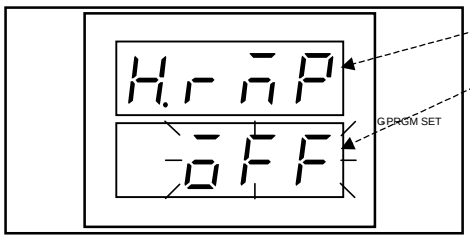
* Temperature ramp control cannot be used in temperature pull-down with LH cabinets because the heater is shut OFF in temperature pull-down. Temperature is pulled down naturally.
* Temperature ramp control cannot be used when soak control is used.
* Temperature ramp control cannot be used with step No. 1. It is kept OFF even if turned ON in step No. 1 setup.

Press the (NEXT) key and move to the next setting.

11. Humidity ramp control ON/OFF (Not necessary for LU cabinet)

Select “OFF” and press the (ENT.) key. Then, press the (NEXT) key.

In ramp control, humidity rise or fall from the setting in the previous step to that of this step is controlled at a constant rate, or ramp.



Stands for “Humidity Ramp”.

Humidity ramp control status

(△) (▽) ON Turns humidity ramp control ON.

OFF Turns humidity ramp control OFF.

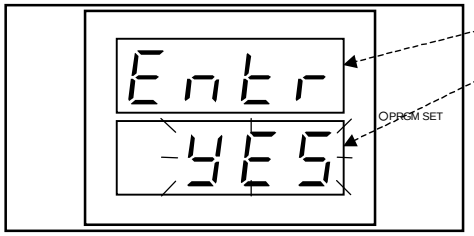
(ENT.) Enters the selection.

* Humidity ramp control cannot be used in humidity pull-down with LH cabinets because the heater is shut OFF in humidity pull-down. Humidity is pulled down naturally.
* Humidity ramp control cannot be used when soak control is used.
* Humidity ramp control cannot be used with step No.1. It is kept OFF even if turned ON in step No.1 Setup.

Press the (NEXT) key and move to the next setting.

12. Step data enter command YES/NO

Select “YES” and press the ENT. key. Then, press the NEXT key.



Stands for “Enter”.

Enter command

△ ▽ : YES Enters data and ends input for the current step.

NO Ends step input without entering the input data.

ENT. : Enters the selection.

* If you perform another operation such as moving to another step without first entering your step data, all the unentered settings you made for that step will be cancelled.

Press the NEXT key and move to the step edit content selection (step 2 in this procedure).

Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Step 2 Setup Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ

2. Select the step edit content selection STEP/END/SAVE.

To setup the next step No., select “STEP” and press the ENT. key.

3. Input the setup No.

Input “2” and press the ENT. key. Then, press the NEXT key.

4. Turn temperature (humidity) link control ON.

Select “ON” and press the ENT. key. Then, press the NEXT key.

5. Set target temperature.

Input “-20.0” and press the ENT. key. Then, press the NEXT key.

6. Turn humidity control OFF.

Select “OFF” and press the ENT. key. Then, press the NEXT key.

8. Set the step exposure time.

Input “2.00” and press the ENT. key. Then, press the NEXT key.

9. Turn soak control OFF.

Select “OFF” and press the ENT. key. Then, press the NEXT key.

10. Turn temperature ramp control ON.

Select “ON” and press the ENT. key. Then, press the NEXT key.

12. Enter step setup.

Select “YES” and press the ENT. key. Then, press the NEXT key.

Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Step 3 Setup Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ

2. Select the step edit content selection STEP/END/SAVE.

To setup the next step No., select “STEP” and press the ENT. key.

3. Input the setup No.

Input “3” and press the ENT. key. Then, press the NEXT key.

4. Turn temperature (humidity) link control ON.

Select “ON” and press the ENT. key. Then, press the NEXT key.

5. Set target temperature.

Input “85.0” and press the ENT. key. Then, press the NEXT key.

6. Turn humidity control ON.

Select “ON” and press the ENT. key. Then, press the NEXT key.

7. Set target humidity.

Input “50” and press the ENT. key. Then, press the NEXT key.

8. Set the step exposure time.

Input “1.30” and press the ENT. key. Then, press the NEXT key.

9. Turn soak control OFF.

Select “OFF” and press the ENT. key. Then, press the NEXT key.

10. Turn temperature ramp control OFF.

Select “OFF” and press the ENT. key. Then, press the NEXT key.

11. Turn humidity ramp control OFF.

Select “OFF” and press the ENT. key. Then, press the NEXT key.

12. Enter step setup.

Select “YES” and press the ENT. key. Then, press the NEXT key.

Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Step 4 Setup Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ

2. Select the step edit content selection STEP/END/SAVE.

To setup the next step No., select “STEP” and press the ENT. key.

3. Input the setup No.

Input “4” and press the ENT. key. Then, press the NEXT key.

4. Turn temperature (humidity) link control ON.

Select “ON” and press the ENT. key. Then, press the NEXT key.

5. Set target temperature.

Input “20.0” and press the ENT. key. Then, press the NEXT key.

6. Turn humidity control OFF.

Select “OFF” and press the ENT. key. Then, press the NEXT key.

8. Set the step exposure time.

Input “1.00” and press the (ENT.) key. Then, press the (NEXT) key.

9. Turn soak control ON.

Select “ON” and press the (ENT.) key. Then, press the (NEXT) key.

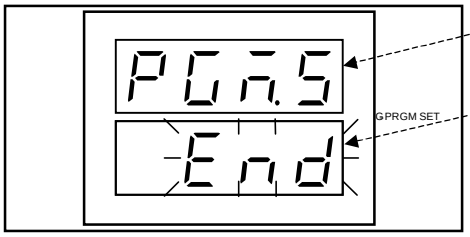
12. Enter step setup.

Select “YES” and press the (ENT.) key. Then, press the (NEXT) key.

Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Number of Repeat Cycles and End Mode Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ Ġ

2. Step edit content selection STEP/END/SAVE

You have now completed program setup, therefore select “END” and press the (ENT.) key.



Stands for ħ Program Set Ĩ

Step edit content selection

(△) (▽) STEP Selects step input.

END Moves to number of repeat cycles setting (and end mode setting).

SAVE Saves the program.

(ENT.) Enters the selection.

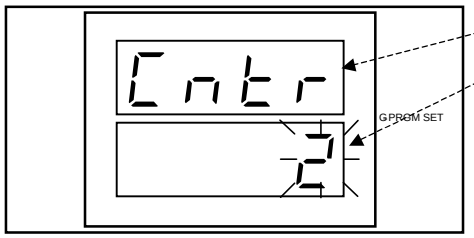
Select “STEP” and press the (ENT.) key. Then, go to the step selection (step 3 in this procedure).

Select “END” and press the (ENT.) key. Then, go to the repeat cycle setting (step 13 in this procedure).

13. Number of repeat cycles

Input “2” and press the ENT. key. Then, press the NEXT key.

Once you set the number of repeat cycles, the program will execute the steps in the repeat range the number of times set here, increasing by 1 each time one cycle is completed. What this means is that testing returns to the repeat counter start step after the repeat counter end step is executed instead of proceeding to the next step in the program. Ultimately, when the number set here is reached, the program will advance to the next chronologically higher number in the program.



Stands for “Counter”.

Number of repeat cycles

△ ▽ Change the value.

◁ Selects the digit. ENT. Enters the selection.

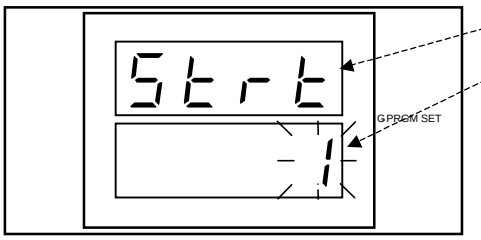
* The number of repeat cycles can be set between 0 and 99.
* If the number of repeat cycles is set to “0”, the program will be executed as usual without repeating any specific part.

If set to “0”, go to the end mode setting (step 16 in this procedure).
If set to a number between 1 and 99, go to the repeat counter start step setting (step 14 in this procedure).

Press the NEXT key and move to the next setting.

14. Repeat counter start step

Input “1” and press the ENT. key. Then, press the NEXT key.



Stands for “Start”.

Repeat counter start step

△ ▽ Change the value.

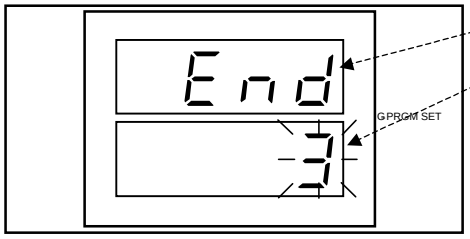
ENT. Enters the selection.

* The repeat counter start step can be set within the following range. 1 ≤ Repeat counter start step ≤ Number of registered steps

Press the NEXT key and move to the next setting.

15. Repeat counter end step

Input “3” and press the (ENT.) key. Then, press the (NEXT) key.



Stands for “End”.

Repeat counter end step

(△) (▽) Change the value.

(ENT.) Enters the selection.

* The repeat counter end step can be set within the following range. Repeat counter start step ≤ Repeat counter end step ≤ Number of registered steps

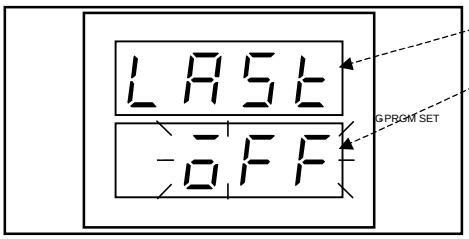
If the repeat range setup does not satisfy the below condition, an error will be generated when you attempt to save the program (“SAVE” → (ENT.) key) and you will not be able to save the program. “EDIT ERR” will appear on the display, therefore correct the repeat range to satisfy the condition.

Repeat counter start step ≤ Repeat counter end step ≤ Number of registered steps

Press the (NEXT) key and move to the next setting.

16. End mode HOLD/OFF/CNST

Select “OFF” and press the (ENT.) key. Then, press the (NEXT) key.



Stands for “Last”.

End mode

(△) (▽)

HOLD	Holds the conditions created in the last step.
OFF	Shuts control power OFF, but primary power remains ON.
CNST	Operates the constant mode conditions.

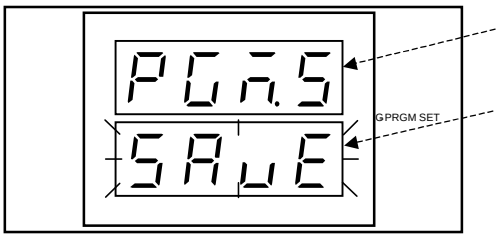
(ENT.) Enters the selection.

Press the (NEXT) key and move to the step edit content selection (step 2 in this procedure).

Saving the Program

2. Step edit content selection STEP/END/SAVE

The program is saved by selecting “SAVE” for the step edit content selection and pressing the ENT. key. If you perform other operations such as switching to the alarm mode without first saving the program, changes you made to the program will be lost.



Stands for ħ Program Set Ĩ

Step edit content selection

△ ▽ STEP Selects step input.

END Moves to number of repeat cycles setting (and end mode setting).

SAVE Saves the program.

ENT. Enters the selection.

This readies the program for operation. Now, start the program as explained in “4.5 Test Startup/End”.

4.5 Test Startup / End

Test Startup

Before starting tests, make the preparations and settings described in sections "4.1 Test Preparations", "4.3 Specimen Safety Device Setup" and "4.4 Target Temperature/Humidity Setup".

Procedure

1. Check control power is ON.
2. If wanting to run the cabinet in the constant mode, press the CONST.OPER./STOP key. To run a program, press the PRGM OPER./STOP key.

Reference

- If the CONST.OPER./STOP key is pressed while testing is in progress, testing will stop. Pressing it again after that will resume testing.
- While a program is running, the program can be stopped and resumed by pressing the PRGM OPER./STOP key. However, when the program is resumed, it starts again from step No. 1.
- You cannot switch between the program and constant modes while tests are running. First stop the test and then switch the operation mode.

Test End

Shut the cabinet down as follows.

Procedure

1. If the cabinet is running in the constant mode, press the CONST.OPER./STOP key. If a program is running, press the PRGM OPER./STOP key.
   Testing will stop and the cabinet will assume the standby state.
2. Press the POWER key. The display on the operating panel will go out.
3. If not planning to use the cabinet for a long period of time, set the main power switch in the OFF position.

4.6 Checking Test Area Temperature and Settings

Both test area status and setup can be monitored during the constant mode and program mode, and by remote control.

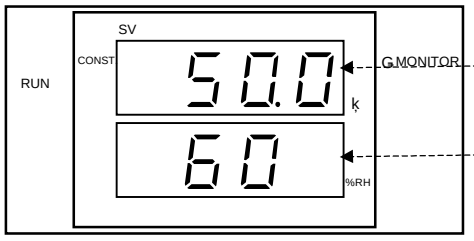
Monitoring in the Constant Mode

While the cabinet is running in the constant mode, you can view constant mode setup.

Ŭ Getting the constant mode monitor

The test area temperature (and humidity) monitor will be on the display when the display comes ON.

1. Test area temperature (and humidity)

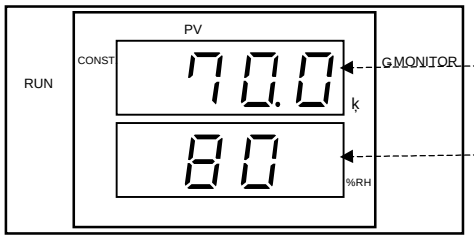


Test area temperature

Test area humidity (Not displayed with LU cabinet)
If humidity control has been turned OFF, “OFF” is displayed here.

Press the NEXT key and move to the next setting.

2. Target temperature (and humidity)



Target temperature

Target humidity (Not displayed with LU cabinet)
If humidity control has been turned OFF, “OFF” is displayed here.

Press the NEXT key and return to the test area temperature (and humidity) monitor (step 1 in this procedure).

1. Test area temperature (and humidity)

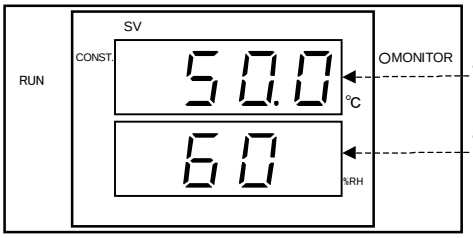
Monitoring in the Program Mode

In the program mode monitor, you can view the current test area temperature (and humidity), the target temperature (and humidity) for the current step, the time remaining to step end, the exposure time set for the current step and the set number of the repeat cycles if set in the program.

Ü Getting the program mode monitor

The test area temperature (and humidity) monitor will be on the display when the display comes ON.

1. Test area temperature (and humidity)

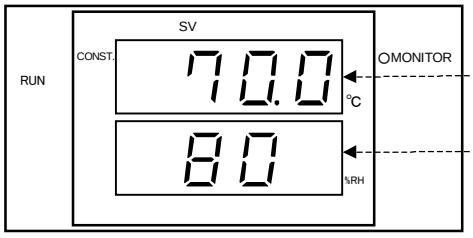


Test area temperature

Test area humidity (Not displayed with LU cabinet)
If humidity control has been turned OFF, “OFF” is displayed here.

Press the NEXT key and move to the next setting.

2. Target temperature (and humidity)

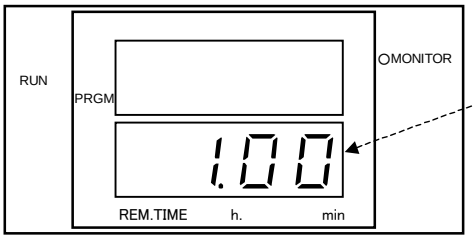


Target temperature

Target humidity (Not displayed with LU cabinet)
If humidity control has been turned OFF, “OFF” is displayed here.

Press the NEXT key and move to the next setting.

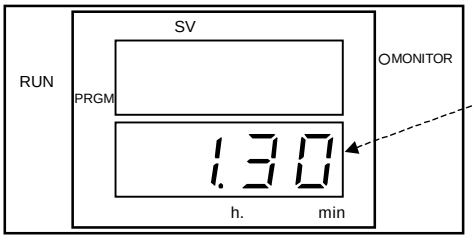
3. Time remaining to step end



Time remaining to step end (Counted down)
* Time is displayed either in the range of 00 (h): 00 (min) to 99 (h): 59 (min), or 100 to 999 hours.

Press the NEXT key and move to the next setting.

4. Target step exposure time

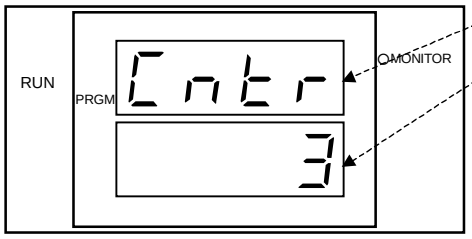


Target step exposure time

* Time is displayed either in the range of 00 (h): 00 (min) to 99 (h): 59 (min), or 100 to 999 hours.

Press the NEXT key and move to the next setting.

5. Number of repeat cycles



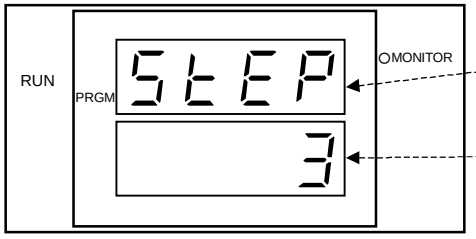
Stands for "Counter".

Number of repeat cycles

* The current number of repeat cycles are displayed.
* If "0" was set for the number of repeat cycles, this monitor item is automatically skipped.

Press the NEXT key and move to the next setting.

6. Current step



Stands for "Step".

Step No.

Press the NEXT key and return to the test area temperature (and humidity) monitor (step 1 in this procedure).

1. Test area temperature (and humidity)

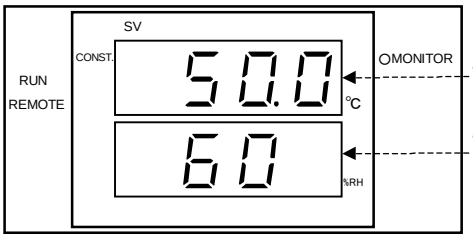
Monitoring by Remote Control

In the remote control monitor, you can view the current test area temperature (and humidity), the target temperature (and humidity) for the current step, the time remaining to step end and the exposure time set for the current step.

Ü Getting the remote control mode monitor

Set the main power switch in the ON position and press the POWER key. The test area temperature (and humidity) monitor will be on the display when the display comes ON.

1. Test area temperature (and humidity)

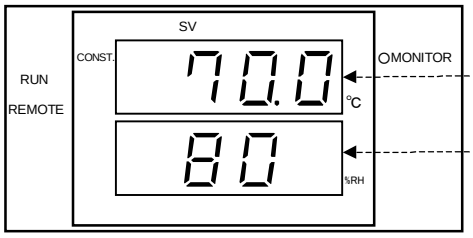


Test area temperature

Test area humidity (Not displayed with LU cabinet)
If humidity control has been turned OFF, “OFF” is displayed here.

Press the NEXT key and move to the next setting.

2. Target temperature (and humidity)

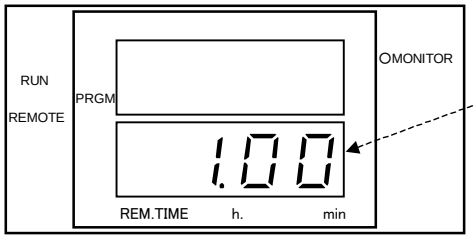


Target temperature

Target humidity (Not displayed with LU cabinet)
If humidity control has been turned OFF, “OFF” is displayed here.

Press the NEXT key and move to the next setting.

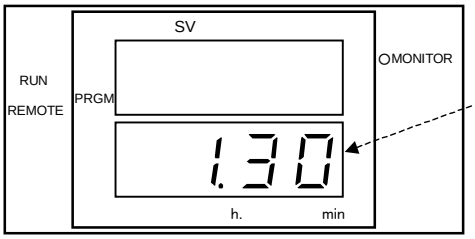
3. Time remaining to step end



Time remaining to step end (Counted down)
* Time is displayed either in the range of 00 (h): 00 (min) to 99 (h): 59 (min), or 100 to 999 hours.

Press the NEXT key and move to the next setting.

4. Target step exposure time



Target step exposure time

* Time is displayed either in the range of 00 (h): 00 (min) to 99 (h): 59 (min), or 100 to 999 hours.

Press the NEXT key and move to the next setting.

1. Test area temperature (and humidity)

4.7 Handy Features

Inner Door (Option)

The inner door (option) can be installed even after the cabinet is delivered. Contact the place of purchase or ESPEC CORP.

⚠ CAUTION

- **FRAGILE! The glass will break under strong impact or force.**
  Broken glass can cause injury, therefore keep fragments away from face and body.
- **HANDLE WITH CARE! Though the inner door uses reinforced glass, do not subject it to string impacts.**
- **HOT! Immediately after operation at high temperature and high humidity, hot air can be blown from the cabinet and hot water can drip from A in the below figure when the door is opened. In such case, crack the inner door and ensure safety before opening the door fully. Also, condensation clinging to the inner door will drip to the floor when the door is open.**

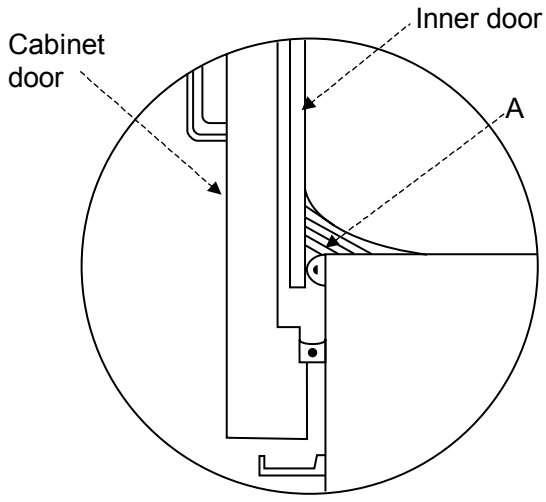


Fig. 4.16 Inner door seen from side

Note

- The inner door is designed so that users can view inside the test area during cabinet operation. However, it can fog up during operation at high temperature and high humidity. In such case, turn the wiper knob until visibility is restored.
  Also, the inner door can be locked and unlocked by the turning the lock knob.

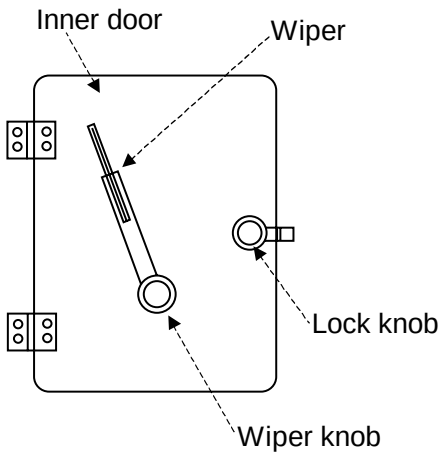


Fig. 4.17 Inner door parts

- Swinging the wipe inattentively can jam the tip between the inner door and the cabinet door. If this happens, open the door and free the wiper.
- Before closing the inner door, check the wiper is not protruding outside the inner door frame. Also, close the inner door slowly and carefully.
- Once a month, wipe the inner door clean with a soft cloth or by other means.

Reference

- If the cabinet is run with the inner door closed but the cabinet door open, temperature pull-down rate, temperature uniformity and other performance specifications will fall outside of guaranteed levels.

Chapter 5 Getting More Out of Your Cabinet

This chapter explains how to get more out of your cabinet.

5.1 Communication Environment Setup (Option)

Communication Setup Mode

To communicate with other external devices, you must set up the communication environment. However, if the cabinet is not equipped for communications, the display will skip over communication items.

Ü Getting communication setup mode

Set the main power switch in the ON position and press the POWER key. With the temperature (and humidity) monitor on the display, press the SET key 4 times. The communication setup top display will appear on the display.

Ü Operation

△ ▽ Selects and inputs settings.

◁ Selects the digit.

ENT. Enters changes to settings.

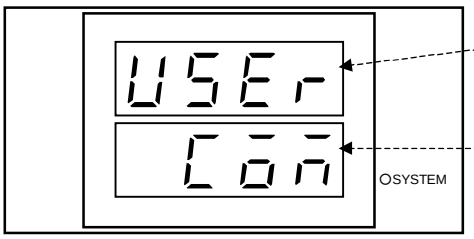
* Unless the ENT. key is pressed, changes you make to settings will not be updated.

NEXT Moves to the next setting.

In this manual, indicates a flashing digit.

ǩ For E-BUS communications

1. Communication setup top display



"Stands for User"

"Stands for Communication"

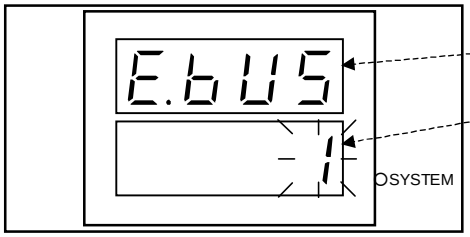
Pressing the NEXT key will move to the next setting.

' If the cabinet is equipped for GP-IB communications (option), the display will change to the GP-IB address setting.

' If the cabinet is equipped for RS-232C communications (option), the display will change to the transmission mode setting.

For environment setup with GP-IB and RS-232C communications, see the Communication Function (Option) User's Manual.

2. E-BUS address



"Stands for E-BUS"

Currently set address

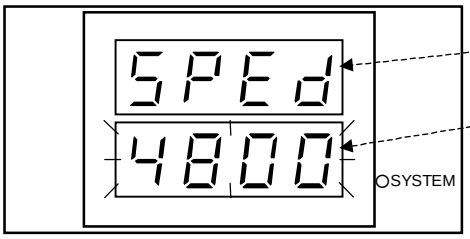
△ ▽ : Selects and inputs settings.

◁ : Selects the digit. ENT. : Enters changes to settings.

* Setting range : 0 ≦ E-BUS address ≦ 31
* Setting the E-BUS address to "0" disables communications.

Press the NEXT key and move to the next setting.

3. E-BUS transmission speed



"Stands for Speed"

Baud rate

△ ▽ : 4800bps 976.6bps

ENT. : Enters changes to settings.

Pressing the NEXT key will move you to the communication setup top display.

1. Communication setup top display

5.2 User Setup and Safety Device Options Setup

This section explains how to set up your test environment and optional safety devices.

User Setup Mode

Ů Getting Use Setup Mode

Set the main power switch in the ON position and press the POWER key. The instrumentation panel will come on in the monitor mode with the test area temperature on the display. While in the monitor mode, press the SET key 5 times. This will get the User Setup Mode and display the mode's top display.

Ů Operation

△ ▽ Selects and inputs settings.

◁ Selects the digit.

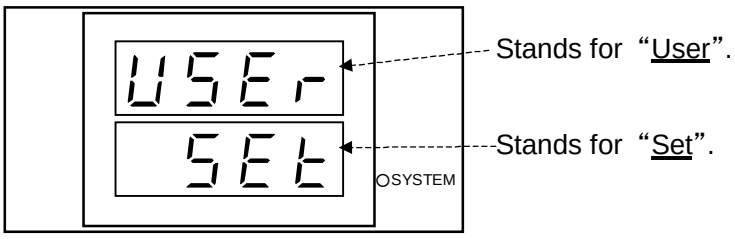
ENT. Enters changes to settings.

* Unless the ENT. key is pressed, changes you make to settings will not be updated.

NEXT Moves to the next setting.

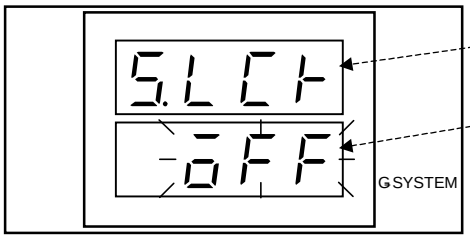
In this manual, indicates a flashing digit.

1. User setup top display



Press the NEXT key and move to the next setting.

2. Setting keys lock ON/OFF



Stands for "Set Lock".

Key lock status

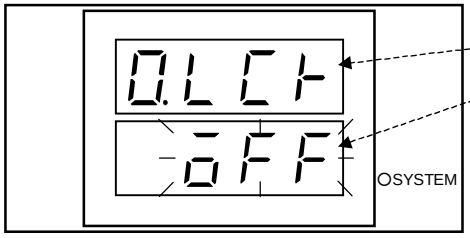
△ ▽ ON Locks the keys. ENT. Enters the selection.

OFF Unlocks the keys.

* Even when keys are locked, the CONST.OPER./STOP key, PRGM OPER./STOP key and POWER key still respond to touch.

Press the NEXT key and move to the next setting.

3. Operation lock ON/OFF



Stands for "Operation Lock".

Operation lockout status

△ ▽ : ON Locks out operation mode changes.

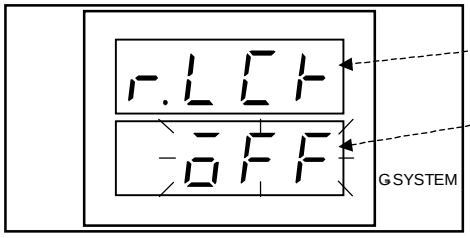
OFF Allows operation mode changes.

ENT. : Enters the selection.

* When the operation lock is ON, you cannot change the operation mode or turn the power OFF.

Press the NEXT key and move to the next setting.

4. Remote control lock ON/OFF



Stands for "Remote Lock".

Operation status

△ ▽ ON Locks out operation from remote.

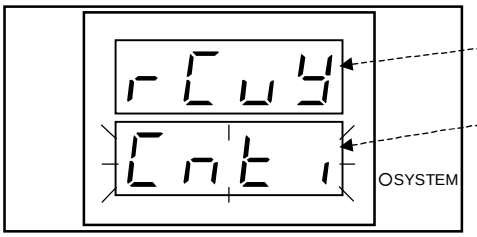
OFF Allows operation from remote.

ENT. Enters the selection.

* When the remote lock is ON, you can only monitor operation from remote, not operate the cabinet.

Press the NEXT key and move to the next setting.

5. Power recovery mode CNTI/REST



Stands for "Recovery".

Power Recovery Mode

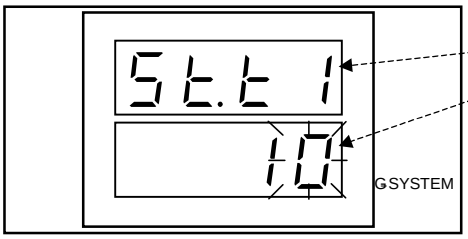
: CNTI Restores state prior to power failure.

RSET Resets chamber to initial state.

ENT. : Enters the selection.

Press the NEXT key and move to the next setting.

6. Temperature attainment range



Stands for ħ Stability Temperature 1 Ĩ

Temperature attainment range

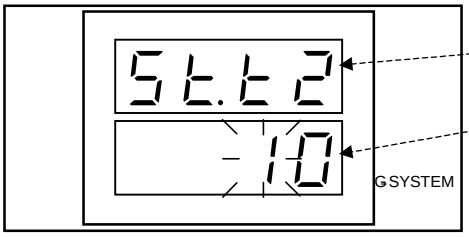
Change the value. Selects the digit.

ENT. Enters the selection.

* Setting range : 0.1 ķ ź Temperature attainment range ź 10 ķ .

Press the NEXT key and move to the next setting.

7. Temperature attainment holding time



Stands for ħ Stability Temperature 2 Ĩ

Temperature attainment holding time (sec)

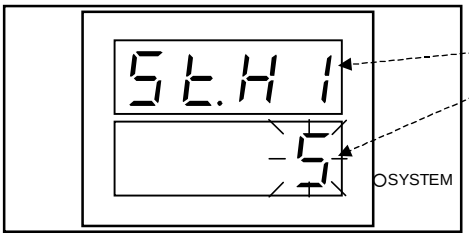
Change the value. Selects the digit.

ENT. Enters the selection.

* Setting range : 0 ź Temperature attainment holding time ź 9999 seconds

Press the NEXT key and move to the next setting.

8. Humidity control attainment range (Not displayed with LU cabinet)



Stands for "Stability Humidity 1"

Humidity attainment range

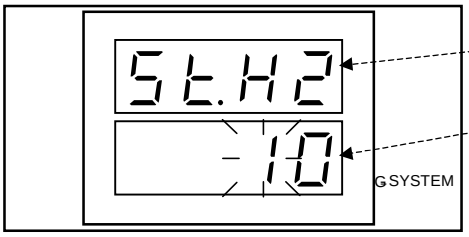
△ ▽ : Change the value. ◁ : Selects the digit.

ENT. : Enters the selection.

* Setting range : 1% RH ≦ humidity attainment range ≦ 10%RH.

Press the NEXT key and move to the next setting.

9. Humidity attainment holding time (Not displayed with LU cabinet)



Stands for "Stability Humidity 2".

Humidity attainment range (sec)

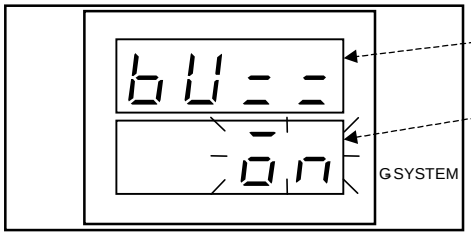
△ ▽ Change the value. ◁ Selects the digit.

ENT. Enters the selection.

* Setting range : 1 second ≦ humidity attainment holding time ≦ 9999 seconds

Press the NEXT key and move to the next setting.

10. Warning buzzer ON/OFF



Stands for "Buzzer".

Operation status

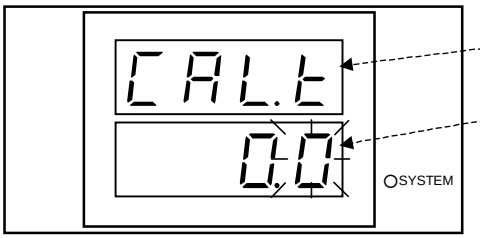
△ ▽ ON Buzzer sounds when 2nd degree alarm is generated.

OFF Buzzer dose not sound when 2nd degree alarm is generated.

ENT. Enters the selection

Press the NEXT key and move to the next setting.

11. Dry-bulb temperature calibration



Stands for "Calibration Temperature".

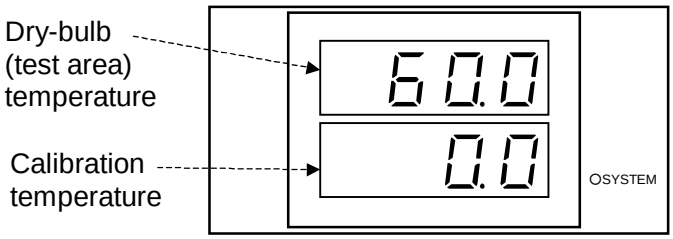
Amount of offset

△ ▽ : Change the value. ◁ : Selects the digit.

ENT. : Enters the selection.

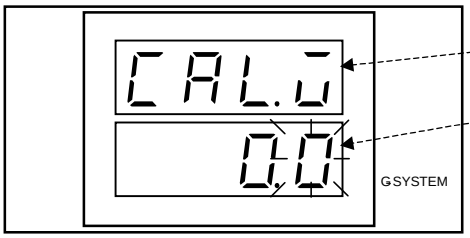
* The target temperature can be set within the below range.
-5.0 ≦ Calibration temperature ≦ 5.0

- With the calibration feature, you are basically setting the number of degrees from the current test area temperature that must be added or subtracted in order to display the temperature you want. For example, if the target temperature is 60.0°C and the calibration value is changed from 0.0°C to –0.2°C while testing is in progress, the display will read "59.8°C." After that, test area temperature is controlled to 60.0°C, or 0.2°C higher than what the target temperature was prior to setting the calibration value.
- How to read the current dry-bulb temperature
  Press the ◁ key until the far right digit starts flashing. At that moment, the dry-bulb temperature (test area temperature) will be displayed in the message area for 1 to 2 seconds.



Press the NEXT key and move to the next setting.

12. Wet-bulb temperature calibration (Not displayed with LU cabinet)



Stands for ħ Calibration Wet Temperature Ĩ .

Amount of offset

△ ▽ Change the value. ◁ Selects the digit.

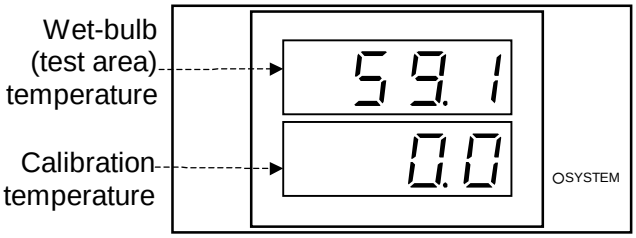
ENT. Enters the selection.

* Setting range: -5.0 ź wet-bulb temperature offset ź +5.0.

- How to read the current wet-bulb temperature

  Press the ◁ key until the far right digit starts flashing.

  At that moment, the wet-bulb temperature will be displayed in the message area for 1 to 2 seconds.



Pressing the NEXT key will move you to the user settings top display.

1. User setup top display

5.3 Checking Cabinet Model, ROM Version and Control Software Version

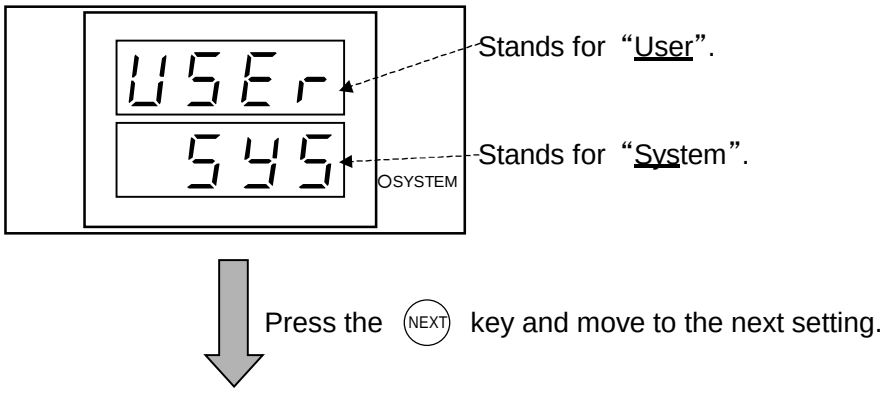
With this cabinet, you can check the model, ROM and control software version. Normally, this isn't necessary, but you will need this information when inquiring about the equipment or calling for service.

System Environment Monitor Mode

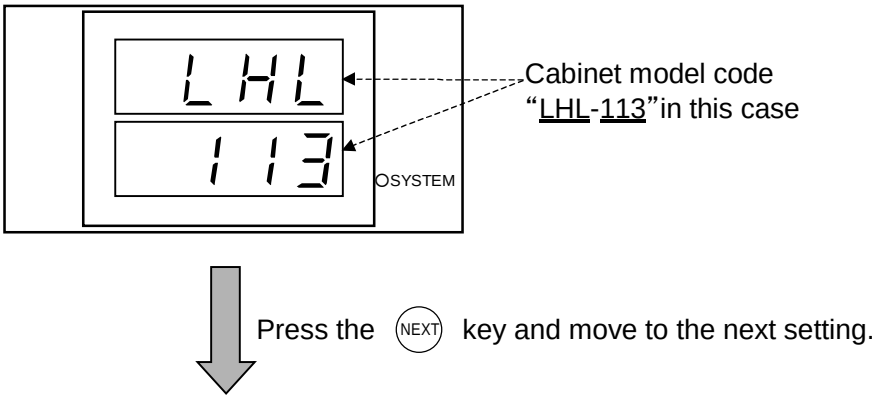
ŮGetting the System Environment Monitor Mode

Set the main power switch in the ON position and press the POWER key. With the temperature (and humidity) monitor on the display, press the SET key 6 times. The top display in the system environment monitor mode will appear on the display.

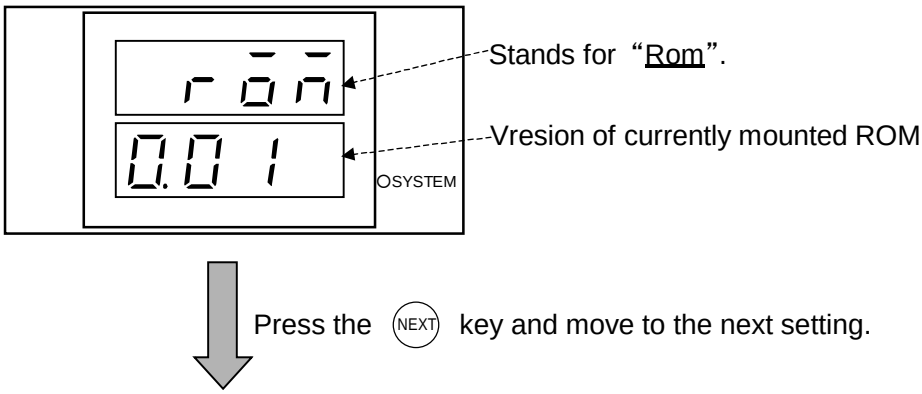
1. System environment top display



2. Cabinet model code

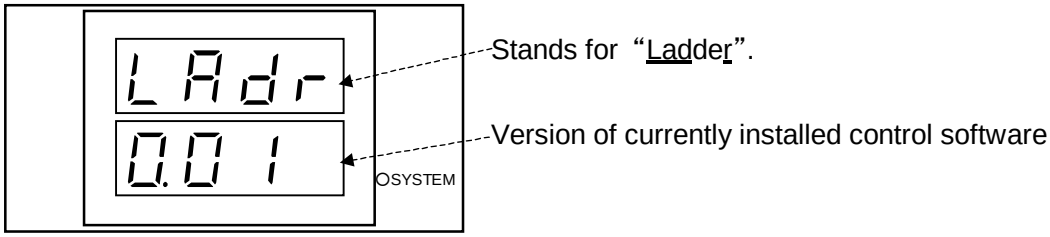


3. ROM version



Press the NEXT key and move to the next setting.

4. Control software (ladder) version



Press the NEXT key and move to the next setting.

1. System environment top display

Chapter 6 Checks and Maintenance

This chapter explains equipment checks and maintenance. To keep the cabinet in good working condition, perform checks and maintenance periodically.

6.1 Check and Maintenance Lists

Check list

For an explanation on each check item, see "6.2 Checks".

If any of the following checks result bad, contact the place of purchase or ESPEC CORP.

Table 6.1 Check list

Check item	When to check
Main power switch (leakage breaker) trip test	Once monthly
Overheat protector trip test	・Before long test runs ・Before unmanned tests
Humidifying tray and regulator water level check (Not necessary for LU cabinet)	・Once every three months ・When cabinet is relocated. See “3.4 Water Level Check”.

Maintenance list

For an explanation on each maintenance item, see "6.3 Maintenance".

Table 6.2 Maintenance list

Maintenance item	When to perform
Condenser cleaning (Not necessary for LH cabinet)	Once monthly
Water tank cleaning (Not necessary for LU cabinet)	Once monthly
Electromagnetic pump (water tank) protective strainer cleaning (Not necessary for LU cabinet)	Once monthly
Humidifying tray cleaning (Not necessary for LU cabinet)	Once monthly
Test area cleaning	Before every test
Water circuit (heat exhaust) compartment cleaning	Once yearly
Take-down	Before long periods of disuse

6.2 Checks

Main Power Switch (leakage breaker) Trip Test

Once a month and before long test runs, test-trip the main power switch (leakage breaker). The switch is found on the rear side of the cabinet. With the main power switch in the ON position, press the gray test button. If the switch's lever falls to the middle position, the breaker is working properly.

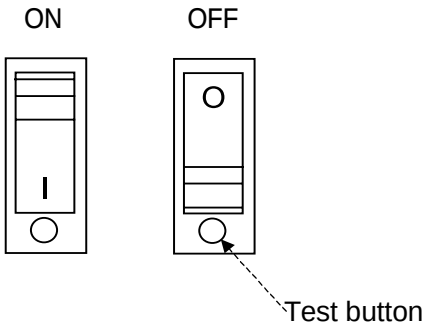


Fig. 6.1 Main power switch test button

Reference

When the leakage breaker in the main power switch trips, the switch's lever falls halfway between the ON and OFF positions. To turn power back ON again, first set the switch to the OFF position and then to the ON position.

Overheat Protector Trip Test

Before every test, test-trip the overheat protector.

Procedure

1. Check the main power switch is in the ON position.
2. Press the POWER key to activate control power.
   The current temperature (humidity) will appear on the display.
3. Press either the CONST.OPER./STOP key or the PRGM OPER./STOP key.
   The cabinet will start up.

4. Set the overheat protector about 5°C lower than cabinet temperature.
   If the overheat protector is working properly, a buzzer will sound and the Alarm screen will be appear on the display when temperature inside the cabinet reaches the overheat protector setting.
   If the buzzer doesn't sound, something is wrong with the equipment. Contact the place of purchase or ESPEC CORP.

5. To silence the buzzer, press either the △ or ▽ keys.

6.3 Maintenance

Condenser Cleaning **(Not necessary for LH cabinet)**

Before cleaning the condenser, open and close the door to rid the inner door of any clinging moisture.

Procedure

1. Unplug the cabinet from its electrical outlet.

2. Remove the screw from the top of the lower front panel. This will require a Phillips screwdriver.

3. Lean the panel downward from its top edge and lift up and out at an angle.

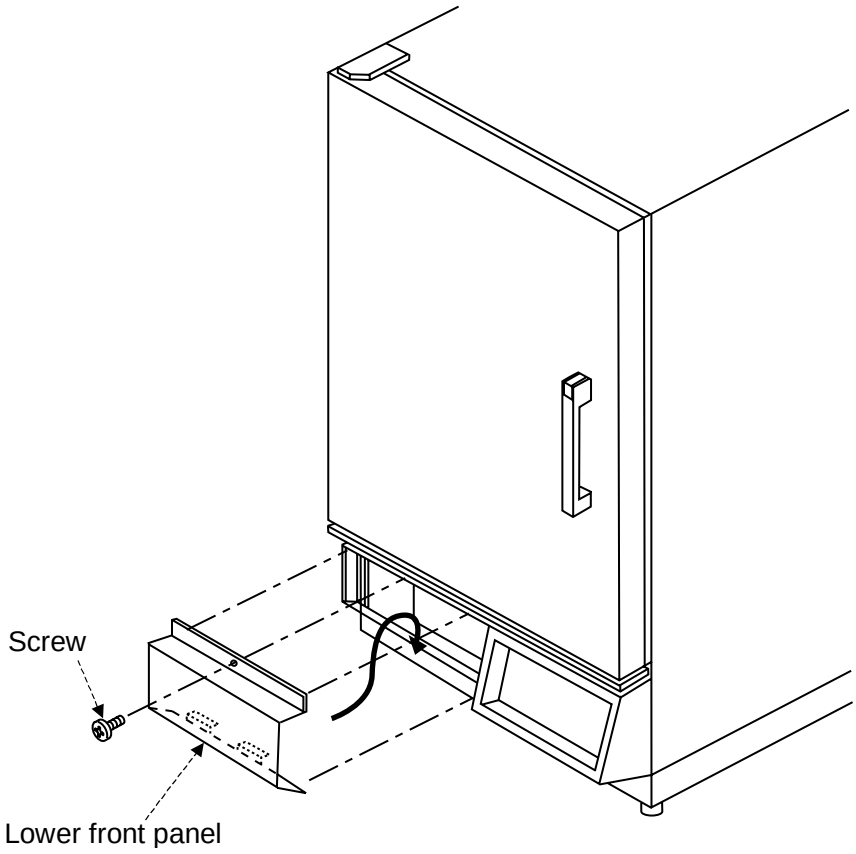


Fig. 6.2 Detaching the lower front panel

4. Clean the condenser and nearby areas of dust with a vacuum cleaner or by other means.

5. Reinstall the lower front panel as before.

Water Tank Cleaning (Not necessary for LU cabinet)

Procedure

1. Connect the included water supply/drain hose to the water tank nipple and drain the water tank empty. (It takes about 8 minutes to drain a full tank.)

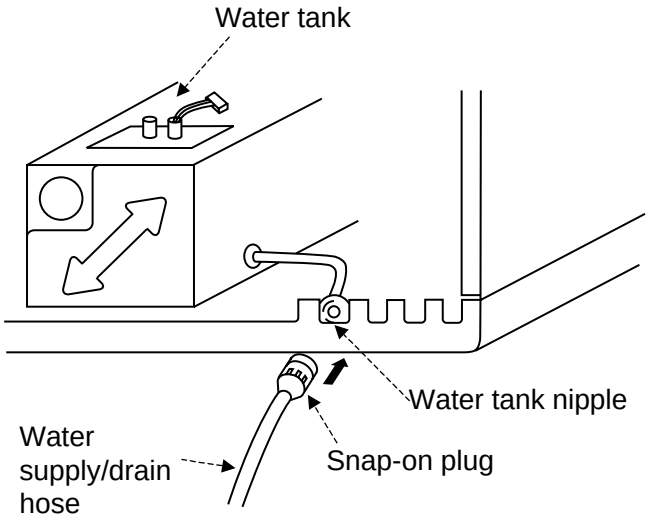


Fig. 6.3 Tank drainage connection

2. Detach the water circuit (heat exhaust) compartment panel from the cabinet.
3. Using the same water supply/drain hose, add water to the tank.
4. When the tank is about 2/3 full, drain it empty again.
5. Repeat steps 3 and 4 two to three times.

Electromagnetic Pump (Water Tank) Protective Strainer Cleaning

(Not necessary for LU cabinet)

Procedure

1. Unplug the cabinet from its electrical outlet.
2. Detach the water circuit (heat exhaust) compartment panel.
3. Loosen the screws to the tank's top plate on which are installed the float switch and strainer. This will require a Phillips screwdriver. Then, lift the plate upward and remove.

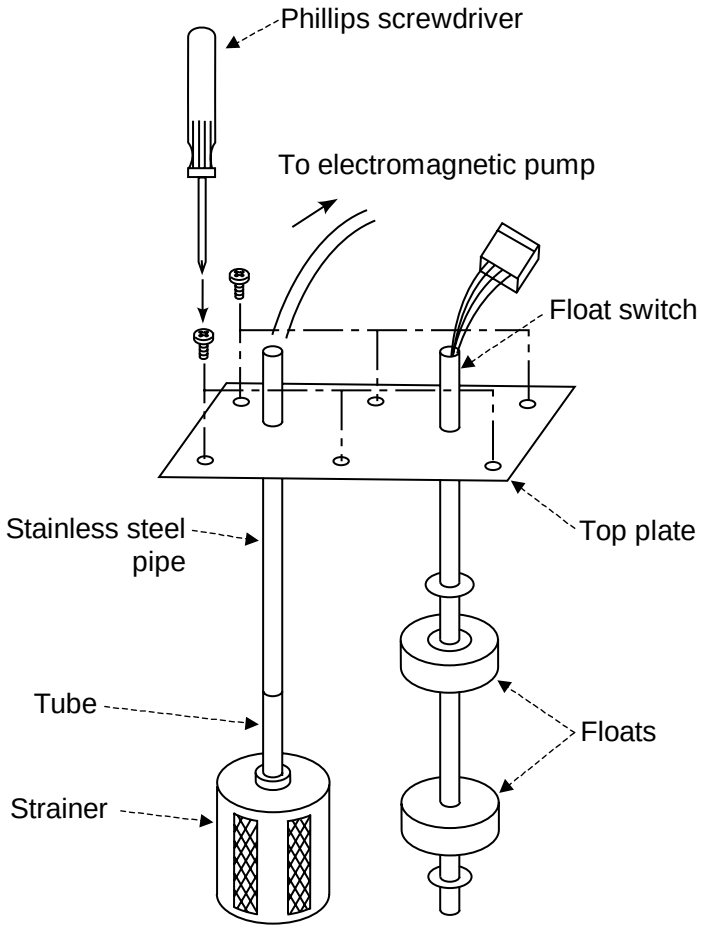


Fig. 6.4 Electromagnetic pump protective strainer

4. Pull the tube to which the strainer is attached out from the top plate and wash off dirt and grime with clean water.

5. Reassemble parts as before.

Humidifying Tray Cleaning (Not necessary for LU cabinet)

⚠ CAUTION

- **SHARP EDGES! Be careful of projections or sharp edges inside the cabinet.**
  For your safety, always wear gloves when working inside the cabinet.
- **HOT ON THE INSIDE! Cool down the test area before cleaning the humidifying tray.**
  During and shortly after operation, the cabinet is HOT and humid on the inside.

During operation, dirt and foreign matter stick to the humidifying tray and humidifying heater. To ensure long lasting use, clean the tray and heater of dirt once a month. A good way to inhibit dirt from accumulating is to drain the humidifying tray after every test.

Procedure

1. Open the cabinet door.

2. Lift the protective grille outwards from the bottom and then upwards to detach.

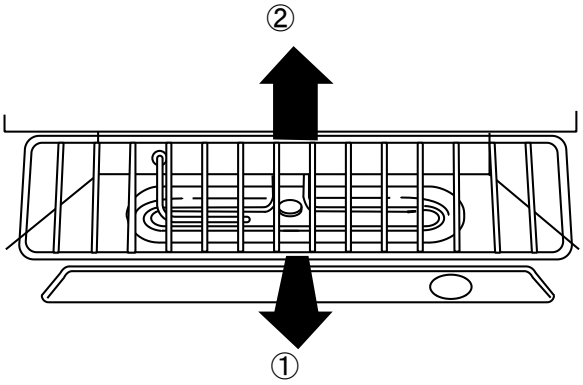


Fig. 6.5 How to detach the protective grille

3. Clean the surfaces of the humidifying tray and humidifying heater with a brush or by other means.

4. Reattach the grille and close the cabinet door.

Test Area Cleaning

Dirt and foreign matter inside the test area can throw test results off. Clean the test area before every test.

Procedure

1. Open the cabinet door.

2. Wipe walls and parts clean with a soft cloth.

3. Close the door.

Water Circuit (Heat Exhaust) Compartment Cleaning

Dust buildup inside the water circuit (heat exhaust) compartment can lead to trouble. Clean inside the compartment once a month.

Procedure

1. Check the main power switch is in the OFF position.
   The water circuit (heat exhaust) compartment has a ventilation fan on the inside. Contact would be dangerous. Always shut OFF power at the main power switch before opening the water circuit (heat exhaust) compartment.

2. Detach the water circuit (heat exhaust) compartment panel.

3. Clean dirt from inside with a vacuum cleaner or by other means.

4. Reattach the compartment panel.

Take-Down Before Long Periods of Disuse

Before disuse of 3 days or more, do the following to prevent mildew or scale formation. Failure to do so can affect testing and shorten equipment service-life.

- Drain the wick pan, humidifying tray and water of water tank. (Not necessary with LU cabinet)
- Dry the test area (run the cabinet).
- Set the main power switch in the OFF position and shut OFF primary power supply.

Ü Drying the test area

The cabinet is run to dry the test area.

Turn humidity control OFF, and run the cabinet at a minimum 70°C for about 60 minutes. After that, crack the cabinet door slightly and run the cabinet under the same conditions for about 15 minutes.

Procedure

1. Check the main power switch is in the ON position.

2. Set target temperature to 70°C and turn humidity control OFF (not necessary for LU cabinet).

3. Press one of the OPER./STOP keys.

   Run the cabinet for about 60 minutes with the door closed, then for 15 minutes with the door slightly cracked.

Ü Power OFF

Set the main power switch in the OFF position, then shut OFF the primary power supply.

Chapter 7 Troubleshooting

This chapter explains equipment trouble and how to remedy it.
When trouble is detected by one of the self-check features, the trouble is displayed on the instrumentation panel display and a trouble buzzer is sounded. For trouble undetected in self-checks and misoperation which can be easily mistaken as trouble, see "7.2 Other Troubles".
This chapter also includes trouble information for options.

7.1 Detectable Troubles

⚠ DANGER

- **ELECTRIC SHOCK! Before working on the power circuits on the primary side of the main power switch (leakage breaker), shut OFF primary power supply and check the line is dead. Also, take measures to prevent accidental charging.**
  Working with primary power supply ON runs the risk of electric shock.
- **Shut OFF power from the main power switch BEFORE detaching the electric parts compartment door.**

Temperature (and humidity) cabinets are equipped with a buzzer that sounds when detects trouble as well as self-check features which display the trouble on the instrumentation panel display. Displayed alarm codes and their content are given in the alarm table on the following pages. Remedy trouble as described therein.
For trouble which is undetected in self-checks, see "7.2 Other Troubles".
If the trouble cannot be remedied after taking the prescribed action, contact the place of purchase or ESPEC CORP. (Call for service.)

1st and 2nd Degree Alarms

Detectable trouble is manifested either as 1st or 2nd degree alarms. They are defined as follows.
1st degree alarm: Even after the cause of the trouble has been eliminated, control is NOT automatically restored. The trouble state must be cleared in accordance with the displayed alarm code and the system restarted.
2nd degree alarm: As soon as the cause of the trouble has been eliminated, control is automatically restored. However, the alarm code will be displayed indefinitely until one of the keys is pressed.

Clearing Alarms

This section explains how to deal with trouble that trips one of the cabinet's self-checks. The buzzer can be silenced by pressing any of the keys, but follow the below procedure as best possible.

Ü When a 1st Degree Alarm Occurs

Procedure

1. Press either the △ or ▽ keys to silence the buzzer.
2. Check the alarm code AL ¨ ¨ on the display.
3. If the cabinet is running, press the OPER./STOP key to stop the cabinet.
4. If control power is ON, press the POWER key to shut OFF power to the instrumentation.
5. Set the main power switch in the OFF position.
6. Remedy the trouble as explained in the Alarm Tables on the following pages.
7. To resume operation, set the main power switch in the ON position, press the POWER key and then press the OPER./STOP key in that order.

Ü When a 2nd Degree Alarm Occurs

Procedure

When the cause of the trouble persists

1. Check the alarm code AL ¨ ¨ on the display.
2. Press either the △ or ▽ keys to silence the buzzer.
3. Remedy the trouble as explained in the Alarm Tables on the following pages. When the cause of the trouble has been cleared, normal control is automatically restored. The alarm code is cleared.

When the cause of the trouble has been eliminated

1. Check the alarm code AL ¨ ¨ on the display.
2. Press either the △ or ▽ keys to silence the buzzer. The alarm code is cleared.

Alarm Table

Table 7.1 Alarm table

Type	Displayed alarm code/channel code (option)	Trouble	Cause	Remedial action
1st	AL00 CH00 î 0 Î	The room temperature compensation input to the temperature controller was disconnected. The cabinet has been stopped.	The sensor is loosely connected to the RTD terminal on the ES102C temperature controller board or there is an open circuit on the ES102C board.	Turn control power OFF from the POWER key and resume testing. If the same alarm occurs again, call for service.
1st	AL00 CH01 î 0 Î	The dry-bulb input to the temperature controller was disconnected. The cabinet has been stopped.	The sensor is loosely connected to the CH1 terminal on the ES102C temperature controller board or there is an open circuit in the connected thermocouple.	Turn control power OFF from the POWER key and resume testing. If the same alarm occurs again, call for service.
1st	AL00 CH02 î 0 Î (Not applicable to LU cabinet)	The wet-bulb input to the temperature controller was disconnected. The cabinet has been stopped.	The sensor is loosely connected to the CH2 terminal on the ES102C temperature controller board or there is an open circuit in the connected thermocouple.	Turn control power OFF from the POWER key and resume testing. If the same alarm occurs again, call for service.
2nd	AL01 î 1 Î	The temperature inside the cabinet has risen above the upper deviation limit. The heater has been stopped until temperature returns within range.	Either specimens inside the cabinet are generating heat or the upper deviation limit is set too low.	Remove the heat-generating specimens and/or set the upper deviation limit about 10°C higher than the target temperature. When temperature returns within range, normal control is restored automatically. The alarm can be cleared by pressing the △ or ▽ key.

Cont.

Type	Displayed alarm code/channel code (option)	Trouble	Cause	Remedial action
1st	AL02 Ì 2 Î	The temperature inside the cabinet has risen above the absolute high limit. The cabinet has been stopped.	Either specimens inside the cabinet are generating heat or the absolute high limit is set too low.	Turn control power OFF from the POWER key. Then, remove the heat-generating specimens and/or set the absolute high limit about 15°C higher than the target temperature. Resume testing. If the same alarm occurs again, call for service.
1st	AL03 Ì 3 Î	The temperature inside the cabinet has dropped below the absolute low limit. The cabinet has been stopped.	Possible causes include infiltrating of outside air, excessive cooling, the effects of cooling sources inside the cabinet, and the absolute low limit being set too high.	Turn control power OFF from the POWER key and check the cabinet door and cable port. Reset the refrigerator control setting. If cooling sources are overcooling the cabinet, reduce their number. Also, correct the absolute low limit setting as necessary. Then, resume testing. If the same alarm occurs again, call for service.
1st	AL06 Ì 6 Î	The temperature inside the cabinet has risen above the overheat protector setting (instrumentation panel). The cabinet has been stopped.	Either specimens inside the cabinet are generating heat or the overheat protector is set too low.	Turn control power OFF from the POWER key. Remove the heat-generating specimens and/or correct the overheat protector setting. Resume testing. If the same alarm occurs again, it is possible that the thermal fuse has blown. Call for service.
1st	AL07 Ì 7 Î	The built-in temperature switch of the air circulator motor (water circuit [heat exhaust] compartment) tripped because the motor was abnormally hot. The cabinet has been stopped.	The air circulator motor is overloaded.	Leave the cabinet OFF until the air circulator cools down. Then, turn control power ON from the POWER key and resume testing.
1st	AL21 Ì 21 Î	Humidifier surface temperature rose and tripped the boil-dry protector. The cabinet has been stopped.	Humidifier surface temperature rose above the trip temperature.	Turn control power OFF from the POWER key and check water level in the humidifying tray water level regulator. Reposition the regulator as necessary and wait till the humidifier cools. Then, resume testing. If the same alarm occurs again, call for service.
2nd	AL22 Ì 22 Î	The humidity inside the cabinet has risen above the absolute high limit. Humidity control has been stopped until humidity returns within range.	The absolute high limit is set lower than the target humidity.	Set the absolute high limit about 10%RH higher than the target humidity. When humidity returns within range, normal control is restored automatically. The alarm can be cleared by pressing the △ or ▽ keys.

Cont.

Type	Displayed alarm code/channel code (option)	Trouble	Cause	Remedial action
2nd	AL23 î 23 Î	The humidity inside the cabinet has dropped below the absolute low limit. The heater has been stopped and refrigerator capacity decreased to the minimum (turned OFF in some cases) until humidity returns within range.	The absolute low limit is set higher than the target humidity.	Set the absolute low limit about 10%RH lower than the target humidity. When humidity returns within range, normal control is restored automatically. The alarm can be cleared by pressing the △ or ▽ keys.
2nd	AL26	During humidity testing, the wet-bulb (measures relative humidity) rose above the specified temperature. *This alarm can be triggered during operation at low temperature and high humidity or when the target humidity is changed. There is nothing wrong with the equipment. Silence the buzzer and continue testing.	Humidity control will continue as is, but humidity control might destabilize and trigger a humidity alarm.The wet-bulb wick (gauze) inside the cabinet may be dry.	Stop the cabinet and replace the wick. After wet-bulb temperature returns within the specified range, the alarm can be cleared by pressing the △ or ▽ keys.
		The water tank is empty. Humidity control will continue, but it will eventually stop unless water is replenished.	The water tank is empty.	Refill the portable (option) water tank and resume testing. After water has been sufficiently supplied to the main water tank, the alarm can be cleared by pressing the △ or ▽ keys. If the same alarm occurs again, call for service.
1st	AL99 î 99 Î	The instrumentation detected communication trouble between the CPU board and display board. The cabinet has been stopped.	Communication error between the CPU board and display board	Reactivate the system from the main power switch (leakage breaker) and resume testing. If the same alarm occurs again, call for service.
		The instrumentation detected system trouble in the display board. The cabinet has been stopped.	Display board error (i.e.: internal memory, etc.)	Reactivate the system from the main power switch (leakage breaker) and resume testing. If the same alarm occurs again, call for service.
		The instrumentation detected system trouble in the CPU board. The cabinet has been stopped.	Sequence task error on CPU board	Reactivate the system from the main power switch (leakage breaker) and resume testing. If the same alarm occurs again, call for service.
		The instrumentation detected system trouble in the CPU board. The cabinet has been stopped.	Refrigeration task error on CPU board	Reactivate the system from the main power switch (leakage breaker) and resume testing. If the same alarm occurs again, call for service.
		The instrumentation detected system trouble in the CPU board. The cabinet has been stopped.	Temperature control task error on CPU board	Reactivate the system from the main power switch (leakage breaker) and resume testing. If the same alarm occurs again, call for service.

7.2 Other Troubles

> **⚠ DANGER**
>
> - **ELECTRIC SHOCK! Before working on the power circuits on the primary side of the main power switch (leakage breaker), shut OFF primary power supply and check the line is dead. Also, take measures to prevent accidental charging.**
> Working with primary power supply ON runs the risk of electric shock.
> - **Shut OFF power from the main power switch (leakage breaker) BEFORE detaching the water circuit (heat exhaust) compartment panel.**

This section explains troubles undetected in cabinet self-checks and cases of misoperation which are easily mistaken as trouble. If the trouble cannot be remedied after taking the prescribed action, contact the place of purchase or ESPEC CORP.

Table 7.2 Other troubles

Trouble	Cause	Remedial action
The instrumentation panel does not light up after pressing the [POWER] key.	Primary power supply is OFF.	Activate the primary power supply.
The display goes out all of sudden or the displayed information is strange.	System trouble or internal board trouble	Switch the main power switch OFF and ON. If the same trouble reoccurs, call for service.
The door is hard to close.	Something is caught in the door.	Remove the obstruction.
	Frost has formed and hardened on the door packing.	Defrost the cabinet. See "7.3 User Practical Servicing".
	Internal pressure is high because the cabinet is hot and highly humid on the inside.	There is nothing wrong with the equipment. Proceed as planned.
The door is hard to open.	Internal pressure is lower than room pressure.	There is nothing wrong with the equipment. Proceed as planned.
	Frost has formed and hardened on the packing.	Defrost the cabinet. See "7.3 User Practical Servicing".
During operation below zero, icicles 5 cm or longer formed on the internal drain port, or the test area is covered in frost. (Not applicable to LH or LHL cabinets)	Outside air has infiltrated through the cable port.	Cover the cable port with the cap or rubber plug.
	Door packing is not properly sealing the door and frame, or packing has deteriorated.	Call for service.

Cont.

Strange noises are heard.	The condenser filter is clogged.	Clean the filter. See "6.3 Maintenance".
Strange odors are detected.	Lingering odors inside the cabinet	Clean the test area. See "6.3 Maintenance".
	Specimens are generated odors.	Remove the source of the odor.
The cabinet is wet on the outside.	The room is highly humid.	There is nothing wrong with the equipment. Proceed as planned.
Frost has formed on door hinges and around the door frame and viewing window. (Not applicable to LH or LHL cabinets)	The room is highly humid.	There is nothing wrong with the equipment. Proceed as planned.
Temperature (&humidity) is unstable.	The door is open.	Shut the door.
	The cable port is not covered.	Reattach cap or plug.
	Ambient temperature changes more than 5°C/hr.	Stabilize ambient temperature and resume testing.
	High heat load equipment is being turned ON/OFF.	Reduce the heat load.
Temperature gradually rises higher than the target temperature.	Specimen heat load is high.	Reduce the specimen heat load.
	Frost has formed on the cooler.	Defrost the cabinet (Not necessary for LH cabinets). See "7.3 User Practical Servicing".
Settings cannot be changed.	The keys are locked.	Unlock the keys. See "5.2 User Setup and Safety Device Options Setup".
Temperature heat-up/pull-down rate does not satisfy specifications.	The door is open.	Shut the door.
	Specimen heat load is high.	Reduce the amount of specimens.
	Ambient temperature too low (high).	Raise (Lower) ambient temperature.
Temperature stops rising or begins to drop during heat-up.	Frost has formed on the dehumidifying-cooler.	There is nothing wrong with the equipment. Defrost the cabinet, if necessary. See "7.3 User Practical Servicing."
Poor temperature uniformity	Air flow inside the cabinet is poor.	Rearrange specimens so as not block air flow.
	Specimen heat load is high.	Reduce the amount of specimens.
	Frost has formed on the cooler.	Defrost the cabinet (Not necessary for LH cabinet) See "7.3 User Practical Servicing".

7.3 User Practical Servicing

Defrosting

Frost may form on the cooler in temperature (humidity) operations below 30 ~ 40°C. Defrost the cabinet in the following cases.

- If temperature (& humidity) inside the cabinet is uncontrollable or rises slowly
- If air blown from the cabinet is weak (when the door is opened)
- If frost or ice form on test area walls
- If frost or ice form on the viewing window on the inside
- If frost forms on the cabinet door gasket and alarm “AL26” is displayed during temperature-humidity operation

Use this procedure to defrost packing as well.

Ü How to defrost cabinet

Procedure

1. Check the main power switch is in the ON position.
2. Set target temperature to 70°C and turn humidity control OFF (not necessary for LU cabinet).
3. Press one of the OPER./STOP keys.

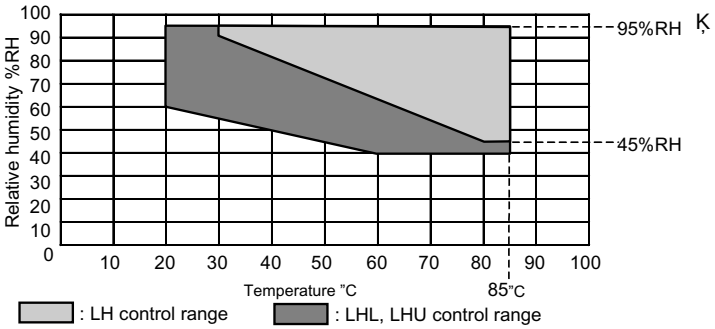
   Run the cabinet for about 60 minutes with the door closed, then for 15 minutes with the door slightly cracked.

Appendix

A. Major Specifications

Table A.1 Temperature and Humidity cabinet specifications

Model		LH-113	LHL-113	LHU-113
Temperature/humidity control system		Balanced temperature and humidity control system(BTHC system)		
Power supply		100V AC 1ϕ 50/60Hz		
Maximum current (A)		15		
Ambient temperature		Allowable operating range 0 40 ķ		
Performance *	Temperature-Humidity range	(Amb. Temp. + 10) 85°C /45 95%RH	5 85 ķ 40 95 RH	20 85 ķ 40 95 RH
	Temperature/ Humidity fluctuation	¢ 0.5 ķ ¢ 3 RH		
	Temperature/ Humidity uniformity	¢ 2 ķ ¢ 6 RH		
Construction	External	Cold-rolled rust-proof steel plate (Melamine baked finish)		
	Internal	18-8 Cr-Ni stainless steel plate		
	Insulation	Glass wool	Ridid polyurethane foam + Glass wool + Urethane board	
	Air circulator	Propeller fan		
	Heater	Nichrome stripped-wire heater		
	Humidifier	Sheathed heater		
	Refrigerator	Ġ	Air-cooled hermetically sealed (R134a)	
Temperature (and Humidity) controller	Operation modes	Program + Constant setting		
	Setter	Mechanical key input		
	Program memory capacity	1 program with 9 steps (Repeat cycles: 1 99)		
	Control principle	PID control		
	Communications	E-BUS (option), GP-IB (option), RS-232C (option)		
	Functions	Input burnout detection function, upper and lower temperature limit alarm function, self-diagnostic function(watchdog timer), alarm indication function, power cut protection function, timer function(automatic start/stop)		
Accessories		Drain filter x 2, cable port (ϕ25 mm), power cable (with 3-pole plug)		
Capacity (L)		Approx.105		
Inside dimensions (W x H x D mm)		500 ¨ 600 ¨ 390 (Excluding projections)		
Outside dimensions (W x H x D mm)		650 ¨ 1090 ¨ 805 (Excluding projections)		
Weight (kg)		Approx.85	Approx.95	Approx.100



- Performance values are given for +23°C ambient temperature and no specimens inside cabinet.
- LH-113 is without a dehumidifying-cooler. Therefore, temperature-humidity control range, and especially the low temperature range, will vary according to installation environmental conditions (ventilation, fluctuation in room temperature/humidity, etc.).
- Performance figures are based on JTM K 01-1998 (Humidity chambers-test and indications method for performance by Japan Testing Machinery Association).

Table A.2 Low Temperature Cabinet specifications

Model		LU-113
Temperature control system		Balanced temperature control system(BTC system)
Power supply		100V AC 1ϕ 50/60Hz
Maximum current (A)		9
Ambient temperature		Allowable operating range 0 40 ķ
Performance *	Temperature range	20 85 ķ
	Temperature fluctuation	¢ 0.5 ķ
	Temperature uniformity	¢ 2 ķ
Construction	External	Cold-rolled rust-proof steel plate (Melamine baked finish)
	Internal	18-8 Cr-Ni stainless steel plate
	Insulation	Ridid polyurethane foam + Glass wool + Urethane board
	Air circulator	Propeller fan
	Heater	Nichrome stripped-wire heater
	Refrigerator	Air-cooled hermetically sealed (HFC134a)
Temperature controller	Operation modes	Program + Constant setting
	Setter	Mechanical key input
	Program memory capacity	1 program with 9 steps (Repeat cycles: 1 99)
	Control principle	PID control
	Communications	E-BUS (option), GP-IB (option), RS-232C (option)
	Functions	Input burnout detection function, upper and lower temperature limit alarm function, self-diagnostic function(watchdog timer), alarm indication function, power cut protection function, timer function(automatic start/stop)
Accessories		Drain filter x 2, cable port (ϕ25 mm), power cable (with 3-pole plug)
Capacity (L)		Approx.105
Inside dimensions (W x H x D mm)		500 ¨ 600 ¨ 390 (Excluding projections)
Outside dimensions (W x H x D mm)		650 ¨ 1090 ¨ 805 (Excluding projections)
Weight (kg)		Approx.90

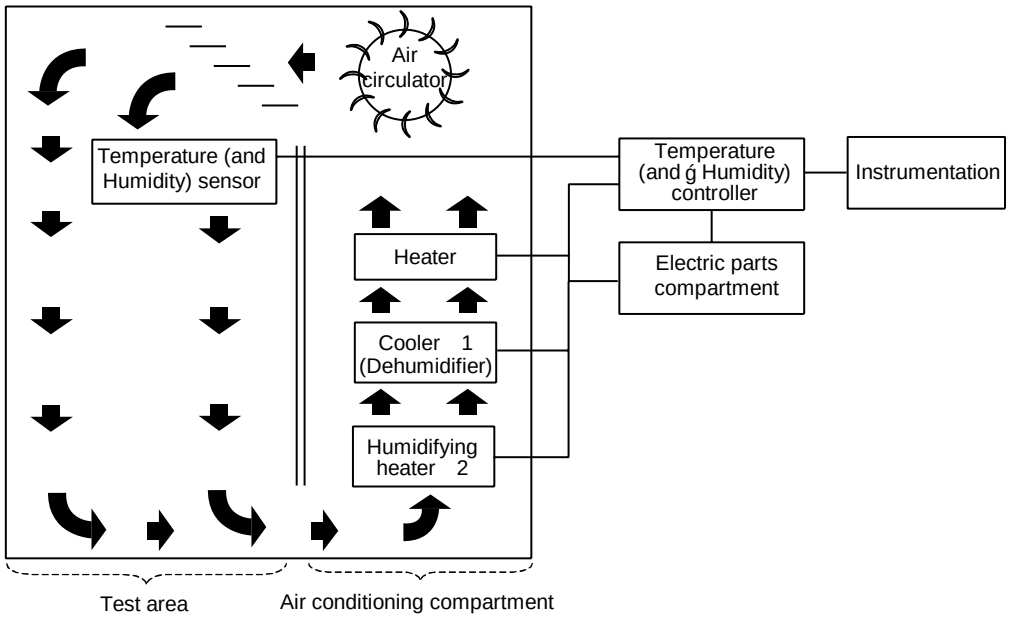
ĶĶ • Performance values are given for +23°C ambient temperature and no specimens inside cabinet.
• Performance figures are based on JTM K 01-1998 (Humidity chambers-test and indication method for performance by Japan Testing Machinery Association).

B. Temperature (Humidity) Control

Temperature (and Humidity) Control

The temperature (and humidity) cabinet employs a BTHC (Balanced Temperature [and Humidity] Control) system to control temperature (and humidity).

The BT(H)C system balances temperature (and humidity) inside the cabinet in order to reproduce the desired conditions. This is done by continuously controlling the capacity of a heater of low heat load and a humidifying heater [2], in real-time. The central unit which controls everything is the temperature (and humidity) controller. The instrumentation acts as the user interface.



1 Not provided on LH cabinet.
2 Not provided on LU cabinet.

Fig. B.1 Principle of BTHC system

C. Parts Construction

Table C.1 Parts construction

Material	Qty.	Where used
Metals (Some names are generalized.)		
18-12-2.5 Cr-Ni-Mo stainless steel	0.6kg	Humidifying heater
18-8 Cr-Ni stainless steel	28.4kg	Test area
Steel	52.6kg	Cabinet stand, mechanical parts compartment, outer shell
Copper	4.5kg	Refrigerator piping
Brass	0.2kg	Piping couplings
Aluminum	2.5 kg	Evaporator, condenser
Synthetics		
Plastic	5.0 kg	Wiring, insulation
Rubber	0.8 kg	Packing, tubing, bushings
Urethane	1.1 kg	Insulation
Glass wool	0.3 kg	Insulation
Refrigerant	0.2 kg	Refrigeration circuit

(For LHU-113)

D. Consumable Parts and Replacement Interval

The below parts must be replaced periodically. Promptly replace them at the specified interval if not sooner.
Maintenance service is also provided by ESPEC ENGINEERING CORP.
For spare parts and servicing, contact the place of purchase, ESPEC ENGINEERING CORP. or ESPEC CORP.

Table D.1 Consumable parts and replacement interval

Part	Replacement interval	Replacement procedure
Wet-bulb wick	After temperature tests or every month	See "4.1 Test Preparations".
Door packing	3 years	Contact the place of purchase or ESPEC CORP.

E. Options

The following options are available for temperature (and humidity) cabinets. They effectively amplify cabinet applications and make operation that much easier. For options and cabinet compatibility, contact the place of purchase or ESPEC CORP.

Safety Devices

Specimen power supply control terminal

A terminal used to charge specimens, which is interlocked with the cabinet power circuit so that power to specimens is shut OFF through a contact (open) in the event of cabinet trouble.

Communications

Communication function

Enables cabinet operation and management from a cable-connected PC station, etc.

E-BUS

GP-IB

RS-232C

Communications cable

Cable used for communicating with PCs, etc.

E-BUS : Select between 5 and 10 m types.

GP-IB : Select from 2 and 4 m types.

RS-232C : Select between 1.5, 3, 5 and 10m types

Auxiliary & Installation

Thermocouple

Measures specimen temperature, etc.

Thermocouple type T (Copper/Copper-Nickel) with brass ball. Select between 2, 4, and 6 m types.

Wet-bulb wick

Same as those included in the product package

Cable port

Through holes opened on the cabinet top, right or left side for charging specimens, etc.

ϕ25, ϕ50, ϕ100 mm

Cable port rubber plug

Rubber plug for plugging up cable port.
φ25, φ50, φ100 mm

Shelf and shelf brackets

Same as those included with the cabinet.

Inner door

Glass door that allows specimen viewing from the outside. Standard performance specifications are not satisfied because of the inner door modification.

Portable water tank

Replenishes water supply in the standard water tank (inside cabinet). Hose and valve included.

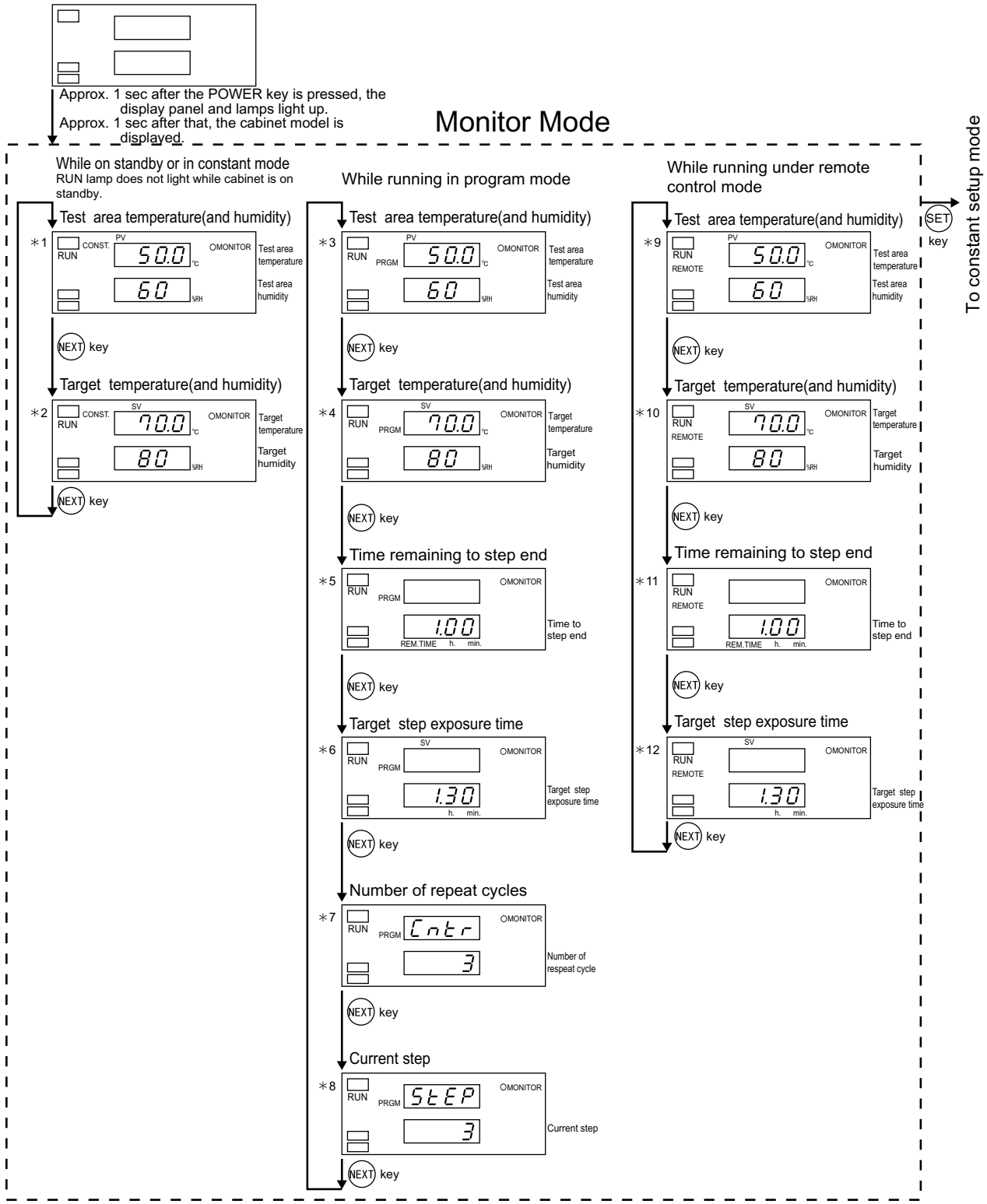
Casters

4 free-wheeling casters with foot adjuster.

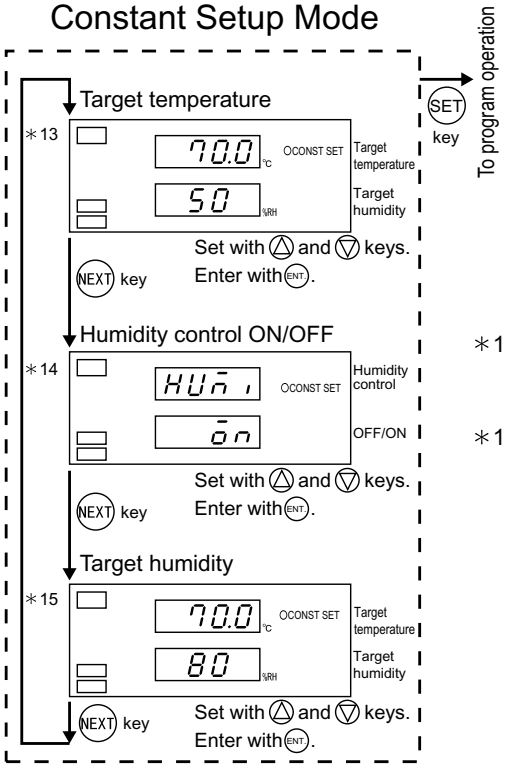
Cabinet stand

Stand for holding the cabinet.

F. Instrumentation Displays



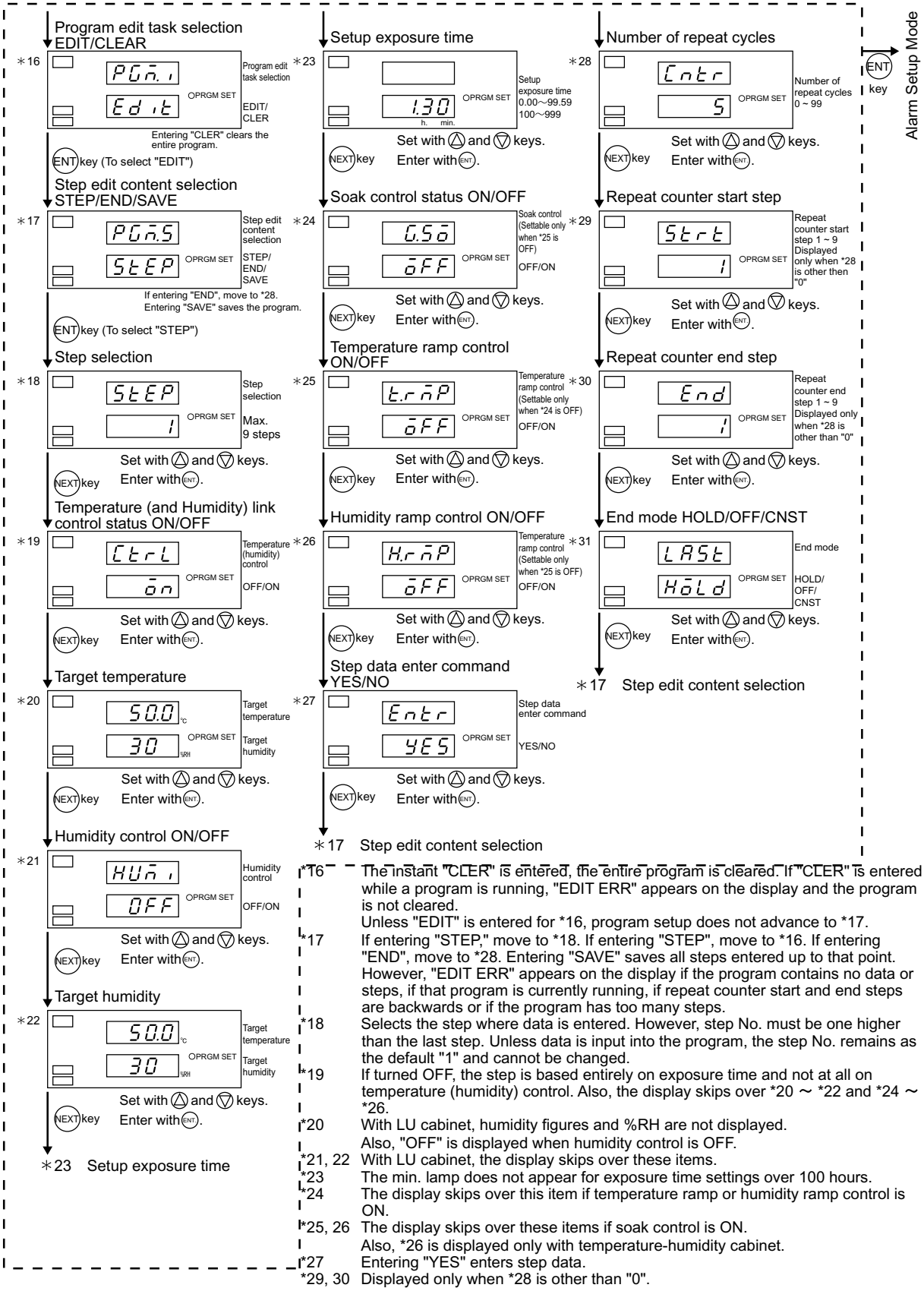
∗1,2,3,4,9,10 With LU cabinet, humidity figures and %RH are not displayed.
∗2. The target temperature is not displayed when the cabinet is on standby or running in the constant mode.
∗5,6,11,12 The min. lamp does not appear for exposure time settings over 100 hours.
∗5～8 "----" is displayed when a running program is stopped.
∗7 This monitor item is automatically skipped if "0" was set for the number of repeat cycles.
∗11～12 "----" is displayed when a program running under remote control is stopped.



∗13 With LU cabinet, humidity figures and %RH are not displayed.
"OFF" is displayed with humidity control is OFF.

∗14,15 These monitor items are automatically skipped with LU cabinets or when OFF is selected.

Program setup



*16 The instant "CLER" is entered, the entire program is cleared. If "CLER" is entered while a program is running, "EDIT ERR" appears on the display and the program is not cleared.
Unless "EDIT" is entered for *16, program setup does not advance to *17.

*17 If entering "STEP," move to *18. If entering "STEP", move to *16. If entering "END", move to *28. Entering "SAVE" saves all steps entered up to that point. However, "EDIT ERR" appears on the display if the program contains no data or steps, if that program is currently running, if repeat counter start and end steps are backwards or if the program has too many steps.

*18 Selects the step where data is entered. However, step No. must be one higher than the last step. Unless data is input into the program, the step No. remains as the default "1" and cannot be changed.

*19 If turned OFF, the step is based entirely on exposure time and not at all on temperature (humidity) control. Also, the display skips over *20 ～ *22 and *24 ～ *26.

*20 With LU cabinet, humidity figures and %RH are not displayed.
Also, "OFF" is displayed when humidity control is OFF.

*21, 22 With LU cabinet, the display skips over these items.

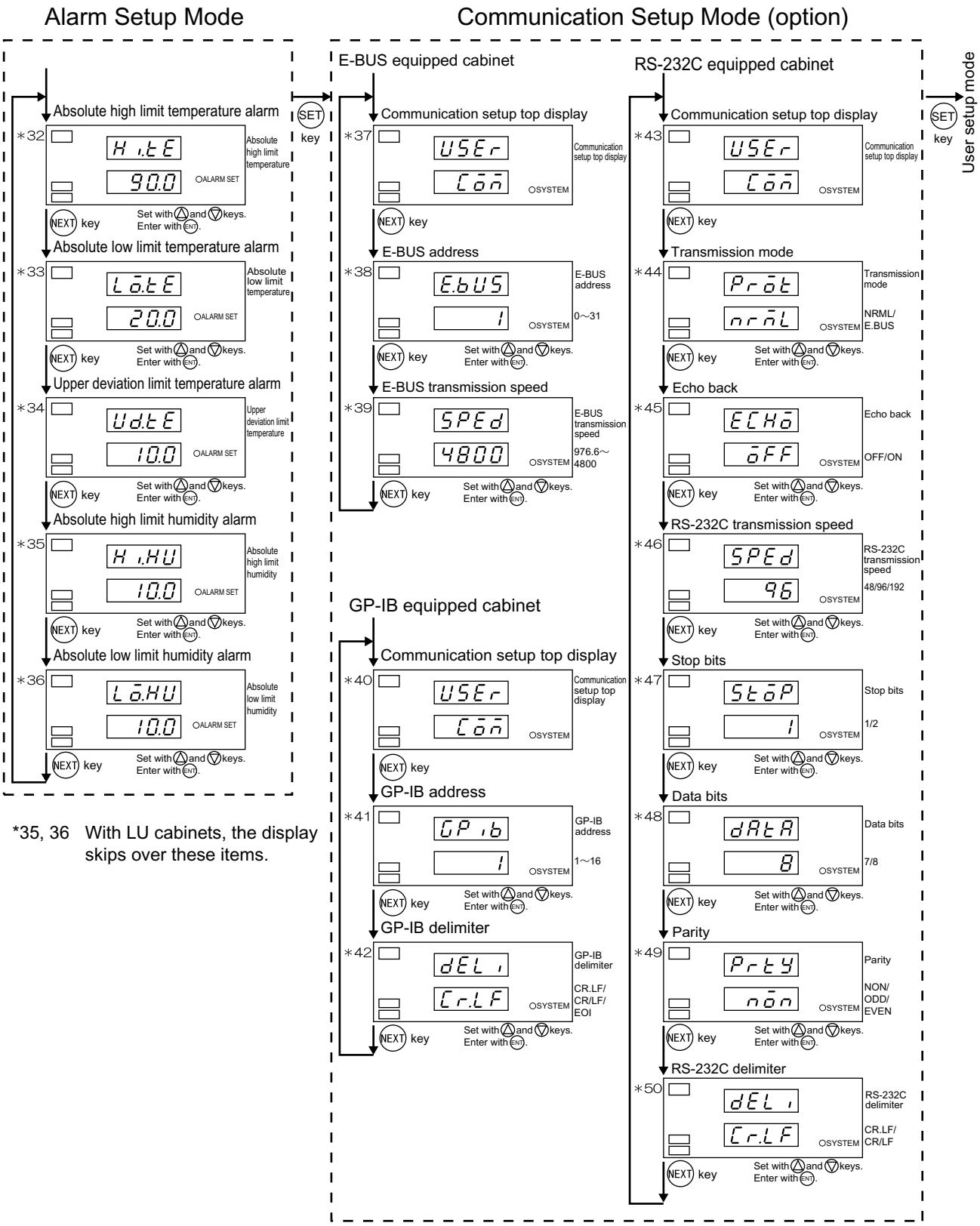
*23 The min. lamp does not appear for exposure time settings over 100 hours.

*24 The display skips over this item if temperature ramp or humidity ramp control is ON.

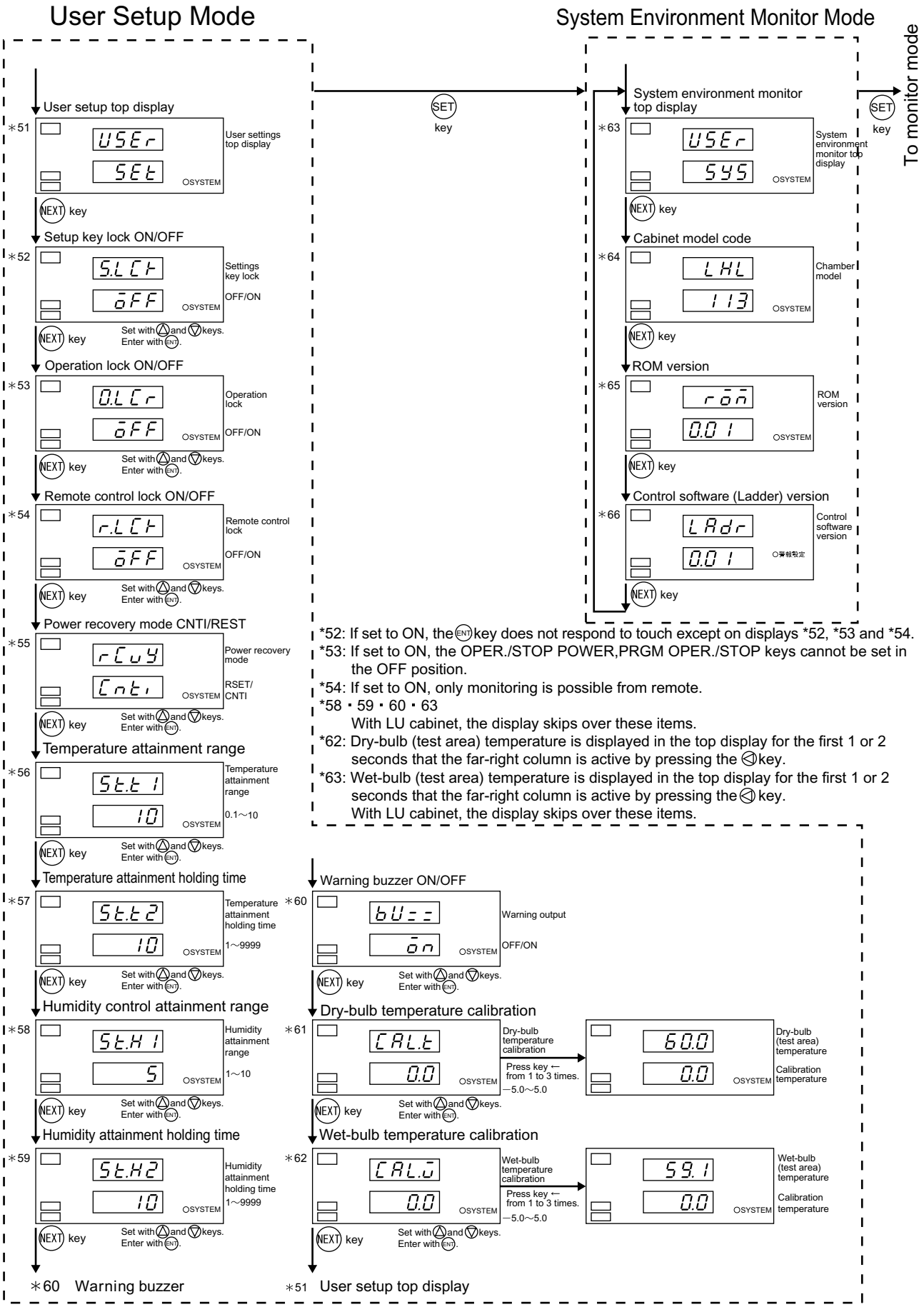
*25, 26 The display skips over these items if soak control is ON.
Also, *26 is displayed only with temperature-humidity cabinet.

*27 Entering "YES" enters step data.

*29, 30 Displayed only when *28 is other than "0".



*35, 36 With LU cabinets, the display skips over these items.

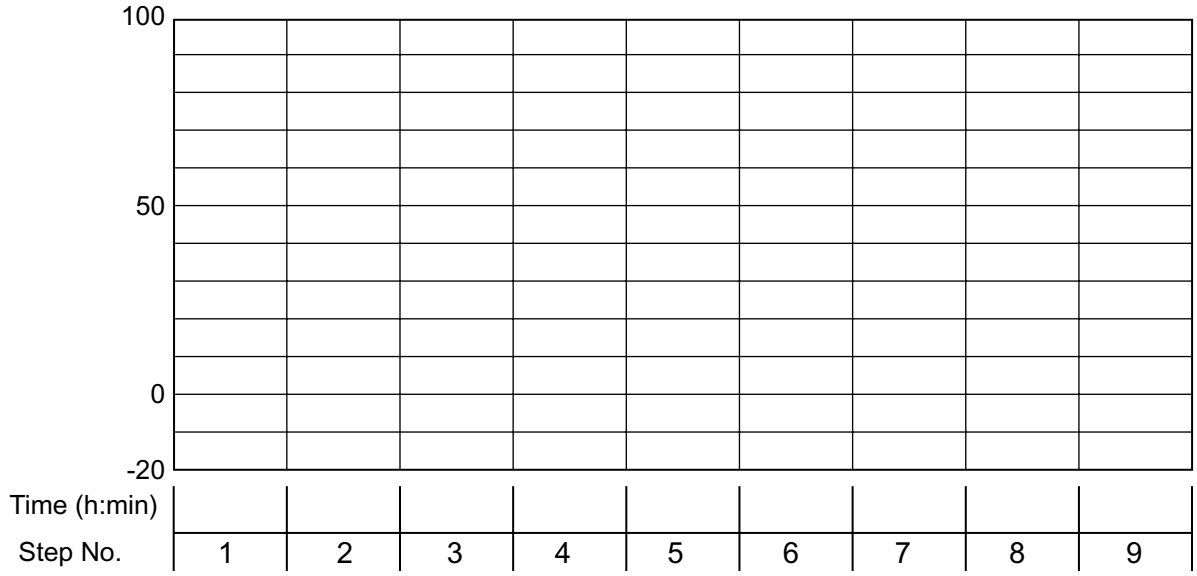


*52: If set to ON, the ENT key does not respond to touch except on displays *52, *53 and *54.
*53: If set to ON, the OPER./STOP POWER,PRGM OPER./STOP keys cannot be set in the OFF position.
*54: If set to ON, only monitoring is possible from remote.
*58・59・60・63
With LU cabinet, the display skips over these items.
*62: Dry-bulb (test area) temperature is displayed in the top display for the first 1 or 2 seconds that the far-right column is active by pressing the ◁ key.
*63: Wet-bulb (test area) temperature is displayed in the top display for the first 1 or 2 seconds that the far-right column is active by pressing the ◁ key.
With LU cabinet, the display skips over these items.

G. Program Sheet

To create your programs on paper, copy this page and fill in the information as necessary.

Temperature (℃) /
Humidity (%RH)



Step No.	1	2	3	4	5	6	7	8	9
Temperature and humidity link control									
Target temperature									
Humidity control ON/OFF									
Target humidity									
Step exposure time									
Soak control									
Temperature ramp control									
Humidity ramp control ON/OFF									

Repeat setup	Number of repeat cycles ( ) Start step ( ) → End step ( )
End mode setting	○ HOLD ○ OFF ○ CNST

User's Manual

Temperature and Humidity Cabinet & Low Temperature Cabinet

LH-113, LHL-113,
LHU-113, LU-113

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