

PHCbi

Operating Instructions Controller MLC-AC0



NOTICE:

This product functions as a live cell metabolic analyzer in combination with the MLC-AD240A (detector). For proper handling and operation of the detector, please refer to these operating instructions in addition to the detector's operating instructions.

Please read the operating instructions carefully before using this product and keep the operating instructions for future use.

See page 130 for the model number.

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1. BEFORE USING

INTRODUCTION

- Read the operating instructions carefully before using the product and follow the instructions for safe operation.
- PHC Corporation takes no responsibility for safety if the product is not used as intended or is used with any procedures other than those given in the operating instructions.
- Keep the operating instructions in a suitable place so that they can be referred to as necessary.
- The operating instructions are subject to change without notice for improvement of performance or function.
- Contact our sales representative or agent if any page of the operating instructions is lost or the page order is incorrect, or if the instructions are unclear or inaccurate.
- No part of the operating instructions may be reproduced in any form without the express written permission of PHC Corporation.

IMPORTANT NOTICE

PHC Corporation guarantees this product under certain warranty conditions. However, please note that PHC Corporation shall not be responsible for:

- any indirect damage caused by data damage or loss
- any accident or damage caused by incorrect installment or handling of the controller

<Intended Use>

This product is designed for the continuous measurement of the glucose concentration and lactate concentration in a culture medium during animal cell culture. This product cannot be used for diagnostic purposes.

<Trademarks>

- Windows is a trademark or registered trademark of Microsoft Corporation in the United States and other countries.
- Intel Core is a trademark of Intel Corporation in the United States and other countries.
- COSTAR and FALCON are registered trademarks of CORNING Incorporated.
- CELLSTAR is a registered trademark of Greiner Bio-One.
- NUNC is a trademark of Thermo Fisher Scientific Inc. of U.S. in the United States and other countries.
- SUMILON is a registered trademark of Sumitomo Bakelite Co., Ltd.

SAFETY PRECAUTIONS

Be sure to observe the operating instructions as they contain important safety advice. If the product is used in a manner not specified by the operating instructions, the protection provided by the product may be impaired.

For correct and safe use of the product, follow the precautions and procedures in these operating instructions carefully. Failure to do so could result in injury or damage to the product.

Precautions are illustrated in the following way:












WARNING

Warning indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.

CAUTION

Failure to observe CAUTION signs could result in injury to personnel and damage to the product and associated property.

The following symbols are used in this document and some of them are attached to the product.

	Actions are prohibited.
	Actions are mandatory.
	Caution must be taken.
	This symbol indicates a risk of an electric shock by touching the product with wet hands.
	This symbol indicates a risk of an electric shock by an electric leakage caused by a wet product.
	This symbol indicates a risk of injuries such as an electric shock caused by disassembling the product.
	This symbol indicates that the user must disconnect the mains plug for the purposes of maintenance, in the case of malfunction or when left unattended.
	This symbol indicates an earth terminal. Connect the earth terminal to the ground to prevent an electric shock.
	This symbol indicates a potential danger or risk by biohazardous material. Ce symbole indique un danger ou un risque potentiel dû à des matières présentant un danger biologique.
	This symbol indicates the power-on switch.
	Read the operating instructions carefully before using the product.

SAFETY PRECAUTIONS

THE FOLLOWING APPLIES ONLY IN THE U.S.A.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Note:

This product has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the product is operated in a commercial environment. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this product in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Importer (U.S.A. only)

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THE FOLLOWING APPLIES ONLY IN CANADA.

CAN ICES-003(A)/NMB-003(A)

For the State of California, USA Only:

This product contains a CR Coin Cell Lithium Battery which contains Perchlorate Material – special handling may apply. See www.dtsc.ca.gov/hazardouswaste/perchlorate.

⚠ WARNING

Installation

Controller



- **Do not install the controller in a humid place or a place with oil/water mist.**
Installing it in such a place (e.g., near a humidifier) may cause a fire or an electric shock.
- **Do not install the controller in a place with inflammable/volatile substance.**
It may cause a fire or explosion.
- **Do not install the controller in a place with corrosive gas such as acid.**
Corrosion may degrade the insulation of electric components, causing electric leakage or an electric shock.
- **Do not leave the plastic bags for packing in a place where children can access.**
They may pull the plastic bag over their head, causing suffocation.



- **Handle the DC power cable of the AC adapter and AC power cable carefully.**
Putting the controller stand on them or bending/twisting them excessively may cause a short circuit or disconnection of a wire, which may lead to a fire or an electric shock.
- **Use a dedicated power source that satisfies the specification indicated on the rating label on the AC adapter.**
Using a power source that deviates from the voltage or frequency indicated on the rating label may cause a fire or an electric shock. Also, putting too many plugs in one outlet may cause a fire due to excessive power consumption.



- **Use a three-pole outlet with a grounding pole to prevent an electric shock.**
Otherwise, deterioration of insulation may cause an electric shock.
- **Do not connect the grounding wire to a gas pipe, water pipe, lightning rod, or the grounding wire of a telephone.**
It may cause an electric shock.

Detector



- **Do not install the detector at a place higher than your eye level.**
You may not see the sensor module assembly on the tray well, which may result in accidentally spilling the culture medium on your body, harming your body.



- **Before connecting the detector to the controller, turn off the controller and pull out the power plug from the outlet.**
Otherwise, you may have an electric shock or get injured when you inadvertently touch an electric part.
- **Make sure that the detector cable and the connection cable are connected properly.**
Otherwise, inadequate connection may cause a fire or an electric shock.
- **Handle the connection cables carefully.**
Putting the controller on them or bending/twisting them excessively may cause a short circuit or disconnection of a wire, which may lead to fire or an electric shock.
- **When you handle a harmful reagent, handle it in an isolated facility prepared for such operations.**
Otherwise, an improper use may cause harm to the human body or natural environment.

SAFETY PRECAUTIONS

WARNING

AC adapter, power plug, and cables



- **Use only the AC adapter and AC power cable that came with the controller.**
Using other AC adapters or AC power cables may cause a fire or an electric shock.
- **Do not use the AC adapter and AC power cable that came with the controller for other electric devices.**
It may cause a fire or an electric shock.
- **Do not handle the DC power cable or AC power cable in a way that damages it (e.g., scratching, modifying, putting it close to a heat source, bending with force, twisting, pulling, adding weight, or binding).**
Using the damaged DC power cable or AC power cable may cause fire or an electric shock. Consult our services agency when you want to repair the DC power cable or AC power cable.
- **Do not install the controller or other equipment in a position that impedes disconnection of the power plug.**
You may not be able to power off the controller or equipment in emergency situations, leading to a fire.
- **Avoid strong impact to the AC Adaptor.**
You may have a fire or electric shock if you continue to use the AC adapter after it was dropped or damaged.



- **Do not insert or pull out the power plug, the plug to the AC adapter, or the connector of the DC power cable with wet hands.**
It may cause an electric shock.



- **Remove dust from the power plug periodically.**
Dust accumulated on the plug deteriorates insulation in a humid atmosphere, which may cause a fire. Pull out the power plug and wipe it with a dry cloth.
- **When inserting the power plug, the plug to the AC adapter, or the connector of the DC power cable, insert them fully.**
Inadequate insertion may cause an electric shock or fire. Do not use damaged or loose plugs or connectors.
- **Insert the power plug into an outlet that is easily accessible.**
Otherwise, you may not be able to power off the product in emergency situations, leading to a fire.



- **When moving the product, disconnect the power plug from the outlet, and be careful not to damage the AC power cable.**
Otherwise, you may have an electric shock or fire.
- **Before cleaning, maintenance, or checkup, turn off the product and pull out the power plug.**
Otherwise, you may have an electric shock or injury.
- **When you pull out the power plug, the plug to the AC adapter, or the connector of the DC power cable, hold the plug or the connector at the end of the cable.**
Pulling the cable may cause an electric shock.

⚠ WARNING

When using the product

Controller



- **Protect from strong vibration or impact when moving or operating the controller.**
Strong vibration or impact damages the controller and may cause a fire.
- **Do not put any foreign objects such as a pin or metal piece into any gap or hole of the controller.**
It may cause an electric shock or injury by accidental contact with moving parts.
- **Do not lay down or place the controller upside down while the power is on.**
The heat accumulated inside may cause a fire.
- **Do not touch the controller or power cable when thunder is heard.**
It may cause an electric shock.



- **Do not spill water directly over the controller.**
Spilled water may cause an electric shock or fire.



- **Unplug the controller, when a foreign object or liquid such as water entered inside the controller, the controller fell to the ground, or the exterior was damaged.**
If you continue to use it under a defective condition, it may cause a fire or other problems. Contact our sales representative or agent right away for inspection and repair.

Detector



- **Protect from a strong vibration or impact when moving or operating the detector.**
Strong vibration or impact damages the detector and may cause a fire.
- **Do not put any foreign objects such as a pin or metal piece into any gap or hole of the detector, or the inside of the detector when the detector tray is pulled out.**
It may cause an electric shock or injury by accidental contact with moving parts.



- **Do not use the detector when a foreign object or liquids such as reagents have spilled into the detector or when the detector fell to the ground.**
If you continue to use it under a defective condition, it may cause a fire or other problems. Contact our sales representative or agent right away for inspection and repair.



- **Do not spill water directly over the detector.**
Spilled water may cause an electric shock or fire.



- **When you open or close the detector tray, open or close it carefully.**
If you open or close the tray quickly, the culture medium may overflow inside the sensor module assembly and enter inside the detector, causing contamination.
- **When installing the detector in the CO₂ incubator, do not put any objects on incubator trays set above the detector.**
If a culture medium spills, it may enter inside the detector, causing contamination or a fault.

When using reagents and samples



- **Wear appropriate protective gear such as gloves and glasses when you handle hazardous substances such as lactate solution.**
A lactate solution causes a serious injury if it comes contact with your skin or eyes.



- **Observe the laboratory biosafety guidelines issued by WHO.**
In addition to the precaution described here, refer to the laboratory biosafety guidelines issued by WHO. This product is assumed to be used in a laboratory at biosafety level 2 or lower.
- **Wear appropriate protective gear when handling a potentially infective sample or a product that may had contact with such a sample.**
Touching them directly may cause infection.
- **Clean the parts that might have come into contact with a potentially infective sample.**
An infective sample left on the surface of the parts may cause infection.

SAFETY PRECAUTIONS

WARNING

When something is wrong with the product



- **When an error occurs, power off the product immediately and pull out the power plug.**
If you continue to use it under a defective condition, it may cause a fire or other problems. Contact our sales representative or agent right away for inspection and repair.



- **Do not disassemble or modify the controller, AC adapter, or detector.**
It may cause an electric shock. Contact our sales representative or agent for the inspection or repair.

When storing and disposing of the product



- **If the product will not be used for a long time, remove the detector from the CO₂ incubator, and pull out the power plug from the outlet.**
Otherwise, the deterioration of insulation may cause an electric shock, electric leakage, or fire.



- **Ask a qualified contractor to disassemble or dispose of the products. Do not leave the product in a location that can be accessed by third parties.**
Otherwise, an unexpected accident (by unintended use, etc.) may happen.



- **Observe the ordinances or regulations of the local government when disposing of the products that had contact with an infectious sample.**
Otherwise, it may cause infection.

⚠ CAUTION

Controller



- **Do not place the controller in an unstable position such as on top of the CO₂ incubator.**
The controller may fall over or drop, causing injury.
- **Do not push hard or give a shock to the controller screen.**
The display may be damaged, causing injury.
- **Do not press a sharp-pointed object on the controller screen or scrub it with a hard object.**
The display may be damaged, causing injury.
- **Do not touch the controller screen if it has a crack or scratch.**
You may be injured.
- **Do not lay connection cables in a traffic area.**
People may trip over the cable, and it causes the connected products to fall or drop, leading to injury.



- **Do not stare at the screen for a long time.**
You may have eye fatigue.
Examples of measures against fatigue:
 - Blink intentionally and take a rest.
 - Look at a far point or move your eyeballs to loosen and stretch muscles around.
 - Cover your eyes with a steamed towel or a hot eye mask to improve blood circulation.
 - Adjust the angle and height of the screen to your eye level.
 - Adjust the brightness of the screen to the appropriate levels.



- **Hold the controller with both hands when you carry the controller.**
Otherwise, you may be injured if you drop it.
- **When you move the controller, be careful not to fall or drop it.**
Otherwise, you may be injured.
- **When you adjust the angle of the controller screen, be careful not to pinch your fingers.**
Otherwise, you may be injured.

Detector



- **Be sure to wear gloves when you clean the detector.**
Otherwise, you may be injured by the parts inside the detector.
- **Do not insert your hand in the opening of the detector tray.**
You may be injured by the parts inside the detector.
- **Hold the detector with both hands when you carry the detector.**
Otherwise, you may be injured when you drop it.
- **Confirm that the CO₂ incubator tray is strong enough to bear the weight of the detector.**
Otherwise, the tray may collapse to cause injury.



- **Before moving the detector, take the sensor module assembly out of the detector.**
Otherwise, the sample may spill within the detector, contaminating the detector. Also, a spilled sample may pass infection to humans.
- **Make sure to clean the detector before storing or transporting it.**
A contaminated detector may cause infection to humans.



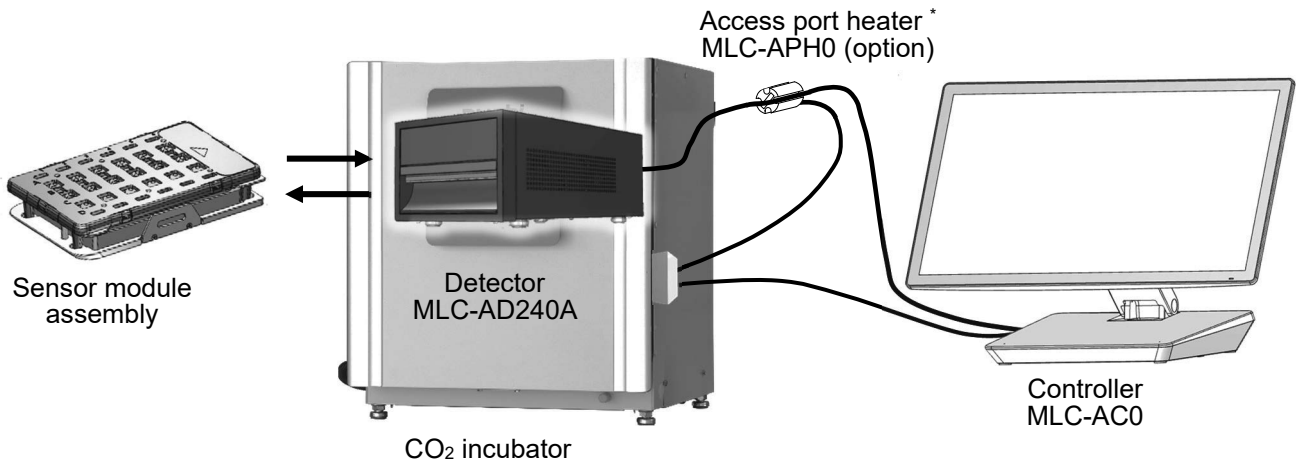
- **Be careful not to pinch your fingers when you close the detector tray.**
Otherwise, you may be injured.

SYSTEM OVERVIEW

Live cell metabolic analyzer consists of a detector (MLC-AD240A) for measuring culture medium and a controller (MLC-AC0) for controlling the detector.

The detector is installed in a CO₂ incubator and connected to the controller by a connection cable. Up to four detectors can be connected to one controller. In the detector, the sensor module assembly with the culture medium to be measured is set.

To prevent condensation around the access port on the CO₂ incubator, the optional access port heater is available (only for CO₂ incubators from PHC).



* The access port heater can only be used for CO₂ incubator from PHC.

Main features

- **Continuous visualization of cellular metabolism changes**

The proprietary high-precision in-line sensor enables the continuous and real-time measurement of glucose that the cultured cells consume to proliferate and differentiate and lactate that is produced in that process. The measurement is made without sampling, so that the measured cells can be reused for a different test.

- **Enables measurements in the usual culture environment.**

Attach the sensor module and the plate adapters to the 24-well plate that you always use and install it in the chamber of the CO₂ incubator. Also, you can use commercially available consumables (culture medium, 24-well plate, calibration liquid, and added reagent) necessary for culture.

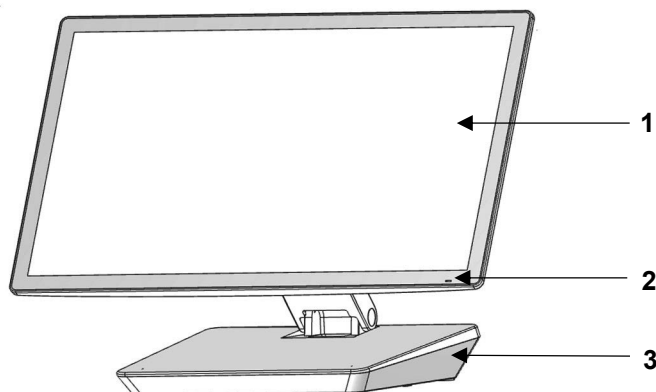
- **Glycolysis can be measured directly by the changes in glucose and lactate concentration.**

Changes in glycolysis can be directly evaluated by measuring the concentrations of the consumed glucose and produced lactate by cells in the culture medium.

COMPONENTS

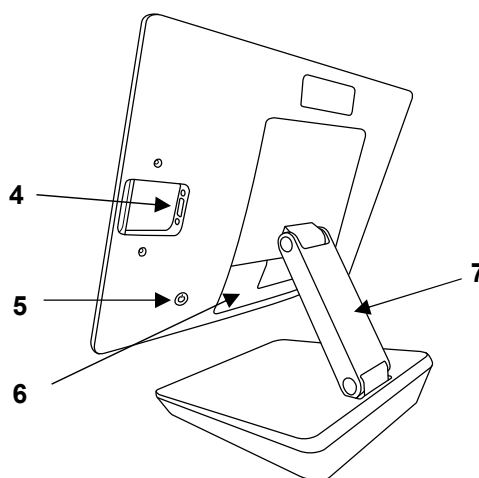
Controller components

Front

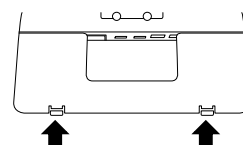


1. **Display**
Used to operate the controller and the detector and to view measurement data. A touch screen is employed for easy operation.
2. **Power LED**
When the display is turned on: Blue
When the display is turned off: Orange
When the power plug is not inserted in the outlet: Off
3. **Stand**
The stand contains a hub inside (see page 14).

Rear

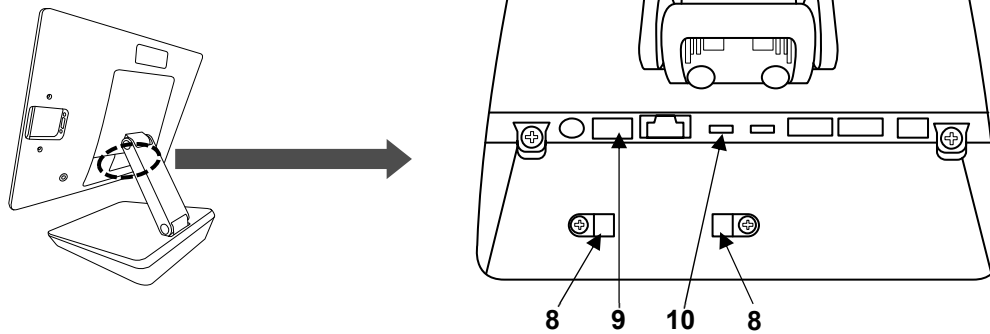


4. **USB port (for data export)**
Insert a USB flash drive here to export data stored in the controller.
Notes:
 - Supported USB flash drives are those without a password function and with an available space of 1 GB or more.
 - We do not guarantee the correct operation of all USB flash drives even if the above condition is satisfied.
 - Do not insert a device other than USB flash drives in the USB port.
5. **Power-on switch**
Use this switch to turn on the controller. To turn off the controller, use the Power Off button displayed on the screen (see page 35).
6. **Cable cover**
It covers the ports on the rear. Remove it by pushing the clicks (▲) on the left and right of the cover.
To set the cover, insert its top first, and then lock the clicks.
7. **Stand neck**
Use the stand neck to adjust the display angle. Run the DC power cable and the hub cable through the stand neck.



COMPONENTS

Ports on the rear



8. Cable clamps

Used to fix the DC power cable of the AC adapter and the hub cable.

9. Power supply port

Connect the DC power cable of the AC adapter.

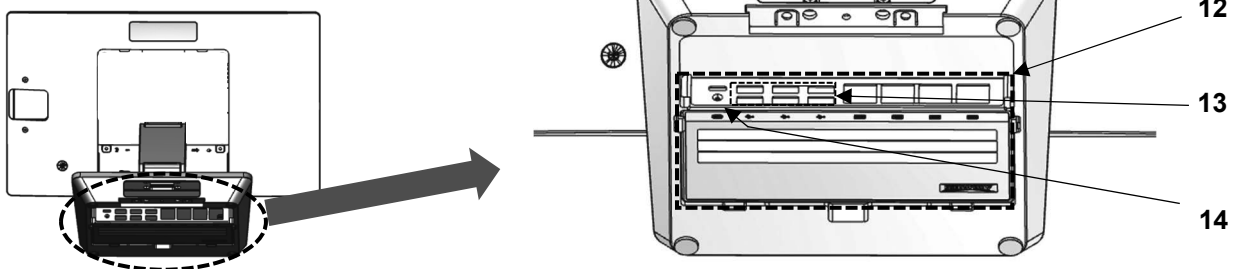
10. USB port for hub

Connect the hub cable from the hub located in the stand.

Note:

Ports other than the power supply port and the USB port for hub are not used.

Inside of stand



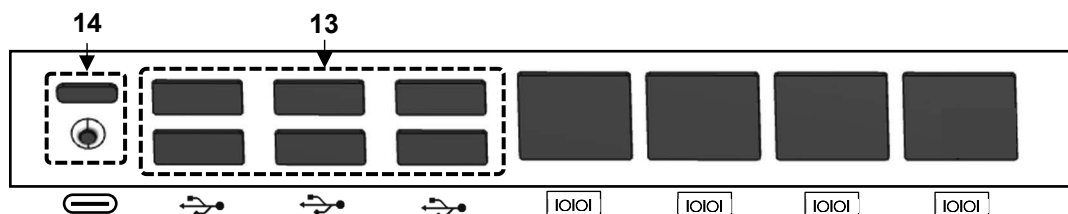
11. Stand cable hole

Opening for running the cables from the detector and access port heater (option) through the stand.

12. Hub

Used for connecting the controller, detector, and access port heater (option).

Hub port



13. USB ports (for detector and access port heater)

Connect the USB cables from the detector and the access port heater (option).

14. Type-C port and screw hole for fixing the connector

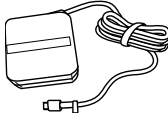
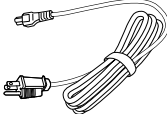
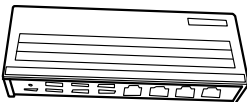
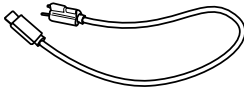
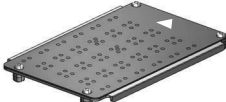
Type-C port to which the DC power cable of the AC adapter is connected and a screw hole for fixing the connector.

Note:

Ports other than the Type-C port and the USB ports are not used.

Controller accessories

Check that the following accessories are included with the controller. If anything is missing, contact our sales representative or agent.

Part name	Quantity	Appearance
AC adapter	1	
AC power cable	1	
Hub	1	
Hub cable	1	
Check module	1	

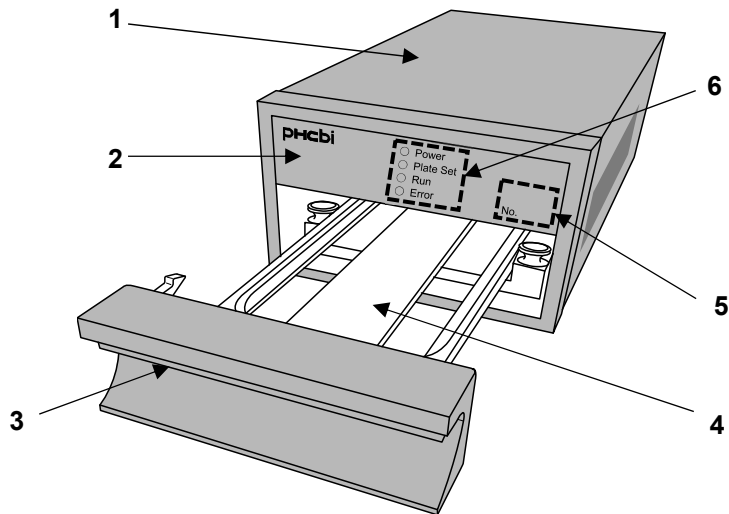
Precautions when using the controller display

- Excessively bright or dark screen may damage your eyes. Adjust the brightness of the display depending on the condition of your environment (see page 121).
- Note that you may have eye fatigue if you continue to look at the display for a long time.
- Do not give an impact on or push the display hard. The display may break down.
- Do not touch the screen with a hard or sharp tip of an object such as a ballpoint pen for screen operation.
- The LCD panel displays images using light emitted from the backlight. However, the backlight has a limited length of life. Contact our sales representative or agent if the screen becomes dark, unstable, or non-functional.
- If the screen displays the same content for a long time, the screen may have a burn. We recommend that you use the screensaver, turn off the controller when it is not used, or take other measures.
- You may find unevenness of color or brightness depending on the angle of vision or temperature changes. Such conditions are not a fault or defect of the controller. Please note that they are not subject to repair or replacement.
- The LCD may have a dark dot defect (black point) or a bright dot defect (point of excessive luminance). Such conditions are not a fault or defect of the controller. Please note that they are not subject to repair or replacement.

COMPONENTS

Detector components

Front and tray



1. Housing

The housing covers the detector. There are ventilation openings on the sides of the housing. Do not block the ventilation openings when you install the detector.

2. Front panel

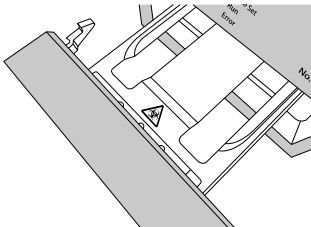
The detector status and detector ID number are indicated on the front panel.


3. Tray trigger

Pull the tray trigger toward you to draw the tray out.

4. Tray

Put the sensor module assembly (or check module assembly) on the tray.



 WARNING	<p>The sensor module assembly may include a potentially infective sample. Clean the tray when such a sample has been attached to the tray.</p> <p>An infective sample left on the tray may cause infection.</p>
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5. Detector ID number indication

Displays the detector ID number that is recognized by the controller.

6. Status LED

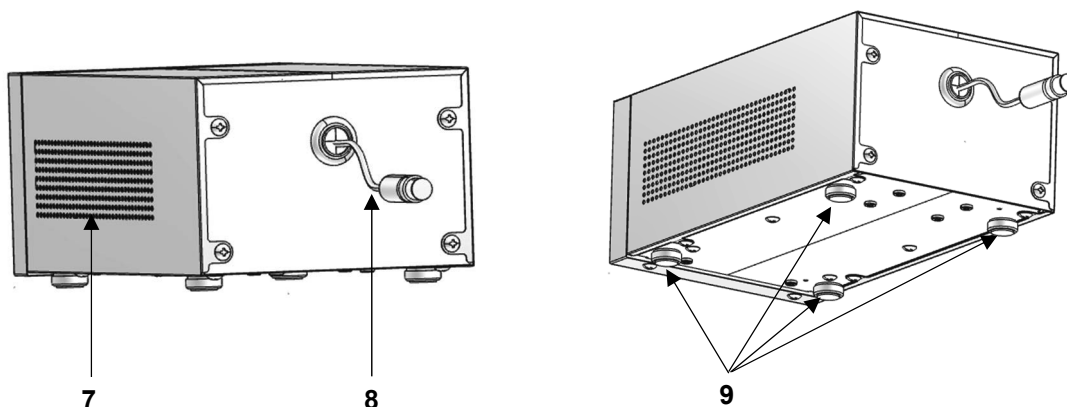
Indicate the detector status.

Status LED	Condition	Details
Power (green)	Lighting	The detector is connected to the controller that is turned on.
Plate Set (white)	Lighting	The sensor module assembly (or check module assembly) is set on the tray in the detector.
Run (white)	Blinking	A voltage is being applied to the sensor module.
	Blinking (fast)	The assay is paused.
	Blinking (fast)	A plate set error has occurred.
Error (red)	Blinking (fast)	An error that needs to be recovered by user operation has occurred.
	Lighting	An error that does not need to be recovered by user operation has occurred.

Note:

After the controller is turned on, all status LEDs are lit for five seconds when the detector is recognized by the controller.

Side, rear, and bottom



7. Ventilation openings (on the left and right sides)

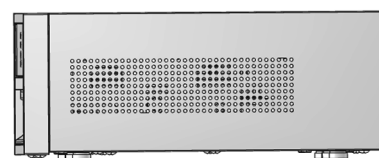
Do not block them when you install the detector. If the ventilation openings are blocked, CO₂ gas and moist air do not circulate and may affect culture.



8. Detector cable

Connect it to the connection cable for connecting the detector and the controller. The connector of this cable is waterproof.

9. Leveling feet

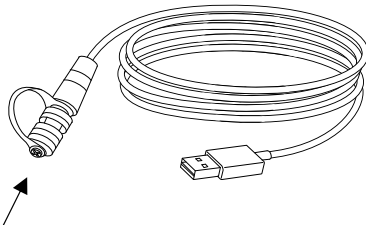
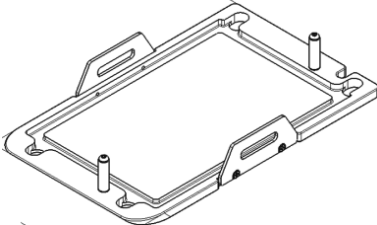
Turn the leveling feet to adjust the lengths of legs. Use the four leveling feet to set the detector horizontally (see page 26).



Shorten 
 Lengthen 

Detector accessories

Check that the following accessories are included with the detector. If anything is missing, contact our sales representative or agent.

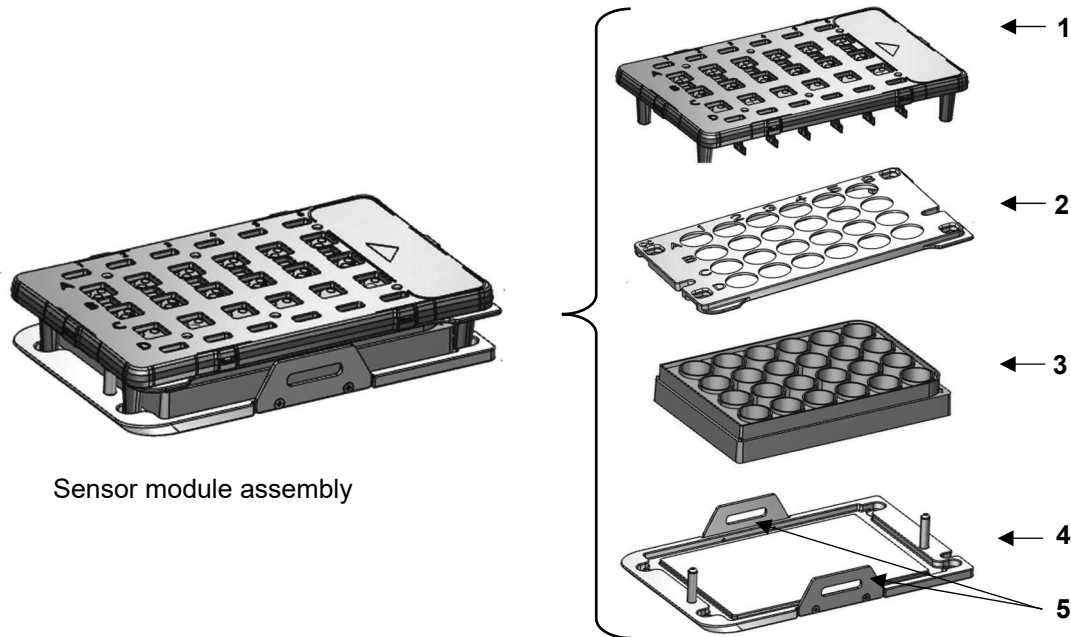
Name	Quantity	Appearance
Connection cable (with a protection cap)	1	 <p>Be sure to cover the waterproof connector with the protection cap when the detector is not connected.</p>
Plate adapter (bottom)	1	

COMPONENTS

Sensor module assembly components

The sensor module assembly consists of four components: the plate adapter (bottom) (detector's accessory), a 24-well plate (commercially available), a plate adapter (top) (option), and the sensor module (option).

On the plate adapter (bottom), a 24-well plate, a plate adapter (top), and the sensor module are stacked, and the assembly is set into the detector to continuously measure the glucose and lactate in the culture medium.



Sensor module assembly

1. Sensor module MLC-AS240A (option)

The module is provided with 24 glucose/lactate sensors. This enables continuous measurement of the glucose concentration and lactate concentration in the culture medium. The sensor module is a single-use product. Do not use it repeatedly.





CAUTION

Do not use a utility knife to open the packing box of the sensor module. You may mistakenly cut the aluminum package of the sensor module, contaminating the sensor module.

Note:

Symbols on the label on the sensor module package are as follows:

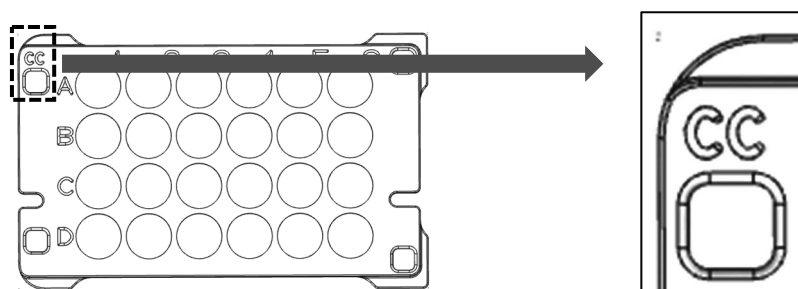
Symbol	Meaning	Details
	Serial number	A serial number identifying the sensor module. The number is indicated on the right side of the symbol.
	Lot number	An identification number assigned to a batch of products for tracking a specific batch. The number is indicated on the right side of the symbol.
	Expiration date	An expiration date of the sensor module is indicated on the right side of the symbol. Do not use the sensor module after expiration date.
	Date of manufacture	A manufacturing date of the sensor module is indicated on the right side of the symbol.
	Research use only	The sensor module is intended to be used for research. Do not use it for medical purposes.
	Repeated use prohibited	The sensor module is intended to be used only once. Do not use it repeatedly.

Symbol	Meaning	Details
	Usage prohibited if the package is damaged	Do not use the sensor module if the aluminum package is damaged or torn.
	Storage temperature	Indicates the storage temperature of the sensor module. Store the sensor module at 2°C to 8°C.

2. Plate adapter (top) (option)

The plate adapter (top) is used to position the sensor module. Plate adapters with different shapes are provided to match different brands of 24-well plates. The matching brand is indicated by two letters printed in the top-left corner of the adapter.

Symbol (two letters)	Manufacturer	Model number
CC	COSTAR provided by Corning	MLC-ATAD2410
CF	FALCON provided by Corning	MLC-ATAD2420
GC	CELLSTAR provided by Greiner	MLC-ATAD2430
TN	NUNC provided by Thermo Fisher Scientific	MLC-ATAD2440
SS	SUMILON provided by Sumitomo Bakelite	MLC-ATAD2450



(Example) CC: COSTAR MLC-ATAD2410 provided by Corning

3. 24-well plate (commercially available)

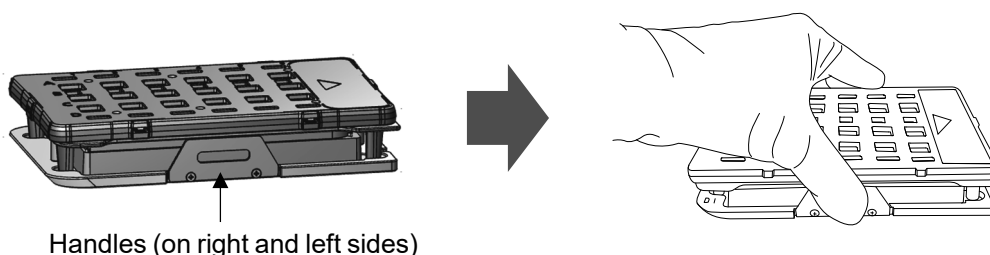
For the model numbers of 24-well plates supported by the plate adapter (top), contact our sales representative or agent. Please prepare the correct type of plate for yourself in advance. The 24-well plate is a single-use product. Do not use it repeatedly.

4. Plate adapter (bottom) (detector accessory)

The plate adapter (bottom) is used to position the sensor module assembly. You can use it regardless of the brand of the 24-well plate that you use.

5. Handles

Hold the sensor module assembly at the handles on both left and right side of the plate adapter (bottom). Never hold an area other than the handles. Doing so may drop the assembly.



2. PREPARATION FOR MEASUREMENT

PREPARATION FLOW

Before starting measurement, prepare the product and CO₂ incubator by following the steps below

1. Assemble and install the controller (pages 21 to 25)



After purchasing the product, assemble and install the controller by following the description in this section.

2. Install the detector (pages 26 to 29)



Install the detector into the CO₂ incubator and connect the detector to the controller. Then, turn on the power to the controller.

When installing the detector after taking it out of the incubator or when adding other detectors, follow the steps again to install them.

3. Check detector operation (pages 30 to 33)



Check if the detector operates properly using the check module assembly.

The detector's operation check is required every time after installing the detector or after cleaning the detector.

4. Start CO₂ incubator operation (page 34)

Start the CO₂ incubator operation.

Do not start humidification in the CO₂ incubator before the detector temperature becomes almost the same as the temperature in the chamber. Starting humidification before then may not perform measurement correctly due to condensation developed in the detector.

1. ASSEMBLING AND INSTALLING THE CONTROLLER

Assembling the controller

Assemble the controller by following the steps below. We are not responsible for any accidents or damages caused by improper installation or improper handling.



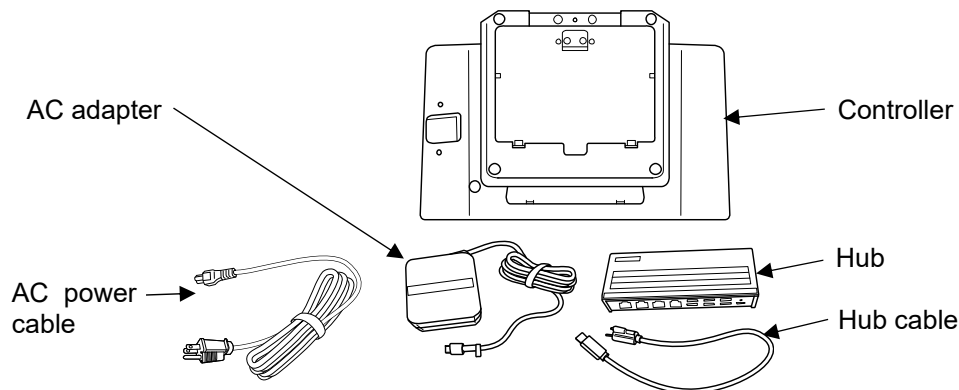
WARNING

Hold the controller with both hands when carrying the controller.
If you drop the controller, you may get injured.

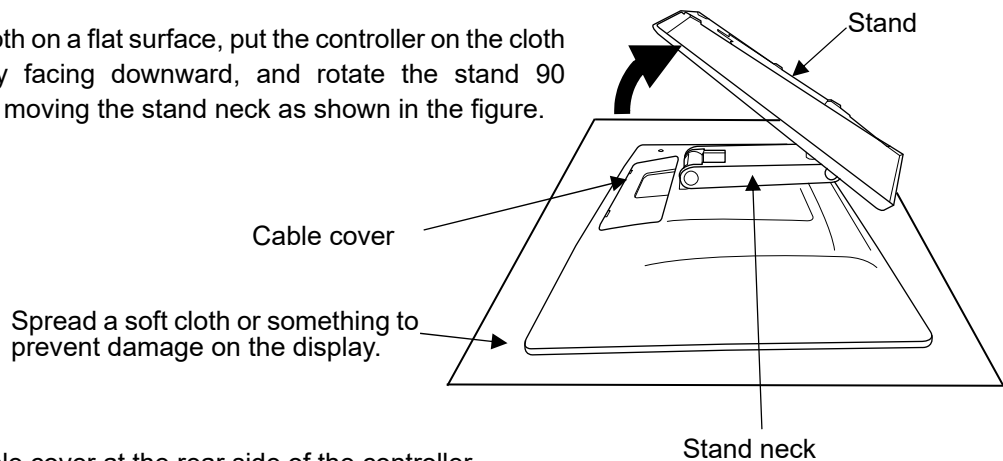
Preparation for assembling

Remove all tapes and other materials fixing this product. If the exterior is dirty, wipe the exterior with a cloth moistened with diluted dishwashing neutral detergent. (Non-diluted detergent may cause a crack on plastics. Read the precaution note to find the way to dilute the detergent.) After that, wipe the exterior with a cloth moistened with water. Then, wipe it with a dry cloth to remove moistness.

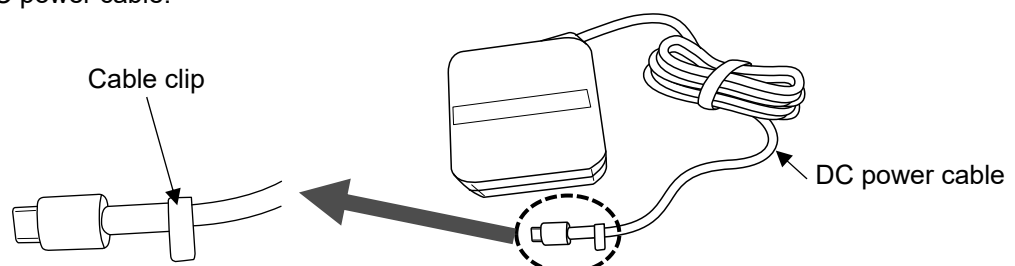
1. Prepare the controller main unit, AC adapter, AC power cable, hub, and hub cable (accessories).



2. Spread a soft cloth on a flat surface, put the controller on the cloth with the display facing downward, and rotate the stand 90 degrees without moving the stand neck as shown in the figure.

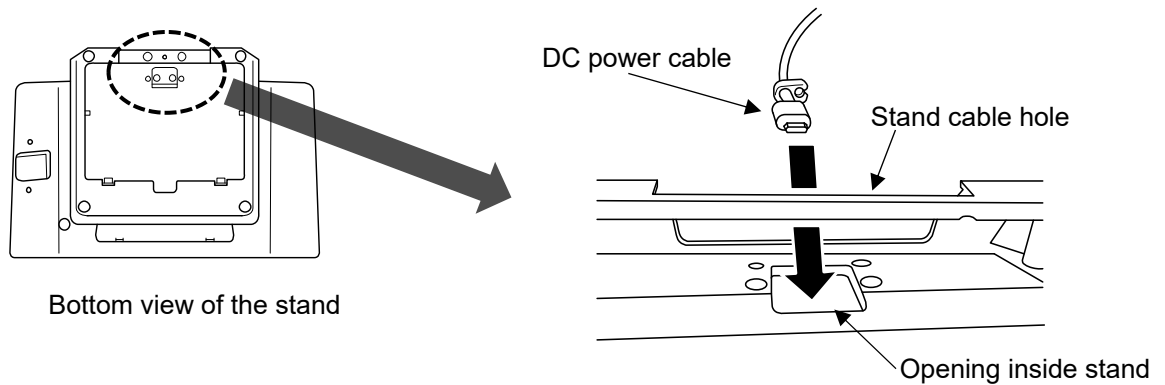


3. Remove the cable cover at the rear side of the controller.
4. Slide the cable clip attached to the DC power cable of the AC adapter to the root of the connector at the end of the DC power cable.

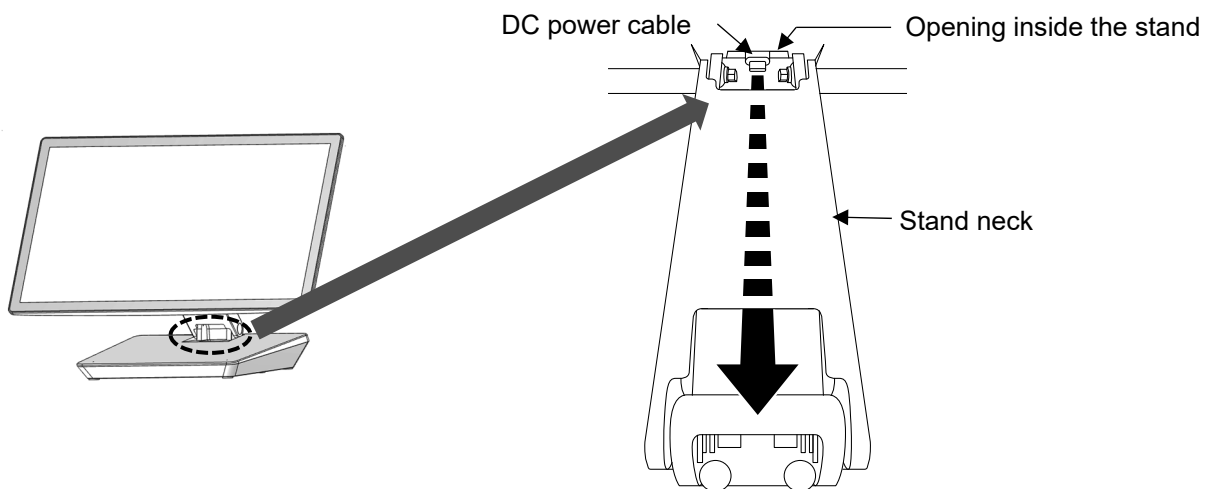


1. ASSEMBLING AND INSTALLING THE CONTROLLER

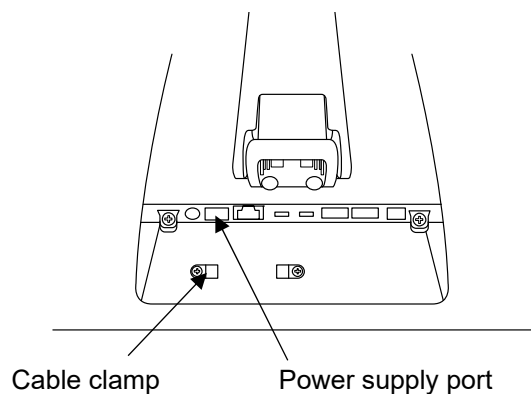
5. Run the DC power cable of the AC adapter through the stand cable hole, and then insert it in the opening inside the stand.



6. After inserting the DC power cable of the AC adapter in the opening inside the stand, run it through the stand neck.



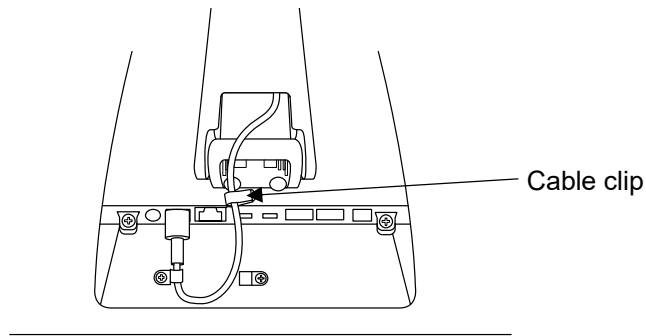
7. After pulling out the DC power cable of the AC adapter that you have run through the stand neck, insert the Type-C connector of the DC power cable into the power supply port in the port section on the back of the controller, and fix the DC power cable with the left-side cable clamp.



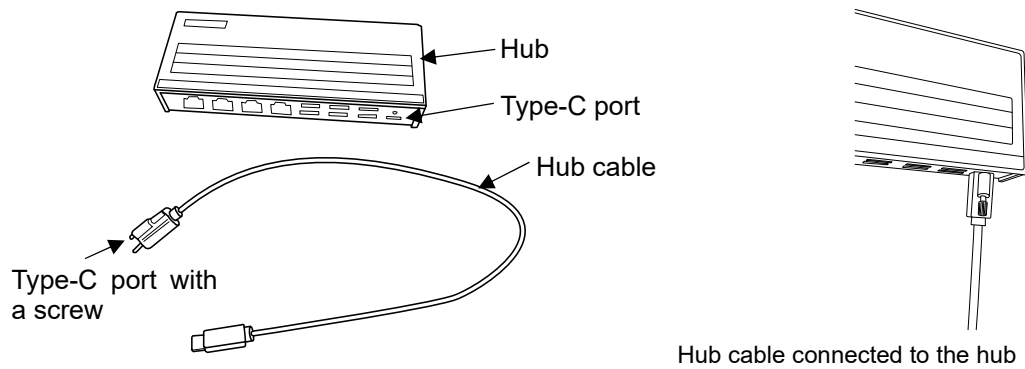
Note:


Before fixing the cable with the cable clamp, insert the connector fully into the port. Then, slightly open the clamp part of the cable clamp with your fingers to slide in the cable.

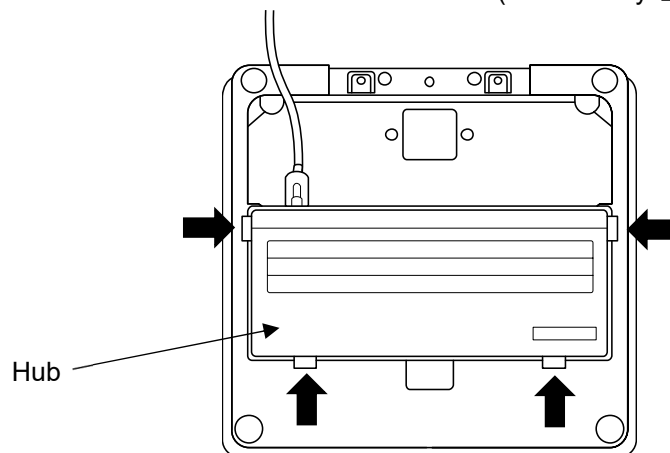
8. Bend the DC power cable of the AC adapter neatly as shown in the figure and slide the cable clip to the position shown in the figure. Pull the excess part of the DC power cable in the stand neck out from the stand side.



9. Connect the Type-C connector (which has a screw) of the hub cable to the Type-C port of the hub and fix the connector with a slotted screwdriver.

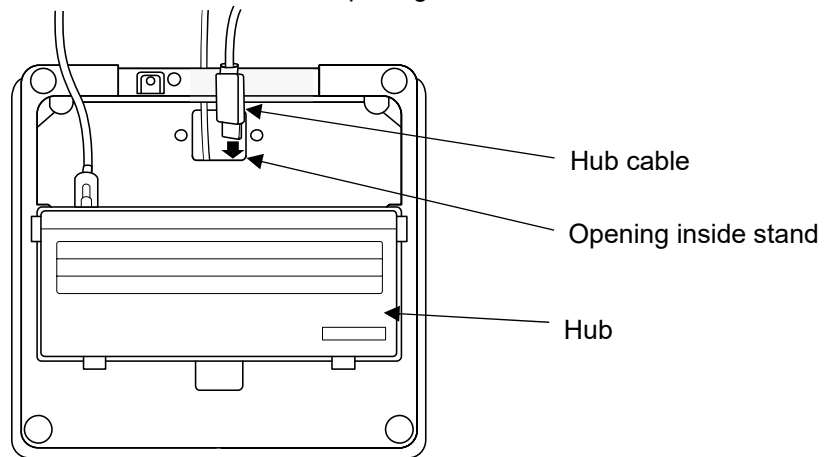


10. Insert the hub into the stand and fix it with the four clicks (indicated by ) on the stand.

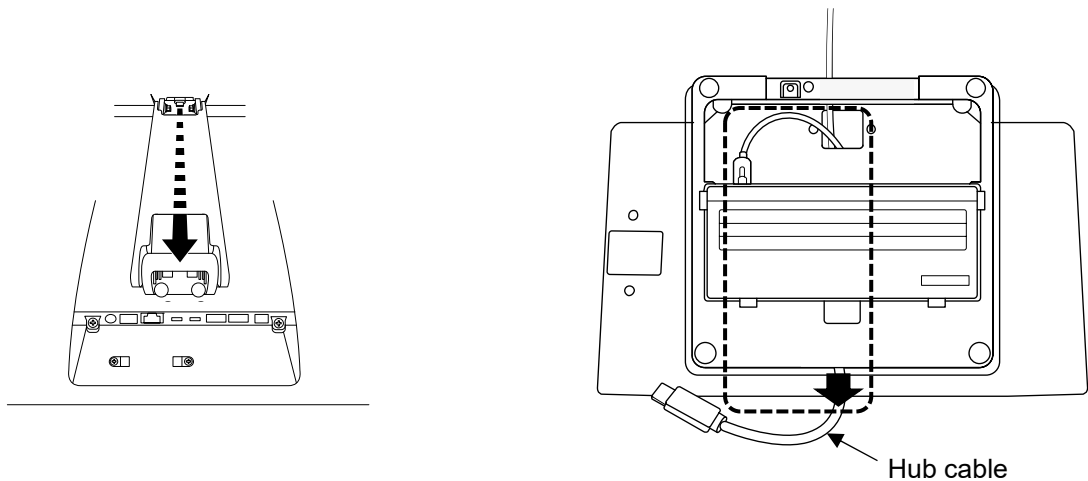


1. ASSEMBLING AND INSTALLING THE CONTROLLER

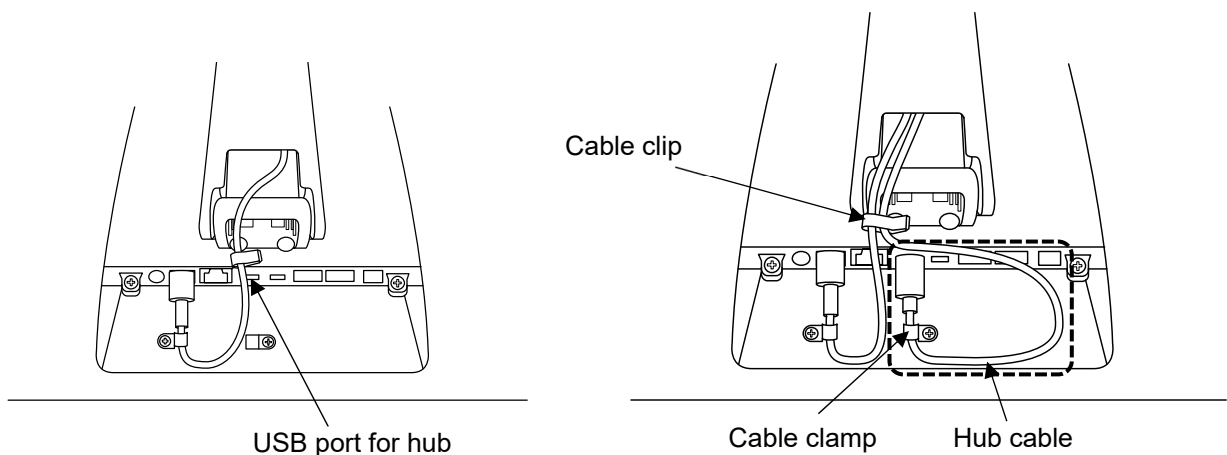
11. Insert the connector at the other end of the hub cable in the opening of the stand.



12. Run the hub cable through the stand neck as you did with the DC power cable of the AC adapter. Then pull the cable toward the port section on the back as shown in the right figure (indicated by the dotted frame) so that the hub cable does not tangle inside the stand.



13. After inserting the Type-C connector of the hub cable in the USB port for hub in the port section on the back, fix the hub cable with the cable clamp on the right at the position shown in the figure. Then, organize the excess part of the hub cable as shown in the right-hand figure (indicated by the dotted frame) and fix it with the cable clip of the AC adapter.

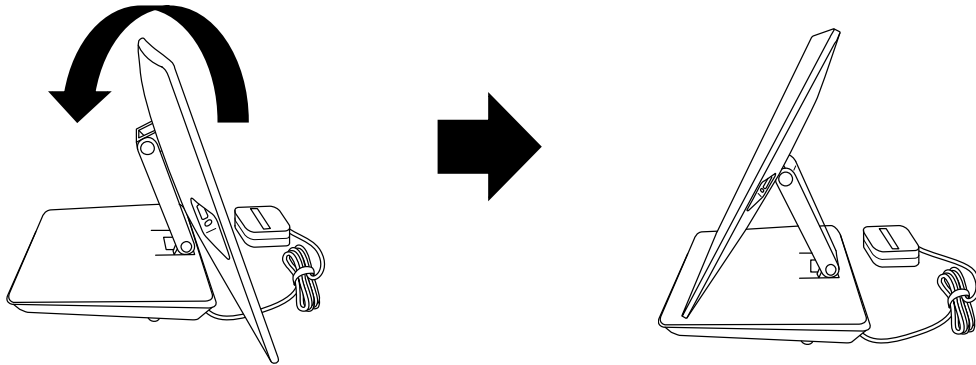


Note:

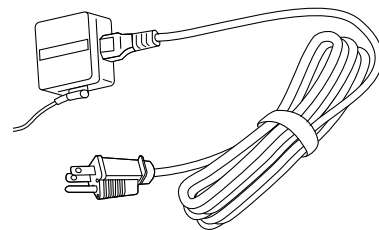
Before fixing the cable with the cable clamp, insert the connector fully into the port. Then, slightly open the clamp part of the cable clamp with your finger to slide in the cable.

14. Put the cable cover on the back.

15. Place the controller so that the bottom of the stand faces downward and then turn the display in the direction shown by the arrow in the following figure without moving the stand neck.



16. Connect the AC power cable to the AC adapter.



Note:

When using cables, remove the cable ties that bind cables. The coating of the cable may rust if the cables are kept bonded by the cable ties.

Installation location

To run the product properly, place the controller at a location which meets all the conditions described below.

■ **An indoor location without direct sunlight**

Direct sunlight may cause housing deformation, screen discoloration, or failure of the product.

■ **A location with a firm and level surface**

Select a location with a firm and level surface. Installing the product on an uneven or tilted surface makes the product unstable, leading to failure or injury.

■ **A location without falling objects**

Avoid a location where an object may drop on the product. Otherwise, the product may be damaged, leading to failure.

■ **A location without the influence of electromagnetic wave**



Do not place an electric device that generates electromagnetic wave near the product. The product may malfunction due to the influence of the electromagnetic wave.

■ **A location at an altitude of 2,000 m or less**

The insulation performance degrades at a high altitude, causing electric leakage or an electric shock.

2. INSTALLING THE DETECTOR

Install the detector in a CO₂ incubator by following the steps below.

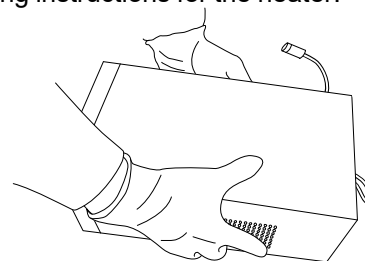
 WARNING	<p>Before connecting the detector, turn off the controller and pull out the power plug from the outlet. Otherwise, you may have an electric shock or get injured when you inadvertently touch an electric part.</p>
 CAUTION	<p>Do not insert your hand in the opening of the detector tray. Otherwise, you may be injured with parts inside the tray.</p>
	<p>When you install the detector, wear disinfected gloves. Otherwise, the detector may be contaminated, and the measurement cannot be performed precisely.</p> <p>Do not perform H₂O₂ decontamination or dry heat sterilization for the detector. H₂O₂ decontamination or dry-heat sterilization is not supported for the detector. Performing the procedure may cause failure of the detector. * When you perform H₂O₂ decontamination or dry heat sterilization, refer to the operating instructions for the CO₂ incubator, and do not put items other than the inner attachments of the incubator into the chamber.</p>

Preparation for installation

- First, turn off the CO₂ incubator in which the detector will be installed, remove all interior parts from the chamber, wipe off moisture in the chamber, and then let the humidity in the chamber be the same as the ambient humidity (if the detector is installed in a CO₂ incubator with a large temperature difference from the environment or with a high humidity, the detector may develop condensation, causing incorrect measurement).
- Clean the interior of the CO₂ incubator by following the incubator's operating instructions and attach the interior parts.
- Install the CO₂ incubator and the trays to be level using a spirit level.
- A commercially available silicone plug is required. Contact the manufacturer of the incubator for the silicone plug suitable for the incubator and how to attach the silicone plug. Then, prepare it for yourself. The diameter of the access port for our incubators is 30 mm.
- For how to install and use the access port heater (option), refer to the operating instructions for the heater.

Notes:

- When carrying the detector, hold the middle part of the main body with both hands. Do not hold the tray trigger, tray, or cable.
- Keep the plastic bag for the detector since it will be used when storing it.

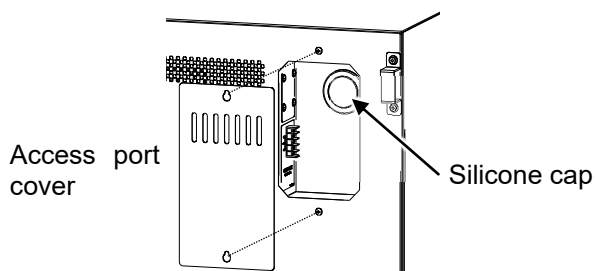


1. Install the silicone plug for the access port and the connection cable (this is an example when a CO₂ incubator from PHC is used).

- 1) Remove the silicone caps (2 pcs) on the CO₂ incubator.

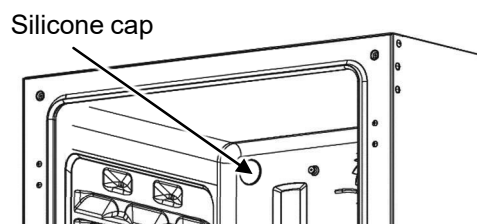
[Rear view]

Loosen the screw of the access port cover on the back, slide the access port cover upward and remove it, and remove the silicon cap inside.



[Interior view]

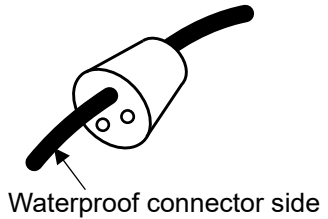
Remove the silicone cap in the upper left corner of the chamber.



- 2) Insert the connection cable that came with the detector into the silicone plug (commercially available).

Note:

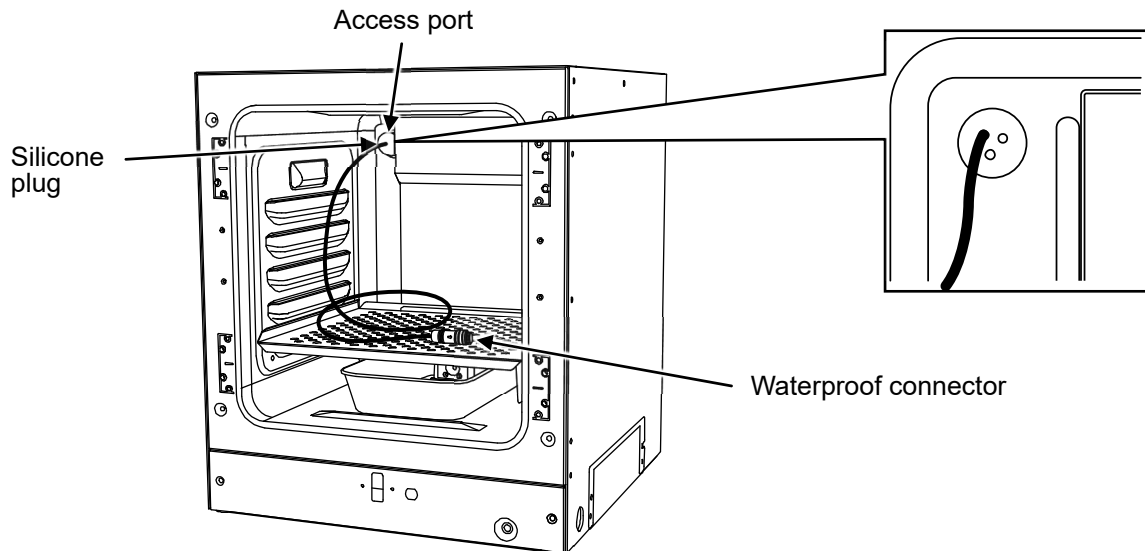
When you use the optional access port heater, attach it in accordance with the operating instructions that came with the access port heater.



- 3) Insert the silicone plug into the access port from the chamber side so that the waterproof connector comes inside the chamber.

Note:

Insert the silicone plug so as not to form any clearance to prevent CO₂ gas leakage.



2. Install the detector.

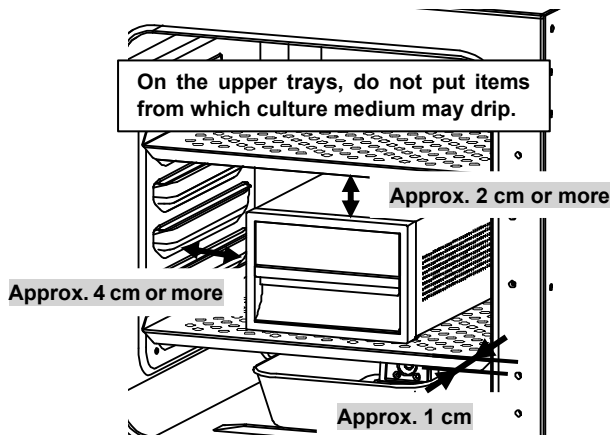
When installing the detector in a CO₂ incubator, note the following points.

- Clean the detector by following the steps below before installing it.
 - 1) Wear rubber gloves and sterilize their surface with 70% ethanol.
 - 2) Let an appropriate amount (the amount that cannot form droplets on the surface) of 70% ethanol moisten in a piece of gauze, and wipe well the exterior and the connection cable of the detector with the gauze. At this time, do not spray 70% ethanol directly on the detector.
 - 3) Fully pull out the detector tray and wipe the exposed portion of the tray well in the same manner.
- Check that the tray of the CO₂ incubator is strong enough to bear the detector.
- On a tray above the detector, do not put a dish or other items from which culture medium may drip. The culture medium may come into the detector when it spills, causing contamination or a fault.
- Do not install the detector at a position higher than your eye level. Such a position makes it difficult for you to see when placing the sensor module on the tray, causing the culture medium to spill over your body.
- If the culture medium spilled, wipe the detector housing, tray, and connection cable with a cloth moistened with 70% ethanol.
- When you install the detector in the CO₂ incubator, secure a clearance of 1 cm between the detector front and the front end of the tray, a side clearance of 4 cm or more, and a top clearance of 2 cm or more.

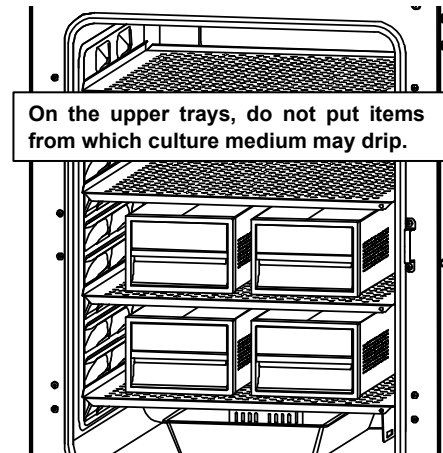
2. INSTALLING THE DETECTOR

<When using the CO₂ incubator manufactured by PHC>

- MCO-50 series (1 detector)



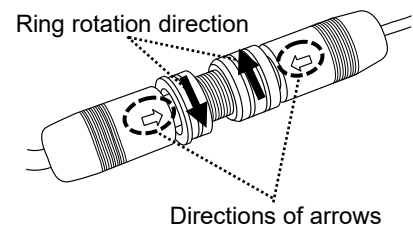
- MCO-170/230 series (up to 4 detectors)



- Same side clearance as MCO-50 series between detectors
- Use the dedicated reinforced tray when placing two detectors on a tray.

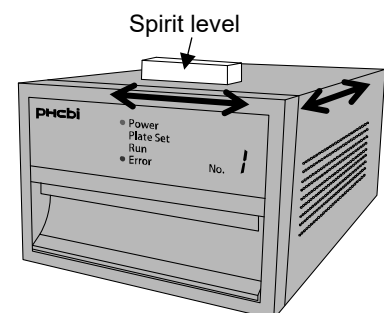
3. Connect the detector cable and the connection cable that came with the detector.

- 1) Connect the detector cable's waterproof connector and connection cable's waterproof connector by aligning the arrows on them (→).
- 2) Rotate the outer rings of the connectors clockwise to fix them.



4. Adjust the leveling of the detector.

- 1) Put a spirit level on the top of the detector.
- 2) Adjust the four leveling feet of the detector to level the detector in the left-right and front-back directions (see page 17).



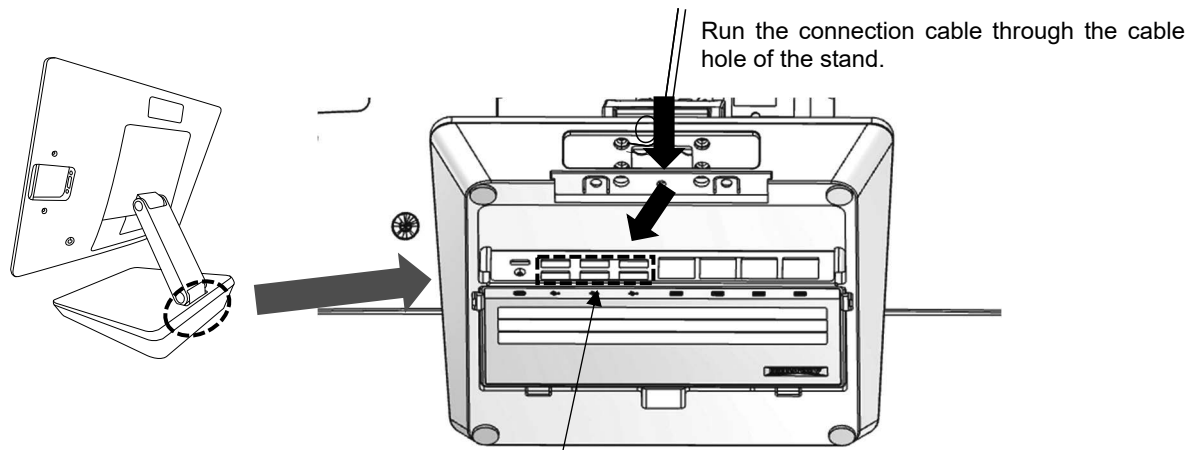
5. Connect the detector and the controller.

- 1) Connect the other end (USB connector side) of the connection cable to the USB port on the hub inside the controller stand.

Note:

Do not connect the USB connector to the USB port on the rear side of the controller.

- 2) Set the connected controller on a firm level surface.



Connect the USB connector to one of the available USB ports of the hub.
Note that only up to four detectors can be connected.

6. Turn on the controller.

- 1) Connect the power plug of the AC power cable to an outlet if the power LED on the controller is off.
 - ▶ The power LED on the controller lights in orange.

Note:

The power plug of this product is a three-pole plug with grounding. When you connect the plug to a three-pole outlet with grounding, ensure that the grounding pole of the outlet is grounded properly. If the outlet that you use is not a three-pole outlet with grounding, ask a qualified contractor to do the earthing work.

- 2) Press the power-on switch on the rear side of the controller (page 13).

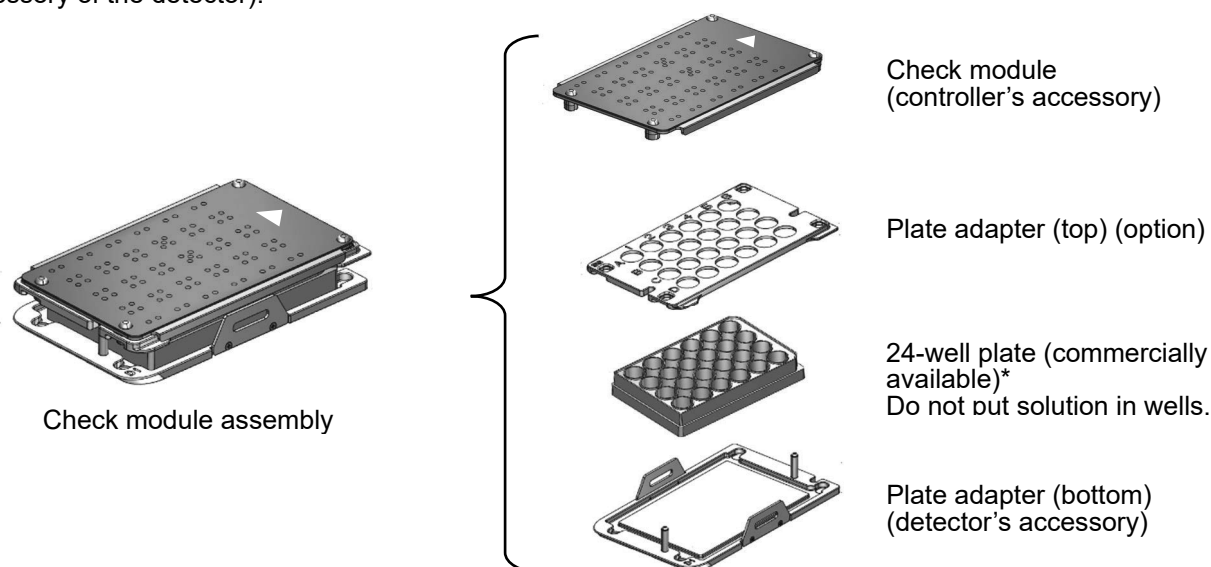
▶ The power LED on the controller lights in blue, and the controller display is turned on.

3. CHECKING THE DETECTOR OPERATION

After installation of the detector, perform the operation check by using the check module. Also, perform the operation check once a month by following the steps below.

Preparing the check module assembly

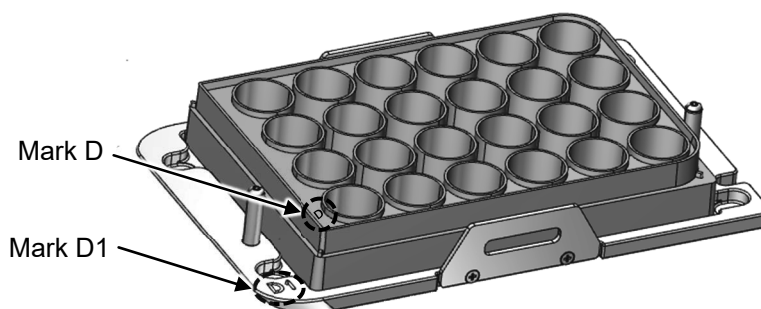
To assemble the check module assembly, stack a 24-well plate (commercially available), a plate adapter (top) (option), and the check module (accessory of the controller) in order on the plate adapter (bottom) (accessory of the detector).



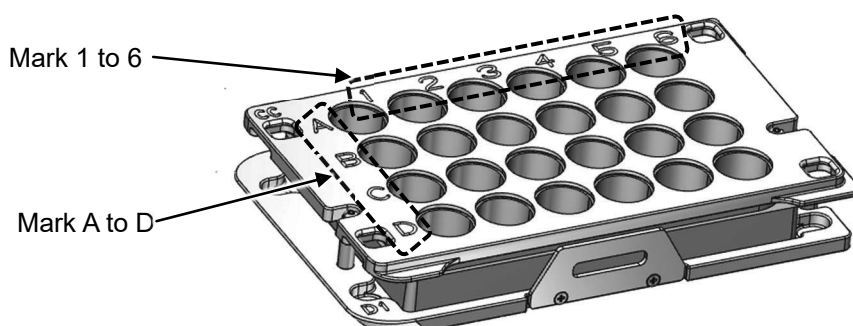
Note:

You can perform operation check with the humidifying function of the CO₂ incubator turned on or with CO₂ concentration level set. However, when doing so, wait until the temperature of the check module assembly becomes almost the same as the temperature in the chamber. If the check module assembly's temperature is low, condensation may develop on the assembly, leading to an incorrect operation check.

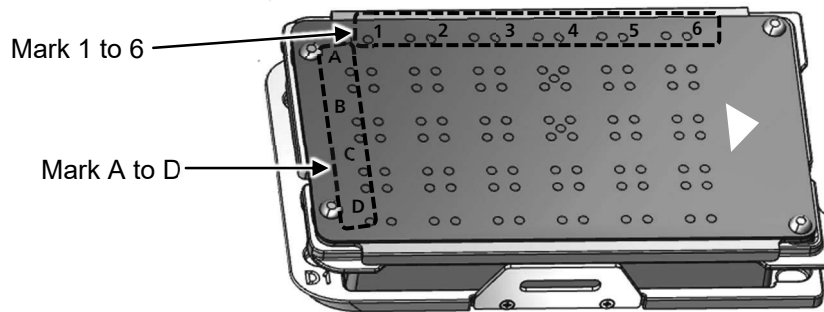
1. Set the 24-well plate on the plate adapter (bottom).
Align the mark (D1) on the plate adapter (bottom) and the mark (D) on the 24-well plate.



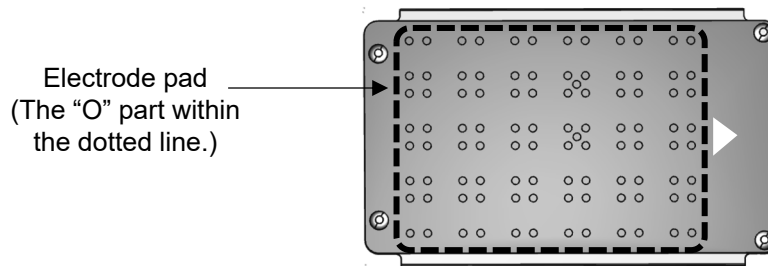
2. Remove the lid on the 24-well plate and then set the plate adapter (top) on the 24-well plate so that the well numbers and letters printed on the 24-well plate and the well numbers and letters on the plate adapter (top) come to the same positions.



- Set the check module on the plate adapter (top) so that the numbers and letters printed on the check module and the well numbers and letters on the plate adapter (top) come to the same positions.

**Note:**

Do not touch the electrode pad on the check module. If fingerprints are left on them, they may not work properly. When the electrode pad surfaces are contaminated, clean them with a soft cloth moistened with 70% ethanol. Do not use disinfectant containing additives (other than ethanol and pure water). Such disinfectant may corrode the electrode pad or prevent correct check operation.



Operation check

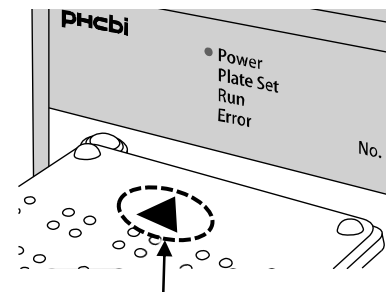
- Check that the power to the controller is turned on.
- Open the CO₂ incubator doors and ensure that the detector is placed in the CO₂ incubator correctly.
- Pull out the detector tray and set the prepared check module assembly on the tray by paying attention to the insertion direction.

**CAUTION**

Do not insert your hand in the opening of the detector tray.

Otherwise, you may be injured with parts inside the tray.

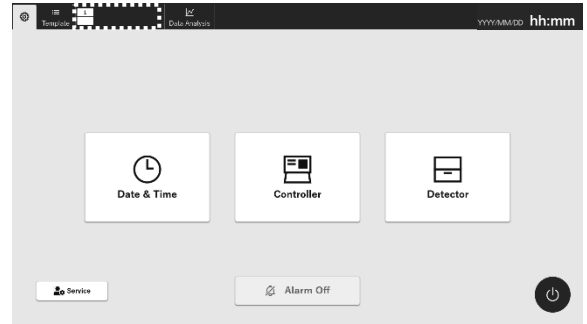
- Close the tray.
 - ▶ The Plate Set LED (white) on the detector turns on.
- Close the CO₂ incubator doors.



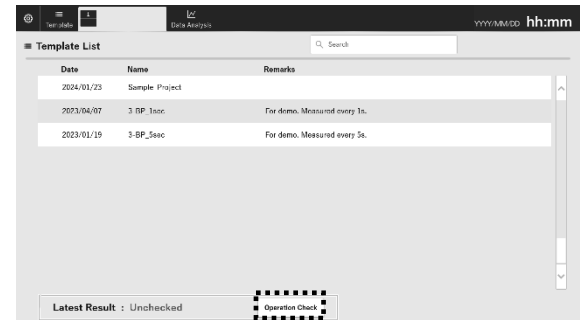
Arrow that indicates insertion direction

3. CHECKING THE DETECTOR OPERATION

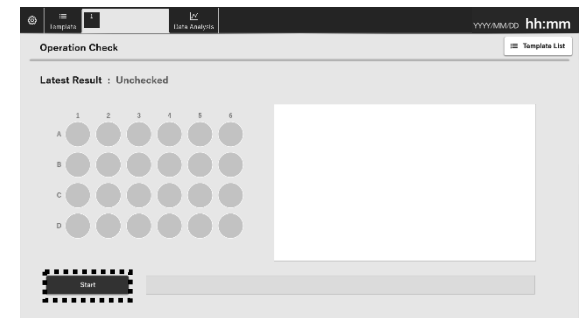
- 6. Tap the detector tab with the detector ID number in which the check module assembly has been placed for performing the operation check.
▶ The top screen of detector menu is displayed.



- 7. Tap the **Operation Check** button on the top screen.
▶ The Operation Check screen is displayed.

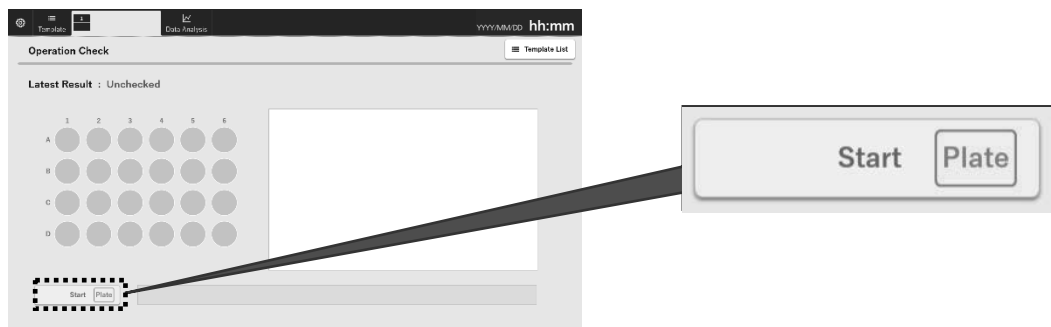


- 8. Tap the **Start** button on the Operation Check screen.
▶ Measurement starts, and the progress bar proceeds. The measurement finishes in about one minute and 30 seconds, and the result is displayed.



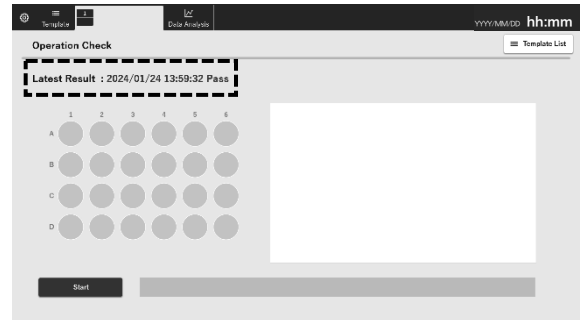
Note:

When the check module assembly is not set in the detector, "Plate" next to the **Start** button blinks and the **Start** button becomes unavailable.

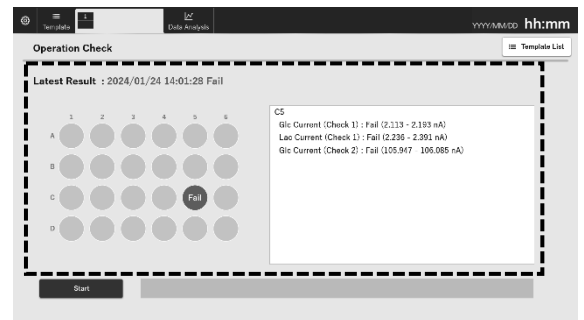


Operation check result

- When the operation check passes without any problem:
 - ▶ The date at the Latest Result is updated, and "Pass" is displayed in blue.



- When the operation check fails with a problem:
 - ▶ The date at the Latest Result is updated, and "Fail" is displayed in red. At the same time, the position of the failed well is indicated.



Note:

Try the following if the operation check fails or does not start.

- Carefully wipe the electrode pad (golden circle part) on the top (green side) of the check module with a gauze moistened with an appropriate amount of 70% ethanol, and then try the operation check again. Do not use disinfectant containing additives (other than ethanol and pure water). Such disinfectant may corrode the electrode pad or prevent correct check operation.
- If the operation check still fails after performing (1), contact our sales representative or agent.

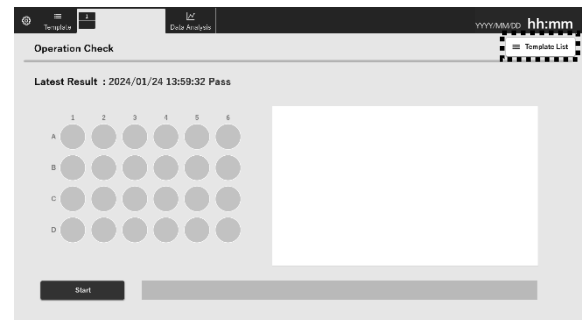
- After confirming that the result is "Pass," tap the **Template List** button.

- ▶ The top screen is displayed again.

Take the check-module assembly out of the detector.

Note:

When you use the plate adapters (top and bottom) used in the operation check for the actual measurement process, autoclave them for sterilization before measurement.



4. STARTING CO₂ INCUBATOR OPERATION

Start the CO₂ incubator by following the steps below.

- 1.** Set the chamber temperature to 37°C and run the incubator for more than four hours to let the detector be almost the same temperature as the incubator temperature (you do not have to set the CO₂ concentration at this point).
- 2.** After the elapse of more than four hours, pour 37°C sterile distilled water into the humidifying pan (pouring low-temperature water may decrease chamber temperature and humidity).
- 3.** Set the CO₂ concentration for culture. After the chamber condition is stabilized, start measurement.

3. BASIC OPERATIONS

TURNING ON AND OFF THE CONTROLLER

The controller can be turned on and off by following the steps below.

Turning on the controller

1. Connect the power plug of the AC power cable to an outlet if the power LED on the controller is off.
 - ▶ The power LED on the controller lights in orange.

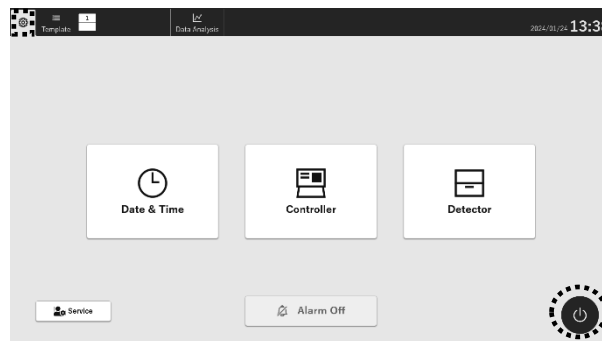
Note:

The power plug of this product is a three-pole plug with grounding. When you connect the plug to a three-pole outlet with grounding, ensure that the grounding pole of the outlet is grounded properly. If the outlet that you use is not a three-pole outlet with grounding, ask a qualified contractor to do the earthing work.

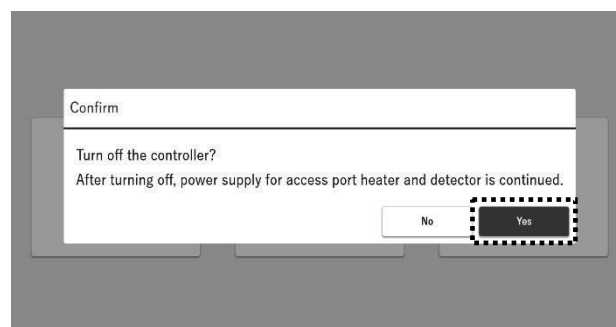
2. Press the power-on switch on the rear side of the controller (page 13).
 - ▶ The power LED on the controller lights in blue, and the controller display is turned on.

Turning off the controller

1. Check that the sensor module assembly (or check module assembly) is not left in the detector. If the sensor module assembly is left in the detector, take it out of the detector.
2. Tap the system menu tab on the display and tap the Power Off button at the bottom-right corner of the screen.
 - ▶ The Confirm dialog is displayed.



3. Tap the **Yes** button.
 - ▶ The controller display is turned off, and the power LED on the controller becomes orange. Tapping the **No** button displays the system menu again.

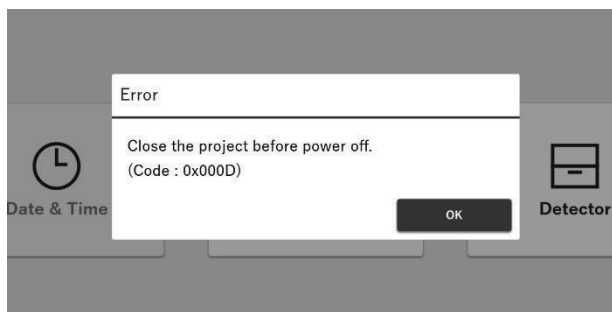


TURNING ON AND OFF THE CONTROLLER

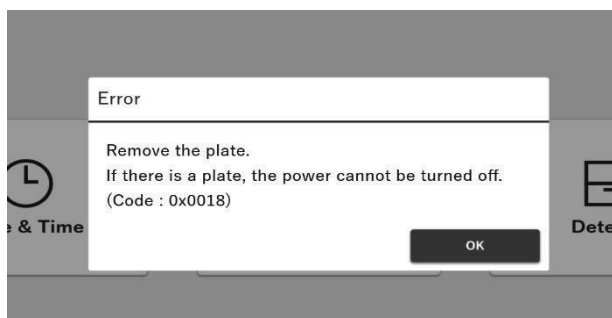
Notes:

- Even after turning off the controller, power to the detector and access port heater continues to be supplied.
- If the project is ongoing or the sensor module assembly (or check module assembly) is left in the detector, the Error dialog is displayed, and you cannot power off the controller. Tapping the **OK** button returns to the system menu.

When the project is ongoing



When the module assembly is left in the detector



- If you will not use the detector for a long time, take the detector out of the CO₂ incubator, and pull out the power plug of the AC power cable from the outlet. Then, clean the detector and put it into the plastic bag kept when unpacking the detector (if the plastic bag is lost, you can use a commercially available plastic bag).

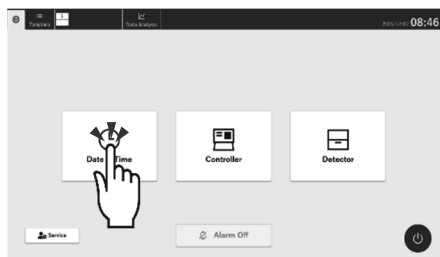
TOUCH SCREEN OPERATIONS

Basic operations

Use the touch screen to operate this product. See below for how to use the touch screen.

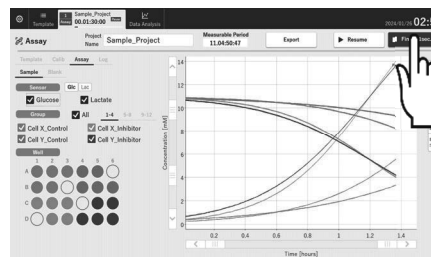
Tap

Lightly touch the screen with your finger and immediately release the finger from the screen.



Long tap

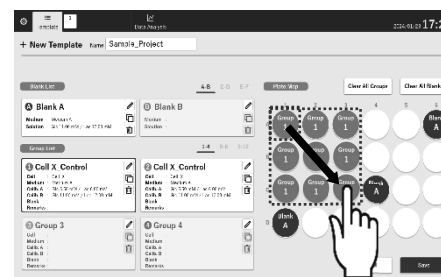
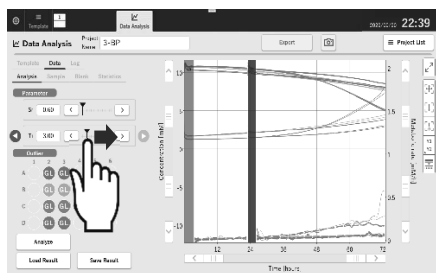
Lightly touch the screen for a few seconds and then release the finger from the screen



Drag

Touch the screen with your finger, slide your finger on the screen toward the target point, and lift your finger at the target point.

You can use this operation for selecting group/blank settings and wells within a rectangular region.



Notes:

- Use your finger or a capacitive stylus pen to protect the screen.
- Do not touch the screen with a hard or sharp tip of an item such as a ballpoint pen.

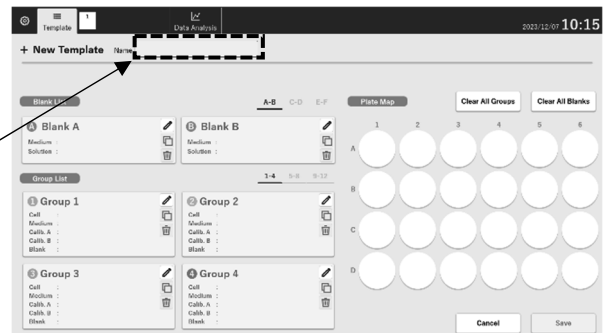
TOUCH SCREEN OPERATIONS

On-screen keyboard

Use the on-screen keyboard to enter characters and numerical values.

1. Tap an entry text box.
▶ The on-screen keyboard suitable for the type of data to be input is automatically displayed.

Text box



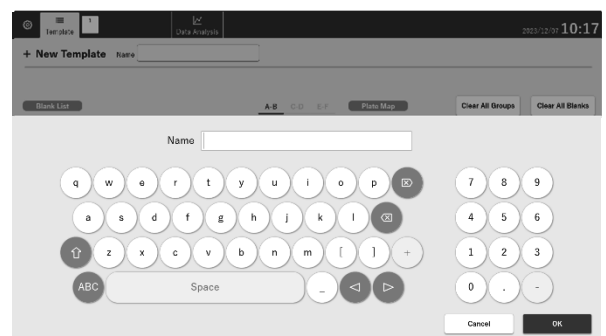
2. Tap keys to enter characters or numerical values.

Notes:

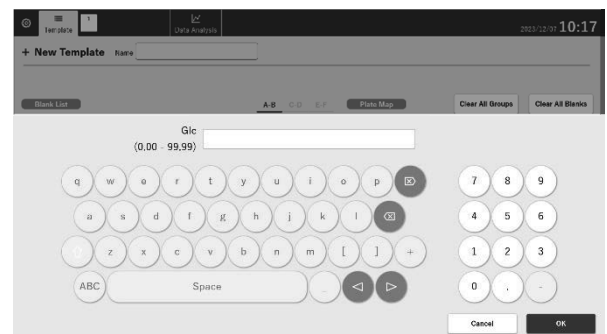
One of the following three types of on-screen keyboards is displayed:

- Full keyboard: Allows you to enter any characters that are normally available on a keyboard.
- File name entry keyboard: Allows you to enter only characters that can be used for file names. (Keys that cannot be used for file names such as "+", "-", and space are deactivated.)
- Numeric keyboard: Allows you to enter only numerical values. (Keys not used for entering numerical values are deactivated.)

One of the above on-screen keyboards is displayed depending on the content you will enter.



[Example of file name entry keyboard]

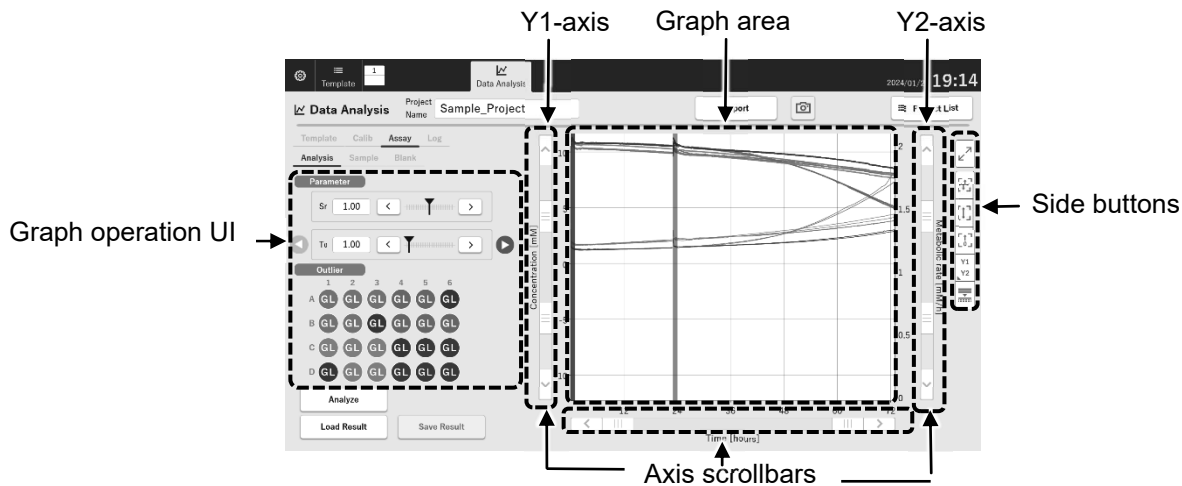


[Example of numeric keyboard]

3. After entering the intended characters, tap the **OK** button.
▶ The entered content is confirmed.

Operation for viewing graph

You can use the graph area, axis scrollbar, graph operation UI, and side buttons to view the graph in detail. The table below shows operations for the graph.

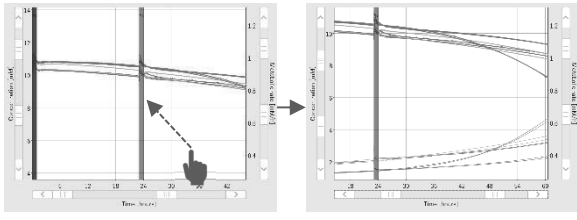
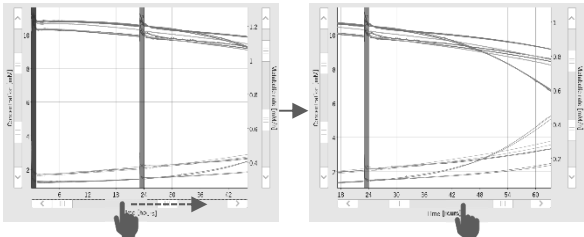
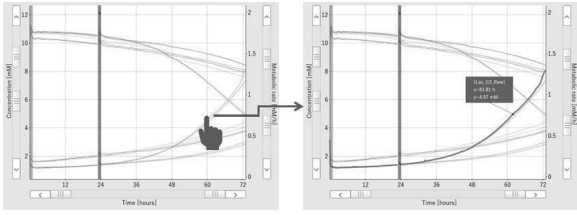


1. Operation in the graph area and axis scrollbars

Manipulate the graph in the graph area with your fingers.






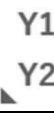



Function	Operation
Zoom in Note: When the amount of data is too large, not all the data may be displayed on the graph. In such a case, zoom in on the part you want to see the details.	Pinch out the graph area.
	Use the slider of the axis scrollbar. <p>* You can use the slider of the vertical axis scrollbar in the same way.</p>
Zoom out	Pinch in the graph area.
	Use the slider of the axis scrollbar. <p>* You can use the vertical axis scrollbar in the same way.</p>

TOUCH SCREEN OPERATIONS

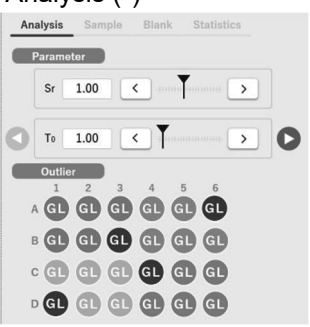


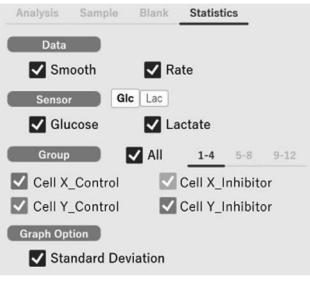
Function	Operation
Pan	<p>Shift the screen content by sliding in the graph area.</p> 
	<p>Shift the screen content by sliding the position other than the slider within the axis scrollbar.</p>  <p>* You can use the vertical axis scrollbar in the same way.</p>
Graph line information and line width	<p>Touch the graph line to see its information and make the line thicker. Touching the same graph line again or another area in the graph (other than graph lines) reverts to the normal thickness.</p> 

2. Side button menu

You can manipulate the graph display using the side buttons.

Icon	Function name	Details
	Full screen	The graph is displayed in full screen mode.
		The graph is displayed in normal screen mode.
	Autoscale (1)	X-axis and Y-axis are automatically scaled to display all data.
	Autoscale in Y axis (2)	The Y-axis is automatically scaled within the selected X-axis range to display all data along the Y-axis.
	Autoscale in Y axis including Y = 0 (3)	The Y-axis is automatically scaled within the selected X-axis range to display all data along the Y-axis including the point of Y = 0.
	Switching the display area mode when autoscale is on (available only during analysis)	When autoscale (1), (2), or (3) is made, concentration is displayed in the upper half of the graph area (Y1-axis) and metabolic rate is displayed in the lower half of the graph area (Y2-axis).
		When autoscale (1), (2), or (3) is made, concentration (Y1-axis) and metabolic rate (Y2-axis) are displayed in the entire graph area.
	1-sensor display	Displays only the selected graph line and temporarily hides other graph lines. This operation is different from and does not affect the show/hide setting of the graph operation UI.
		Displays all graph lines according to the show/hide setting made by the graph operation.

3. Graph operation UI

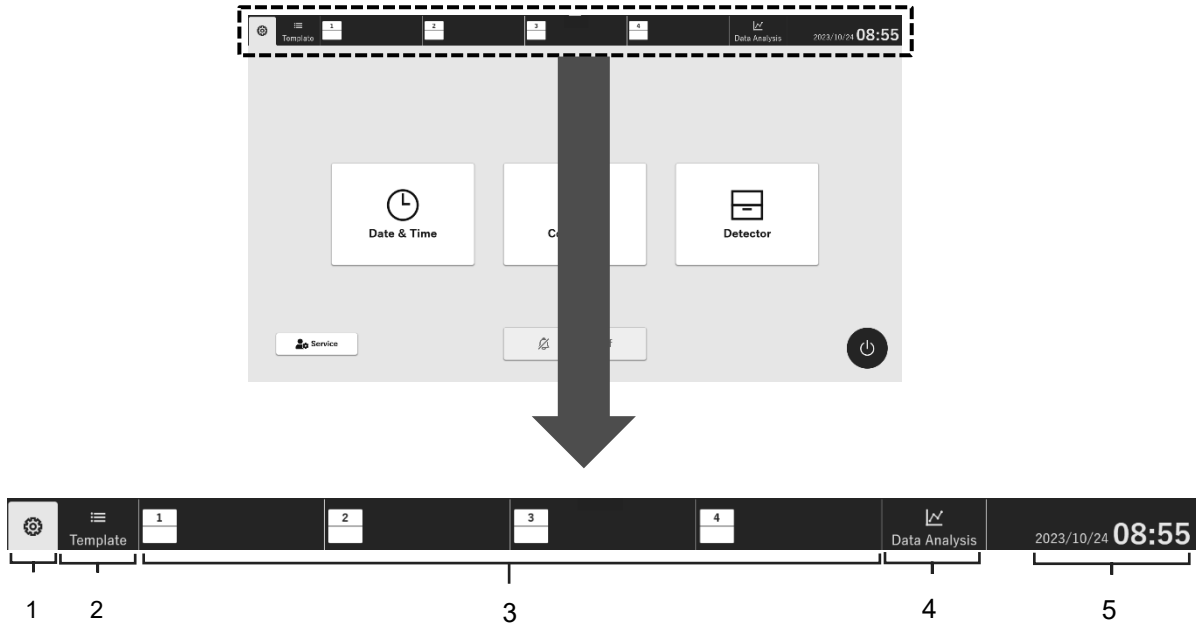
Tab	Item name	Details
Analysis (*) 	Parameter	Value for analysis parameters Sr and Ti. For details, see step 4 on pages 85 and 86.
	Outlier	Outlier setting. For details, see step 5 on page 86.
Sample 	Data (*)	Type of data to be displayed in a graph area. Select the checkbox(es) of the data you want to display in the graph. Raw: Measured concentration [mM] (Y1-axis) Concentration measured during assay. Smooth: Smoothed concentration [mM] (Y1-axis) Smoothed concentration that is calculated by analysis processing. Rate: Metabolic rate [mM/h] (Y2-axis) Metabolic rate calculated by analysis processing.
	Sensor	Sensor type to be displayed in the graph area. Select the checkbox(es) of the sensor(s) you want to display in the graph. Tapping Glc or Lac button thickens the line of the sensor in the graph. Tapping the button again reverts the line to the normal thickness.
	Group	Group type to be displayed in the graph area. Select the checkbox(es) of the group(s) you want to display in the graph. This operation is reflected to the selection of "Well" below.
	Well	Selection of wells to be displayed in the graph area. Tapping a well displays or hides it alternately. This operation is reflected to the selection of "Group" above.
Blank 	Sensor	Sensor type to be displayed in the graph area. Select the checkbox(es) of the sensor(s) you want to display in the graph. The displayed data is obtained by normalizing the electric current of each blank at the time of assay by the electric current at the completion of calibration B. Use the Glc and Lac buttons to switch between thick line display and normal-width line display.
	Well	Select the well to be displayed in the graph area. Tapping a well displays or hides it alternately.
Statistics (*) 	Data	Data type to be displayed in the graph area. Smooth: Average of smoothed concentration of each group [mM] (Y1-axis) Rate: Average of metabolic rate of each group [mM/h] (Y2-axis)
	Sensor	Sensor type to be displayed in the graph area. Select the checkbox(es) of the sensor(s) you want to display in the graph. Tapping Glc or Lac button thickens the line of the sensor in the graph. Tapping the button again reverts the line to the normal thickness.
	Group	Group type to be displayed in the graph area. Select the checkbox(es) of the group(s) you want to display in the graph.
	Graph option	Select the checkbox to display the unbiased standard deviation of the smoothed concentration and the metabolic rate of each group.

* Only available during analysis. You can select the tab only when performing analysis.

FUNCTIONAL UNITS OF CONTROLLER SOFTWARE

Main tab bar

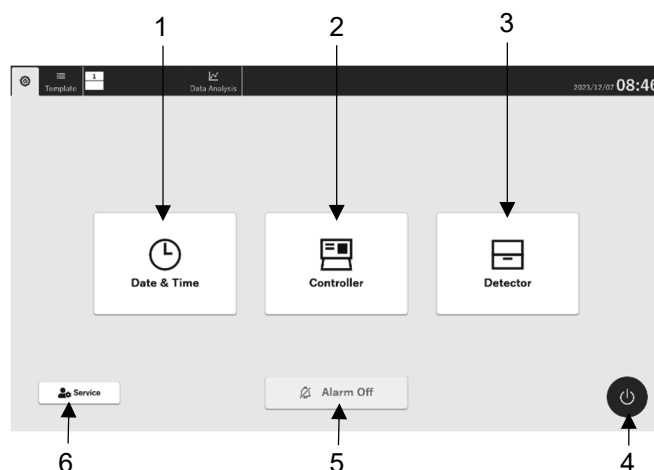
The main tab bar at the upper part of the controller screen is used for switching between different operation groups (system menu, template creation, detector control, and data analysis). Date and time are always displayed on the right side of the menu.



No.	Name	Details
1	System menu tab	Screen for setting date and time, configuring controller settings, and showing detector information is displayed.
2	Template tab	Screen for creating and editing templates is displayed.
3	Detector tab 1 to 4	The connected detector ID number is indicated on the tab. Tapping the tab displays a screen for starting each detector's measurement. Also, detector's simple status indication is displayed on the tab part. When a detector is not connected, its tab is not displayed on the menu.
4	Data analysis tab	Screen for starting data analysis is displayed.
5	Date & time	Current date and time are displayed.

System menu

The system menu is displayed after turning on the controller, or when you tap the system menu tab at the left end of the main tab bar. From this screen, you can view the information of the controller and the detector, configure settings, power off the controller, and turn off the alarm.

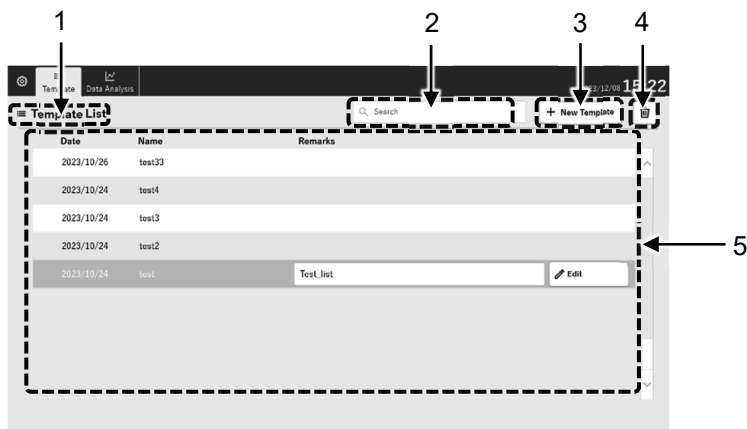


No.	Name	Details
1	Date & Time	Tapping this button displays the Date & Time dialog for setting date and time and their display format (see page 120).
2	Controller	Tapping this button displays the Controller dialog for viewing the controller version information, setting the brightness of the display, making screen-saver setting, and viewing the license and other information (see pages 121 to 124).
3	Detector	Tapping this button displays the Detector dialog for viewing the version information of the firmware and updating the firmware (see page 125).
4	Power Off	Tapping this button turns off the controller (see page 35).
5	Alarm Off	Tapping this button stops the alarm that sounds when an error occurs (see page 107).
6	Service	This is used by the service personnel. Users cannot use it.

FUNCTIONAL UNITS OF CONTROLLER SOFTWARE

Template menu

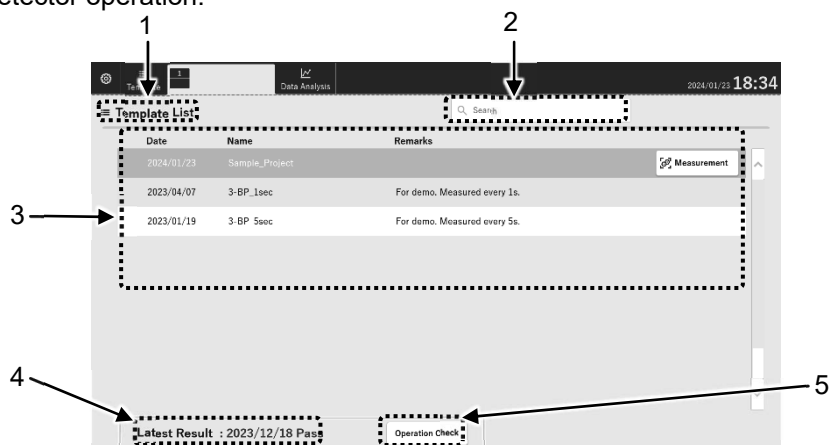
Tapping the Template tab displays the top screen of template menu. On this screen, you can create and edit an assay template that defines the measurement conditions (see pages 49 to 55).



No.	Name	Details
1	List title	Title of the displayed list (Template List)
2	Search box	Tapping this box displays the on-screen keyboard for entering a keyword to search for a template saved in the controller.
3	New Template button	Use this button to create a new template.
4	Trash icon	Tapping this icon shows checkboxes for selecting templates to be deleted. Tapping this icon again hides the checkboxes.
5	Template List	List of templates is displayed here with date of creation, name, and remarks. When a template is selected, the Edit button appears to the right side of the selected line.

Detector menu

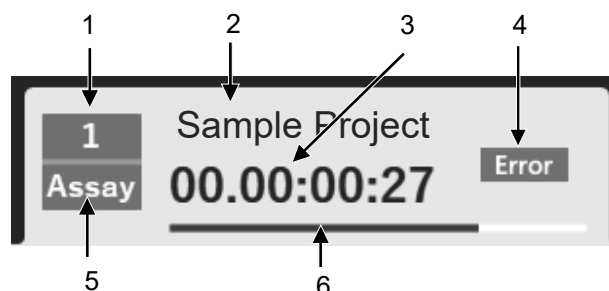
After a detector is connected to the controller, a detector tab is displayed (1 to 4). Tapping the detector tab displays the top screen of detector menu that shows template list you can use for measurement. Also, tapping the **Operation Check** button at the bottom of this screen displays the Operation Check screen for checking the detector operation.






No.	Name	Details
1	List title	Title of the displayed list (Template List).
2	Search box	Tapping this box displays the on-screen keyboard for entering a keyword to search for a template saved in the controller.
3	Template list	List of templates is displayed here with date of creation, name, and remarks. When a template is selected, the Measurement button appears to the right side of the selected line.
4	Latest operation check result	The result and date of the latest operation check using the check module is indicated. When the result is successful, the indication like the following is displayed in blue. Latest Result : 2023/03/10 Pass When the result is failed, the indication like the following is displayed in red. Latest Result : 2023/07/25 Fail When operation check is not performed, the indication like the following is displayed in red. Latest Result : Unchecked
5	Operation Check button	Use this button to check the operation (see pages 31 to 33).

Indication on the detector tab


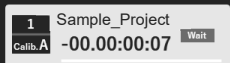
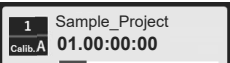
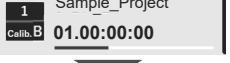
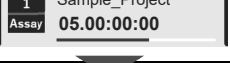
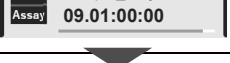
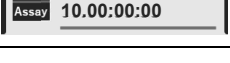
The information listed in the following table is displayed on the detector tab. The time elapsed from the start of the current measurement phase (calibration A, calibration B, or assay) is indicated by a numerical value in the center of the tab. The time elapsed from the start of calibration A up to now is indicated by the progress bar. When the bar reaches the rightmost position, it indicates the measurement period reached the measurable period of 12 days.



FUNCTIONAL UNITS OF CONTROLLER SOFTWARE

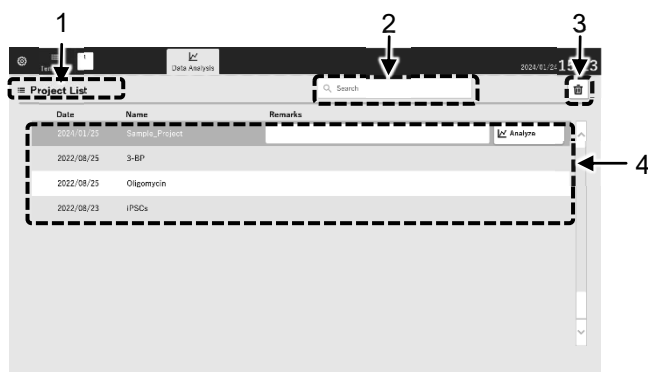
No.	Name	Details
1	Detector ID number	Indicates the detector ID number.
2	Project name	Indicates the project name defined in calibration A.
3	Measurement elapsed time	Indicates the time elapsed (DD.hh:mm:ss) from the start of the current measurement phase (calibration A, calibration A, or assay).
4	Status	Indicates the operation status of the detector. No indication: Normal status  (blinking): Waiting for the start of calibration A  (lighting): Measurement is paused  (blinking): Error Note: When multiple statuses occur at the same time, the Error indication takes precedence.
5	Measurement phase	Indicates the current measurement phase. Calib.A: Calibration A measurement is in progress Calib.B: Calibration B measurement is in progress Assay: Assay is in progress
6	Progress bar	Indicates the time elapsed from the start of calibration A (When the bar reaches the rightmost position, it indicates the measurement period reached the measurable period of 12 days).

Example: Indications on the detector tab in a measurement flow

Indication	Status	Remarks
	Detector is connected.	
	Waiting for the start of calibration A.	<ul style="list-style-type: none"> The Wait icon blinks. The countdown starts from 10 to 0 minutes. The remaining time is shown in negative numbers.
	Calibration A is in progress. Calibration A is completed.	User can stop the calibration at any time after four hours have elapsed.
	Calibration B is in progress. Calibration B is completed.	User can stop the calibration at any time after four hours have elapsed.
	Assay is in progress.	
	Assay is in progress. (Less than 24 hours until automatic completion.)	The progress bar blinks in orange.
	Assay is automatically completed.	The progress bar lights in red.

Data analysis menu

Tapping the Data Analysis tab displays the top screen of data analysis menu. On this screen, you can select the project to view, analyze, or export the measured data (see page 84 to 105).



No.	Name	Details
1	List title	Title of the displayed list (Project List).
2	Search box	Searches the templates stored in the controller.
3	Trash icon	Tapping this icon shows checkboxes for selecting projects to be deleted. Tapping this icon again hides the checkboxes.
4	Project list	List of projects is displayed here (project start date, project name, remarks). When a project is selected, the Analyze button appears to the right side of the selected line.

4. MEASUREMENT AND ANALYSIS

MEASUREMENT AND ANALYSIS FLOW

After installed the analyzer and checked its operation, perform measurement, analysis, and data export as follows:

1. Creation of an assay template (pages 49 to 55)



Create an assay template based on the experimental conditions. Enter the information of cells, culture medium, and other details, as well as the positioning of wells in the assay template. To create an assay template, the information of the glucose concentration and lactate concentration in the culture medium to be measured (target culture medium) is required.

Notes:

- If you do not know the glucose concentration and lactate concentration in the target culture medium, you cannot calculate concentration correctly in the measurement processes. Make sure to obtain the information of the glucose concentration and lactate concentration from the data sheet of the culture medium or by quantitative analysis such as the colorimeter method.
- This system cannot perform measurement properly in a low-oxygen environment. Do not use the system for low-oxygen culture.

2. Preparation of solution (pages 56 to 58)



Determine the type and amount of the solutions required for calibration and assay based on the assay template and prepare them. Prepare a calibration solution for each type of target culture medium since the sensor sensitivity varies depending on the type of culture medium. The calibration solution is also used as the solution for the blank condition (no cells) to determine the impact of the culture medium on the sensor.

3. Calibration (pages 59 to 76)



By measuring the prepared calibration solution of a known concentration, obtain the standard curve that represents the relation between the electric current (nA) and glucose/lactate concentration (mM). In this system, two-point calibration is performed by measuring two calibration solutions (A and B) of different concentrations. Performing each calibration for 24 hours is recommended.

4. Assay (pages 77 to 83)



Using the sensor that has been calibrated, continuously measure the glucose concentration and lactate concentration in the culture medium during cell culturing. The interval of measurement is one minute. The sensor module can be used for measurement for 12 days from the start of calibration. The measurement automatically stops when 12 days have elapsed after starting calibration.

5. Data analysis (pages 84 to 95)



Analyze the project data after assay. Smooth the data to remove noise from measured values. The smoothed data is converted to 15-minute-interval data. By differentiating the smoothed data, the glucose consumption rate and the lactate production rate can be obtained.

6. Data export (pages 96 to 105)

Export the measured data and analysis results stored in the system to a USB flash drive connected to the USB port at the back side of the controller as a CSV file and a PNG file.

Note:

If an error or warning status occurs during operation, take an appropriate measure by referring to the description on pages 108 to 112.

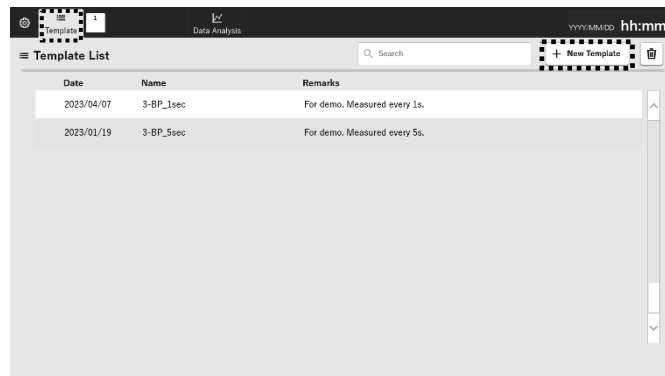
1. CREATION OF AN ASSAY TEMPLATE

Create an assay template by entering the information about the cells, culture medium, and well assignment based on the experimental conditions.

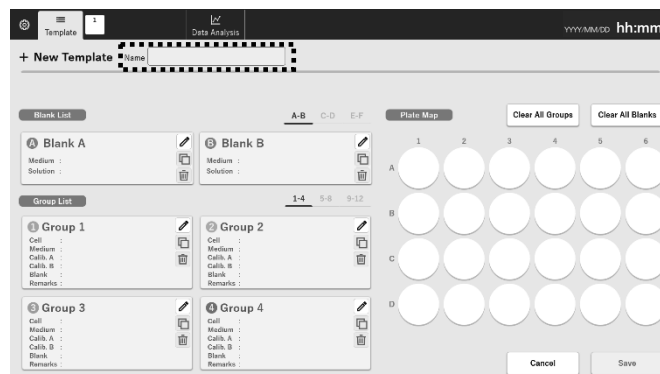
Creating new assay template


Follow the steps below to create a new assay template.

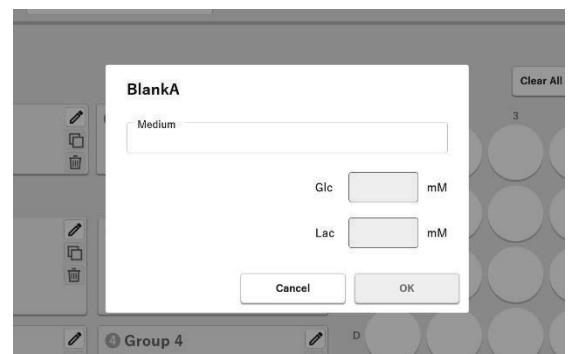
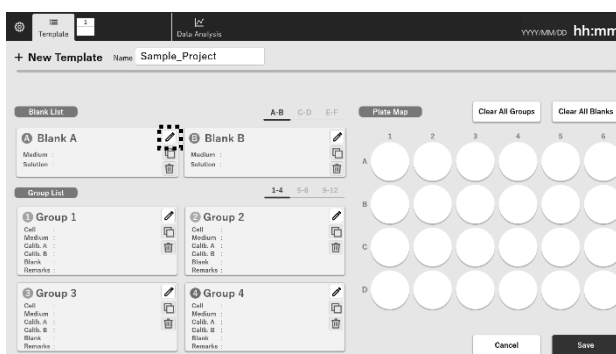
1. Tap the Template tab on the main tab bar and tap the **New Template** button on the top screen of detector menu.
 - ▶ The New Template screen is displayed.



2. Tap the Name text box and enter an assay template name.



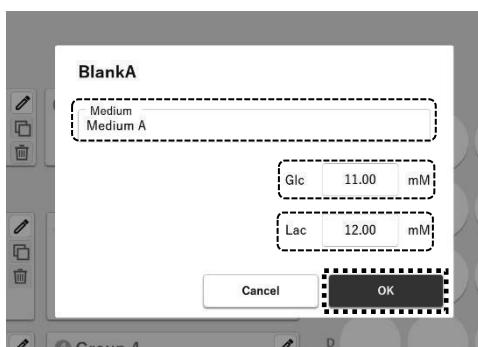
3. Tap the edit icon () in any Blank (e.g., Blank A).
 - ▶ A dialog for entering the Blank information is displayed.



1. CREATION OF AN ASSAY TEMPLATE

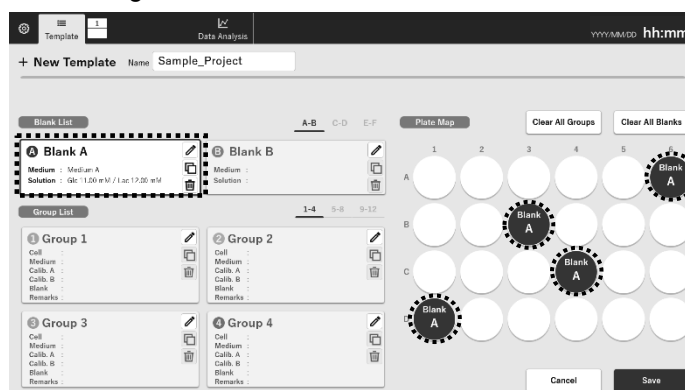
- Tap and fill out each text box in the dialog (for details, see the table below) and tap the **OK** button. The use of Blank allows you to evaluate the influence of the target culture medium and the measurement environment on the sensor by measuring only the medium not containing cells. This is done by comparing the electric current obtained at the end of calibration B and the electric current obtained during the assay using the same calibration B solution. For this purpose, the same calibration B solution should be used for Blank during calibration B and assay.
 - The values are saved, and the New Template screen is displayed. Tapping the **Cancel** button cancels the entered values, and the New Template screen is displayed again.


Medium	Enter a name of the culture medium to be used (optional).
Glc	Enter the glucose concentration of calibration B solution (mandatory). Recommended value: The value of the glucose concentration of the target culture medium. * If you add an additive such as FBS that contains glucose or lactate in the assay phase, use the concentration values before adding it.
Lac	Enter the lactate concentration of calibration B solution (mandatory). Recommended value: 12 mM.

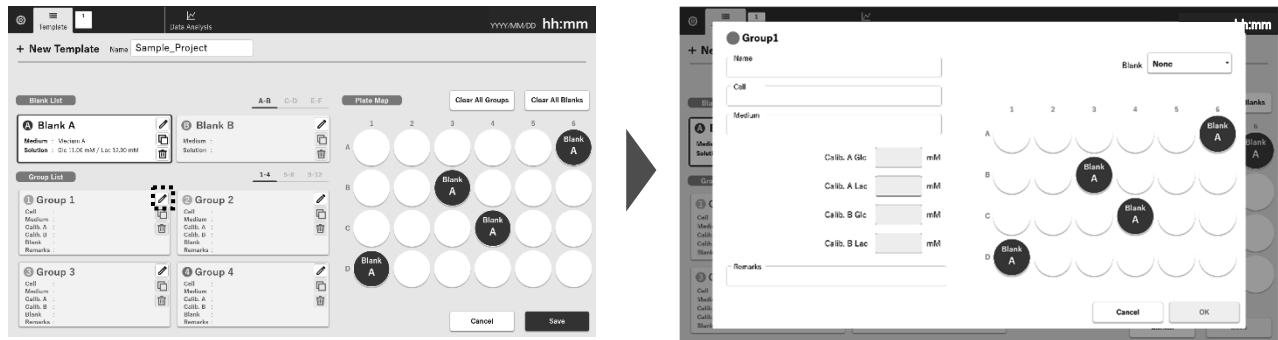


Notes:

- The sensor's sensitivity may fluctuate over time depending on the type of the target culture medium. To check whether the target culture medium affects the measurement result, we recommend that you prepare a Blank condition that does not contain cells.
 - A Blank condition is configured for each type of target culture medium. Therefore, if you use the same culture medium for the experimental conditions (Groups) in a plate, the same Blank condition can be shared.
 - Before starting measurement, we recommend that you verify all culture media's conditions are within the sensor's supported range.
 - The **OK** button does not become available until you enter the Blank information (Glc and Lac), which is necessary for measurement.
- Tap a Blank (e.g., Blank A) and tap any wells to which you want to assign the Blank on the Plate Map (Assigning the Blank condition to three or more wells is recommended).
 - The Blank condition is assigned.

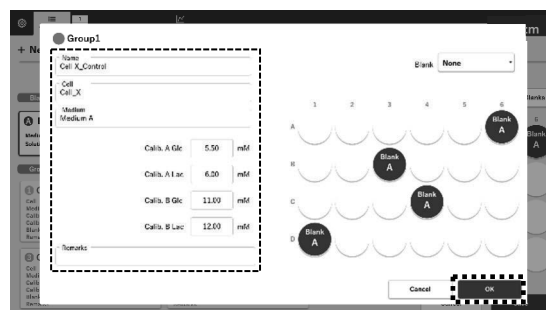


6. Tap the edit icon () in any Group (e.g., Group1).
 ► A dialog for entering the Group information is displayed.



7. Tap and fill out each text box in the dialog (for details, see the table below) and tap the **OK** button.
 ► The values are saved, and the New Template screen is displayed again.

Name	Enter a name of the Group (optional).									
Cell	Enter a name of the cell to be measured (optional).									
Medium	Enter a name of the culture medium (optional).									
Calib. A Glc/Lac, Calib. B Glc/Lac	<p>Enter the glucose concentration and lactate concentration of calibration A solution and calibration B solution (mandatory). The recommended values of the glucose concentration and lactate concentration of the calibration solution are as follows:</p> <table border="1"> <thead> <tr> <th></th> <th>Glucose concentration</th> <th>Lactate concentration</th> </tr> </thead> <tbody> <tr> <td>Calibration A solution</td> <td>Half of the glucose concentration of the target culture medium *1</td> <td>6 mM</td> </tr> <tr> <td>Calibration B solution</td> <td>Glucose concentration of the culture medium to be measured *2</td> <td>12 mM</td> </tr> </tbody> </table> <p>*1: If you cannot obtain a glucose-free version of the target culture medium, enter the value of "glucose concentration of target culture medium + 2 mM" as the glucose concentration of calibration A solution. *2: If you add an additive such as FBS that contains glucose or lactate at the assay phase, use the concentration values before adding it.</p>		Glucose concentration	Lactate concentration	Calibration A solution	Half of the glucose concentration of the target culture medium *1	6 mM	Calibration B solution	Glucose concentration of the culture medium to be measured *2	12 mM
	Glucose concentration	Lactate concentration								
Calibration A solution	Half of the glucose concentration of the target culture medium *1	6 mM								
Calibration B solution	Glucose concentration of the culture medium to be measured *2	12 mM								
Remarks	Enter remarks such as other experimental conditions (optional).									
Blank	<p>Since Blank is not used at the start of measurement, leave this menu with None selected.</p> <p>When performing blank correction, select a blank ID (e.g., A) that will be used for the blank correction. Blank correction is used to correct the changes in sensor sensitivity due to target medium or temperature fluctuations. For details about blank correction, refer to "Blank correction" on page 90.</p>									

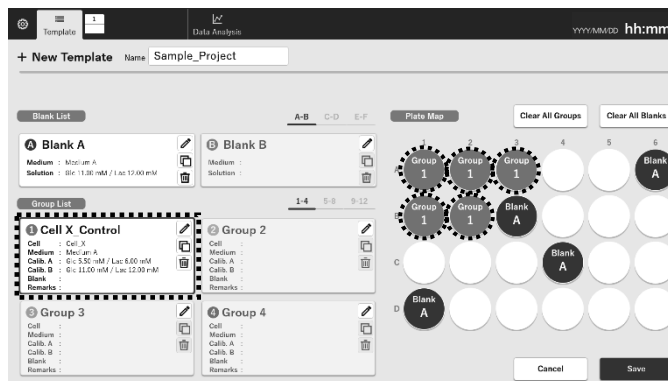


Notes:

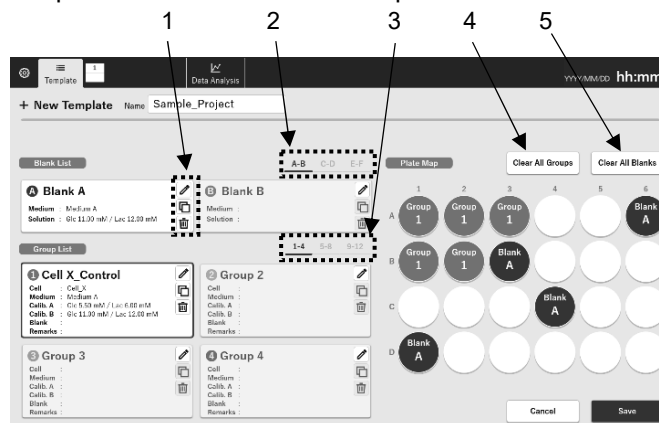
- You cannot use 2-DG, which is an inhibitor of glycolysis, since it is measured as glucose. An additive such as ascorbic acid may affect the measured value. We recommend that you confirm that reagents used in the experiment do not affect the measurement results by comparing them with the result of an additive experiment or other quantitative analysis.
- The sensor has different standard curves depending on the type of culture medium. Therefore, before assay, obtain standard curves using two types of solutions for calibration that are prepared based on the experimental condition (Group).
- The **OK** button does not become available until you enter the Group information (Calib. A Glc/Lac and Calib. B Glc/Lac), which is necessary for measurement.

1. CREATION OF AN ASSAY TEMPLATE

- Tap the Group (e.g., Cell X_Control) condition and tap any wells to which you want to assign the condition in the Plate Map (Assigning the Group condition to three or more wells is recommended).
▶ The Group condition is assigned.



- Set the Blank and Group conditions based on the experimental condition.



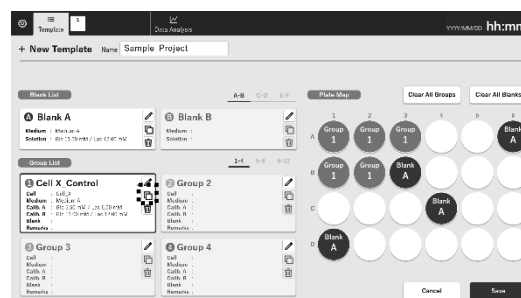
No.	Item	Description
1	Edit icon	Tap these icons to edit, copy, or delete a Blank or Group. ✎ : Edit the setting of a Blank or Group. 📄 : Copy a Blank or Group. 🗑️ : Delete a Blank or Group.
2	Blank selection tab	You can configure 6 Blanks (tabs A-B, C-D, and E-F).
3	Group selection tab	You can configure 12 Groups (tabs 1-4, 5-8, and 9-12).
4	Clear All Groups button	Tap this button to delete all Groups displayed on the Plate Map.
5	Clear All Blanks button	Tap this button to delete all Blanks displayed on the Plate Map.

Notes:

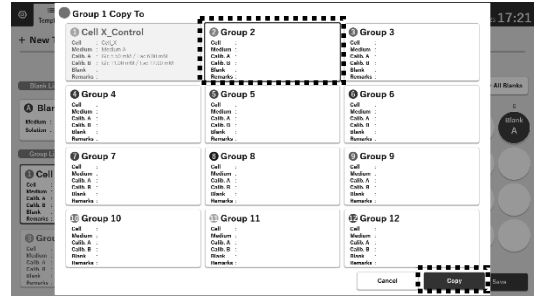
- You do not have to set conditions for the wells not to be used for measurement (indicated in white). Such wells are called “unassigned wells” and are excluded from graph indication and analysis. After calibration A starts, you cannot assign a Blank or Group conditions to the unassigned wells. If there is a possibility of using the wells, assign some conditions to the wells beforehand.
- To copy the data in a Blank or Group to another Blank or Group, follow the steps below.

- Tap the copy icon (📄) on a Blank or Group you want to copy the data (in this example, copy icon on “Cell X_Control”).

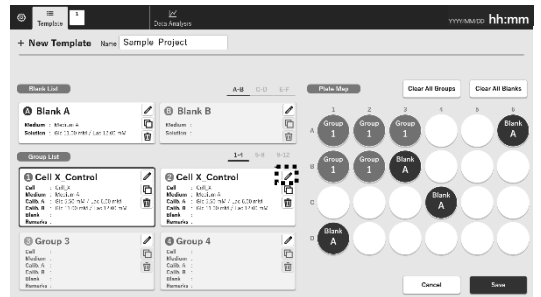
▶ The list of Blanks or Groups is displayed.



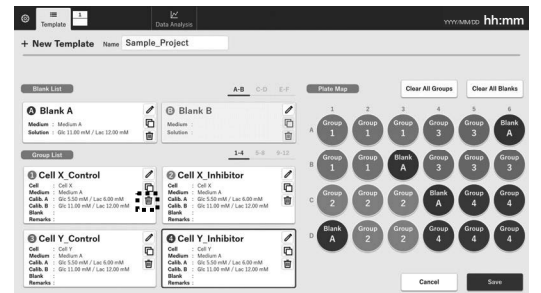
- On the list screen, tap a copy target Blank or Group (in this example, Group 2) and then tap the **Copy** button at the bottom.
 - The copied blank or group is displayed on the New Template screen.



- As necessary, tap the edit icon on the Blank or Group to which you copied the data and edit it.



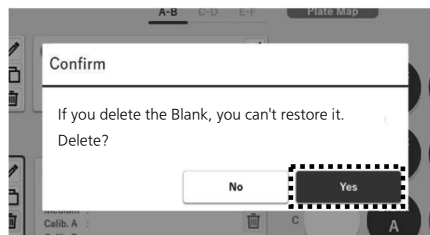
- Follow the steps below to delete a Blank or Group.
 - Tap the delete icon () in a Blank or Group (e.g., Cell X_Control).
 - The Confirm dialog is displayed.



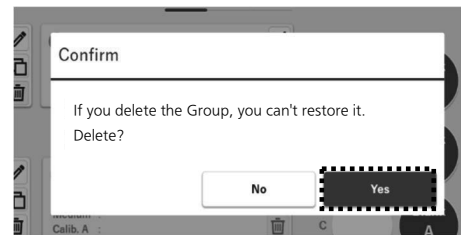
2. Tap the **Yes** button.

- The selected Group or Blank is deleted, and the New Template screen is displayed again. Tapping the **No** button returns to the New Template screen.

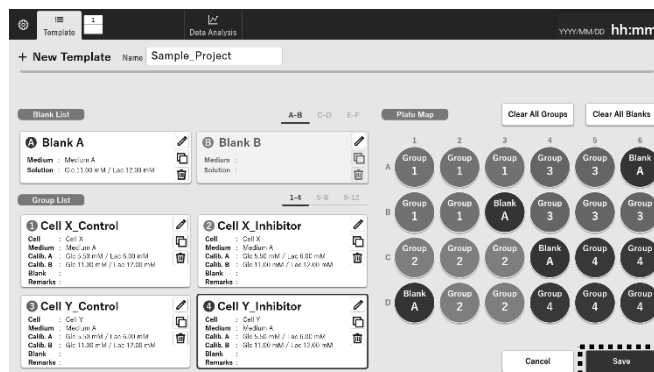
Confirm dialog (Blank)



Confirm dialog (Group)



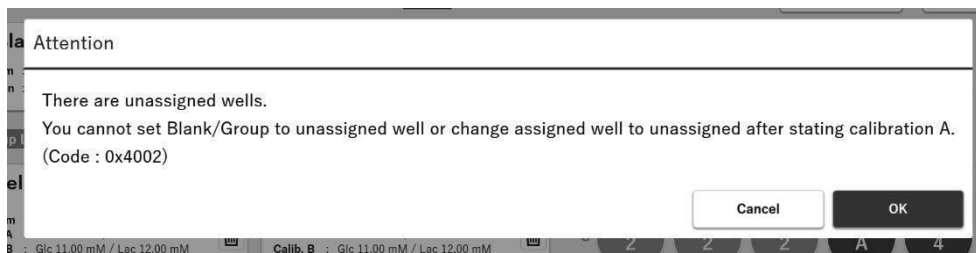
- After completing the configuration, tap the **Save** button.
 - A confirmation dialog for saving the template is displayed.



1. CREATION OF AN ASSAY TEMPLATE

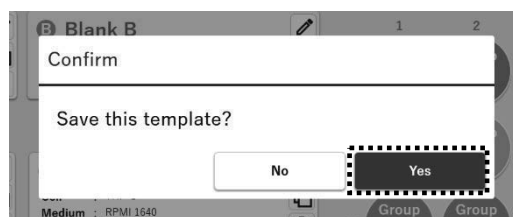
Note:

When you tap the **Save** button with any unassigned (that is, Group or Blank conditions are not assigned) wells, the following Attention dialog is displayed. After starting calibration A, you cannot assign Blank or Group conditions to the unassigned wells. If there is a possibility of using the wells, tap the **Cancel** button and assign some conditions to the wells beforehand. If you do not use unassigned wells after starting calibration A, tap the **OK** button.



11. Tap the **Yes** button.

► The template is saved, and the top screen is displayed. Tapping the **No** button displays the New Template screen again without saving the template.

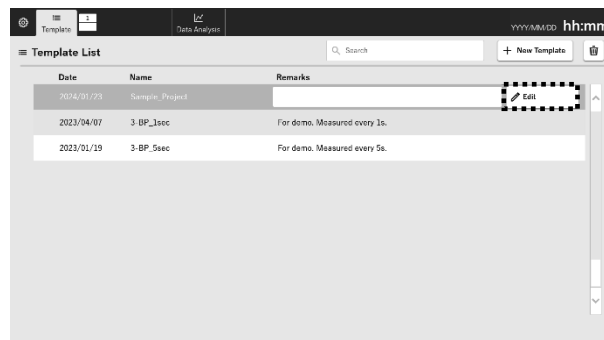
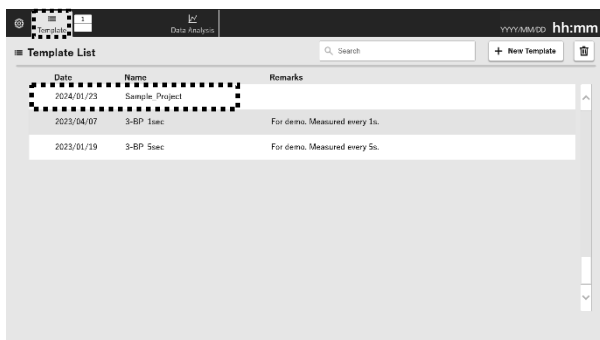


Editing existing assay template

Follow the steps below to edit the data in an existing assay template.

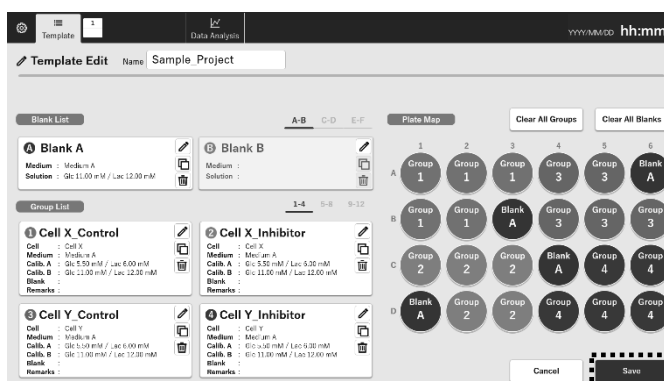
1. Tap the Template tab on the main tab bar, tap the template that you want to edit on the top screen of template menu and then tap the **Edit** button.

► The Template Edit screen is displayed.



2. After editing the template information (see step 3 to 9 in “Creating new assay template” on pages 49-53), tap the **Save** button.

► The Error dialog is displayed.



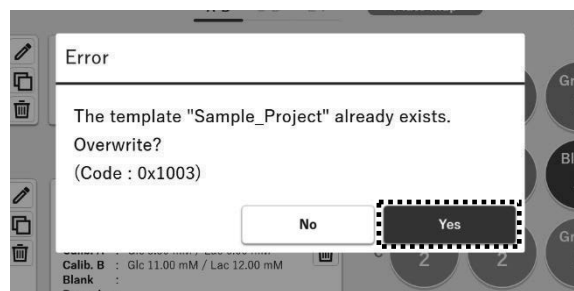
Note:

Tapping the **Cancel** button displays the Confirm dialog.

If you tap the **Yes** button on the Confirm dialog, the top screen is displayed without saving the edited template. If you tap the **No** button, the screen returns to the Template Edit screen.



3. Tap the **Yes** button to save the template with the original template name by overwriting the old data.
▶ The edited template is saved, and the top screen is displayed. Tapping the **No** button displays the Template Edit screen again.

**Note:**

To save the template with a different name, tap the **No** button, change the template name (in the Name field), and then tap the **Save** button again.

2. PREPARATION OF SOLUTION

Prepare a calibration solution based on the assay template by following the steps below in a sterile environment in a biological safety cabinet (or a clean bench).



WARNING

Observe the laboratory biosafety guidelines issued by WHO.

Refer to laboratory biosafety guidelines issued by WHO. This product is expected to be used with biosafety level 2 or lower.

Wear an appropriate protective gear such as gloves and glasses when you handle a hazardous substance such as lactate liquid.

A lactate solution causes a serious injury if it contacts your skin or eye.

Preparing a sterilized lactate solution

1. Prepare the following items in the biological safety cabinet.

- High-purity lactate (powder)
- Sterilized ultrapure water (cell culture grade)
- $\phi 0.22 \mu\text{m}$ syringe filter
- Sterilized syringe
- Items necessary for sterile preparation such as a pipette and tube.

Notes:

- The concentration of low-purity lactate changes during calibration by hydrolysis because it contains multimeric lactate. Always use L-lactate of a purity of 98% or higher.
- The performance of the following product has been confirmed as a high-purity lactate (powder).
L6402: Sigma-Aldrich: L-(+)-lactate

2. Prepare a lactate solution.

► Weigh the high-purity lactate in a sterilized tube and add sterilized ultrapure water (cell culture grade) to make it 1.2 M.

Example: Preparing a lactate solution of 1 mL

	Necessary amount
High-purity lactate	108 mg
Sterilized ultrapure water (cell culture grade)	1 mL

3. Filter sterilize the prepared lactate solution using a syringe filter and measure the lactate concentration of the sterilized lactate solution.

Note:

Determine the concentration just after preparing the lactate solution since high-purity lactate (powder) absorbs moisture rapidly.

Preparing a calibration solution

- Prepare the following items in the biological safety cabinet.
 - Culture medium to be measured (target culture medium)^{*1}
 - Glucose-free version of the target culture medium^{*2}
 - Sterilized lactate solution (prepared in "Preparing a sterilized lactate solution" above)
 - 50 mL sterilized tube
 - Items necessary for sterile preparation such as a pipette and tube.

*1: If you add an additive such as FBS that contains glucose or lactate, use the culture medium before adding it.

*2: If you cannot obtain a glucose-free culture medium, use a sterilized glucose solution instead.

Note:

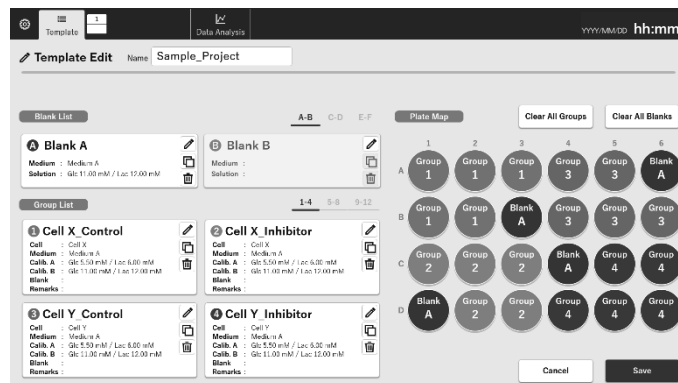
As a sterilized glucose solution, the performance of the following product has been verified:
G8769: Sigma-Aldrich: D-(+)-Glucose

- Calculate the amount of the calibration solution based on the number of the Group wells and Blank wells in the assay template.

Note:

The amount of solution required for each well is 1 mL. Regardless of the experimental conditions, the same calibration solution can be used if the conditions of the target culture medium are the same.

The following table shows example a preparation pattern of the solutions for the following experimental protocol.



	Calibration		Assay	
Time	24 hours	24 hours	24 hours	48 hours
Group	Calib. A	Calib. B	Assay 1	Assay 2
Blank	Calib. A	Calib. B	Calib. B	

Group	Use the same calibration solution for all groups since the same culture medium is used for all groups. Amount of calibration A/B solution: 4 Groups x 5 wells/Group x 1 mL/well = 20 mL
Blank	During calibration, calibration A and B solutions are measured in the same way as the Group wells. During assay, calibration B solution* is measured. When exchanging the culture medium for Group wells, also exchange these solutions. Amount of calibration A solution for Blank A: 4 wells x 1 mL/well/exchange x 1 exchange = 4 mL Amount of calibration B solution for Blank A: 4 wells x 1 mL/well/exchange x 2 exchanges = 8 mL
Total	Calibration A solution: 24 mL Calibration B solution: 28 mL

* Using a Blank, you can evaluate the influence of the target culture medium and the measurement environment on the sensor by measuring only the medium not containing cells. This is done by comparing the electric current obtained at the end of calibration B and the electric current obtained during the assay using the same calibration B solution. For this purpose, the same calibration B solution should be used for Blank during calibration B and assay.

2. PREPARATION OF SOLUTION

3. Prepare necessary amount of calibration solutions with extra amount at the same calibration solution concentration entered in the assay template.

•The case of preparing 10 mL calibration solution with the recommended conditions:

	Calibration A solution	Calibration B solution
Medium A	5 mL	10 mL
Medium A, no glucose	5 mL	0 mL
1.2 M lactate solution *	0.05 mL	0.1 mL

•The case of preparing calibration solution when a glucose-free culture medium is not available:

	Calibration A solution	Calibration B solution
Medium A	10 mL	10 mL
45% (= 2.5 M) glucose solution	0.008 mL	0 mL
1.2 M lactate solution *	0.05 mL	0.1 mL

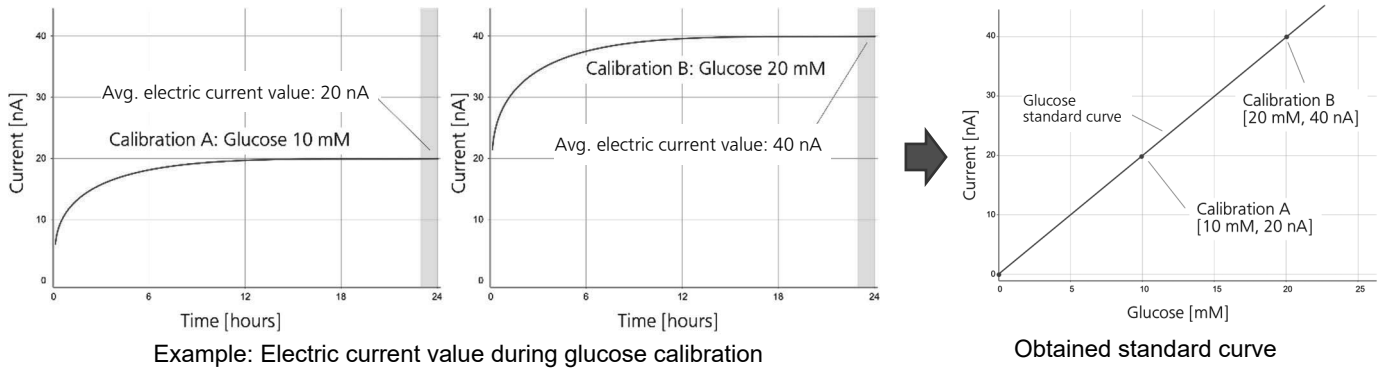
* Adjust the amount of added lactate solution if medium A contains lactate.

4. Determine the glucose concentration and lactate concentration of each solution after preparation as necessary.

3. CALIBRATION

In the calibration phase, prepared calibration solution of a known concentration is measured to obtain a standard curve that represents the relation between the electric current value measured by the sensor and glucose/lactate concentration.

The electric current value used for the standard curve is the average electric current value during the last one hour before the end of each calibration.



WARNING

Observe the laboratory biosafety guidelines issued by WHO.

Refer to laboratory biosafety guidelines issued by WHO. This product is expected to be used at biosafety level 2 or lower.

Wear an appropriate protective gear such as gloves and glasses when you handle a hazardous substance such as lactate liquid.

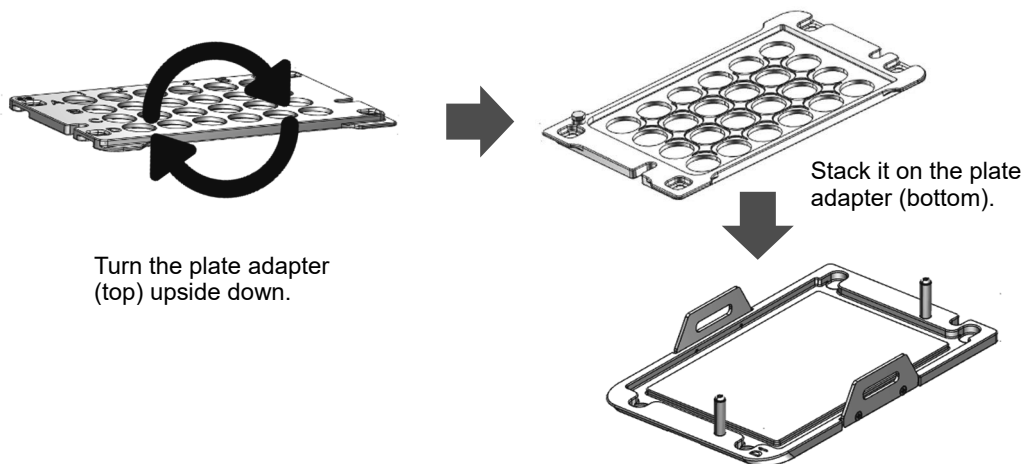
A lactate solution causes a serious injury if it contacts your skin or eye.

Preparation

1. Clean the plate adapters (top and bottom) that match the brand of the 24-well plate to be used using a cloth moistened with 70% ethanol, put it in an autoclave bag, and auto-clave it (20 minutes at 121°C).

Notes:

- Always autoclave the plate adapters (top and bottom) before using them. Failure to autoclave them may cause contamination.
- When putting the plate adapter (top) in an autoclave bag, stack the plate adapter (top) on the plate adapter (bottom) with the plate adapter (top) upside down. If not and if it receives pressure from above, the plate adapter (top) may be deformed.



- If you use a plate adapter (top) that does not match the brand of the 24-well plate to be used, correct measurement may not be performed due to damage on the sensor or increased evaporation from the culture medium.

3. CALIBRATION

2. Take the sensor module wrapped in an aluminum package out of the refrigerator to warm it to room temperature.

Notes:

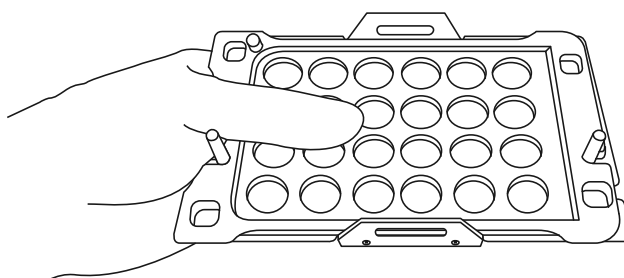
- Do not use the sensor module before it warms to room temperature. Otherwise, contamination may occur, or correct measurement may not be performed due to condensation.
- Be careful not to drop the sensor module wrapped in an aluminum package when carrying it. We cannot guarantee the barrier properties of the package if it is dropped.
- If there is a tear on the package, do not use the sensor module since the sensor module may be contaminated.
- Before putting the sensor module in the biological safety cabinet, wipe its aluminum package with a cloth moistened with 70% ethanol.

Performing calibration A

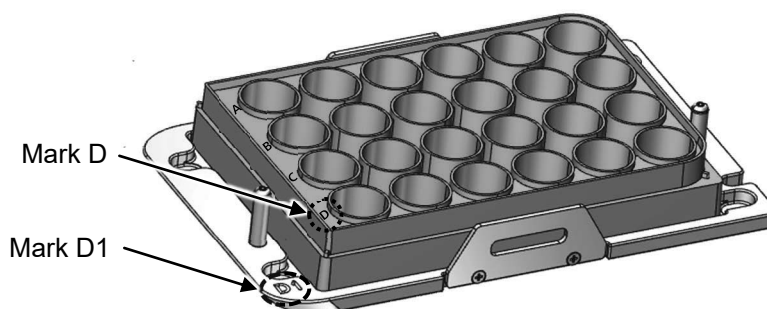
1. Prepare the following items in the biological safety cabinet.
 - Sensor module at room temperature (wrapped in an aluminum package)
 - Autoclaved plate adapters (top and bottom)
 - 24-well plate
 - Calibration A solution
 - Phosphate-buffered saline (PBS) (if there are unused wells)
 - Items necessary for sterile operations
2. Prepare the 24-well plate for calibration A based on the created assay template (pages 49-54).
 - Add corresponding 1 mL calibration A solution to each Group well.
 - Add corresponding 1 mL calibration A solution to each Blank well.
 - Add 1 mL phosphate-buffered saline (PBS) to each of other empty wells.

Note:
If phosphate-buffered saline (PBS) is not added to empty wells, evaporation from other adjacent wells increases, which may cause incorrect measurement.
3. Take the sterilized plate adapters (top and bottom) out of the autoclave bag.
When doing this, do not touch the top and bottom surfaces of the plate adapter (top). Touching them may cause contamination.

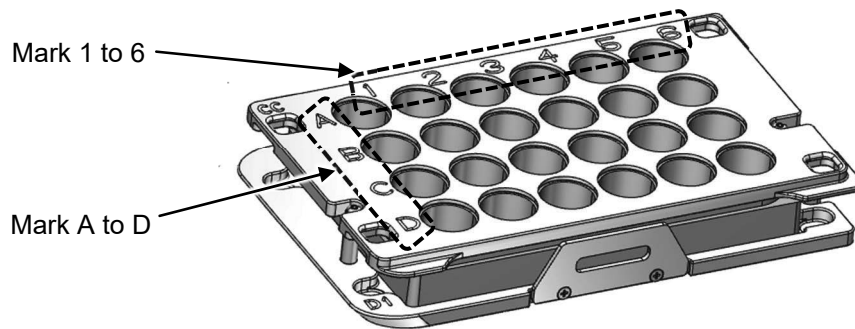
Incorrect



4. Set the 24-well plate on the plate adapter (bottom) so that the mark (D) on the 24-well plate comes to the mark (D1) position on the plate adapter (bottom).

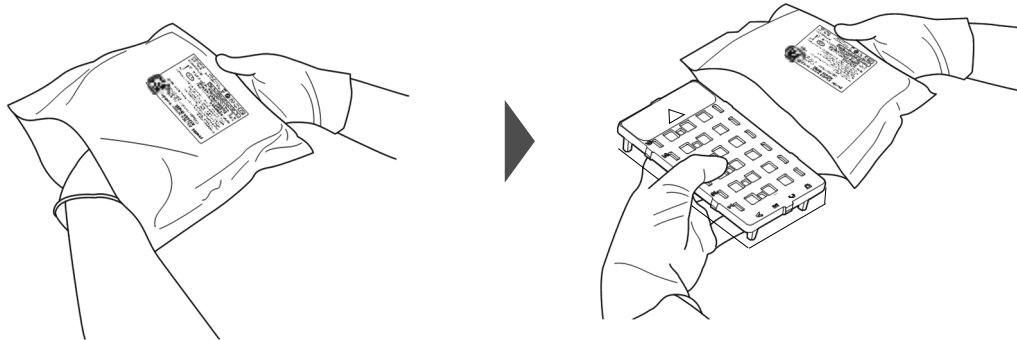


5. After removing the 24-well plate lid, set the plate adapter (top) so that the marks on the plate adapter (top) come to the same marks on the 24-well plate.



6. Take the sensor module out of the aluminum package.

- 1) With holding the aluminum package with the labeled surface facing upward, cut the side of the package with scissors.
- 2) Put your hand into the package and take out the sensor module and the protection container together.



Notes:

- The sensor serial number printed on the aluminum package is required at the start of calibration. Do not throw away the aluminum package until you start calibration.
- When you take the sensor module out of the package, the desiccant inside may fall.
- Do not touch the sensor tips and electrode pads when you handle the sensor module.
- Do not wipe the sensor tips on the sensor module with a cloth moistened with 70% ethanol.

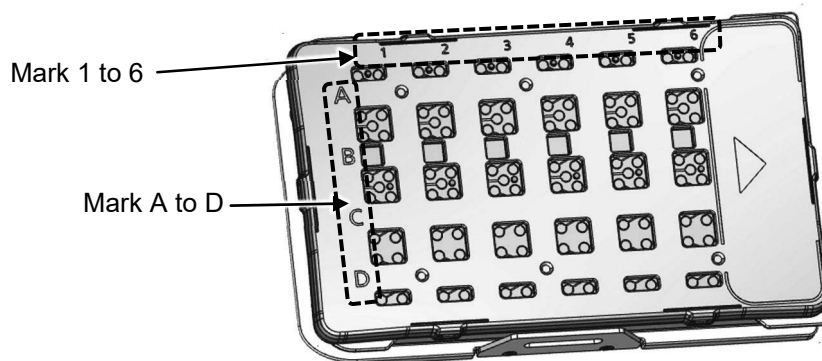
7. Set the sensor module on the plate adapter (top) so that the well numbers and letters printed on the plate adapter (top) and marks on the sensor module come to the same position.



CAUTION

Do not use the sensor module for measurement when its resin part is damaged.

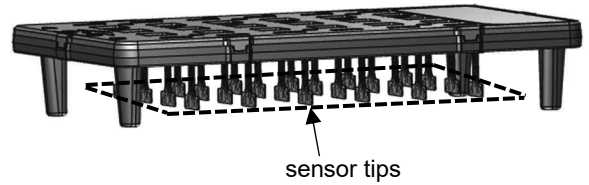
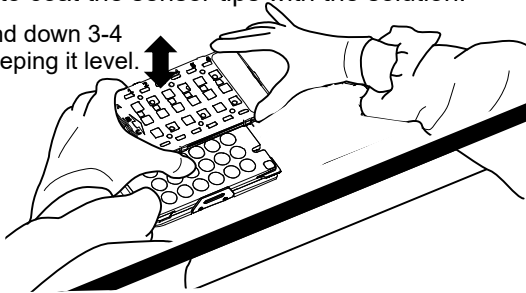
Correct measurement may not be performed. Handle it with caution. You may get injured by damaged part.



3. CALIBRATION

- By holding the sensor module horizontally, lift the sensor module out of the Calibration A solution, then lower the sensor module to immerse the sensor tips into the solution again. Repeat this action 3 to 4 times to coat the sensor tips with the solution.

Move up and down 3-4 times by keeping it level.



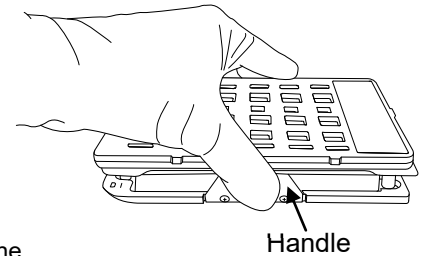
Note:

The sensor tips are dry when preparing the sensor module assembly for calibration A. Therefore, air bubbles may occasionally be formed on the tips when immersing them in the solution. The air bubbles hinder the correct performance of calibration. Doing this up-and-down movement removes the bubbles.

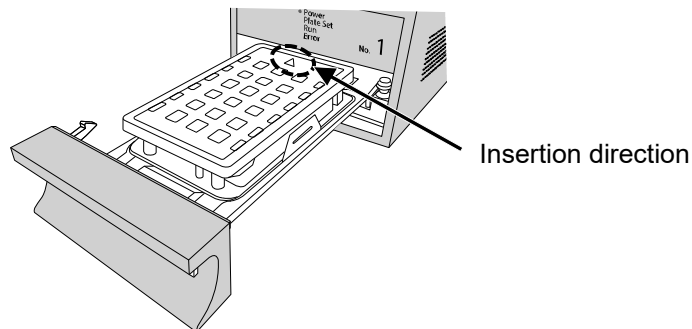
- Take out the sensor module assembly from the biological safety cabinet keeping the assembly horizontal.

Notes:

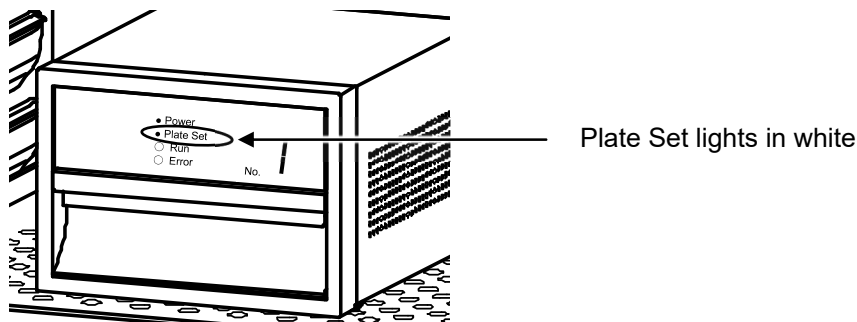
- When you hold the sensor module assembly, hold the handles of the plate adapter (bottom). If you hold other sections, the sensor module or other components may disengage to spill the culture medium in the 24-well plate.
- Hold the sensor module assembly keeping it in horizontal. Otherwise, the culture medium may spill from the 24-well plate.
- Make sure that culture medium does not adhere to the electrode pad of the sensor module. Otherwise, measurement may not be performed correctly.
- When you clean the sensor module, wipe the resin part on the top surface of the sensor module with a cloth moistened with a small amount of 70% ethanol. Do not spray 70% ethanol directly on the sensor module. Wet electrode pad of the sensor module may hamper correct measurement.



- Open the CO₂ incubator door, slide open the detector tray fully, and then set the sensor module assembly on the tray so that the triangle mark on the sensor module assembly points to the back of the detector.



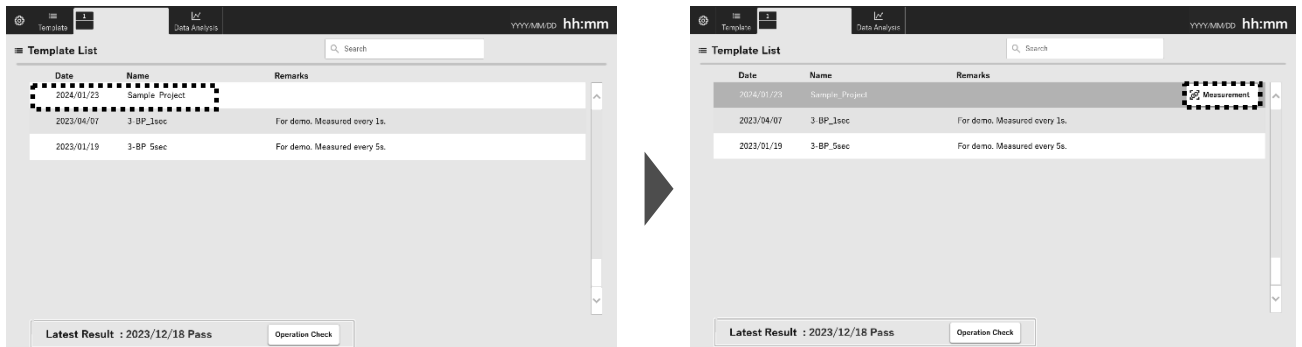
- Push the tray trigger to close. Then, confirm that the Plate Set LED on the front panel lights in white, and close the CO₂ incubator door.



Note:

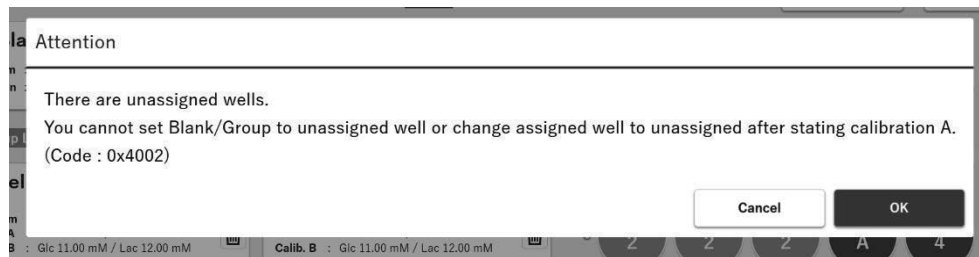
Open or close the tray carefully. If you open or close the tray carelessly, the culture medium may spill inside the sensor module assembly.

12. Tap the detector tab with the detector ID number in which you inserted the sensor module assembly. Then, select the template you use from the template list and tap the **Measurement** button.
- ▶ The Calibration A screen is displayed.

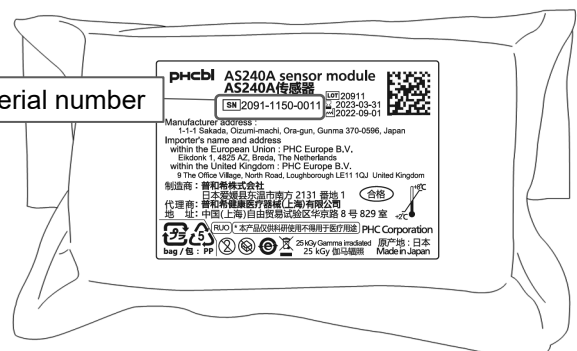
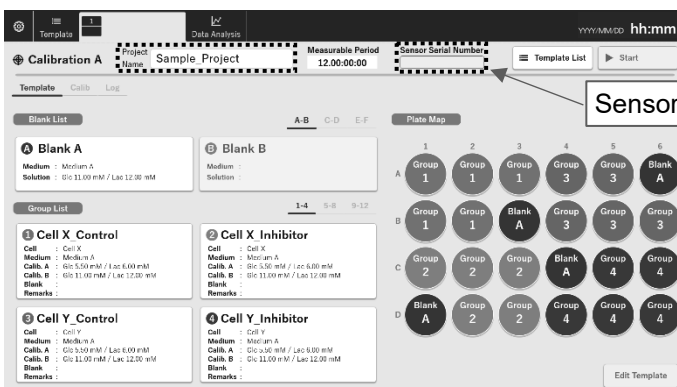


Notes:

- After measuring the glucose concentration and lactate concentration of calibration solutions or other solutions, update the concentration information in the template as necessary. For details, see “Editing existing assay template” on pages 54 and 55.
- If the template has any unassigned (that is, Group or Blank conditions are not assigned) wells, the following Attention dialog is displayed. After starting calibration A, you cannot assign Blank or Group conditions to the unassigned wells. If there is a possibility of using the wells, tap the **Cancel** button and open the Template Edit screen (see “Editing existing assay template” on pages 54 and 55) to assign some conditions to the wells beforehand. If you do not use unassigned wells after starting calibration A, tap the **OK** button.

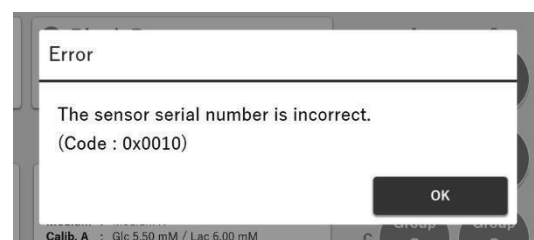


13. Enter the project name (in the Project Name field) and sensor serial number (in Sensor Serial Number field).
- Project Name**
The default value of the Project Name is the template name. The experiment starting date is automatically added to the project.
 - Sensor Serial Number (mandatory)**
Enter the sensor serial number printed on the aluminum package for the sensor module.



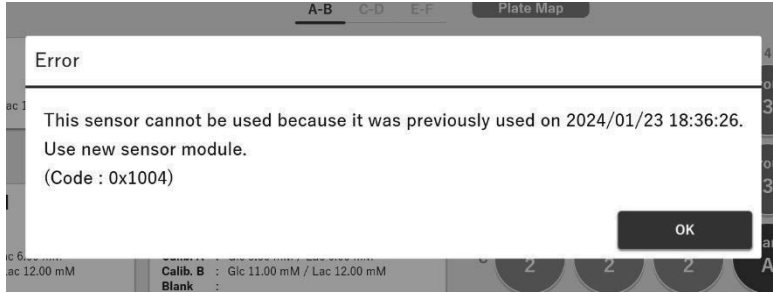
Notes:

- If you enter an incorrect sensor serial number, the following Error is displayed. Tap the **OK** button and enter a correct sensor serial number.

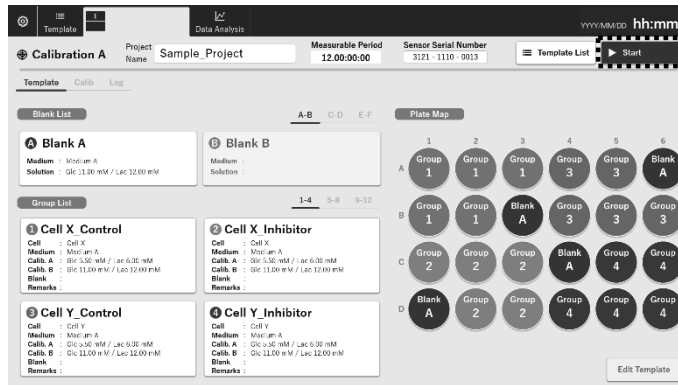


3. CALIBRATION

- If you enter the sensor serial number that has been already used, the following Error is displayed. Tap the **OK** button and enter the sensor serial number for a new sensor module.

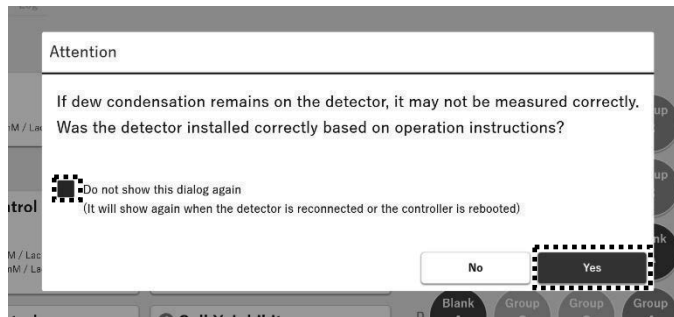


14. Tap the **Start** button.
 - ▶ Calibration A starts.

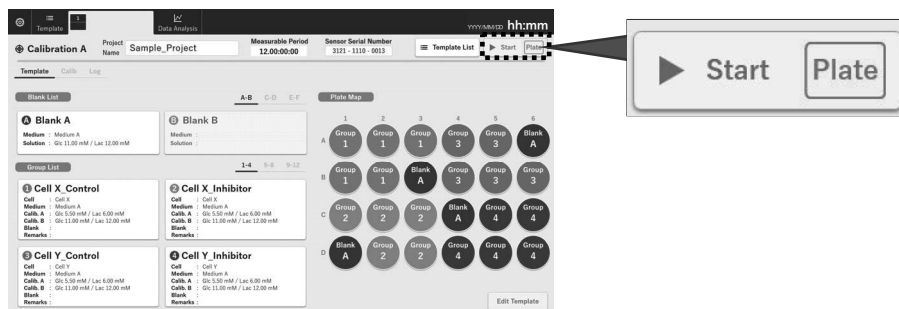


Notes:

- Tapping the **Start** button displays the Attention dialog about condensation. If you do not want to see this message anymore, select the check box and tap the **Yes** button. However, this Attention message is displayed when you select the **No** button, disconnect the detector and connect it again, select a different detector, or restart the controller.

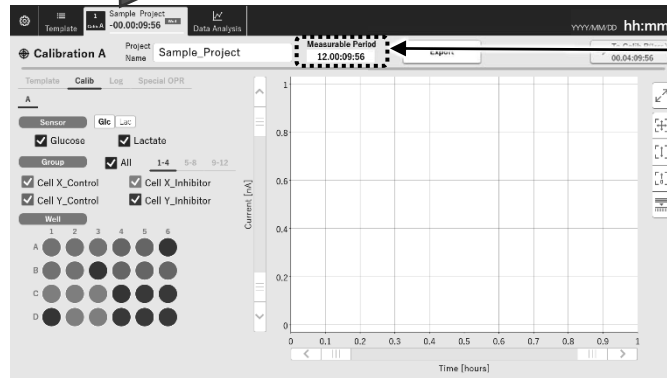
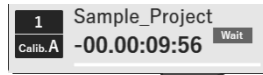


- When the sensor module assembly is not set in the detector, the **Start** button is grayed out and "Plate" blinks next to the **Start** button.



15. Adjustment before measurement is performed automatically.

► Measurement does not start for 10 minutes, during which the sensor is adjusted to the culture medium. During this period, the time displayed in the detector tab is counted down, and the green Wait icon blinks. Measurement automatically starts after 10 minutes.



Remaining time available for measurement

Note:

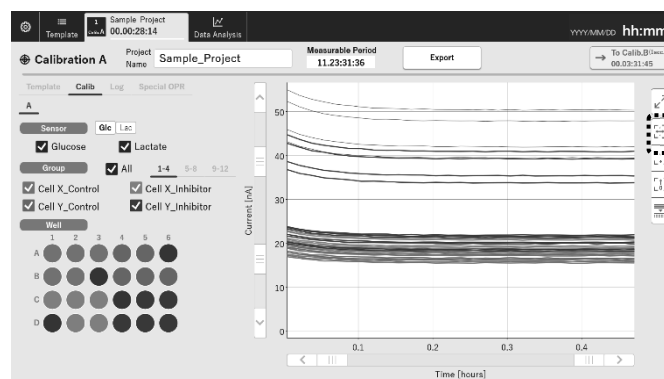
The sensor module can be used for 12 days from the start of measurement. The remaining time available for measurement is displayed in the Measurable Period field.

16. Measurement starts.

► Measurement is performed in one-minute intervals, and the measured data is displayed in the graph in real time in electric current unit (nA). Before finishing calibration A, prepare for calibration B by following step 1 and step 2 of "Performing calibration B" (see page 70).

Notes:

- While the graph display is zoomed in, new data is not reflected automatically. To automatically reflect new data in the graph on every data reception, tap the autoscale button.

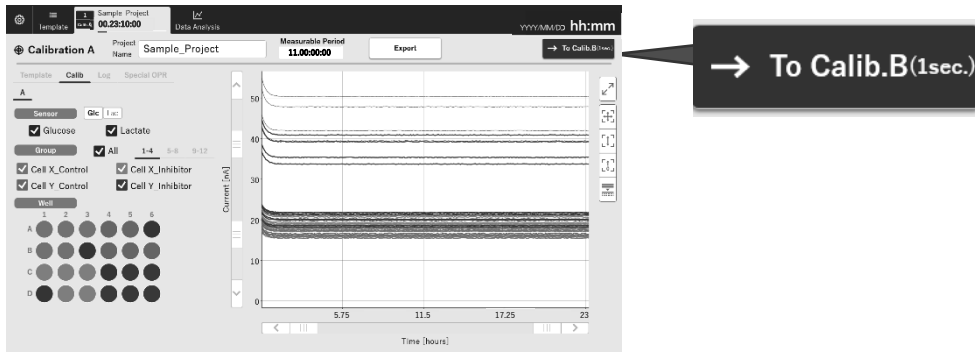


Autoscale button

- If you leave the CO₂ incubator door open for a long time, the measurement value fluctuates depending on the temperature characteristics of the sensor. Keep opening and closing of the door to a minimum. If you open and close the door during the last four hours before the completion of calibration, you cannot obtain the correct standard curve due to the changing liquid temperature. Do not open and close the incubator doors during the last four hours before completion of calibration.
- After calibration A starts, you can export obtained data at any time. Insert a USB flash drive in a USB port (for data export) on the back of the controller and tap the **Export** button. For details, see pages 96 and 97.
- You can stop calibration A in the middle and redo it from the beginning. For details, see "Redoing or aborting calibration A" (page 69).

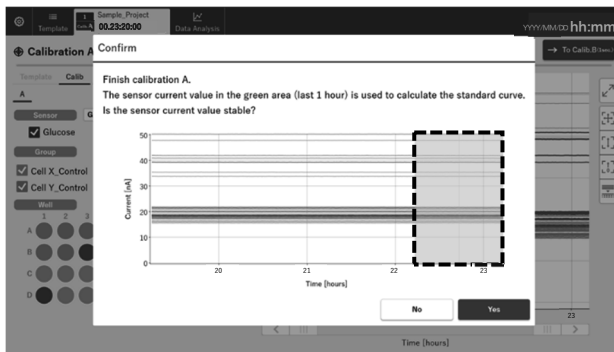
3. CALIBRATION

17. To finish calibration A, after elapse of four hours or more from the start of the calibration, long tap the **To Calib.B** button, which becomes available after four hours or more, for one second.



► The Confirm dialog is displayed.

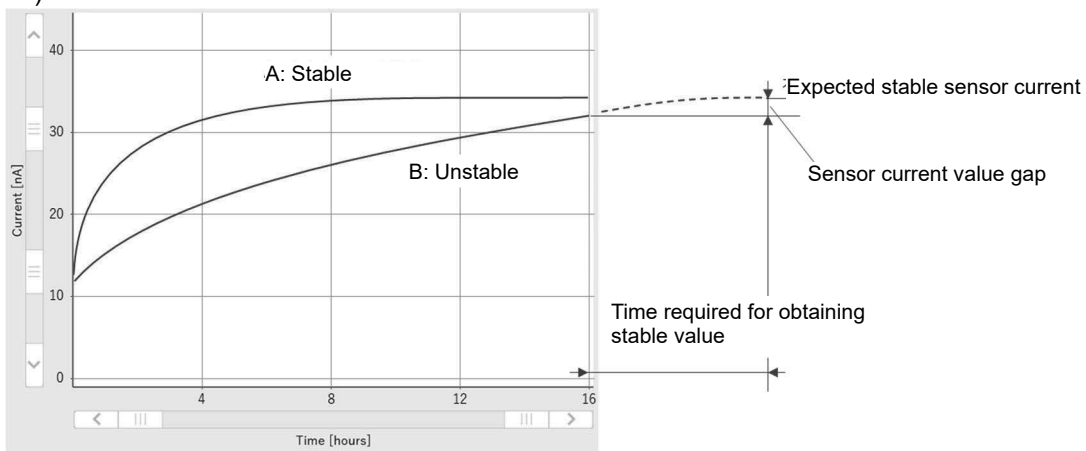
Check that the sensor current value obtained in last one hour indicated in green area (indicated by the dotted line in the following figure) is stable.



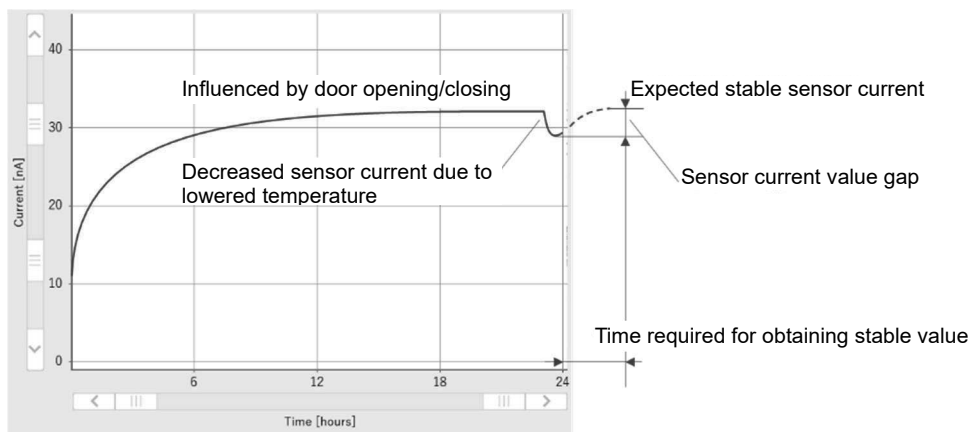
Notes:

- Recommended calibration duration is 24 hours. If the calibration duration is short or the incubator doors have been opened and closed just before the completion of the calibration, the sensor current value becomes unstable, and the expected value may not be obtained. When the sensor current during calibration is unstable, extending the calibration time may help obtain the appropriate sensor current.

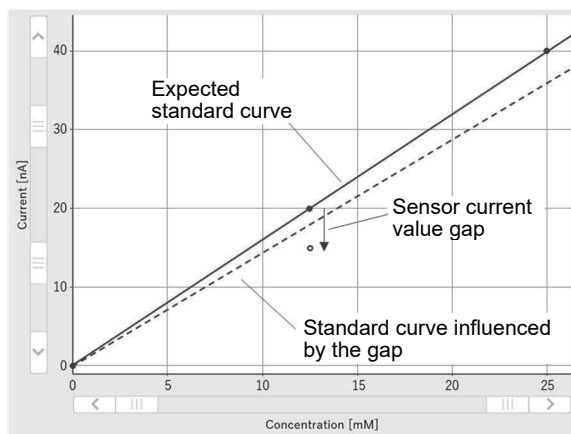
1) When the calibration duration is short:



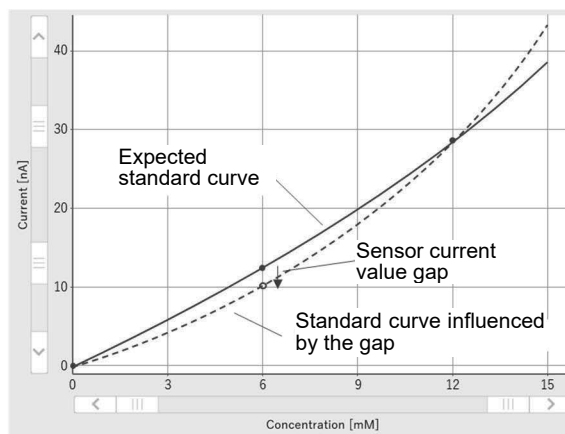
2) When the incubator doors have been opened and closed just before the completion of the calibration:



▪ If the calibration is completed with the sensor current value gap, correct measurement cannot be performed due to the influence on the standard curve.



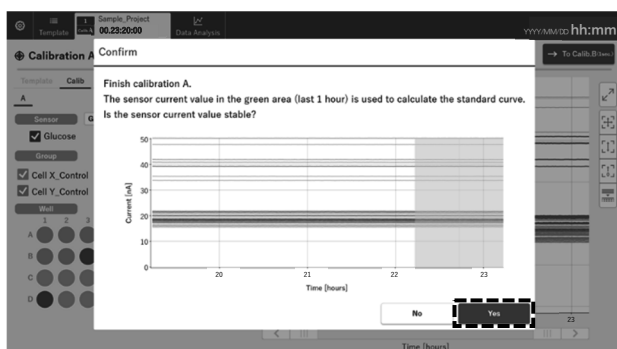
Sensor current value gap occurred in calibration A for glucose



Sensor current value gap occurred in calibration A for lactate

18. Tap the **Yes** button.

► Calibration A finished, and the screen for calibration B is displayed. Tapping the **No** button displays the Calibration A screen again.

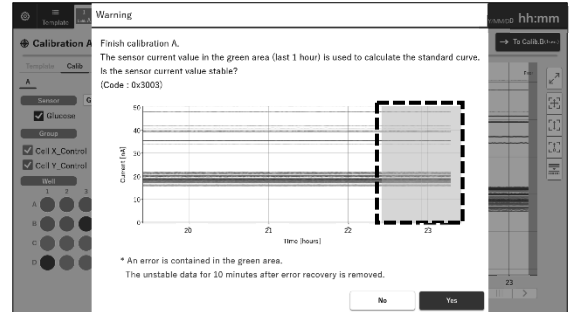


3. CALIBRATION

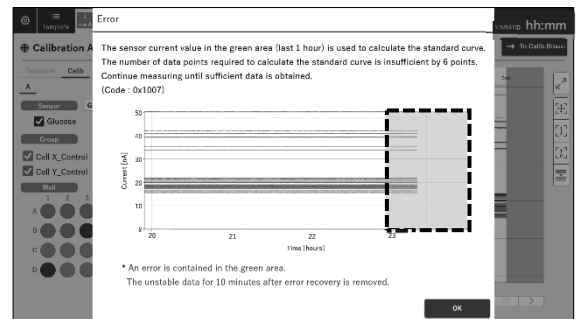
Notes:

- The sensor current values during particular errors (communication error, plate set error, and power failure error) and during 10 minutes after recovery from an error are not used for the calculation of the standard curve. These current values are not displayed in the green area indicated on the Confirm dialog.

- When a sensor current error occurs in the green area (last one-hour result area enclosed with the dotted line in the following figure) in the graph, which is used to calculate the standard curve, the following Warning dialog is displayed. Before tapping the **Yes** button to finish calibration A, check that the sensor current values in the green area are stable. Tapping the **No** button returns to the Calibration A screen without finishing calibration A.



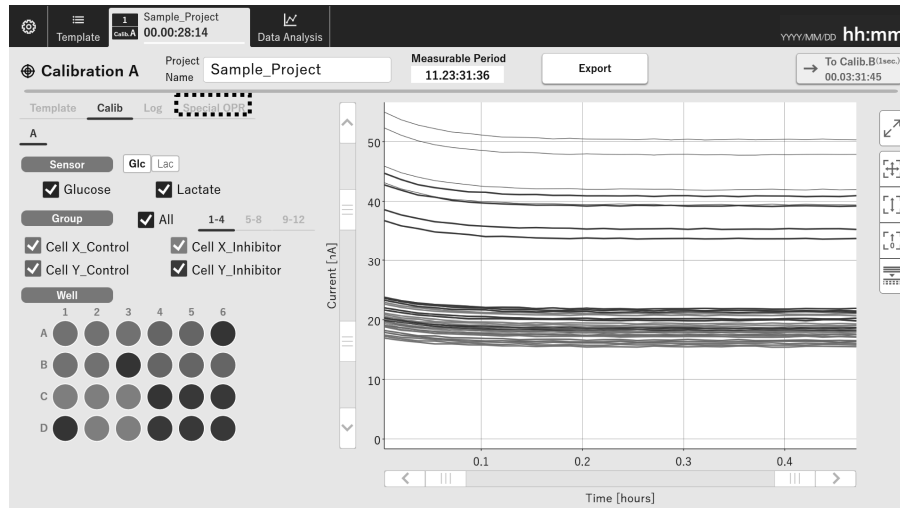
- When a sensor current error occurs in the green area (last one-hour result area enclosed with the dotted line in the following figure) in the graph, which is used to calculate the standard curve, and the data is insufficient to calculate the standard curve, the following Error dialog is displayed. In this case, you cannot finish calibration A. Continue the measurement until sufficient data is obtained and then finish calibration A. In the Error dialog, the number of insufficient data is indicated.



Redoing or aborting calibration A

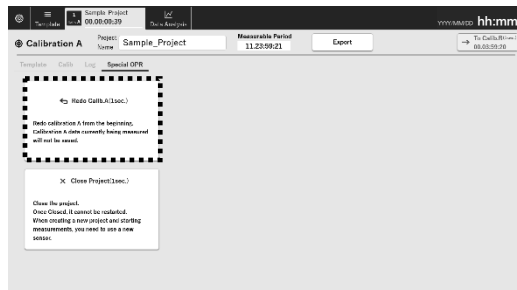
You can stop calibration A in the middle and redo it from the beginning or you can abort calibration A. If you redo calibration A, the data before redoing is discarded. To redo or abort calibration A, follow the steps below.

1. Tap the Special OPR tab during measurement.
 - ▶ The Special OPR screen is displayed.

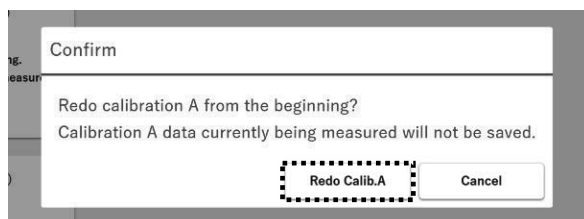


Steps for redoing calibration A

2. Long tap the **Redo Calib.A (1sec.)** button for one second.
 - ▶ The Confirm dialog is displayed.

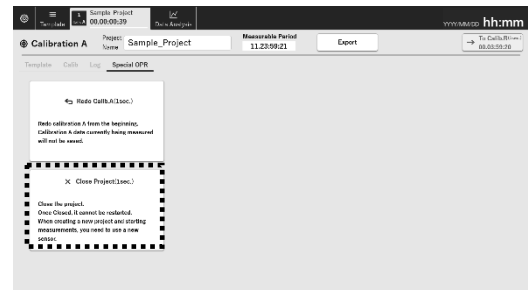


3. Tap the **Redo Calib.A** button.
 - ▶ The screen for starting calibration A is displayed. Tapping the **Cancel** button returns to the Special OPR screen.

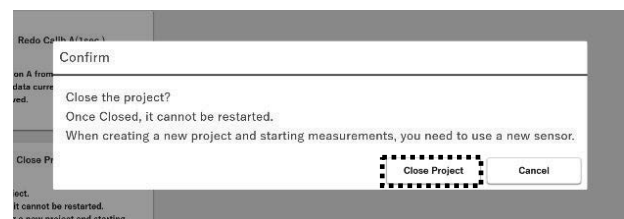


Steps for aborting calibration A

2. Long tap the **Close Project (1sec.)** button for one second.
 - ▶ The Confirm dialog is displayed.



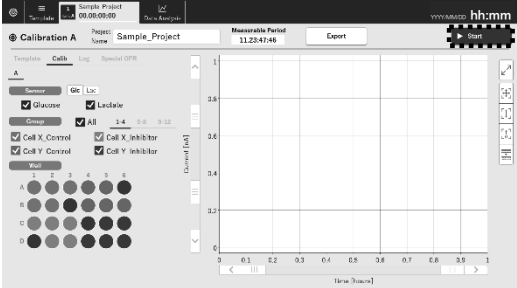
3. Tap the **Close Project** button.
 - ▶ Calibration A is aborted and the top screen of detector menu is displayed. Tapping the **Cancel** button returns to the Special OPR screen.



Note:

Once you close the project, you cannot resume the calibration. When you create a new project and start measurement, you need to prepare a new sensor module assembly.

3. CALIBRATION

Steps for redoing calibration A	Steps for aborting calibration A
<p>4. Tap the Start button.</p> <p>▶ Calibration A starts from the beginning.</p>  <p>Note: If you redo calibration A during adjustment in step 15 of the “Performing calibration A” section, measurement starts after the remaining adjustment process that was not completed when calibration A was suspended. Example: If you tap the Redo Calib.A(1sec.) button when adjustment has been performed for seven minutes and then restart calibration A, measurement starts after performing the remaining three minutes of adjustment.</p>	

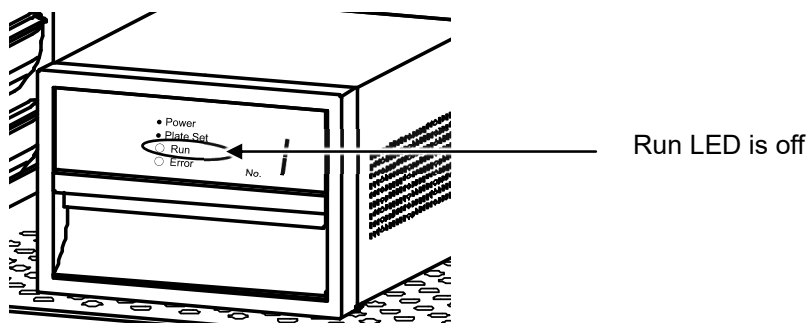
Performing calibration B

- Before calibration A finishes, prepare the following items required for calibration B in the biological safety cabinet.
 - 24-well plate
 - Calibration B solution
 - Phosphate-buffered saline (PBS) (if there are unused wells)
 - Items necessary for sterile operations
- Prepare the 24-well plate for calibration B based on the created assay template (pages 49-54).
 - Add corresponding 1 mL calibration B solution to each Group well.
 - Add corresponding 1 mL calibration B solution to each Blank well.
 - Add 1 mL phosphate-buffered saline (PBS) to each of other empty wells.

Note:

If phosphate-buffered saline (PBS) is not added to empty wells, evaporation from other adjacent wells increases, which may cause incorrect measurement. Do not leave wells empty.

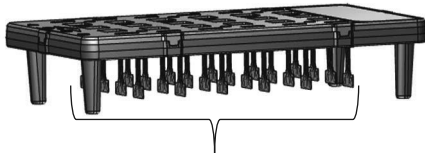
- Finish calibration A, open the CO₂ incubator door, confirm that the Run LED on the front panel of the detector is turned off, slide open the tray fully, and then take out the sensor module assembly.



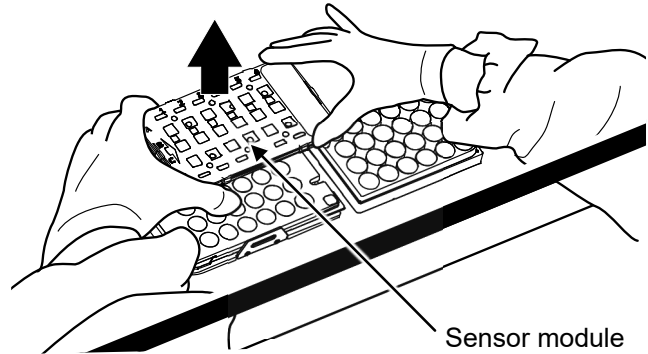
4. Close the detector tray, close the CO₂ incubator doors, and put the sensor module assembly in the biological safety cabinet.
5. Remove the sensor module from the sensor module assembly and put it on the workspace in the biological safety cabinet.

Notes:

- When you remove the sensor module, hold both sides of the sensor module and lift it while keeping it horizontal so that the sensor tips do not touch the plate adapter (top).

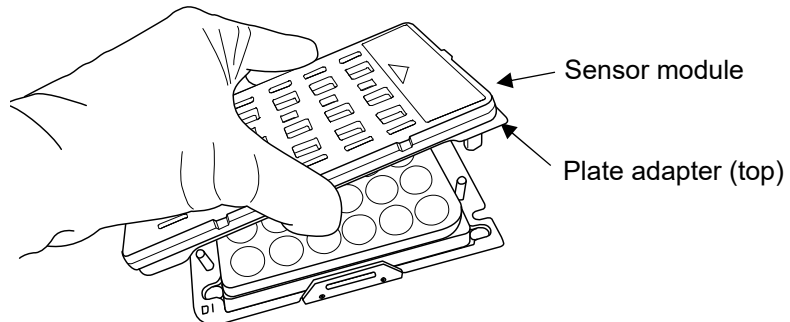


Be careful not to let sensor tips touch the plate adapter (top).
Do not wipe the sensor part with a cloth moistened with 70% ethanol.



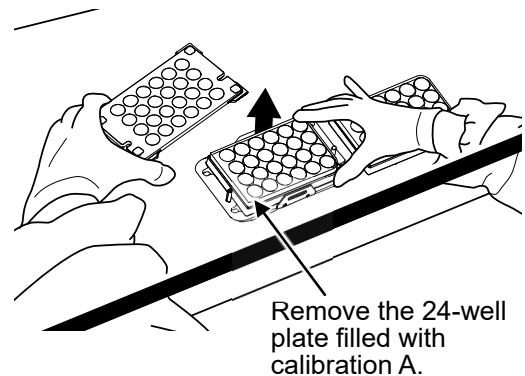
- Do not remove the sensor module and plate adapter (top) together. Doing so may hit sensor against the 24-well plate, causing damage to it.

Incorrect



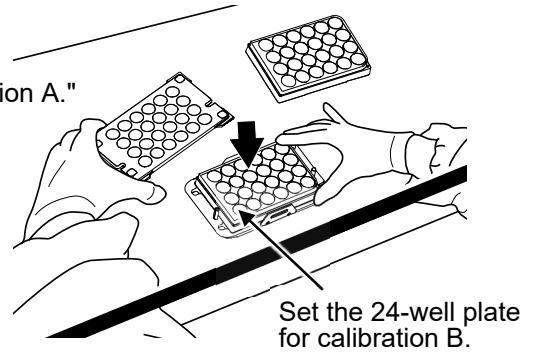
- To prevent the sensor from drying, the time the sensor tips are exposed to the air should be within one minute.
- When you handle the wetted sensor module, be careful not to allow the liquid on the sensor tip to drip. Dripping of the liquid may cause contamination or cross-contamination between different samples.

6. Lift the plate adapter (top) by one hand and replace the 24-well plate filled with the calibration A solution with the 24-well plate filled with the calibration B solution by the other hand.
At this time, set the 24-well plate with correct orientation (see step 4 in page 60).

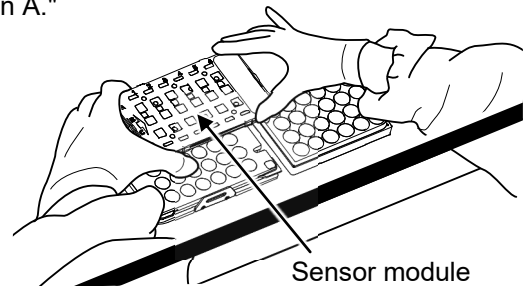


3. CALIBRATION

7. Remove the lid of the 24-well plate filled with calibration B solution and set the plate adapter (top) on it.
 - ▶ For details, see step 5 (page 54) of "Performing calibration A."

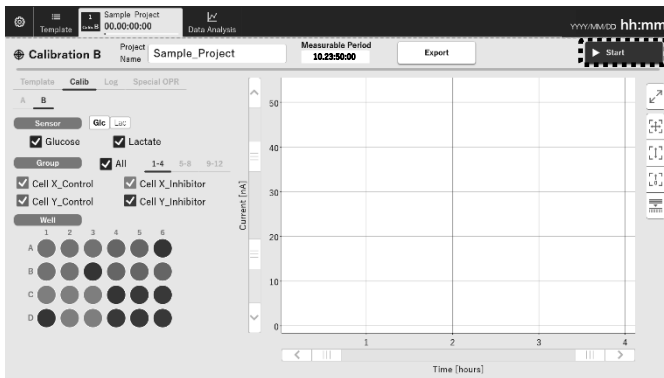


8. Set the sensor module on the plate adapter (top).
 - ▶ For details, see step 7 (page 61) of "Performing calibration A."



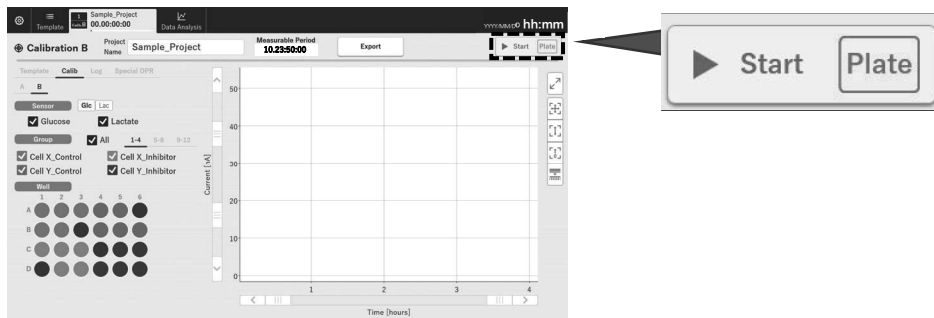
9. Set the sensor module assembly filled with the calibration B solution in the detector.
 - ▶ For details, see step 9 and 10 (page 62) of "Performing calibration A."

10. Tap the **Start** button.
 - ▶ Calibration B starts.



Note:

If you do not set the sensor module assembly again after the completion of calibration A, the Plate indication blinks, and the **Start** button is grayed out.

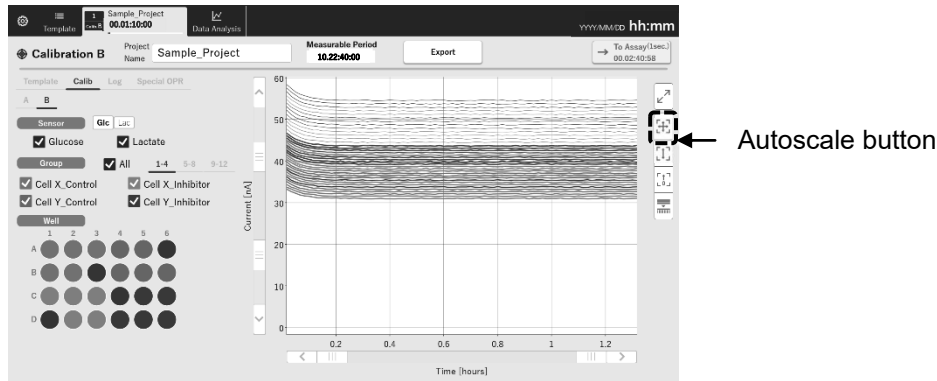


11. Measurement starts.

► Measurement is performed in one-minute intervals, and the measured data is displayed in the graph in real time in electric current unit (nA). Before finishing calibration B, perform step 1 and step 2 of assay for preparation (see page 77).

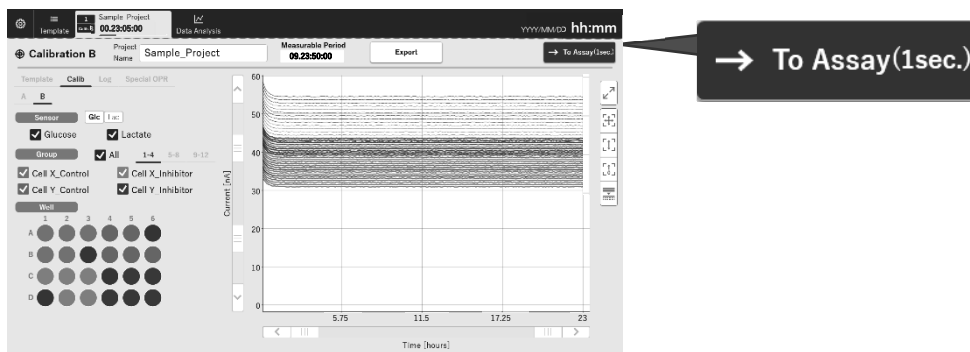
Notes:

- While the graph is expanded, new data is not reflected to the graph automatically. To reflect new data automatically in the graph every time it is received, tap the autoscale button.



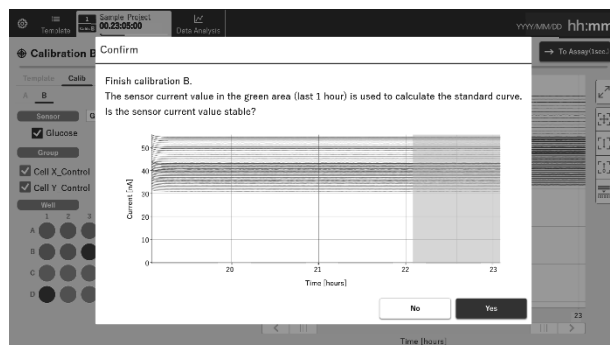
- If you leave the CO₂ incubator door open for a long time, the measurement value fluctuates depending on the temperature characteristics of the sensor. Minimize the frequency of opening and closing the incubator doors.
- You can stop calibration B in the middle and redo it from the beginning. For details, see "Redoing or aborting calibration B" (page 76).

12. To finish calibration B, after elapse of four hours or more from the start of the calibration, long tap the To Assay button (becomes available after four hours or more) for one second.



► The Confirm dialog is displayed.

Check that the sensor current value obtained in last one hour indicated in green area (indicated by the dotted line in the following figure) is stable.

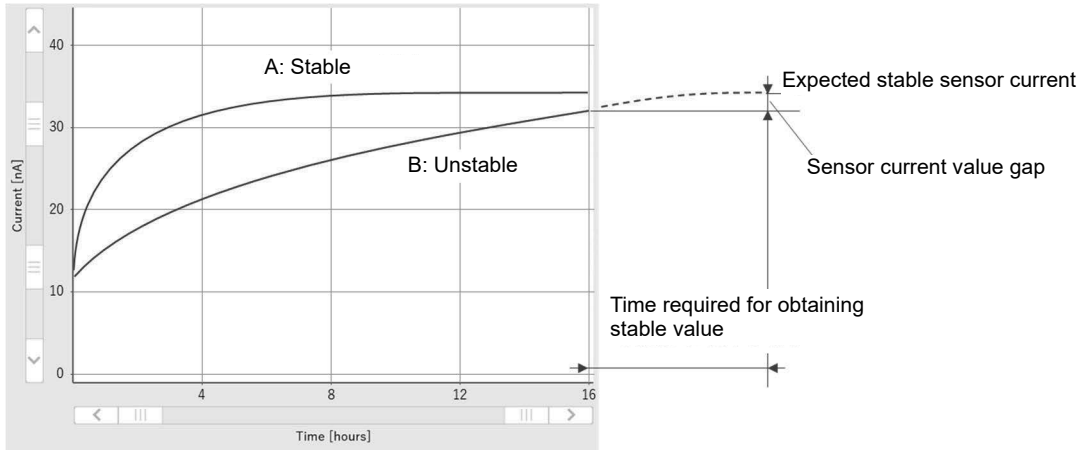


3. CALIBRATION

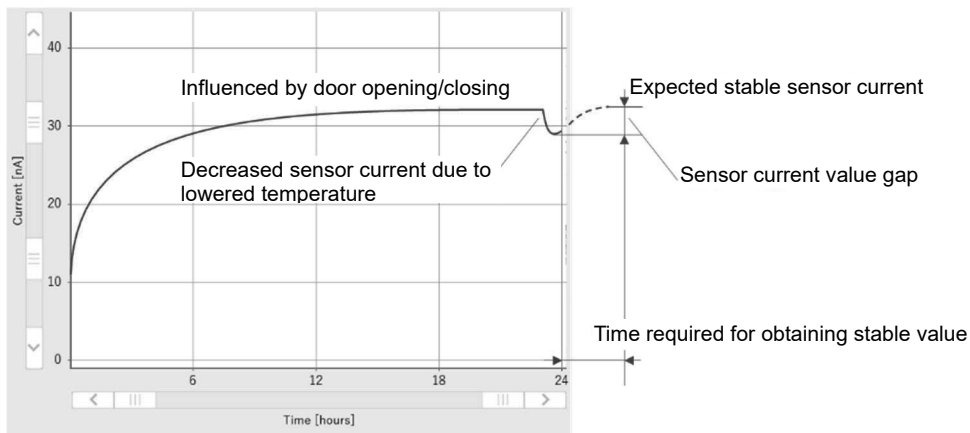
Notes:

- Recommended calibration duration is 24 hours. If the calibration duration is short or the incubator doors have been opened and closed just before the completion of the calibration, the sensor current value becomes unstable, and the expected value may not be obtained. When the sensor current during calibration is unstable, extending the calibration time may help obtain the appropriate sensor current.

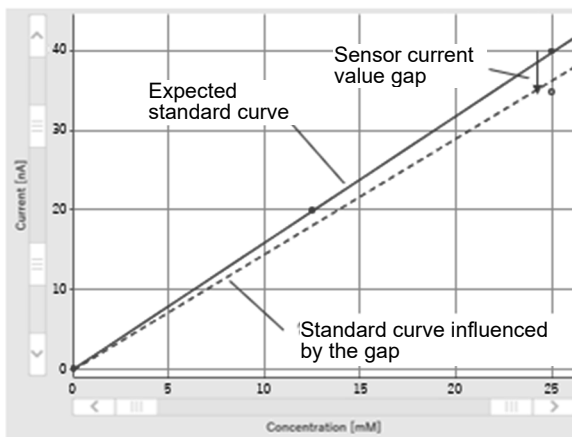
1) When the calibration duration is short:



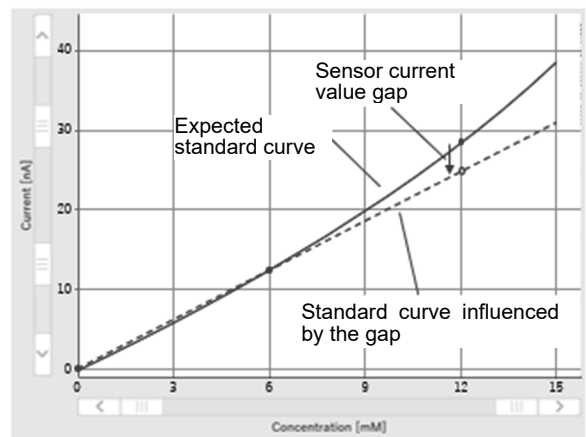
2) When the incubator doors have been opened and closed just before the completion of the calibration:



- If the calibration is completed with the sensor current value gap, correct measurement cannot be performed due to the influence on the standard curve.



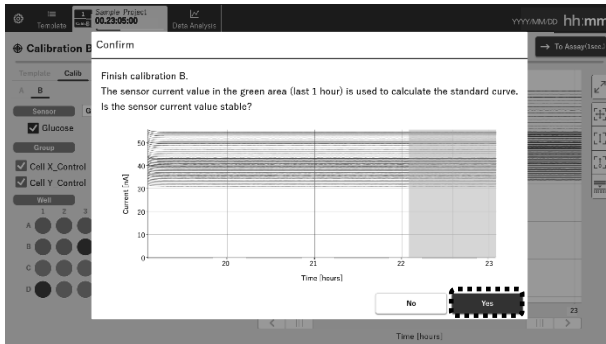
Sensor current value gap occurred in calibration B for glucose



Sensor current value gap occurred in calibration B for lactate

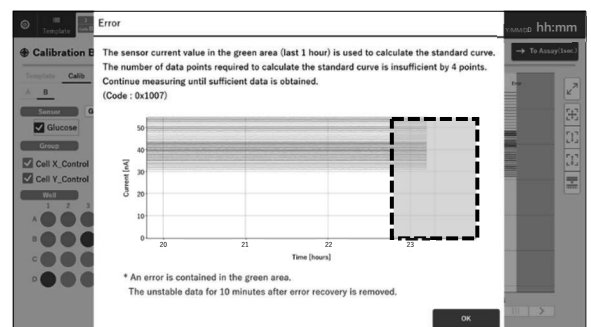
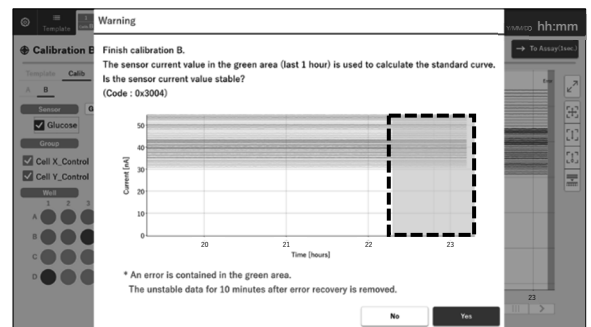
13. Tap the **Yes** button.

► Calibration B finishes, and the standard curve is automatically calculated and displayed in a graph on the Standard Curve screen. Tapping the **No** button displays the Calibration B screen again.



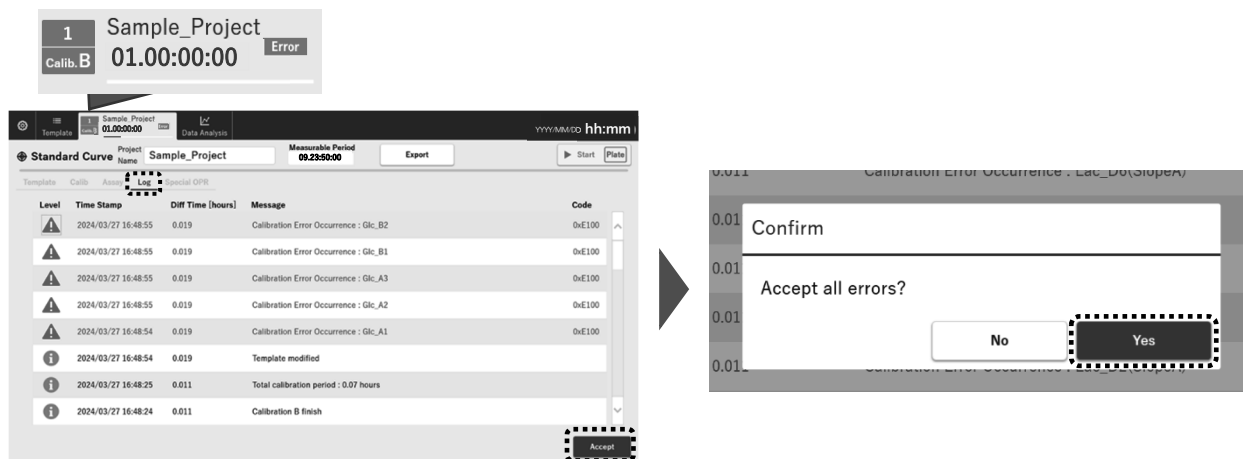
Notes:

- The sensor current values during particular errors (communication error, plate set error, and power failure error) and during 10 minutes after recovery from an error are not used for the calculation of the standard curve. These current values are not displayed in the green area indicated on the Confirm dialog.
- When a sensor current error occurs in the green area (last one-hour result area enclosed with the dotted line in the following figure) in the graph, which is used to calculate the standard curve, the following Warning dialog is displayed. Before tapping the **Yes** button to finish calibration B, check that the sensor current values in the green area are stable. Tapping the **No** button returns to the Calibration B screen without finishing calibration B.
- When a sensor current error occurs in the green area (last one-hour result area enclosed with the dotted line in the following figure) in the graph, which is used to calculate the standard curve, and the data is insufficient to calculate the standard curve, the following Error dialog is displayed. In this case, you cannot finish calibration B. Continue the measurement until sufficient data is obtained and then finish calibration B. In the Error dialog, the number of insufficient data is indicated.



3. CALIBRATION

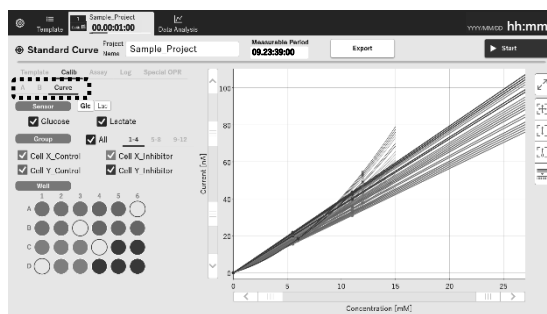
- If an error is found during the calculation of the standard curve, a calibration error is issued, and the error status is shown on the corresponding detector's tab. In this case, tap the Log tab, check the erroneous measurement item, the well number, and the cause of the error. After taking an appropriate measure, tap the **Accept** button. Tapping the **Yes** button of the Confirm dialog accepts all errors, and the system proceeds to assay. Tapping the **No** button displays the error Log screen again.



A sensor that had an error may not be able to perform correct measurement in assay. For details about the solutions of errors, refer to “Types and solutions” on page 108. Also, edit the template as necessary (see page 114).

14. Check the result of calibration. Then, proceed to next assay.

On the Standard Curve screen, you can check the electric current value for calibration A, the electric current value for calibration B, and the standard curve by switching the A tab, B tab, and Curve tab respectively.



Notes:

- If an electric current value or standard curve is extremely different from the ones with the same calibration condition, the sensor may not have been calibrated correctly. In such a case, modify the template as necessary. For modifying the template, refer to “MODIFYING ASSAY TEMPLATE AFTER MEASUREMENT” on page 114.
- You can also check the result of the calibration during an assay or data analysis by tapping the Calib tab.

Redoing or aborting calibration B

As with calibration A, you can stop calibration B in the middle and redo it from the beginning or abort calibration B. If you redo calibration B, the data before redoing is discarded. For the procedure, see "Redoing or aborting calibration A" (page 69).

4. ASSAY

Using the sensor that has been calibrated, measure continuously the glucose concentration and lactate concentration in a culture medium while cells are grown. Assay phase is performed in the steps below.

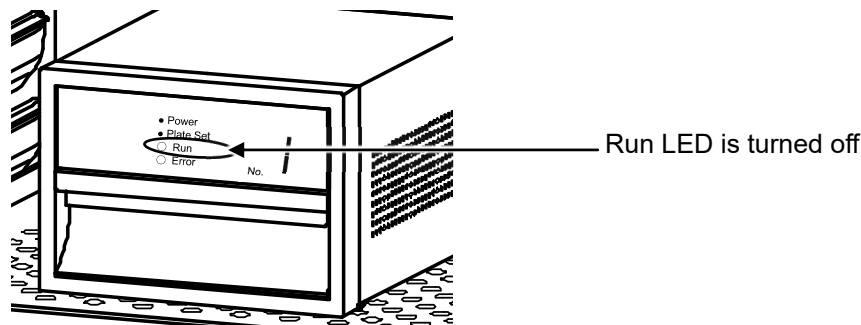


WARNING

Wear appropriate protective gear when you handle a potentially infective sample or a product that may have contacted such a sample. Touching them directly may cause infection.

Starting an assay

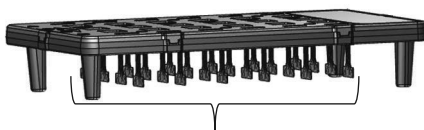
- Before finishing calibration B, prepare the following items required for assay in the biological safety cabinet.
 - 24-well plate
 - Cells and culture medium required for assay
 - Calibration B solution
 - Phosphate-buffered saline (PBS) (if there are unused wells)
 - Items necessary for sterile operations
- Prepare the 24-well plate for assay based on the crated assay template (pages 49-54).
 - Add corresponding 1 mL cells and culture medium to each Group well.
 - Add corresponding 1 mL calibration B solution to each Blank well.
 - Add 1 mL phosphate-buffered saline (PBS) to each of other empty wells.
- Finish calibration B, open the CO₂ incubator doors, check that the Run LED on the front panel of the detector is turned off, slide open the tray fully, and then take out the sensor module assembly.



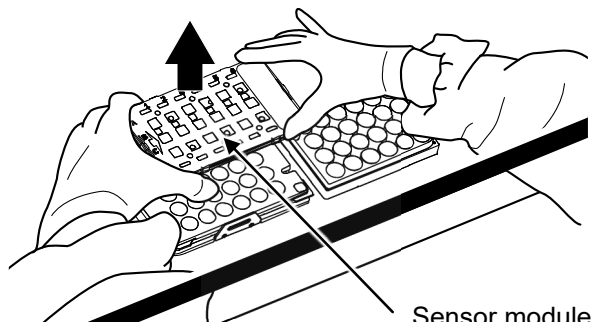
- Close the detector tray, close the CO₂ incubator doors, and put the sensor module assembly in the biological safety cabinet.
- Remove the sensor module from the sensor module assembly and put it on the workspace in the biological safety cabinet.

Notes:

- When you remove the sensor module, hold both sides of the sensor module and lift it while keeping it horizontal so that the sensor tips do not touch the plate adapter (top).



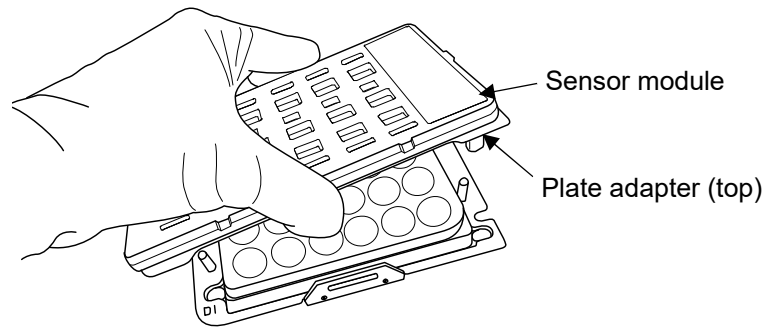
Be careful not to let sensor tips touch the plate adapter (top).
Do not wipe the sensor part with a cloth moistened with 70% ethanol.



4. ASSAY

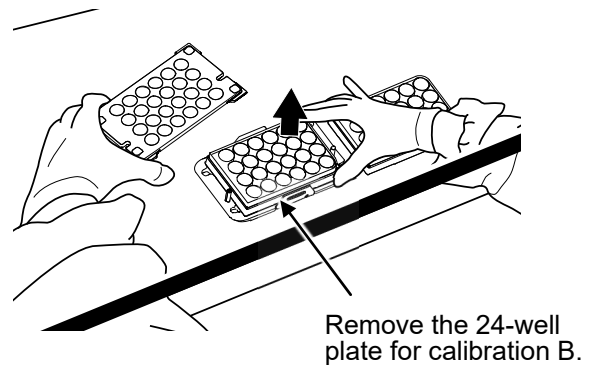
- Do not remove the sensor module and plate adapter (top) together. Doing so may hit sensor against the 24-well plate, causing damage to it.

Incorrect

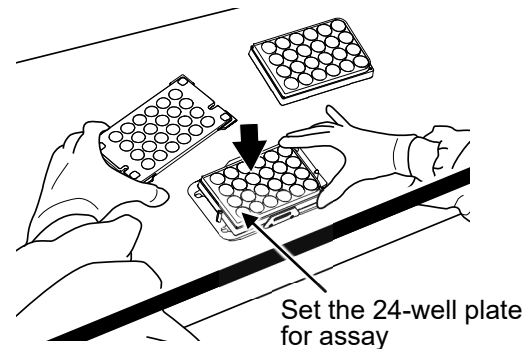


- To prevent the sensor from drying, the time the sensor tips are exposed to the air should be within one minute.
- When you handle the wetted sensor module, be careful not to let the liquid on the sensor tip to drip. Dripping of the liquid may cause contamination or cross-contamination between different samples.

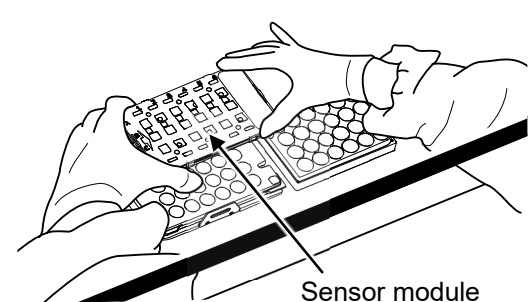
- 6.** Lift the plate adapter (top) by one hand and replace the 24-well plate filled with the calibration B solution with the 24-well plate filled with the assay solution by the other hand. At this time, set the 24-well plate with correct orientation (see step 4 on page 60).



- 7.** Remove the lid of the 24-well plate filled with the assay solution and set the plate adapter (top) on it. ▶ For details, see step 5 (page 61) of "Performing calibration A."



- 8.** Set the sensor module on the plate adapter (top). ▶ For details, see step 7 (page 61) of "Performing calibration A."



Note:

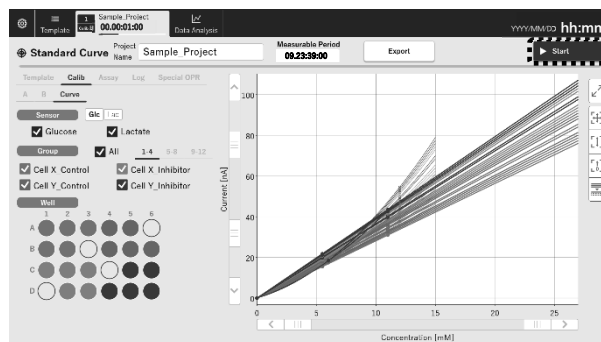
To prevent the sensor from drying, the time the sensor tips are exposed to the air should be within one minute.

9. Set the sensor module assembly for assay in the detector.
 ▶ For details, see steps 9 and 10 (page 62) of "Performing calibration A."

10. Tap the **Start** button to start assay.

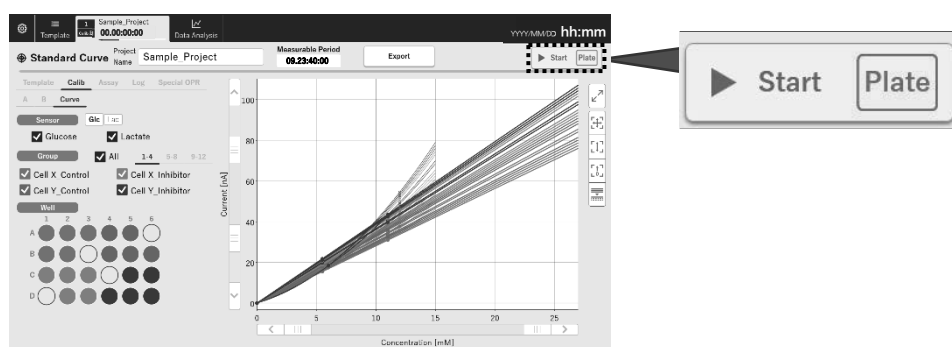
- ▶ Assay starts.

The measurement data is shown as concentration in mM units. Blank data on the graph is obtained by normalizing the electric current at the time of assay with the electric current at the completion of calibration B.



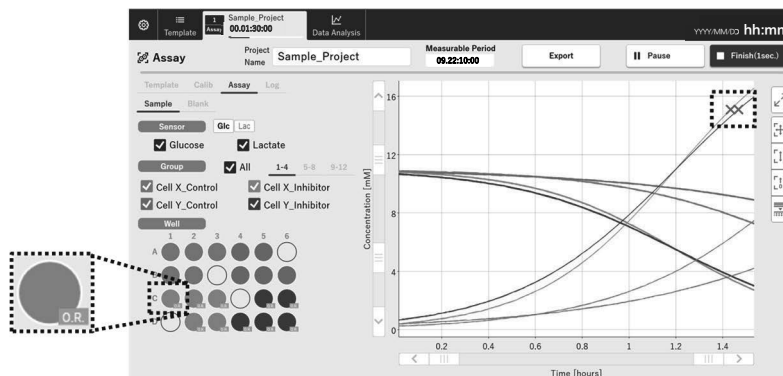
Notes:

- If you do not set the sensor module assembly again after finishing calibration B, the Plate indication blinks, and the **Start** button is grayed out.



- If the measurement value exceeds the upper limit of the sensor measurement range (Glc: 27 mL, Lac: 15 mM) for a certain period during assay, the value is determined as "over range", and an "X" mark is displayed on the graph line of the sensor, and the "O.R." mark is displayed on the well indication on the screen. The "X" mark is not displayed more than once on the graph line of a sensor. (A second "X" mark is not displayed on the graph after the first over range detection even if the measurement value exceeds the upper limit after it drops under the upper limit of the measurement range.) The over range determination is not made for 10 minutes after the start of measurement*.

*This includes when resuming measurement after pausing and when resuming after recovery from a communication error, plate setting error, or power failure error.



4. ASSAY

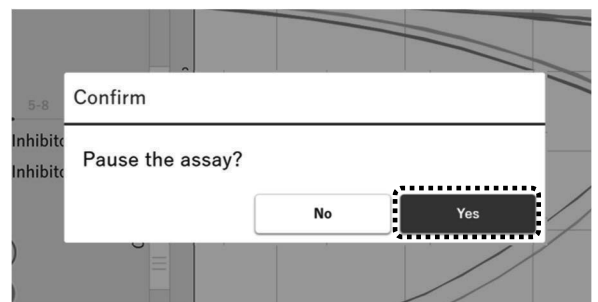
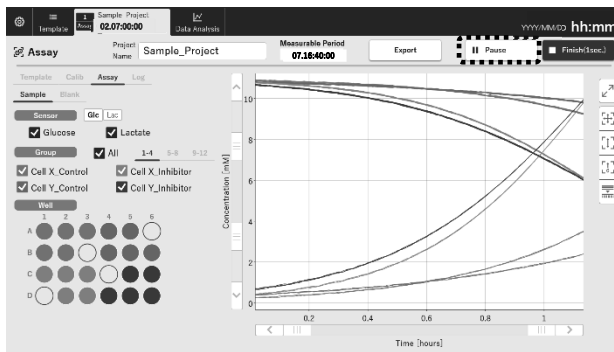
Pausing an assay

You can pause an assay for exchanging culture media or subculturing. To pause assay, follow the steps below.

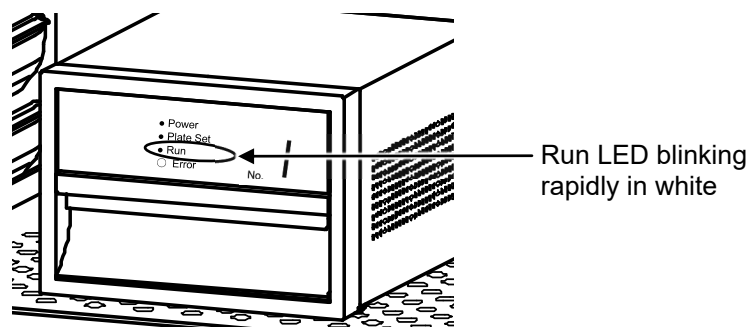
Note:

If you pause an assay, the data before and after the pause is analyzed as separate unrelated data.

1. Before pausing an assay, prepare the following items in the biological safety cabinet.
 - 24-well plate
 - Phosphate-buffered saline (PBS)
 - Calibration B solution (not necessary when Group culture media is not exchanged)
 - Items necessary for culture media exchange and other operations
2. Dispense 1 mL phosphate-buffered saline (PBS) in each well on the 24-well plate.
3. Tap the **Pause** button.
 - ▶The Confirm dialog is displayed asking if you pause the assay. Tap the **Yes** button. Tapping the **No** button displays the Assay screen again.



4. Open the CO₂ incubator doors, confirm that the Run LED on the front panel of the detector is blinking rapidly in white, slide open the tray fully, and take out the sensor module assembly.

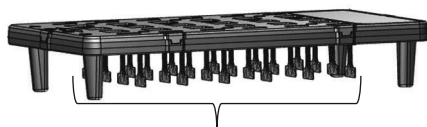


5. Close the detector tray, close the CO₂ incubator doors, and then put the sensor module assembly in the biological safety cabinet.

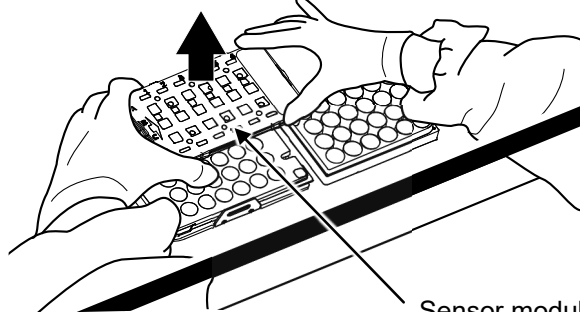
6. Remove the sensor module from the sensor module assembly and put it on the workspace in the biological safety cabinet.

Notes:

- When you remove the sensor module, hold both sides of the sensor module and lift it while keeping it horizontal so that the sensor tips do not touch the plate adapter (top).



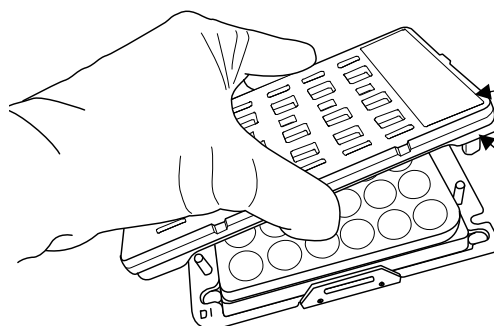
Be careful not to let sensor tips touch the plate adapter (top).



Sensor module

- Do not remove the sensor module and plate adapter (top) together. Doing so may hit sensor against the 24-well plate, causing damage to it.

Incorrect



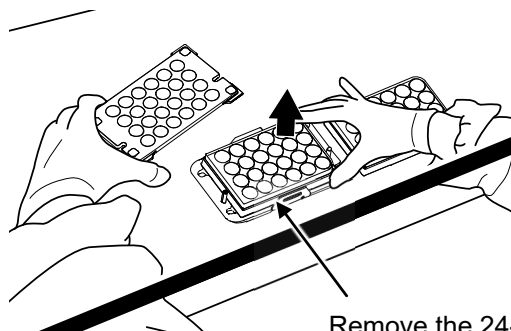
Sensor module

Plate adapter (top)

- To prevent the sensor from drying, the time the sensor tips are exposed to the air should be within one minute.
- When you handle the wetted sensor module, be careful not to let the liquid on the sensor tip to drip. Dripping of the liquid may cause contamination or cross-contamination between different samples.

7. Lift the plate adapter (top) by one hand and replace the 24-well plate for assay with the 24-well plate filled with dispensed phosphate-buffered saline (PBS) by the other hand.

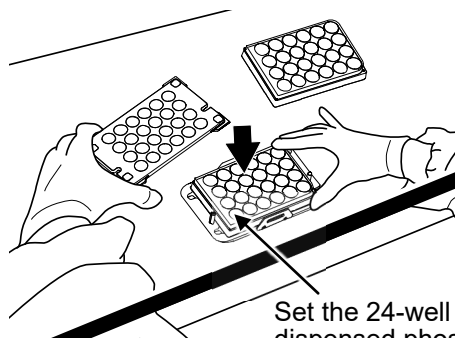
At this time, pay attention to the orientation of the 24-well plate when you set it (see step 4 on page 60).



Remove the 24-well plate for assay.

8. Remove the lid of the 24-well plate filled with dispensed phosphate-buffered saline (PBS) and set the plate adapter (top).

► For details, see step 5 (page 61) of "Performing calibration A."



Set the 24-well plate filled with dispensed phosphate-buffered saline (PBS).

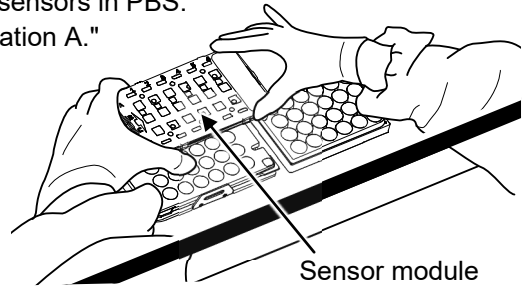
4. ASSAY

9. Set the sensor module on the plate adapter (top) to dip sensors in PBS.

► For details, see step 7 (page 61) of "Performing calibration A."

Note:

To prevent the sensor from drying, the time the sensor tips are exposed to the air should be within one minute.



10. Exchange the culture medium in the 24-well plate prepared for assay and make other necessary operations.

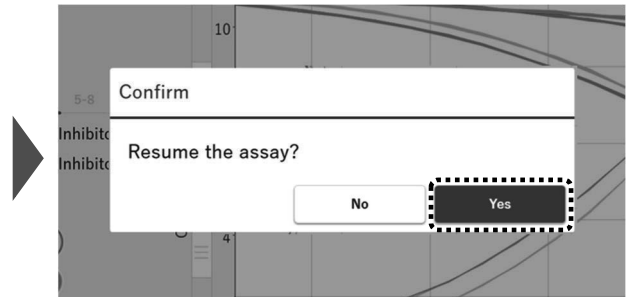
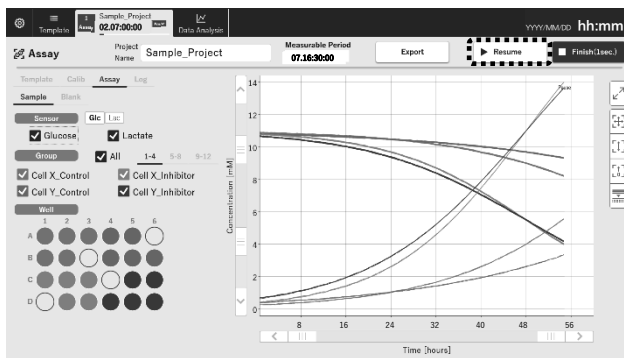
Note:

When the Group culture media is exchanged by culture medium exchange or subculturing, also exchange calibration B solution for Blank.

11. Exchange the 24-well plate dispensed with PBS and the 24-well plate for assay and set the sensor module assembly in the detector (see steps 9 and 10 (page 62) of "Performing calibration A.").

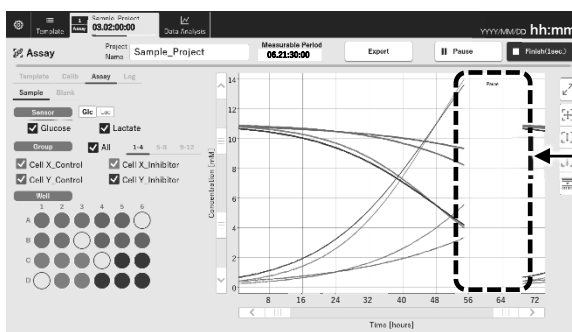
12. Tap the **Resume** button.

► The Confirm dialog asking if you resume the assay is displayed. Tap the **Yes** button. Tapping the **No** button displays the Assay screen again that is in paused state.



Note:

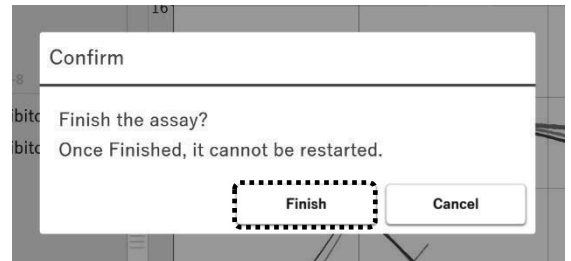
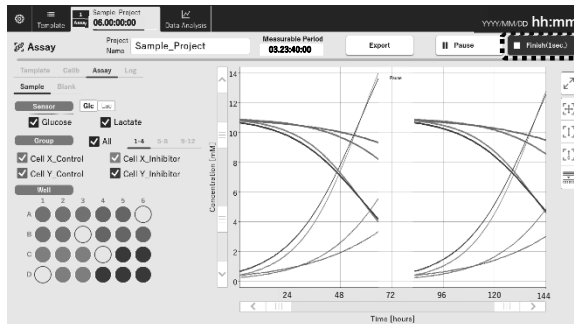
The data in the graph during the pause disappears.



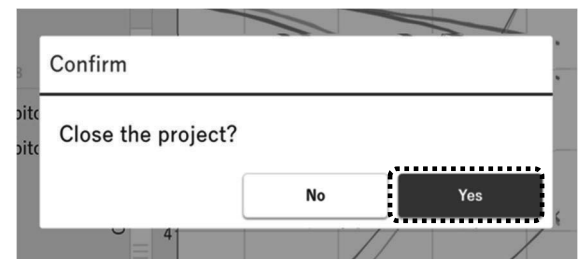
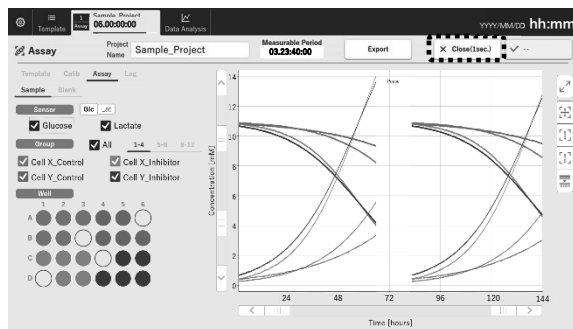
The graph lines during the pause disappear.

Finishing an assay

- To finish an assay, long tap the **Finish** button in the Assay screen for one second.
 - The Confirm dialog is displayed. Tap the **Yes** button to finish an assay. Then, the Assay screen with the **Close** button for finishing the project is displayed.
 - Tapping the **Cancel** button returns to the Assay screen before tapping the **Finish** button.



- Long tap the **Close** button for one second.
 - The Confirm dialog is displayed. Tapping the **Yes** button finishes the project and displays the top screen of detector menu. Tapping the **No** button displays the Assay screen again.



Note:

If there is an error that you have not accepted, check the content of the Log tab screen, and tap the **Accept** button to accept all errors. For details, see "Operation when a system error occurs" on pages 106 and 107.

- Take the sensor module assembly out of the detector.

Note:

The sensor module and 24-well plate are single-use product. After finishing an assay, dispose of the sensor module and 24-well plate appropriately in accordance with the biohazard level of the target cells for measurement.

5. DATA ANALYSIS

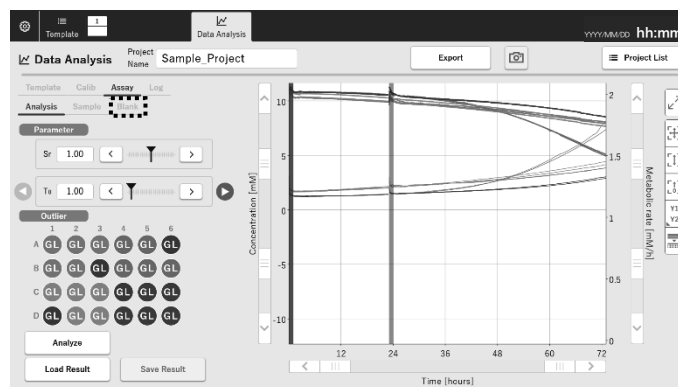
In the data analysis phase, project data after performing assay is analyzed. The glucose consumption rate and the lactate production rate can be obtained by smoothing the data to remove noise from measured values and then differentiating the smoothed data.

Analyzing the metabolic rate

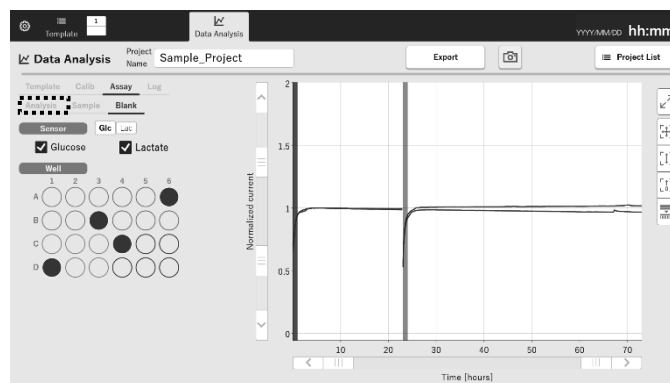
1. Tap the Data analysis tab, and from the project list displayed, tap the data to be analyzed. Then, tap the **Analyze** button on the right side of the line.
▶ The Data Analyses screen for the selected project is displayed.



2. Tap the Blank tab on the Data Analysis screen.
▶ The normalized electric current for Blank is displayed in the graph.

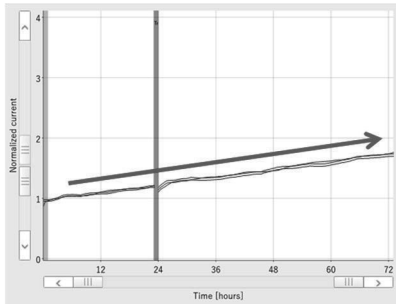


3. Confirm that the normalized electric current for Blank stays approximately at 1 over time, and tap the Analysis tab.
▶ The Analysis screen is displayed.

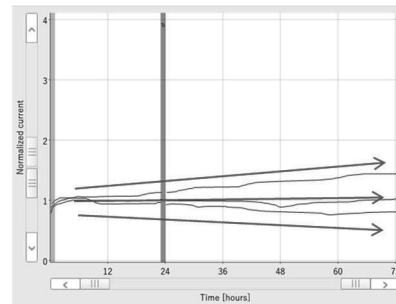


Note:

The normalized electric current for Blank is obtained by dividing the electric current level during assay by the electric current level at the completion of calibration B. In the following cases using the same Blank, the target culture medium may be affecting the measurement performance of the sensor, thus measurement may not have been performed correctly.



Example 1: Increasing (decreasing) over time*1,2



Example 2: No certain trend in fluctuation

*1: One of the causes of the change in the normalized electric current for Blank is that the culture medium is concentrated due to evaporation during assay. The increase caused by the evaporation is about 1% per day, this degree of increased change is not a problem.

*2: If the normalized electric current is 1.2 or lower, blank correction may be effective. For details about blank correction, refer to pages 90-92.

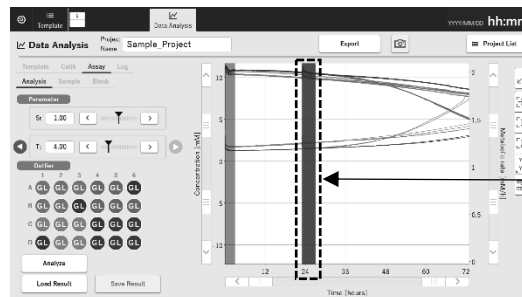
4. Set analysis parameters Sr and Ti in the Parameter section.
For an example of analysis parameter setting, refer to page 88.

Sr (smoothing parameter): Settable range 0.6 to 1.4

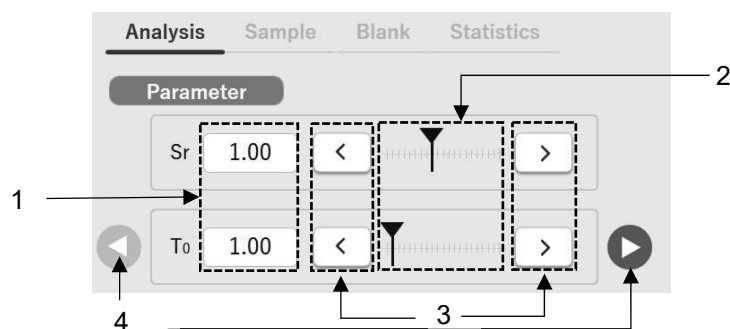
This parameter indicates the degree of smoothing of the analyzed data. A smaller value generates data that is more faithful to the original data and less smooth. A larger value generates data that is less faithful to the original data and smoother. At the start of analysis, set the smoothing parameter to the minimum value (0.6).

Ti (unstable period after starting or resuming an assay (i=0, 1, ...): Settable range 0 to 20

This parameter indicates the period (hours) in which the sensor sensitivity is unstable after starting or resuming an assay. Data during this period is excluded from analysis. The period highlighted in the graph is the target of the setting.



The parameters can be set using the following buttons, slide bars, or keyboard entry.



5. DATA ANALYSIS

Details of button operation

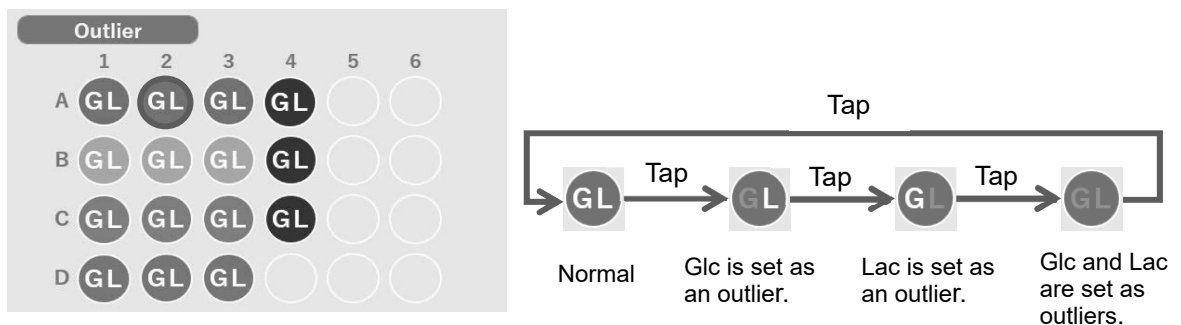
No.	Name	Description
1	Input field	You can type the numeric value directly into the input field.
2	Slide bars	Increase or decrease the parameter by sliding it to the right or left, respectively (coarse adjustment). Sr: Increase or decrease by 0.05. Ti: Increase or decrease by 0.5.
3	< and > buttons	Increase or decrease the parameter by tapping the < or > button, respectively (fine adjustment). For both Sr and Ti, the value increases or decreases by 0.01.
4	◀ and ▶ buttons (For setting the i value of Ti)	Increase or decrease the i value by tapping the ◀ or ▶ button by 1. The value specifies the area where the data becomes unstable. i = 0 indicates the unstable period just after starting an assay. i=1 indicates the unstable period just after resuming the assay for the first time.

Notes:

- "Resuming of an assay" means resuming an assay when a measurement is paused, or when the system recovers from an error status. The errors include communication error, plate set error, and power outage error.
- The data before and after pausing the measurement is analyzed as separate data that has no relation to each other. On the other hand, the data before and after error occurrence is analyzed as continuous data.

5. Set outliers on the Analysis screen

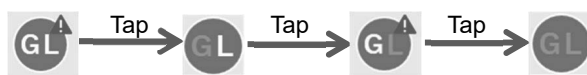
- ▶ Tapping a well changes the indication of G (Glc) and L (Lac) displayed on the well. If you specify a Group as an outlier sensor, the specified sensor is excluded from the analysis target.



As necessary, exclude wells (sensors) with certain errors^{*1} or over range^{*2}, which are indicated by the error mark or "O.R." mark, from data analysis by setting them as outliers. When such wells are set as outliers, the error marks and "O.R." marks disappear.

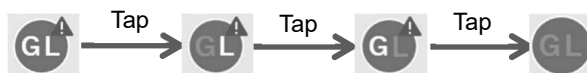
Example 1. A certain error has occurred on glucose measurement:

The error mark disappears when G (Glc) is set as an outlier.



Example 2. Certain errors have occurred on both of glucose measurement and lactate measurement:

The error mark disappears when G (Glc) and L (Lac) are set as an outlier.

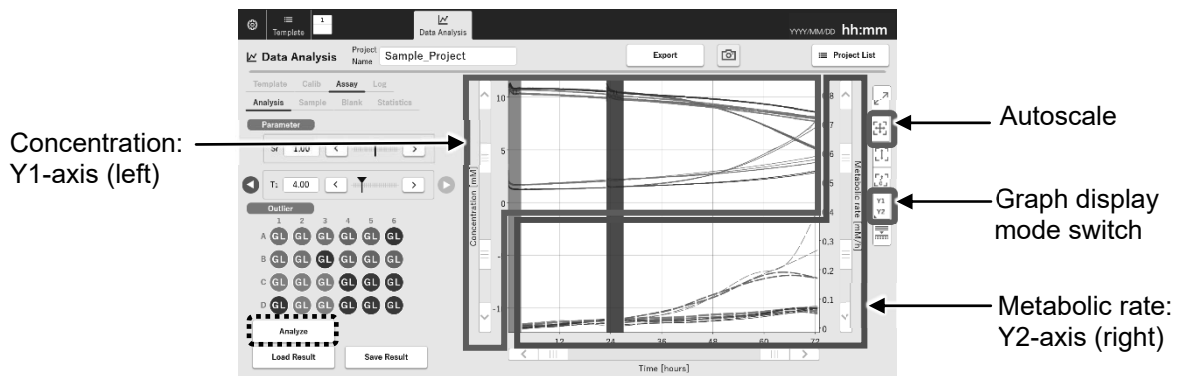


*1 CE sensor error, AFE ADC error, calibration error, and current sensor error. For details, refer to "Types and solutions for system errors" on pages 108 and 109.

*2 This error occurs when the measured value exceeds the measurement range. Measurement data is acceptable while it is within the measurement range, but after it exceeds the measurement range, measurement may not be performed correctly. Therefore, set outlier as necessary. However, the sensor with outlier setting is excluded from analysis throughout the entire period. If the sensor data includes necessary data, perform analysis without setting outlier and then edit the data in the exported file. For details about exporting data, see "Exporting analysis result data" (page 98).

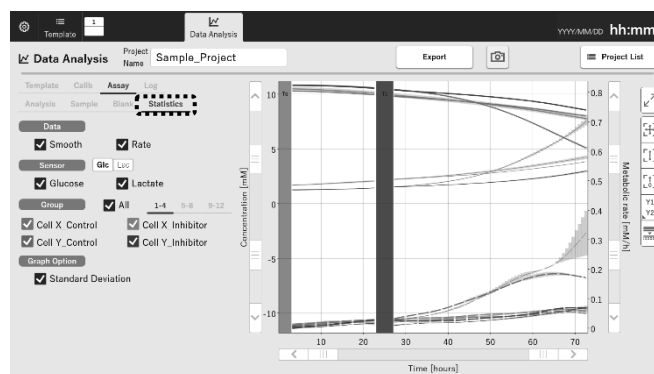
6. Tap the **Analyze** button to analyze.

► The analysis results (smoothed concentration and metabolic rate) are displayed in the graph area. Tapping the autoscale button on the side button menu automatically scales the graph so that the entire data is displayed appropriately. When you tap the graph display mode switch button to change it to the Y1/Y2 button, concentration is displayed in the upper half of the graph area (left Y1-axis) and metabolic rate is displayed in the lower half of the graph area (right Y2-axis). For details, see "Side button menu" (page 40).



Note:

Tapping the Statistics tab displays the average and the standard deviation of the analysis result (Smooth and Rate) of each Group. The displayed standard deviation is the unbiased standard deviation.



7. Repeat analysis by gradually increasing the value of the smoothing parameter.

► This operation removes noise from the raw data while retaining changes caused by metabolism. For an example of setting analysis parameters, see "Example of analysis parameter setting" (pages 88 and 89).

5. DATA ANALYSIS

Example of analysis parameter setting

The following example shows steps for setting analysis parameters.

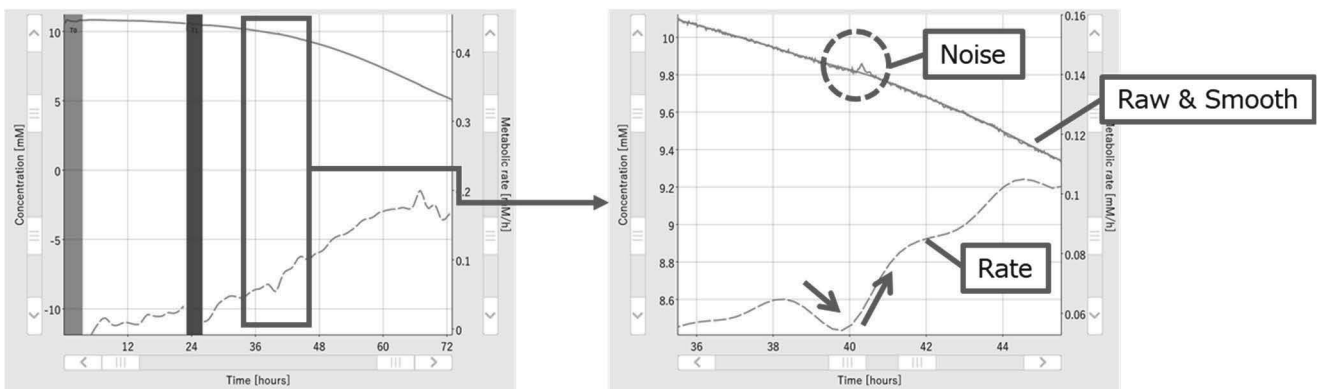
1. Set the smoothing parameter (S_r) to the minimum value (0.6).
2. Zoom in the graph view and extend the period just after starting or resuming an assay during which the measurement data is unstable by adjusting T_i value.
Adjust the T_0 parameter value (for just after starting an assay) so that the whole unstable data area is included within the highlighted part in the graph. Also, adjust T_i ($i = 1, 2, 3 \dots$) parameter value(s) (for just after resuming the assay) in the same way.



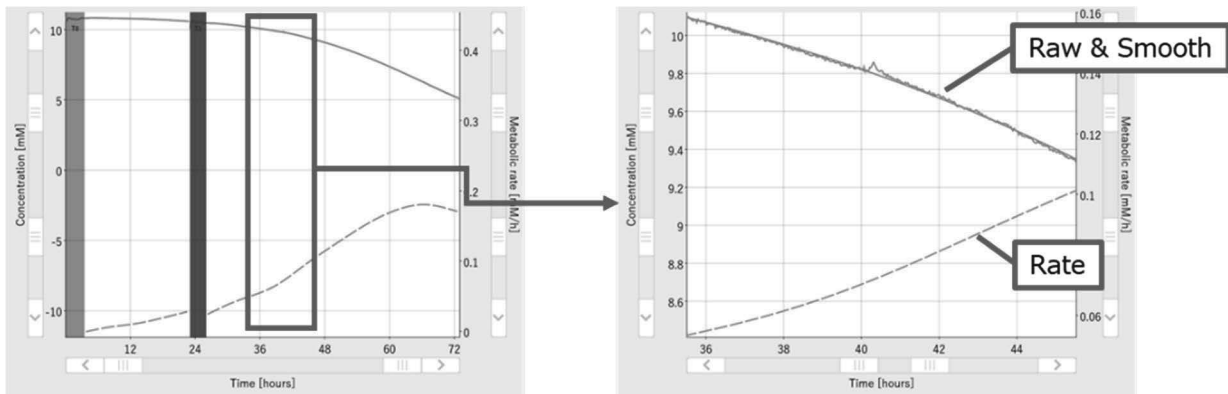
3. Tap the **Analyze** button.

4. Remove noise.

- 1) The raw data may contain noise not associated with metabolism. Measurement data that contains noise may affect the analysis result. Therefore, remove noise by adjusting the S_r value.
In the example shown below, the rate data fluctuates temporarily due to noise during measurement.

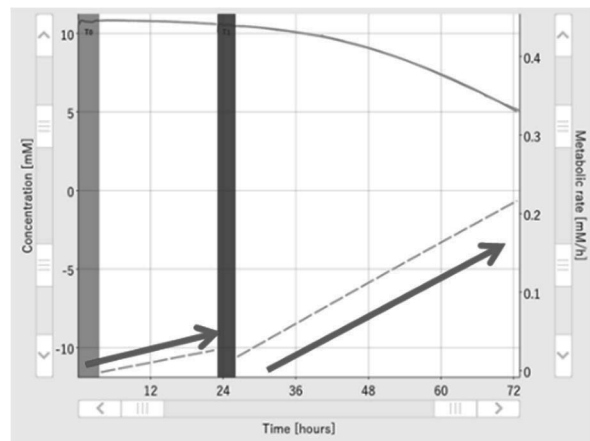


- 2) Gradually increase the value of S_r to reduce the impact of the noise on the rate data.
In the example, the impact of the noise is reduced when S_r is set to 1.0.



Note:

Be careful not to set the S_r value too high since changes related to metabolism are also removed from the data. This example shows the analysis result obtained by setting S_r to 1.4. Changes related to metabolism are removed and the rate is calculated to be a straight line.



5. DATA ANALYSIS

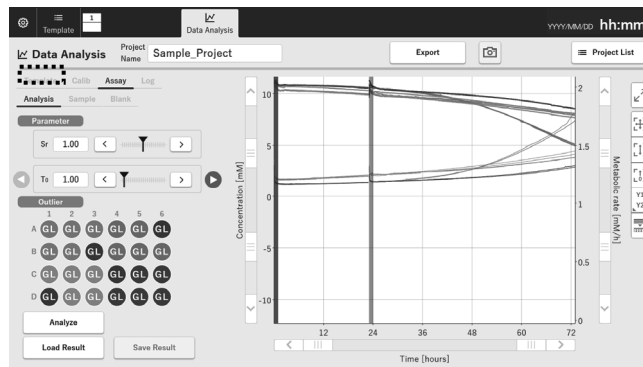
Blank correction

The influence of sensor sensitivity variation caused by the culture medium or measurement environment can sometimes be eliminated from the measurement result for a group by using a blank's normalized electric current value changed over time for correction.

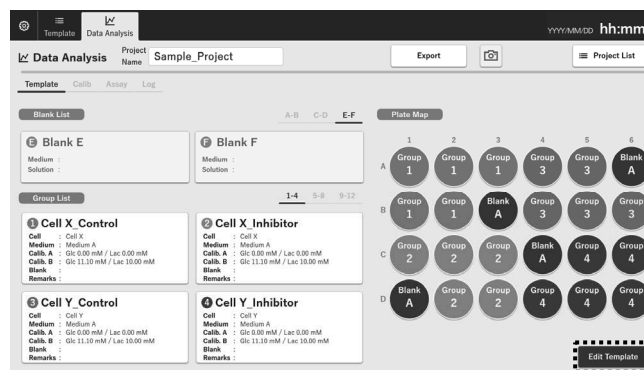
Notes:

- Blank correction cannot remove the influence of sensor sensitivity variation caused by influences such as cell-derived influence, that is other than culture medium and measurement environment.
- In addition to the influence of the sensor sensitivity variation, normalized electric current value of Blank will be influenced by evaporation of culture medium. Therefore, measurement results are over-corrected by the amount concentrated due to the evaporation of culture medium. You cannot use blank correction when the amount of culture medium evaporation is large for the reason that culture medium is not replaced often, or humidification is not enough.
- Blank correction may not work properly depending on the type of culture medium. We recommend that you verify if the blank correction works correctly within the measurement concentration range beforehand by measuring the culture media prepared within the desired glucose concentration and lactate concentration.

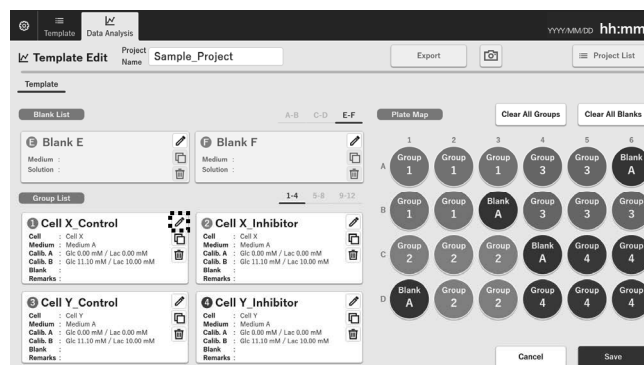
1. Tap the Template tab on the Data Analysis screen.
▶ The Template Edit screen is displayed.



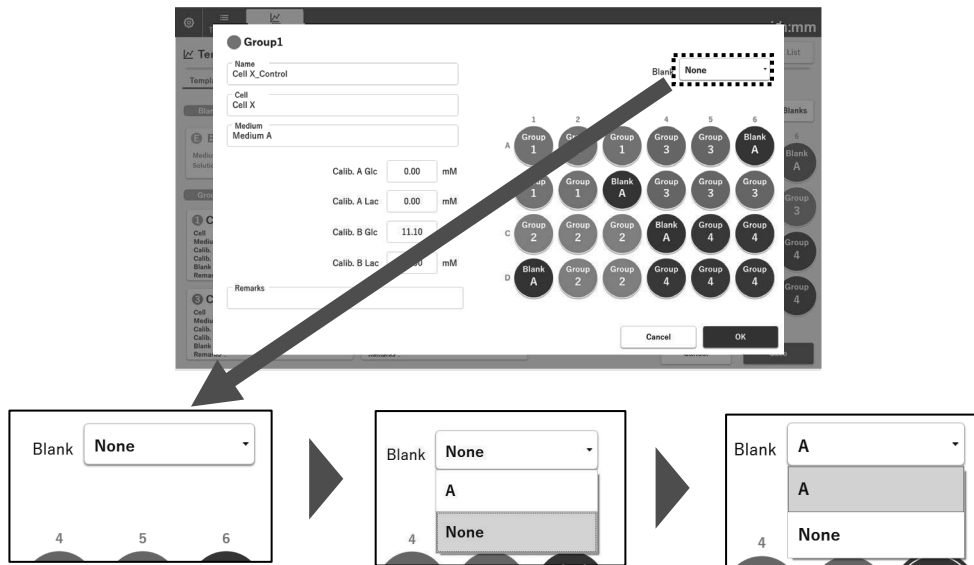
2. Tap the **Edit Template** button.
▶ The Template Edit screen is displayed.



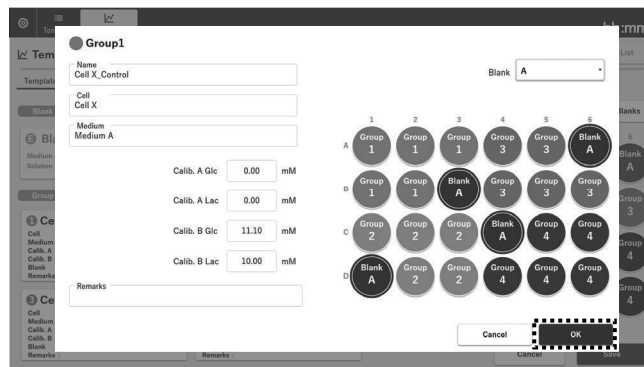
3. Tap the edit icon on a Group in the Group List against which you want to perform Blank correction.
▶ The Group information dialog is displayed.



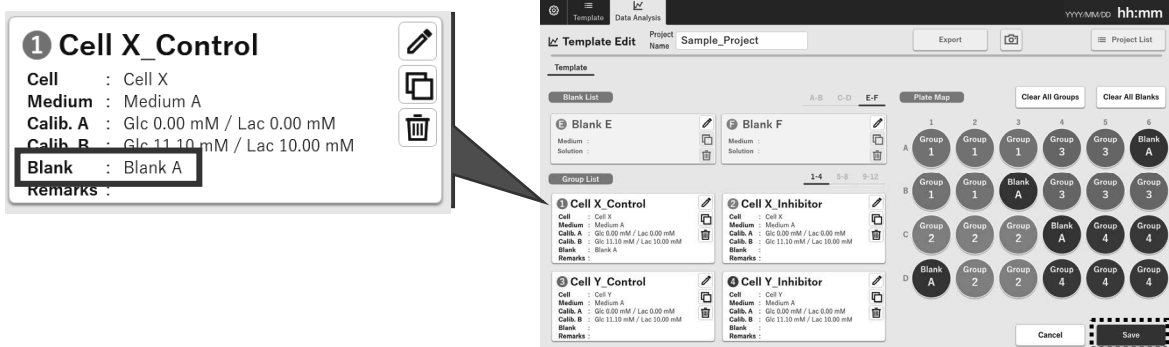
- Select the Blank ID corresponding to the selected Group from the Blank pull-down menu.



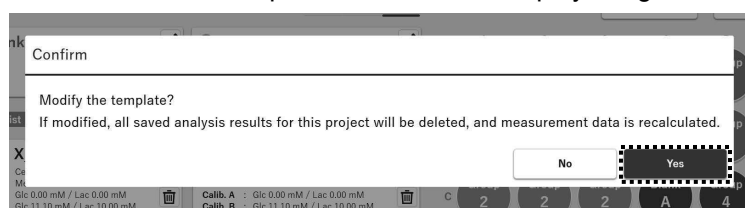
- After editing the Blank, tap the **OK** button.
 - ▶ The Template Edit screen is displayed again.



- Tap the **Save** button.
 - ▶ The Confirm dialog is displayed.



- Tap the **Yes** button.
 - ▶ The changes are saved, and the Template Edit screen is displayed again.

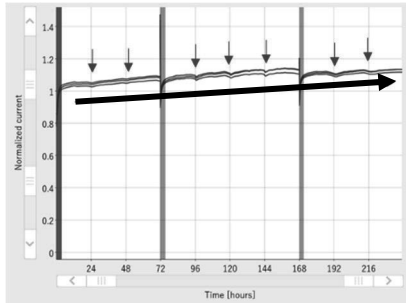


Note:
Editing the template deletes all saved data analysis results.

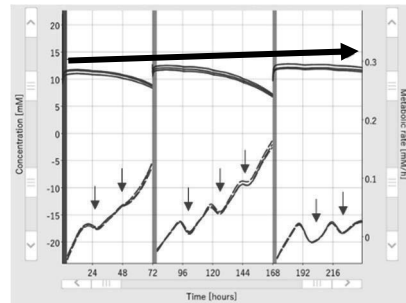
5. DATA ANALYSIS

Example for blank correction

1. Tap the **Blank** button on the Data Analysis screen.
Then, confirm that the normalized electric current value of the Blank that has changed over time is kept at 1.2 or less, and the changing trends for other sensors are the same.



Blank variation



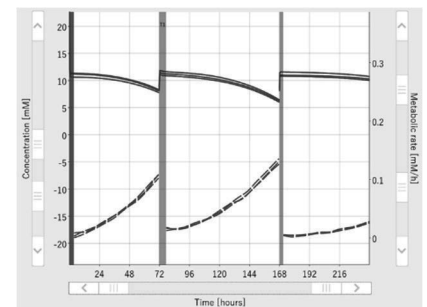
Group variation (before blank correction)

In this example, the culture medium for Blank is possibly influencing the sensor sensitivity since the normalized electric current value of the blank rises over time (shown by the arrow: \rightarrow). Also, since the normalized electric current value of the blank has changed periodically (shown by the arrow: \downarrow), the chamber temperature has possibly fluctuated due to the incubator environment and the incubator's door opening and closing. These changes are observed in different Groups using the same culture medium.

Note:

Blank correction cannot be performed unless there is a certain trend in changes in the normalized electric current value of the Blank. Also, a larger variation of changes may cause over-correction.

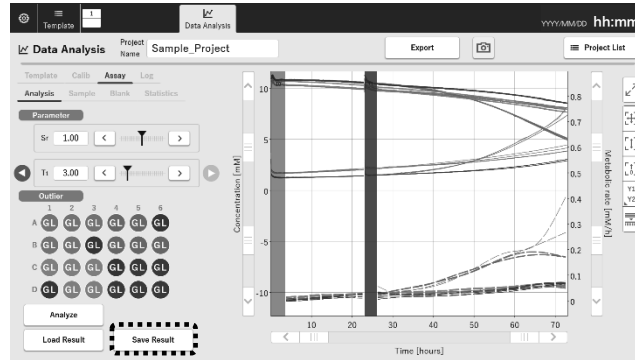
2. Configure the blank correction setting for the target group by following steps 1 to 7 in the previous "Blank correction" section.
► You can observe that blank correction has reduced the increase in sensitivity over time and periodical increase and decrease in sensitivity.



Saving analysis results

Follow the steps below to save the analysis result.

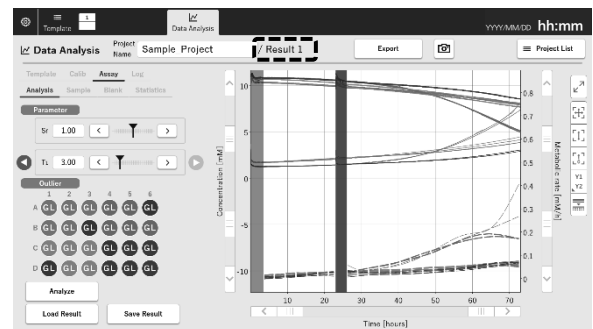
1. On the Data Analysis screen displaying the analysis result you want to save, tap the **Save Result** button.
 - ▶ A dialog for entering the analysis name is displayed.



Note:

After tapping the **Analyze** button, the **Save Result** button becomes inactive until the analysis finishes. The **Save Result** button also becomes inactive when you change an analysis parameter or the outlier setting after analysis. To save the analysis result in such a situation, tap the **Analyze** button to update the analysis result.

2. Tap Name input field and enter an analysis result name and tap the **Save** button.
 - ▶ The analysis result is saved, and the name is displayed on the right of the project name. Tapping the **Cancel** button cancels to saving the result and returns to the Data Analysis screen.

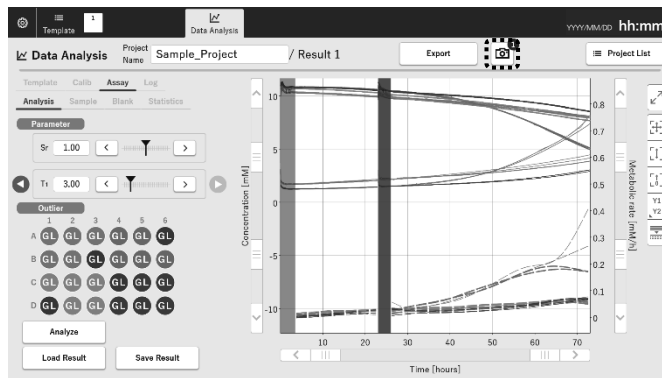


5. DATA ANALYSIS

Capturing the screen

After saving the analysis result by tapping the **Save Result** button, you can save screen capture images. You can save up to 20 images for each analysis result. When you try to save the 21st image, the oldest image is overwritten with a new one.

1. Tap the **Save Result** button to save the analysis result (see page 93).
2. Tap the camera button.
 - ▶ The whole screen is captured and saved as an image. The number on the upper right of the camera button indicates the number of images currently saved in the controller.



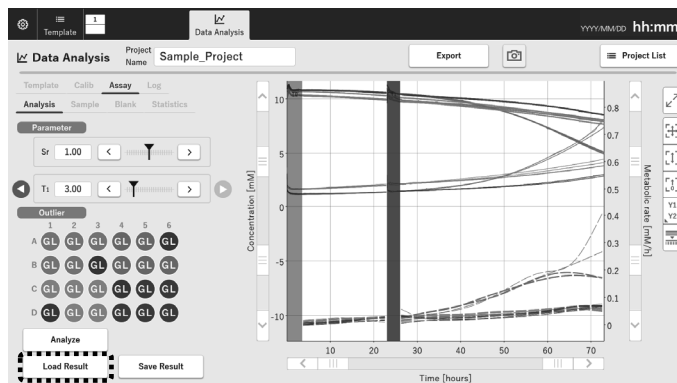
Notes:

- You can find the captured images in the exported project folder (see pages 98 and 99).
- The captured images are saved being associated with the analysis result and can be exported to a USB flash drive.
- The camera button is inactive if the analysis result displayed on the screen has not been saved.

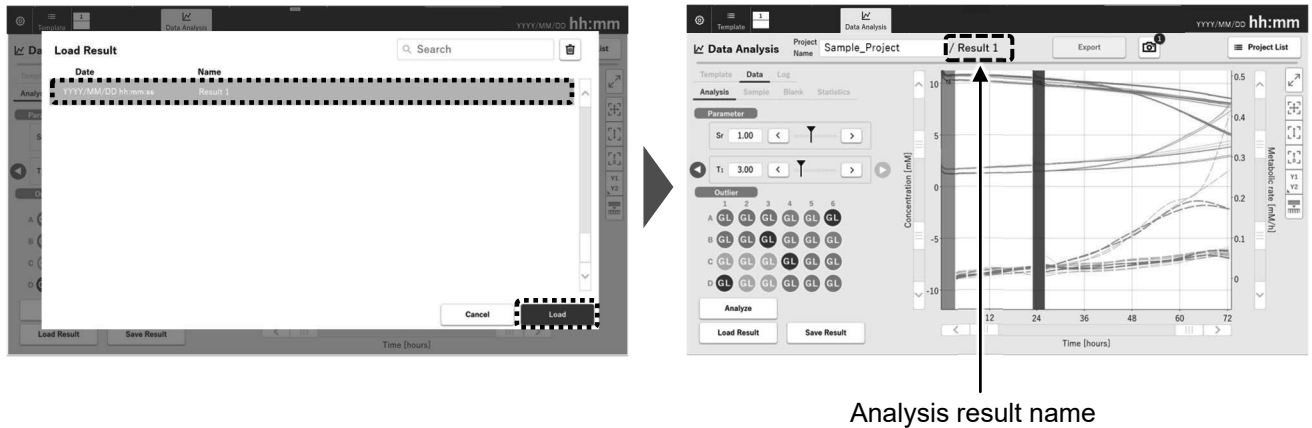
Loading analysis results

Follow the steps below to load an analysis result.

1. Tap the **Load Results** button in the Data Analysis screen.
 - ▶ The Load Result list is displayed.



- Tap an analysis result from the list, and then tap the **Load** button.
 - ▶ The analysis result (smoothed concentration and metabolic rate) is loaded and displayed in a graph.

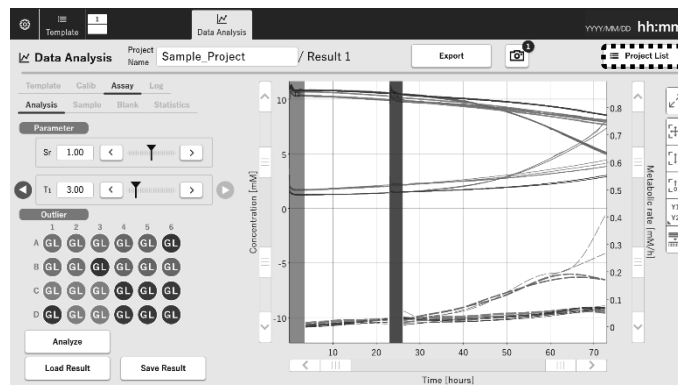
**Note:**

The analysis result name is indicated on the right of the project name.

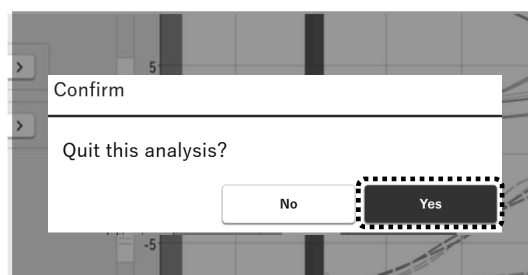
Finishing data analysis

Follow the steps below to finish data analysis.

- Tap the **Project List** button on the Data Analysis screen.
 - ▶ The Confirm dialog is displayed.



- Tap the **Yes** button.
 - ▶ Data analysis finishes, and the top screen of Data analysis menu is displayed. Tapping the **No** button displays the Data Analysis screen again.



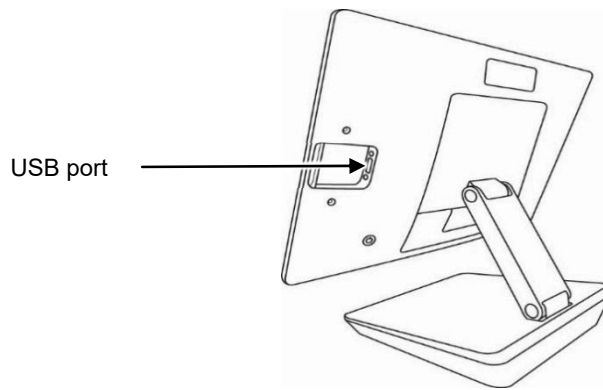
6. EXPORTING DATA

You can export measurement data and analysis results to a USB flash drive. For this operation, USB flash drives with a capacity of 1 GB or more without password function are supported. However, we do not guarantee the correct operation of all USB flash drives even if these conditions are satisfied.

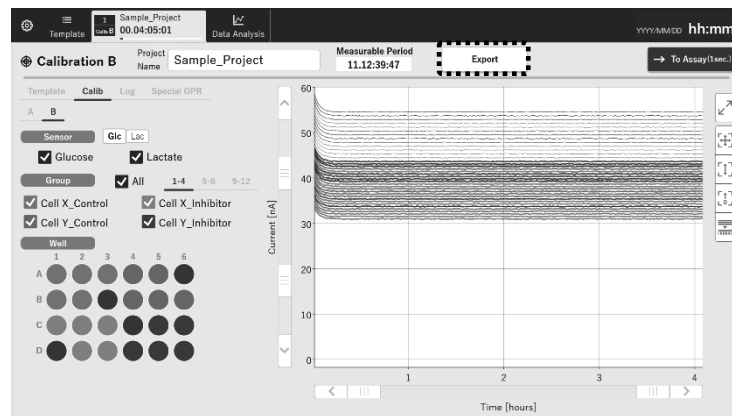
Exporting measurement data during measurement phase

To export measurement data during a measurement phase (calibration A, B, and assay), follow the steps below.

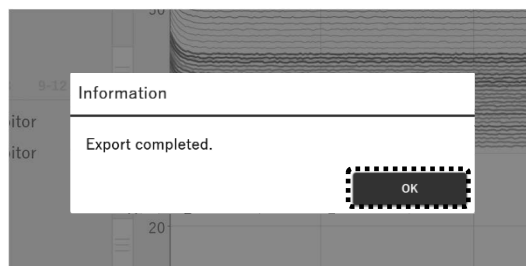
1. Connect a USB flash drive to the USB port (for data export) on the back side of the controller.



2. During a measurement phase, tap the **Export** button.
▶ The measurement data to that point is exported to the USB flash drive.



3. On completion of the export, tap the **OK** button on the Information dialog.
▶ The screen returns to the previous screen.

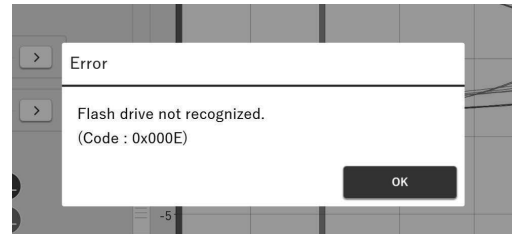


Exported files

YYMMDD_[ProjectName]_xx	Project folder
template_[TemplateName].csv	Template file
log.csv	Project log file
calibration.csv	Calibration data file
assay.csv	Measurement result file
YYYYMMDD_hhmmss.png	Captured image file (Export button)
System.zip	System file (for service inquiries)

Notes:

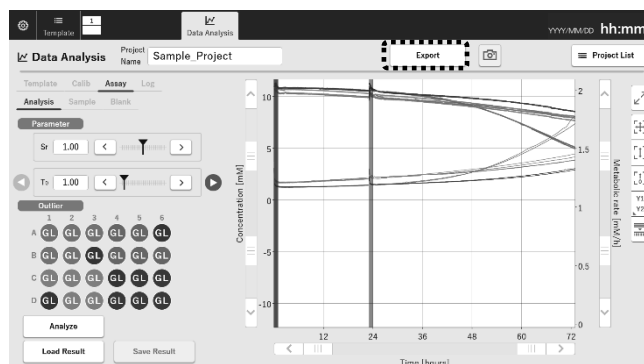
- “xx” at the end of the project file folder name indicates the number of revisions after the project has been started. At project start, the number is 00 and increments to 99. After 99, the number returns to 00. If the template is revised, the data is saved as a different folder.
- When data is exported during calibration, the measurement result file is not exported.
- The image of the screen displayed at the time when the **Export** button is tapped is saved as the captured image file (PNG file). A new captured image file is exported every time the **Export** button is tapped with a different date and time indication.
- Files other than captured image files are exported and overwritten every time the **Export** button is tapped.
- If a USB flash drive is not inserted when the **Export** button is tapped, the following error dialog is displayed. Tap the **OK** button, insert a USB flash drive, and then export the data again.



Exporting measurement result data

To export measurement result data, follow the steps below.

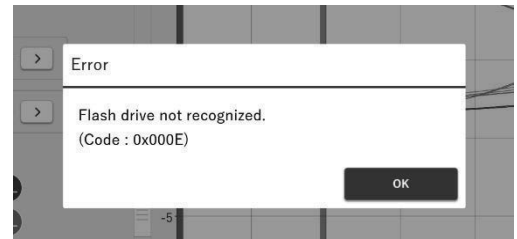
1. Load a measured project to be exported. For details, refer to step 1 in “Analyzing the metabolic rate” on page 84.
2. Connect a USB flash drive to the USB port (for data export) on the back side of the controller. For details, refer to step 1 in “Exporting measurement data during measurement phase” on page 96.
3. Tap the **Export** button.
 - ▶ The measurement result data is exported to the USB flash drive. The exported files are same as the one shown in “Exported files” section in “Exporting measurement data during measurement phase” on page 97.



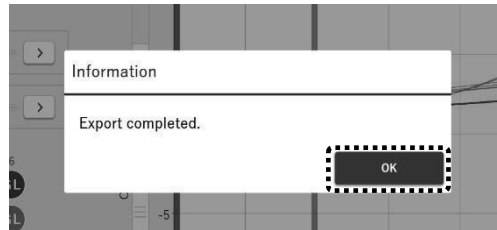
6. EXPORTING DATA

Note:

If a USB flash drive is not inserted when the **Export** button is tapped, the following Error dialog is displayed. Tap the **OK** button, insert a USB flash drive, and then export the data again.



- 4. On completion of the export, tap the **OK** button on the Information dialog.
▶ The screen returns to the previous screen.



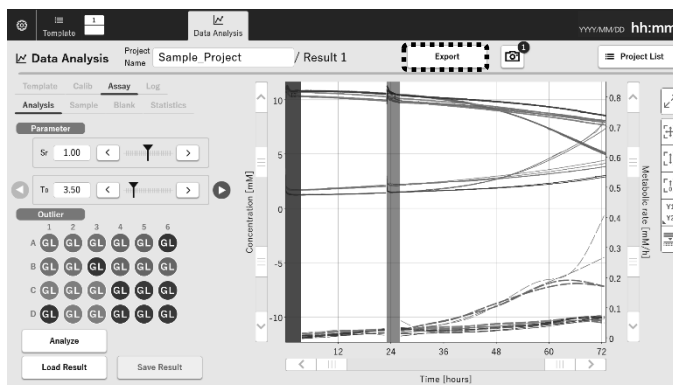
Exporting analysis result data

- 1. Load a measured project. For details, refer to step 1 in “Analyzing the metabolic rate” on page 84.
- 2. Load an analysis result. For details, refer to “Loading analysis results” on pages 94 and 95.

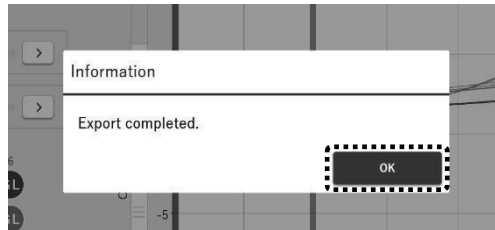
Note:

You can also export an analysis result after saving the analysis result by tapping the **Save Result** button.

- 3. Connect a USB flash drive to the USB port (for data export) on the back side of the controller. For details, refer to step 1 in “Exporting measurement data during measurement phase” on page 96.
- 4. Tap the **Export** button.
▶ The analysis result data is exported to the USB flash drive.



5. On completion of the export, tap the **OK** button on the Information dialog.
 ▶ The Data Analysis screen is displayed.

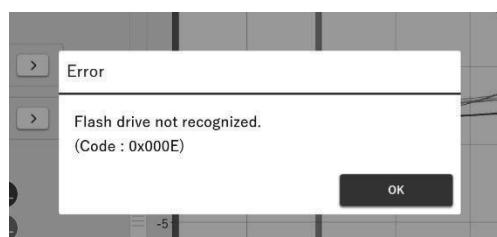


Exported files

YYMMDD_[ProjectName]_xx	Project folder
[AnalysisName]	Analysis result folder
[AnalysisName]_analysis_result.csv	Analysis result file
YYYYMMDD_hhmmss.png	Captured image file (Camera button)
template_[TemplateName].csv	Template file
log.csv	Project log file
calibration.csv	Calibration data file
assay.csv	Measurement result file
YYYYMMDD_hhmmss.png	Captured image file (Export button)
⋮	
System.zip	System file (for service inquiries)

Notes:

- Only the analysis result shown next to the project name on the screen is exported.
- Measurement result is also exported if it has not been exported.
- The captured image file in the AnalysisName folder is the image taken by tapping the camera button after saving the analysis result (page 94).
- If a USB flash drive is not inserted when the **Export** button is tapped, the following Error dialog is displayed. Tap the **OK** button, insert a USB flash drive, and then export the data again.



6. EXPORTING DATA

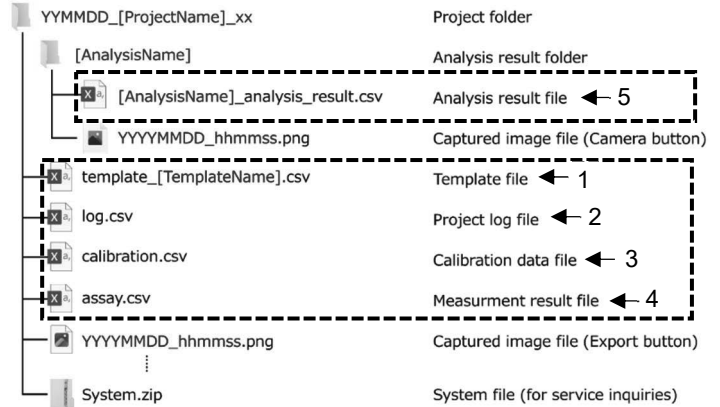
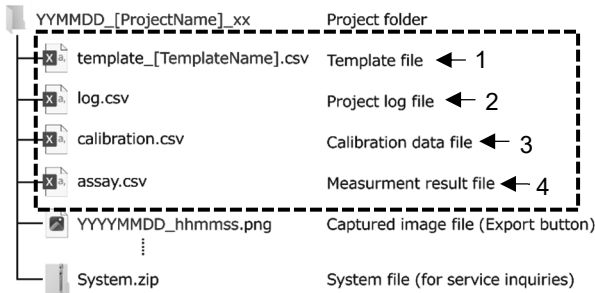
Files in the exported folder

The exported folder consists of CSV files, PNG files, and system files (for inquiries) as shown in the following figure.

Exported files

Data during measurement phase and Measurement result data

Analysis result data



1. Template file (template_[TemplateName].csv)

The template file includes the following information.

	A	B	C	D	E	F	G	H	I	J
1	[Plate/Well]									
2		1	2	3	4	5	6			
3	A	Group 1	Group 1	Group 1	Group 3	Group 3	Blank A-REF			
4	B	Group 1	Group 1	Blank A-REF	Group 3	Group 3	Group 3			
5	C	Group 2	Group 2	Group 2	Blank A-REF	Group 4	Group 4			
6	D	Blank A-REF	Group 2	Group 2	Group 4	Group 4	Group 4			
7		1	2	3	4	5	6			
9	A	Cell X_Control	Cell X_Control	Cell X_Control	Cell Y_Control	Cell Y_Control	Blank A-REF			
10	B	Cell X_Control	Cell X_Control	Blank A-REF	Cell Y_Control	Cell Y_Control	Cell Y_Control			
11	C	Cell X_Inhibitor	Cell X_Inhibitor	Cell X_Inhibitor	Blank A-REF	Cell Y_Inhibitor	Cell Y_Inhibitor			
12	D	Blank A-REF	Cell X_Inhibitor	Cell X_Inhibitor	Cell Y_Inhibitor	Cell Y_Inhibitor	Cell Y_Inhibitor			
14	[Blank Information]									
15	Blank Number	Medium	Glc [mM]	Lac [mM]						
16	Blank A	Medium A		11						
18	[Group Information]									
19	Group ID	Group Name	Cell	Medium	Calib.A Glc [mM]	Calib.A Lac [mM]	Calib.B Glc [mM]	Calib.B Lac [mM]	Blank	Remarks
20	Group 1	Cell X_Control	Cell X	Medium A	5.5	6	11	12	-	
21	Group 2	Cell X_Inhibitor	Cell X	Medium A	5.5	6	11	12	-	
22	Group 3	Cell Y_Control	Cell Y	Medium A	5.5	6	11	12	-	
23	Group 4	Cell Y_Inhibitor	Cell Y	Medium A	5.5	6	11	12	-	

2. Project log file (log.csv)

The project log file includes the following information.

	1. Log level	2. Measurement time	3. Log message	4. Error code
	B	C	D	E
1	Level	Time Stamp	Diff Time [h]	Message
2	Information	2024/1/24 20:16	-0.16661	Calibration A start
3	Information	2024/1/24 20:16	-0.15842	Controller Software Version : 0.0.88.0 (A08069B247C8)
4	Information	2024/1/24 20:16	-0.15798	Detector Software Version : 6.2.2748
5	Information	2024/1/24 20:16	-0.15798	Detector Bootloader Version : 0.0.00
6	Information	2024/1/24 20:16	-0.15798	Detector Serial Number : 0000012345
7	Information	2024/1/24 20:16	-0.15798	Sensor Serial Number : 111111111111
8	Information	2024/1/24 20:16	-0.15798	Template : Sample_Project
9	Information	2024/1/24 20:26	0.00756	Measurement delay end
10	Error	2024/1/24 20:54	0.47402	CE Sensor Error Occurrence : Well A2
11	Error	2024/1/24 20:54	0.47403	CE Sensor Error Occurrence : Well A5

1) Log level

Log types are indicated by the following three levels.

Level	Details	Example
Error	An error that impacts significantly on the measurement	Comm Error (page 106)
Warning	Warning situation other than Error	Expired sensor
Information	Information of an operation or event	Assay start

2) Measurement time

Both absolute time (Time Stamp) and differential time (Diff Time [h]) at each phase (Calibration A/ Calibration B/ Assay) are indicated.

3) Log message

Description of the log.

4) Error code

Error code for Error or Warning.

3. Calibration data file (calibration.csv)

The calibration data file includes the following information.

The image shows a detailed view of a CSV calibration data file. It is divided into several sections: Calibration A, Calibration B, Standard Curve information, and Lactate Standard Curve. Numbered callouts (1-9) identify specific data points and sections:

- 1. Event type:** Points to the 'Type' column, specifically 'Plate Set Error'.
- 2. Calibration start time:** Points to the 'Start Time' column.
- 3. Measurement time:** Points to the 'Time Stamp' column.
- 4. Header information:** Points to the 'CE/ADC/CUR/CAL' and 'CUR/CAL' headers.
- 5. Calibration data:** Points to the main data columns for Glucose (Glc_A1 nA to Glc_B5 nA).
- 6. Standard curve function:** Points to the formula $[NA] = P0 * [mM]^2 + P1 * [mM] + P2$.
- 7. Standard curve time range:** Points to the 'From [h]' and 'To [h]' columns.
- 8. Glucose standard curve coefficients:** Points to the P0, P1, and P2 values for the Glucose standard curve.
- 9. Lactate standard curve coefficients:** Points to the P0, P1, and P2 values for the Lactate standard curve.

6. EXPORTING DATA

[Calibration A, B]

1) Event type

Event types are indicated by the following three types.

Event type	Details
Comm Error	Communication error.
Plate Set Error	The sensor module assembly has been removed during measurement operation.
Power Outage Error	A power failure has occurred.

2) Calibration start time

The date and time when the calibration started.

3) Measurement time

Both absolute time (Time Stamp) and differential time (Diff Time [h]) since the start of calibration are indicated. The measurement interval of the calibration data is every minute.

4) Header information

The information of each well is indicated as follows.

Line	Item	Indication in the file
1	CE/ADC/CUR/CAL	CE, ADC, CUR, or CAL (or combination of them) (Indicates that CE sensor error, AFE ADC error, current sensor error or calibration error occurred in the indicated well.)
2	Group ID	Group ID (If it is Blank, Blank ID is recorded, when not set, "-" is shown.)
3	Group Name	Group name entered when creating assay template (If it is Blank, Blank ID is recorded, when not set, no name is shown.)
4	Measured item, unit	-
	Electric current value measured at each well	Glc_[well No.] nA Lac_[well No.] nA

5) Calibration data

Measured electric current values (nA) for Group and Blank are recorded.

[Standard curve information]

6) Standard curve function

Formula of the standard curve function. Electric current value (nA) is obtained by a function that takes the concentration (mM) as a variable.

7) Standard Curve Time Range

Time range of calibration A or B used for the calculation of the standard curve. The time is the differential time (Diff Time [h]) from the start of the calibration A or B.

A symbol "*" is added to the first column of the calibration data A or B that was used for the calculation of standard curve.

8), 9) Glucose/Lactate standard curve coefficients

Standard curve coefficients (P0, P1, P2) of each sensor. "P0 = 0" indicates that the standard curve is a linear function. "P2 = 0" indicates that the standard curve is a function of which line passes through the origin.

4. Measurement result file (assay.csv)

The measurement result file includes the following information.

Line	Item	Indication in the file
1	O.R.[h]	The time when an over range occurred (relative time [h])
2	CE/ADC/CUR/CAL	CE, ADC, CUR, or CAL (or combination of them) (Indicates that CE sensor error, AFE ADC error, current sensor error or calibration error occurred in the indicated well.)
3	Group ID	Group ID (If it is Blank, Blank ID is recorded, when not set, "-" is shown.)
4	Group Name	Group Name entered when creating assay template (If it is Blank, Blank ID is recorded, when not set, no name is shown.)
5	Measured item, unit	-
	Electric current value measured at each well	Glc_[well No.] mM Lac_[well No.] mM

1) Event type

Event types are indicated by the following four types.

Type	Details
Pause	Assay was paused.
Comm Error	Communication error.
Plate set Error	The sensor module assembly has been removed during measurement operation.
Power Outage Error	A power failure has occurred.

2) Assay start time

The date and time when the assay started.

3) Header information

The information of each well is indicated as follows.

Line	Item	Indication in the file
1	O.R.[h]	The time when an over range occurred (relative time [h])
2	CE/ADC/CUR/CAL	CE, ADC, CUR, or CAL (or combination of them) (Indicates that CE sensor error, AFE ADC error, current sensor error or calibration error occurred in the indicated well.)
3	Group ID	Group ID (If it is Blank, Blank ID is recorded, when not set, "-" is shown.)
4	Group Name	Group Name entered when creating assay template (If it is Blank, Blank ID is recorded, when not set, no name is shown.)
5	Measured item, unit	-
	Electric current value measured at each well	Glc_[well No.] mM Lac_[well No.] mM

4) Measurement time:

Both absolute time (Time Stamp) and differential time (Diff Time [h]) since the start of assay are indicated. The measurement interval of the assay results is every minute.

5) Measurement result

For Group, measured concentration is recorded. For Blank, normalized electric current value is recorded.

6. EXPORTING DATA

5. Analysis result file ([AnalysisName]_ analysis_result.csv)

1. Analysis start time
2. Analysis parameter
3. Header information

4. Event type
5. Measurement time
6. Analysis result

1) Analysis start time

The date and time when the analysis started.

2) Analysis parameter

Values set for Sr and Ti when analysis was performed.

3) Header information

The information of each well and group is indicated as follows.

Line	Item	Details	
1	Outlier	Outlier. (The indicated sensor has been set as the outlier.)	
2	O.R.[h]	The time when an over range occurred (relative time [h])	
3	CE/ADC/CUR/CAL	CE, ADC, CUR, or CAL (or combination of them) (Indicates that CE sensor error, AFE AD error, current sensor error, or calibration error occurred in the indicated well.)	
4	Group ID	Group ID (If it is Blank, Blank ID is recorded, when not set, "-" is shown.)	
5	Group Name	Group Name entered when creating assay template (If it is Blank, Blank ID is recorded, when not set, no name is shown.)	
6	Measured item, unit		
	Concentration value measured at each well		
	Smoothed concentration value measured at each well		
	Metabolic rate measured at each well		
	Concentration value at each group	Average	Smooth Glc_[Group ID](avg.) mM Smooth Lac_[Group ID](avg.) mM
		Standard deviation	Smooth Glc_[Group ID](S.D.) mM Smooth Lac_[Group ID](S.D.) mM
Metabolic rate at each group	Average	Rate Glc_[Group ID](avg.) mM/h Rate Lac_[Group ID](avg.) mM/h	
	Standard deviation	Rate Glc_[Group ID](S.D.) mM/h Rate Lac_[Group ID](S.D.) mM/h	

4) Event type

Event types are indicated by the following four types.

Type	Details
Pause	Assay was paused.
Comm Error	Communication error.
Plate set Error	The sensor module assembly has been removed during measurement operation.
Power Outage Error	A power failure has occurred.

5) Measurement time

Both absolute time (Time Stamp) and differential time (Diff Time [h]) since the start of assay are indicated. The measurement interval of the assay results is 15 minutes.

6) Analysis result

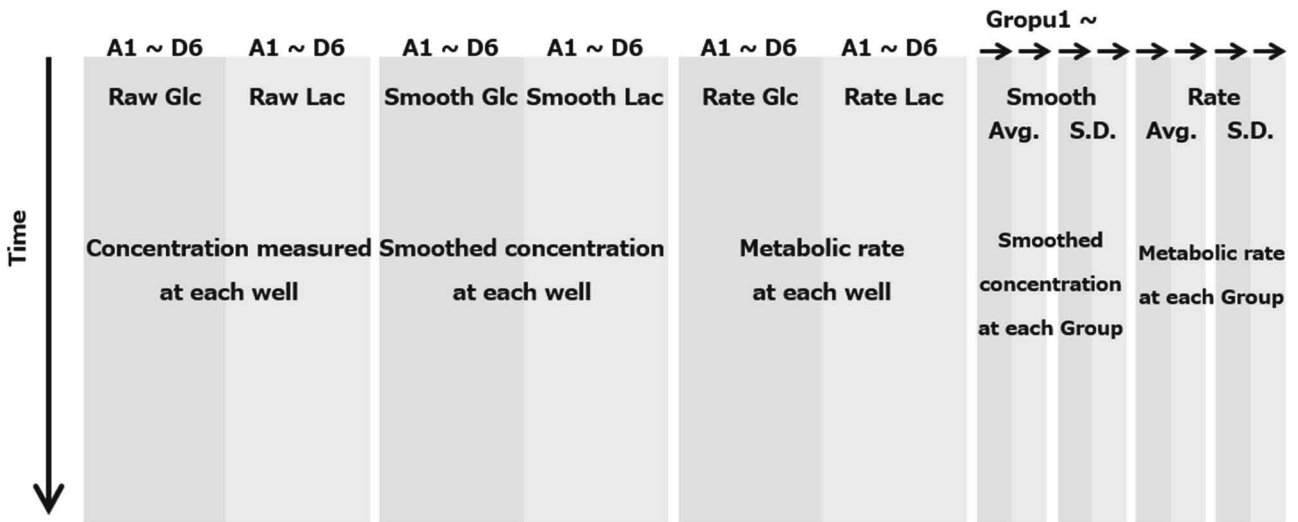
Measured concentration and smoothed concentration:

For Group, measured concentration is recorded. For Blank, normalized electric current value is recorded.

Metabolic rate:

For Group, concentration change rate is recorded. For Blank, nothing is recorded.

The analysis result consists of the following data groups.



5. ERROR AND MAINTENANCE

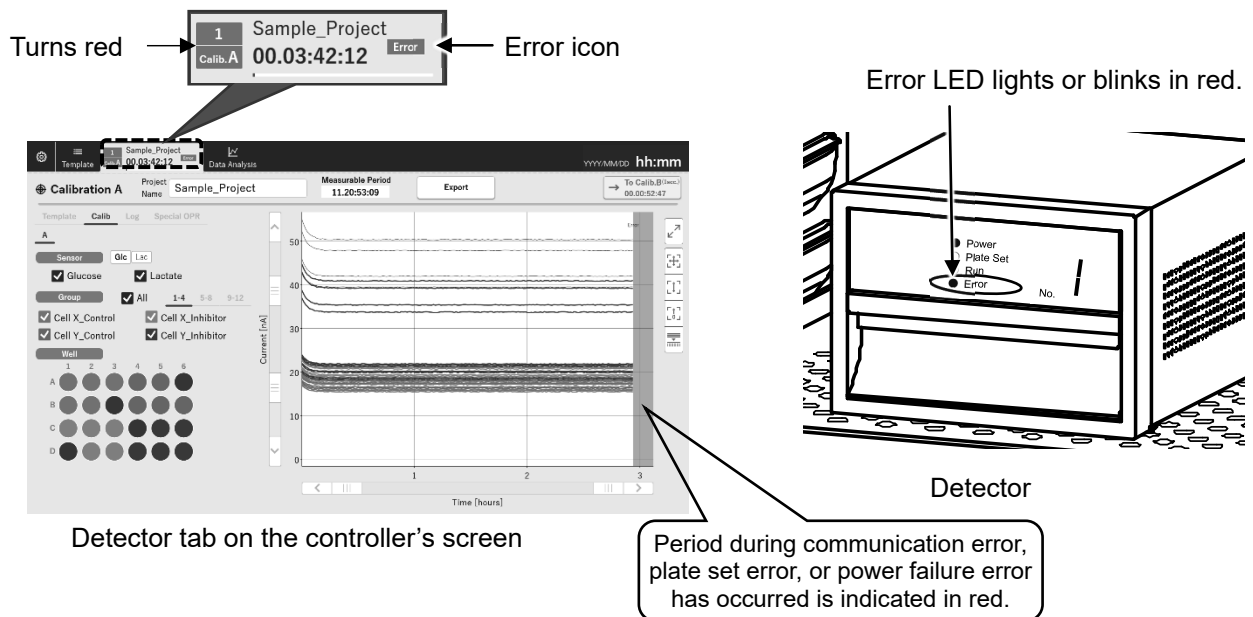
SYSTEM ERROR

When a system error occurs, the system notifies the user about the error by the indications below:

- 1) The Error icon at the detector tab on the controller's screen blinks in red.
- 2) Alarm sound beeps.
- 3) The Error LED on the front panel of the detector blinks or lights in red.
Red light: The user does not need to perform a recovery operation.
Red blinking: The user needs to perform a recovery operation.

Note:

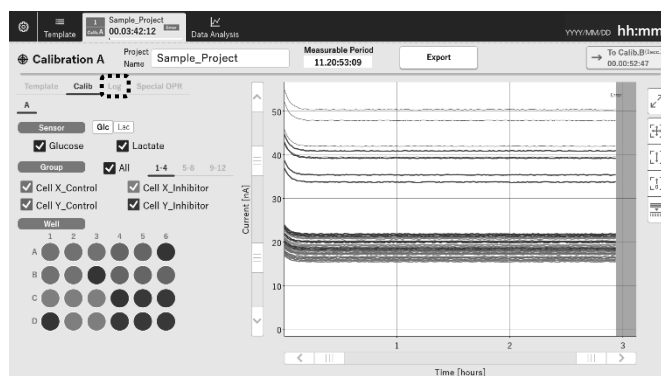
When the system recovers from the error, the alarm sound stops but the indications by the Error icon and Error LED continue. The indications disappear when the user accepts the recovered system error.



Operation when a system error occurs

When a system error is notified, check the error and accept it by following the steps below.

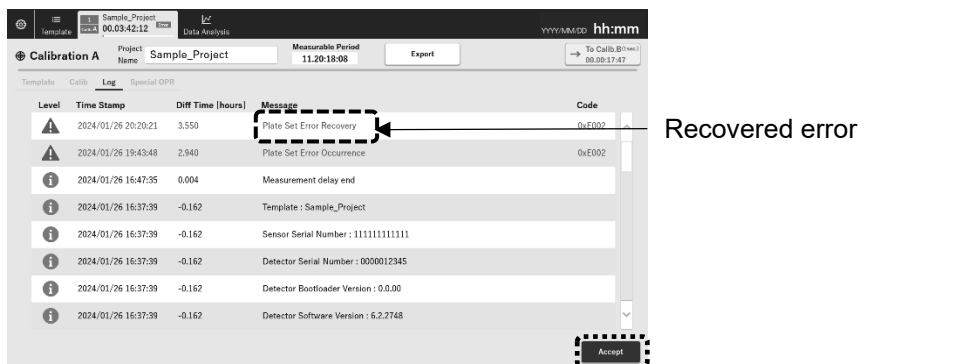
1. Tap the Log tab (following figure shows Calibration A screen as an example).
▶ The Log screen is displayed.



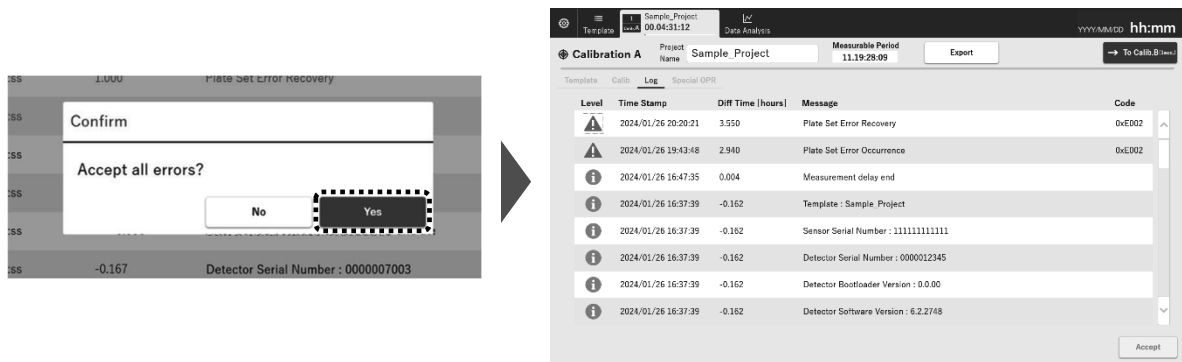
2. Check that system errors has been recovered (indicated as “Recovery”) and tap the **Accept** button.
 - ▶ The Confirm dialog is displayed.

Notes:

- The system errors with red fonts are the errors not accepted by the user.
- When multiple system errors are indicated, you need to take measures to solve all errors with red fonts.



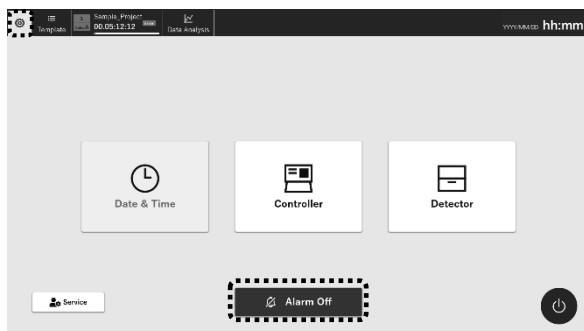
3. Tap the **Yes** button on the Confirm dialog.
 - ▶ All of the system errors in red fonts are accepted and turn black. The indications by the Error icon and Error LED disappear. If you tap the **No** button, the errors are not accepted.



To stop the alarm sound without accepting error:

You can stop the alarm sound before the system errors recover or without accepting the errors.

- 1) Select the System menu tab and tap the **Alarm Off** button.
 - ▶ The Confirm dialog is displayed.



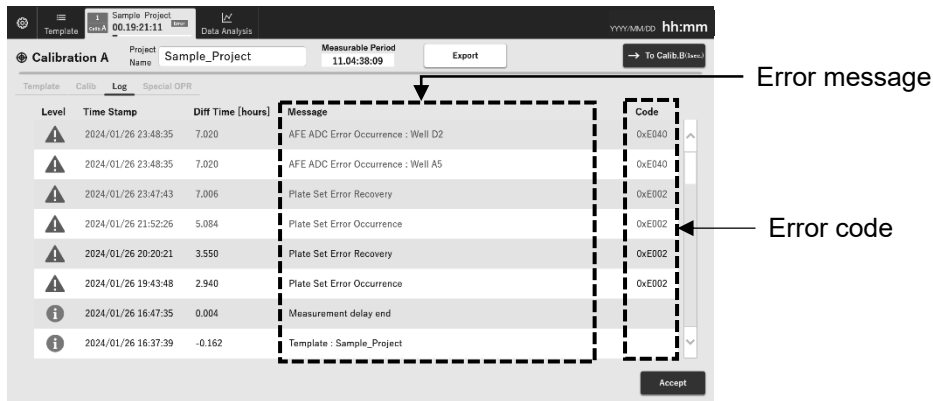
- 2) Tap the **Yes** button.
 - ▶ The alarm sound stops.
 - If you tap the **No** button, the alarm sound continues, and the screen returns to the System menu.







SYSTEM ERROR

Types and solutions for system errors

The messages and error codes shown on the Log screen are as follows. When a system error occurs, check the details and solution listed below and take measures appropriately. If the system error cannot be solved by taking the measures described below, contact our sales representative or agent.



Error message	Code	Error LED*1	Error sound	Details	Solution
Comm Error (Occurrence or Recovery)	0xE001	OFF/ Blinking*2	ON	A communication error with the detector has occurred.	Check that the connector of the detector connection cable is properly connected.
Plate Set Error (Occurrence or Recovery)	0xE002	Blinking	ON	The sensor module assembly has been taken out of the detector during measurement.	When taking out the sensor module assembly of the detector, pause the measurement.
Power Outage Error (Occurrence or Recovery)	0xE008	OFF/ Blinking*3	-	Power outage has occurred during measurement.	Check that the power is supplied.
CE Sensor Error Occurrence:* *Erroneous well information (e.g., Well A3)	0xE010	Blinking	ON	The value of counter electrode voltage is abnormal. Contamination may have occurred. When this error occurs, the well is indicated by the following error mark. 	The value measured at the well with this error should be considered as only a reference value throughout the entire period.
AFE ADC Error Occurrence:* *Erroneous well information (e.g., Well A3)	0xE040	ON	ON	AD could not be obtained by the detector. When this error occurs, the well is indicated by the following error mark. 	The detector needs to be repaired. Contact your service staff.
Over Measurable Period Error Occurrence: 12.0 days	0xE080	Blinking	ON	Sensor measurable period has expired before starting assay.	The sensor measurable period is 12 days after the calibration started. Start measurement within 12 days. Do not leave the sensor module for a long period of time without doing nothing.

Error message	Code	Error LED*1	Error sound	Details	Solution
Calibration Error Occurrence: * *Erroneous sensor information (e.g., Glc_A1)	0xE100	Blinking	-	A sensor was determined to have an error in the standard curve coefficient. When this error occurs, the well is indicated by the following error mark. 	Information in the template may be wrong. Tap the template tab on the Standard Curve screen and check if the calibration setting for the erroneous sensor is correct or not. If the calibration setting is correct, the sensor may be broken. Modify the template as necessary.
Current Sensor Error Occurrence: * *Erroneous sensor information (e.g., Glc_A1)	0xE200	Blinking	ON	Electric value of the sensor has exceeded the upper limit. When this error occurs, the well is indicated by the following error mark. 	The value measured at the well with this error should be considered as only a reference value throughout the entire period.

*1 Status of the Error LED on the detector.

*2 When the error occurs, the LED is turned off since the detector is not connected to the controller. After the communication recovers, the LED starts to blink.

*3 During power failure, the LED is turned off due to no power supply. After the power comes back, the LED starts to blink.

Note:

On the Log screen, the warning messages are also listed. If any of the following warning message is displayed on the Log screen, take an appropriate measure to solve the problem.

Unlike error messages, there is no item that notifies you of the occurrence of a warning status.

Warning messages

Message	Code	Details	Remarks
Assay restart after power outage	0xA001	Assay restarted after recovery from power failure.	—
Expired sensor (EXP: 2023/02/17)*	0xB001	An expired sensor was used.	You can perform measurement, but the results are not covered by warranty.
Calibration A (or B) restart after power outage	0xB002	Calibration A (or B) restarted after recovery from power failure.	—
Over period between calibration B and assay: 9.20 hours (> 8 hours)*	0xB006	The period from the end of calibration B to the start of assay exceeded the limitation (8 hours).	Results are not covered by warranty for this usage of the system.
Over measurable period: 12 days	0xB007	The measurable period of the sensor was exceeded during assay. (Measurement automatically ends.)	—
Over total error period: 35.20 hours (> 24 hours)*	0xB008	The total error period during the assay exceeded the limit (24 hours).	Analysis may not be performed correctly.

* Numerical values in the table are examples.

OPERATION ERRORS

This product has the function of displaying an error dialog or warning dialog when an error occurs during operation. If such a dialog is displayed, take an appropriate action listed below.

Error dialogs

Message in dialog	Appears when ...	Solution
An unexpected error has occurred. (Code: 0x0001 to 0x0004, 0x0012)	When an unexpected error occurs	Contact our sales representative or agent.
Failed to load the template. (Code: 0x0005)	When you tap the Measurement button in the template list	Create a new template and try again. If the same message is displayed, contact our sales representative or agent.
Failed to load the project. (Code: 0x0006)	When you tap the Analyze button in the project list	Try again. If the same message is still displayed, contact our sales representative or agent.
Failed to communicate with the detector. Try again, and if failed, contact customer support. (Code:0x0007)	When writing of the AFE parameter failed at the start of measurement	
Failed to communicate with the detector. Try again, and if failed, contact customer support. (Code:0x0008)	When temperature could not be measured at the start of measurement	
The number of projects has reached the limit. Delete unnecessary projects. (Code: 0x000C)	When you create a new project	Delete unnecessary projects.
Close the project before power off. (Code: 0x000D)	When you tap the Power OFF button without closing the project	Close the project before turning of the system.
Flash drive not recognized. (Code: 0x000E)	When exporting data	Insert a USB flash drive into the controller.
Several removeable drives found. (Code: 0x000F)	When exporting data	Insert only one USB flash drive into the controller.
The sensor serial number is incorrect. (Code: 0x0010)	When you enter a sensor serial number	Enter the correct number again.
This sensor is not supported. Contact customer support. (Code: 0x0011)	When you enter a sensor serial number	Contact our sales representative or agent.
There is an error (or are errors) not accepted. Accept it (or them). (Code: 0x0013)	When you tap the Close button for a project without accepting errors	Open the Log screen, check the errors occurred, and tap the Accept button.
There is an error (or are errors) not accepted. Accept it (or them). (Code: 0x0014)	When you tap the Start button for assay without accepting errors	
The number of templates has reached the limit. Delete unnecessary templates. (Code: 0x0015)	When you create a new template (or save a template with a different name) (The maximum number of assay templates is 200.)	Delete unnecessary templates.
The number of analysis results has reached the limit. Delete unnecessary analysis results. (Code: 0x0016)	When you save the analysis result (The maximum number of analysis results that can be saved for one project is 10.)	Delete unnecessary analysis results.

Message in dialog	Appears when ...	Solution
No analysis results. (Code: 0x0017)	When you save an analysis result	Tap the Analyze button to execute analysis, and then save the analysis result by tapping the Save Result button.
Remove the plate. If there is a plate, the power cannot be turned off. (Code: 0x0018)	When you tap the Power OFF button while the sensor module remains in the detector	Take the sensor module out of the detector and then turn off the system.
Calibration error occurred. Check the log and which wells the error occurred. (Code: 0x0019)	When you correct a template	Find the sensor that detected failure, and then continue the operation of this system.
Export failed. Check the flash drive. (Code: 0x001C)	When you tap the Export button	Check whether there is enough space in the USB flash drive or whether the USB flash does not have password function etc..
A communication error has occurred. Recover it. (Code : 0x001F)	When you tap the Start button to perform calibration or assay during communication error.	Solve the communication error condition.
Flash drive not ready. (Code: 0x0021)	When you try to use a USB flash drive	The USB flash drive may not have been formatted correctly. Format it correctly.
The project "xxx" already exists. Modify the project name. (Code: 0x1001)	When you tap the Measurement button in the template list (or when you enter a project name)	Change the project name to the correct name.
There is not enough disk space to start new project. Delete unnecessary projects. (Code: 0x1002)	When you tap the Measurement button in the template list (A disk space of at least 10 GB is required.)	Delete unnecessary projects.
The template "xxx" already exists. Overwrite? (Code: 0x1003)	When you tap the Save button for the template (when overwriting the selected template itself)	Overwrite the existing one or save it with a new name.
This sensor cannot be used because it was previously used on yyyy/MM/dd HH:mm:ss. Use new sensor module. (Code: 0x1004)	When you enter a sensor serial number	Prepare a new sensor module assembly.
The analysis result "xxx" already exists. Save with a different name. (Code: 0x1005)	When you tap the Save button for an analysis result	Save it with a new name.
The template "xxx" already exists. Save with a different name. (Code: 0x1006)	When you tap the Save button for a template (when creating a new template or saving with a different template name)	
The sensor current value in the green area (last 1 hour) is used to calculate the standard curve. The number of data points required to calculate the standard curve is insufficient by XX points. Continue measuring until sufficient data is obtained. (Code: 0x1007) * An error is (/ Errors are) contained in the green area. The unstable data for 10 minutes after error recovery is removed.	When you tap the To Calib.B (/ To Assay) button	Finish the calibration with more than 30 measurement data in the green area.

OPERATION ERRORS

Warning dialogs

Message in dialog	Appears when ...	Solution
The sensor has expired. Expired sensor may affect the result. Use this sensor? (Code: 0x2002)	When you tap the Start button for calibration A	Use a sensor within its expiration date.
XX hours have passed since the calibration was completed. It is recommended to start assay within 8.00 hours. (Code: 0x3001)	When you tap the Start button for assay	—
The error was occurring more than 24 hours (total XX hours). It may not be analyzed correctly. (Code: 0x3002)	When you tap the Analyze button in the project list (relevant errors: communication error, plate set error, and power outage error)	Examine the analysis results.
Finish calibration A. The sensor current value in the green area (last 1 hour) is used to calculate the standard curve. Is the sensor current value stable? (Code: 0x3003) * An error is (or Errors are) contained in the green area. The unstable data for 10 minutes after error recovery is removed.	When you tap the To Calib.B button	Finish the calibration after checking the sensor current values to be used for the calculation of standard curve are stable.
Finish calibration B. The sensor current value in the green area (last 1 hour) is used to calculate the standard curve. Is the sensor current value stable? (Code: 0x3004) * An error is (or Errors are) contained in the green area. The unstable data for 10 minutes after error recovery is removed.	When you tap the To Assay button	

DURING AND AFTER A POWER FAILURE

Operation during a power failure

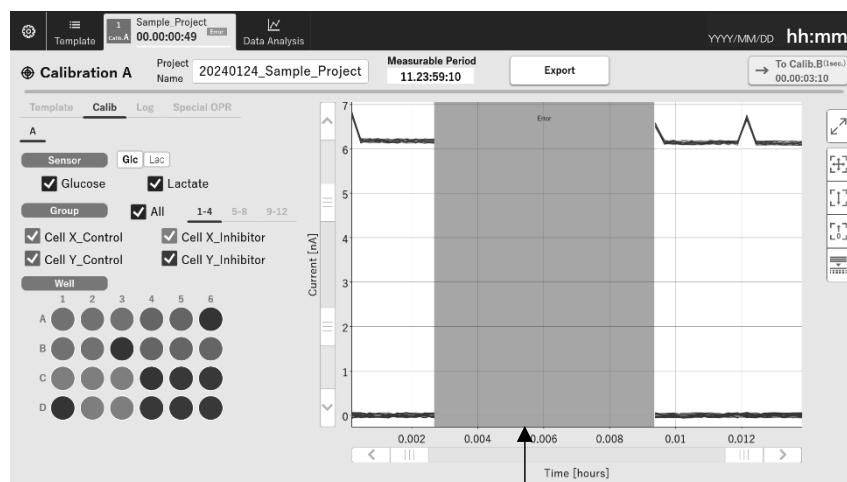
- During a power failure, the power to the controller is not supplied, and operations of all projects stop (all measurement operations stop).
- The clock does not stop.

Operation after recovery from a power failure

- After the power comes back, the alarm sound continues until the detectors are recognized.
- After the detectors are recognized, all of the projects that were ongoing when the power failure occurred resume and continue measurement.
- To notify the user of the power failure, the Error LED (red) on the detector blinks. Also, on the controller screen, on each of the detector tab, the detector icon that indicates detector ID number and measurement phase becomes red and the Error status icon blinks (the indication disappears when you tap the **Accept** button on the Log screen).
- After recovery from the power failure, recovery and occurrence messages of “Comm Error” and “Plate Set Error” in addition to those of the “Power Outage Error” are displayed on the Log screen.

Level	Time Stamp	Diff Time [hours]	Message	Code
▲	2024/01/24 12:45:07	0.009	Plate Set Error Recovery	0xE002
▲	2024/01/24 12:44:56	0.006	Comm Error Recovery	0xE001
▲	2024/01/24 12:44:47	0.004	Power Outage Error Recovery	0xE008
▲	2024/01/24 12:44:47	0.004	Calibration A restart after power outage	0xB002
▲	2024/01/24 12:44:47	0.004	Comm Error Occurrence	0xE001
▲	2024/01/24 12:44:47	0.004	Plate Set Error Occurrence	0xE002
▲	2024/01/24 12:44:43	0.003	Power Outage Error Occurrence	0xE008
i	2024/01/24 12:44:34	0.000	Measurement delay end	

- The measurement data during the power failure is not recorded but indicated as an error by red area.



Error (indicated by red area)

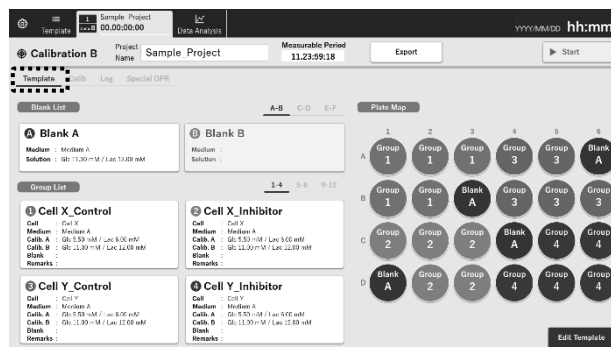
MODIFYING ASSAY TEMPLATE AFTER MEASUREMENT

You can modify the assay template after calibration A or B, or during analysis.

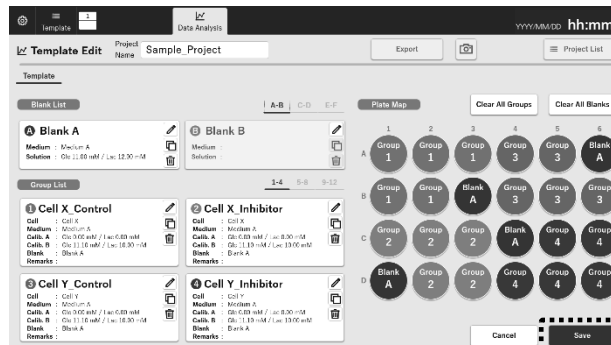
At the end of calibration A or B

The following steps show an example of adjusting assay template at the end of calibration A, you can follow the same steps for calibration B.

1. Tap the **Template** tab on the Calibration B screen.
▶ The Template Edit screen is displayed.



2. After editing the template information (for details, see step 3 to 9 in “Creating new assay template” on pages 49-53), tap the **Save** button.
▶ The Confirm dialog is displayed.



3. Tap the **Yes** button.
▶ The change is saved, and the Calibration B screen is displayed. If you tap the **No** button, the change is not saved, and the screen returns to the Template Edit screen.



Note:

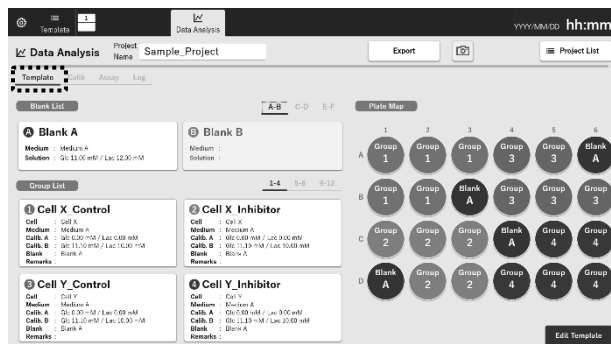
When you modify the template at the end of calibration B or during analysis, standard curve is calculated again. If a calibration error occurs, check the failed sensor in the Log tab.

When performing analysis

Note:

If you edit the template during analysis, all saved analysis result data is deleted.

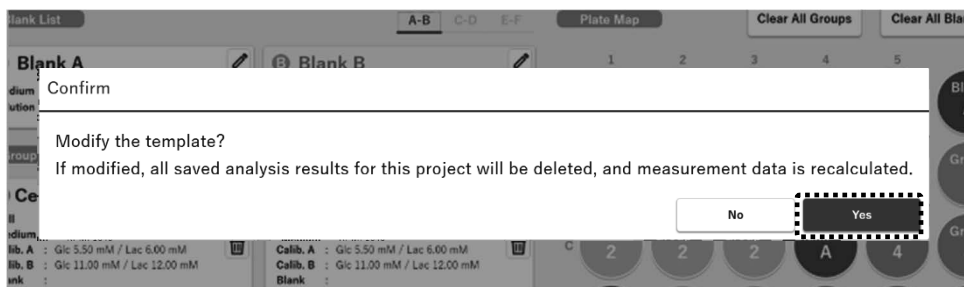
1. On the Data Analysis screen, tap the **Template** tab and then tap the **Edit Template** button.
 - ▶ The Template Edit screen is displayed.



2. After editing the template information (for details, see step 3 to 9 in “Creating new assay template” on pages 49-53), tap the **Save** button.
 - ▶ The Confirm dialog is displayed.



3. Tap the **Yes** button, the change is saved, and the Data Analysis screen is displayed. If you tap the **No** button, the change is not saved, and the screen returns to the Template Edit screen.



Note:

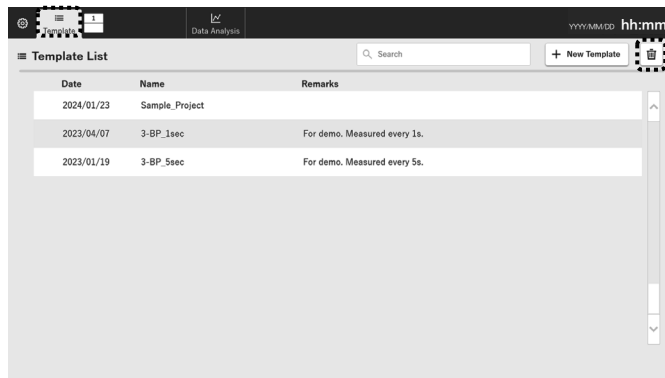
When you modify the template at the end of calibration B or during analysis, standard curve is calculated again. If a calibration error occurs, check the failed sensor in the Log tab.

DELETING DATA

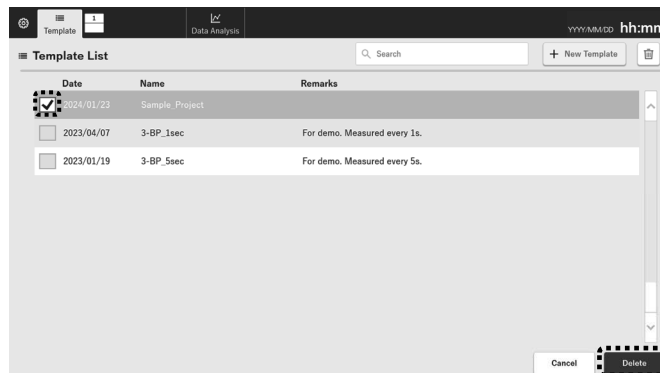
Deleting assay templates

You can delete unnecessary templates by following the steps below. Note that the deleted data cannot be restored again.

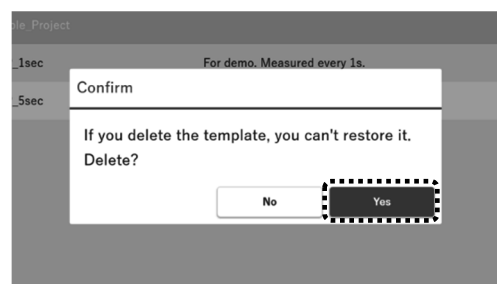
1. Tap a Template tab in the main tab bar and tap the trash icon at the upper right of the top screen of template menu.
 - ▶ A checkbox is displayed at the beginning of each template line.



2. Select the checkbox for the template you want to delete and tap the **Delete** button. You can select multiple checkboxes to delete multiple templates at a time.
 - ▶ The Confirm dialog is displayed.



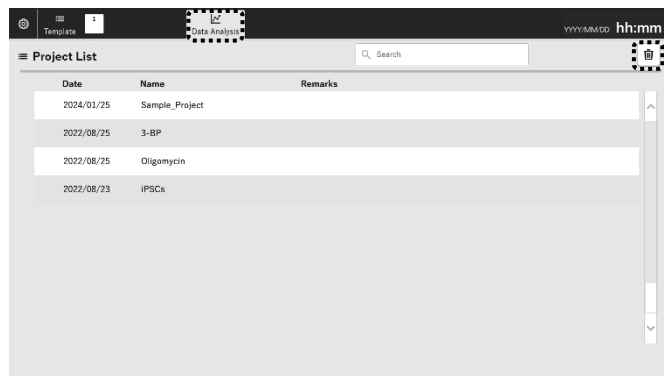
3. Tap the **Yes** button.
 - ▶ The selected template is deleted, and the screen returns to the top screen. If you tap the **No** button, the selected template is not deleted.



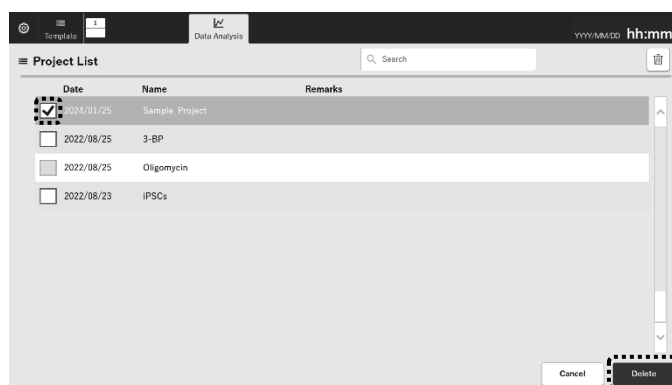
Deleting measurement results

You can delete unnecessary measurement results by following the steps below. Note that the deleted data cannot be restored again.

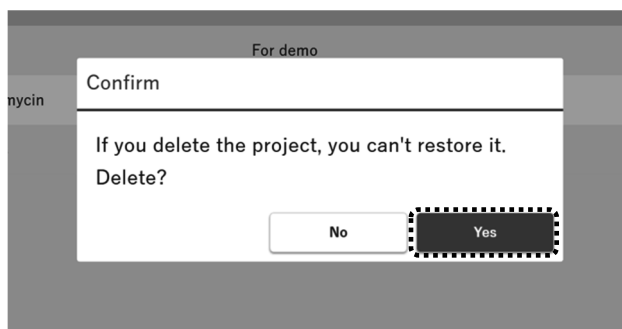
1. Tap the Data Analysis tab and tap the trash icon at the upper right of the top screen.
 - ▶ A checkbox is displayed at the beginning of each project line.



2. Select the checkbox of the project you want to delete and tap the **Delete** button. You can select multiple checkboxes to delete multiple measurement results at a time.
 - ▶ The Confirm dialog is displayed.



3. Tap the **Yes** button.
 - ▶ The selected project is deleted, and the screen returns to the top screen. If you tap the **No** button, the selected project is not deleted.

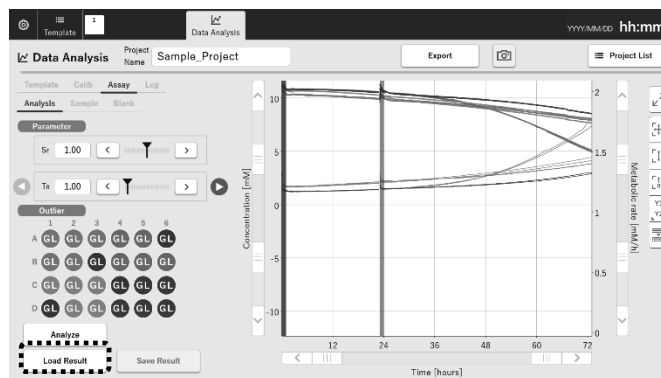


DELETING DATA

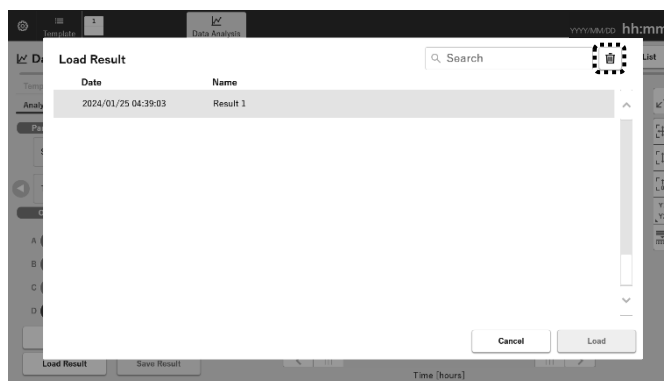
Deleting analysis result

You can delete unnecessary analysis results by following the steps below. Note that the deleted data cannot be restored again.

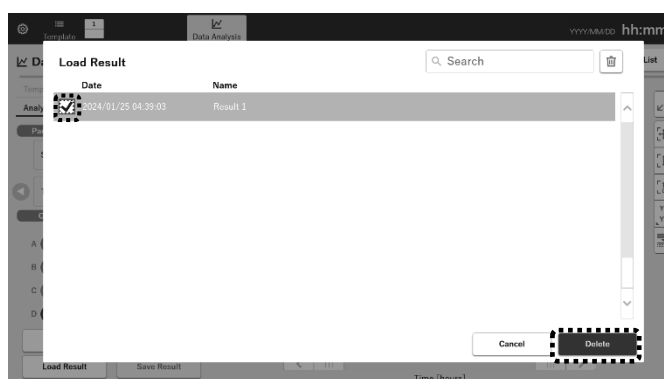
1. Load the project containing the analysis result you want to delete by referring to “Analyzing the metabolic rate” on pages 84 to 87.
▶ The Data Analysis screen is displayed.
2. Tap the **Load Result** button.
▶ The Load Result screen is displayed.



3. Tap the trash icon at the upper right of the Load Result screen.
▶ A checkbox is displayed at the beginning of each analysis result line.

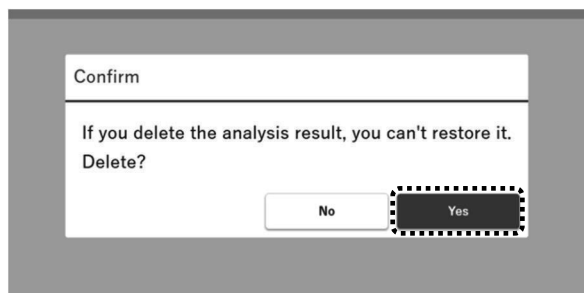


4. Select the checkbox of the analysis result you want to delete and tap the **Delete** button. You can select multiple checkboxes to delete multiple analysis results at a time.
▶ The Confirm dialog is displayed.



5. Tap the **Yes** button.

► The selected analysis result is deleted, and the screen returns to the Load Result screen. If you tap the **No** button, the selected analysis result is not deleted.

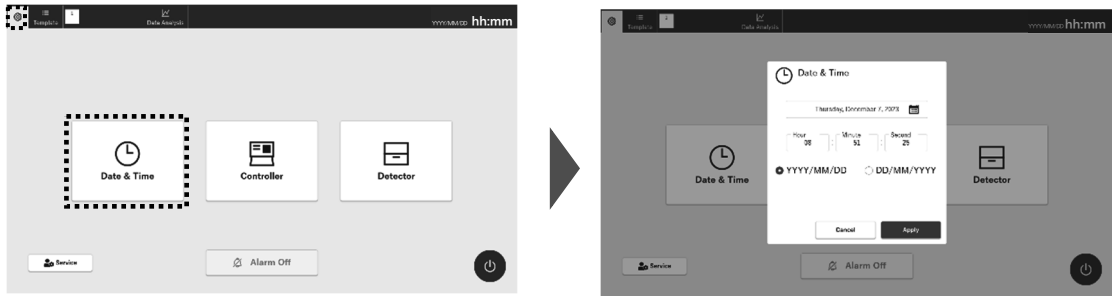


CONTROLLER SETTINGS

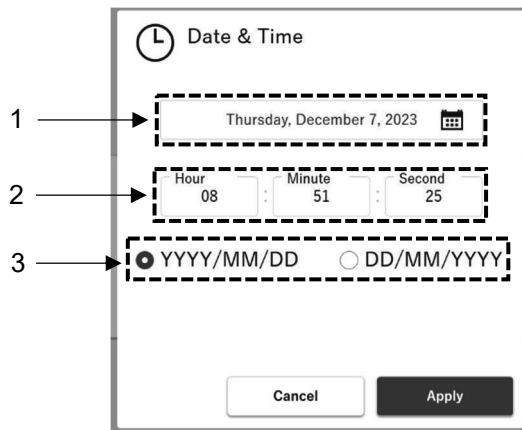
Setting date and time

Date and time can be set as follows. Note that you cannot set date and time during measurement (the **Date & Time** button becomes unavailable).

1. Tap the system menu tab to display the system menu and tap the **Date & Time** button.
 - ▶ The Date & Time dialog is displayed.



2. On the Date & Time dialog, select current date, time, and date format.



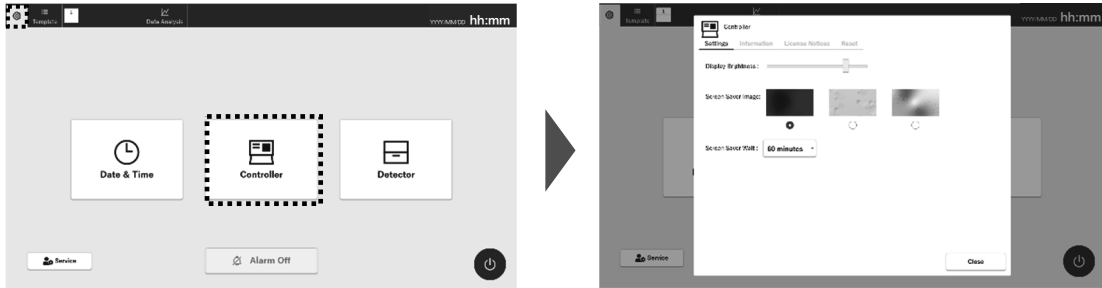
No.	Item	Details
1	Date	Select the current date by tapping the calendar icon and tapping the desired date on the calendar.
2	Time	Enter the current time by tapping each input field of Hour, Minute, or Second to enter the time using the on-screen keyboard shown on the display. The time is expressed using a 24-hour clock. Note: It is advisable to set the right time regularly since the error of about 1 minutes may be observed within a month.
3	Date format	Select the date format (Year/Month/Day or Day/Month/Year) by tapping the radio button.

3. Tap the **Apply** button.
 - ▶ The values are saved, and the screen returns to the system menu.

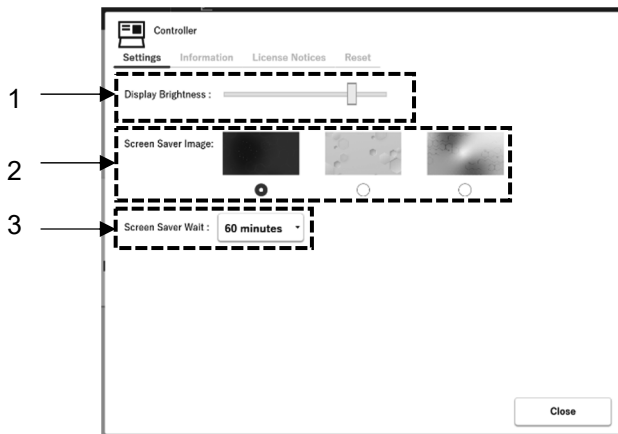
Configuring screen setting

You can configure the screen settings by following the steps below.

1. Tap the system menu tab to display the system menu and tap the **Controller** button.
▶ The Controller dialog is displayed with the Settings tab selected.



2. Configure each setting.



Details of each setting

No.	Item	Details
1	Display Brightness	You can adjust brightness of the controller's display by sliding the slide bar to the left or right.
2	Screen Saver Image	Select a type of the screen saver by tapping the radio button.
3	Screen Saver Wait	Select the time before the screen saver starts. Tap the ▼ symbol to display the drop-down list and select one of the following: Disable, 30 minutes, 60 minutes, 120 minutes, 180 minutes Default: 60 minutes

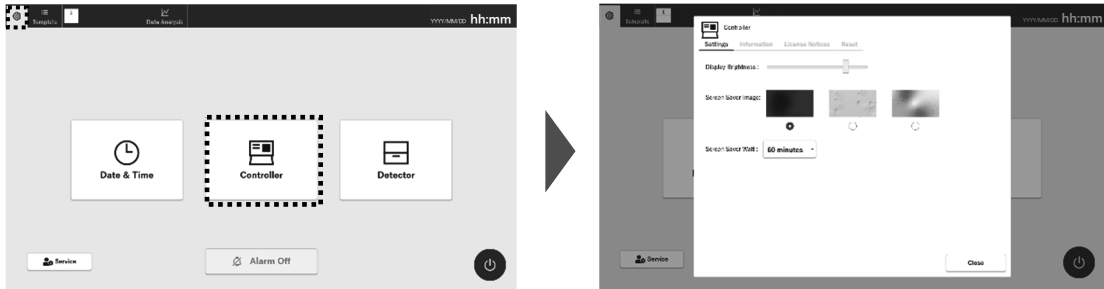
3. Tap the **Close** button.
▶ The values are saved, and the screen returns to the system menu.

CONTROLLER SETTINGS

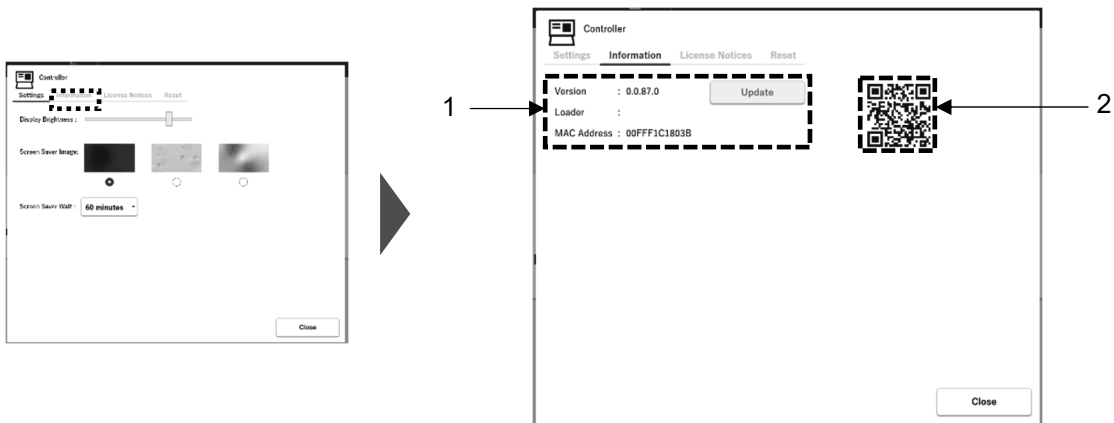
Checking controller's information

You can check the controller's information by following the steps below.

1. Tap the system menu tab to display the system menu and tap the **Controller** button.
 - ▶ The Controller dialog is displayed with the Settings tab selected.



2. Tap the Information tab.
 - ▶ Controller information and QR code is displayed.

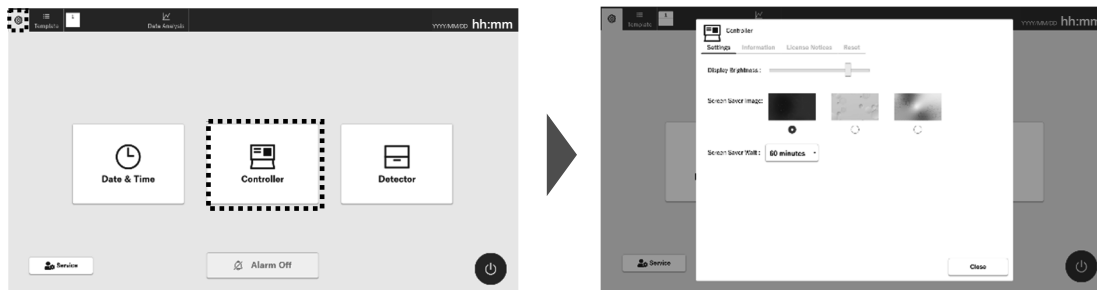


No.	Item	Details
1	Controller information	Information of the controller (the version number of the controller and loader software and MAC address is indicated.) Note: The user cannot use the Update button. The button is provided for support staff use.
2	QR code	You can get the information of the controller (model number, version number, MAC address, and current time).

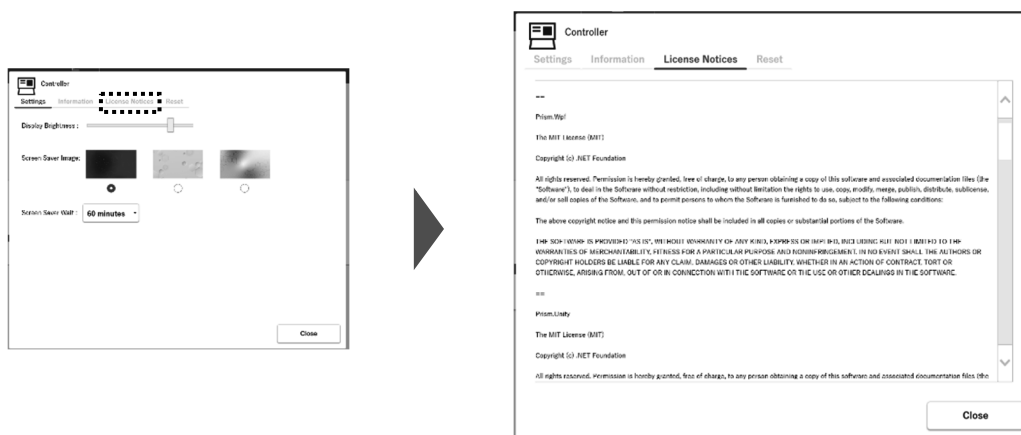
3. Tap the **Close** button.
 - ▶ The screen returns to the system menu.

Referring to the software license information

1. Tap the system menu tab to display the system menu and tap the **Controller** button.
 - ▶ The Controller dialog is displayed.



2. Tap the License Notices tab in the Controller dialog.
 - ▶ The software license information is displayed.

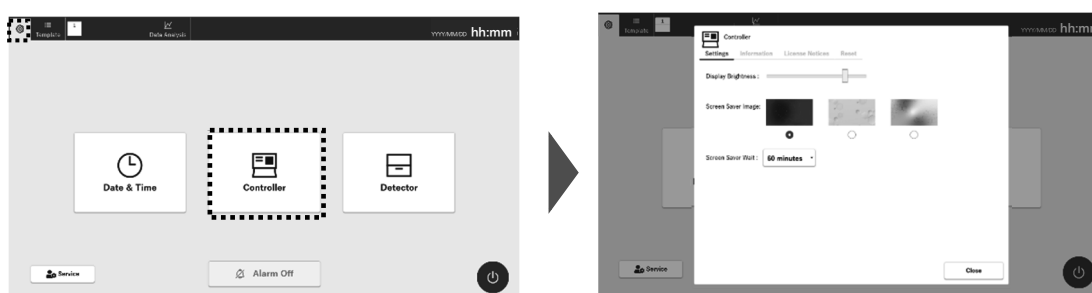


3. Tap the **Close** button.
 - ▶ The screen returns to the system menu.

Resetting to the factory setting

You can reset the controller to the factory setting by following the steps below. By this operation, all of the assay templates, measurement results, and analysis results are deleted.

1. Tap the system menu tab to display the system menu and tap the **Controller** button.
 - ▶ The Controller dialog is displayed.

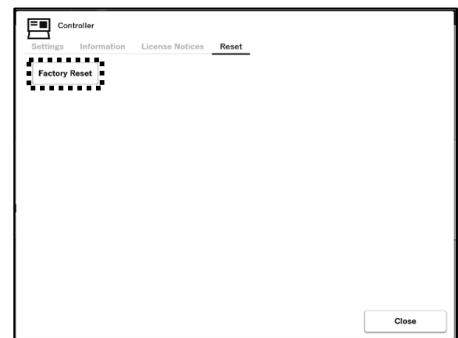


CONTROLLER SETTINGS

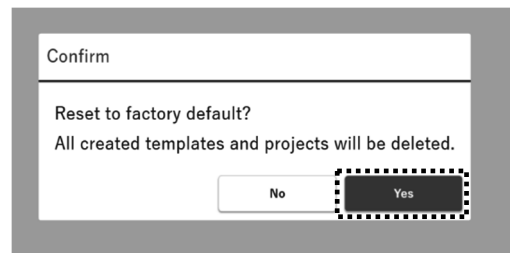
2. Tap the Reset tab in the Controller dialog.
▶ The Reset dialog is displayed.



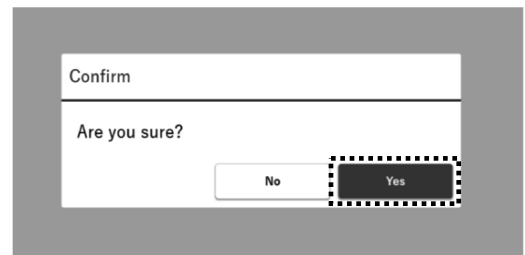
3. Tap the **Factory Reset** button.
▶ The Confirm dialog is displayed.



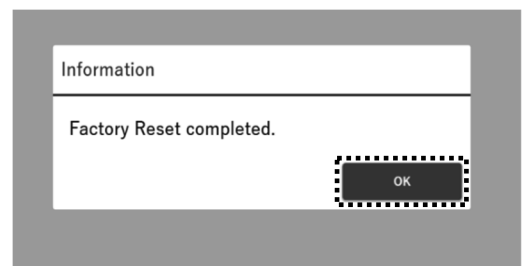
4. Tap the **Yes** button.
▶ The Confirm dialog reconfirming the reset operation is displayed again. If you tap the **No** button, reset operation is not performed and the screen returns to the Controller dialog.



5. Tap the **Yes** button.
▶ All of the assay templates, measurement results, and analysis results are deleted, and the Information dialog is displayed to notify the user of completion of reset operation. If you tap the **No** button, reset operation is not performed and the screen returns to the Controller dialog.



6. Tap the **OK** button.
▶ The screen returns to the Confirm dialog.



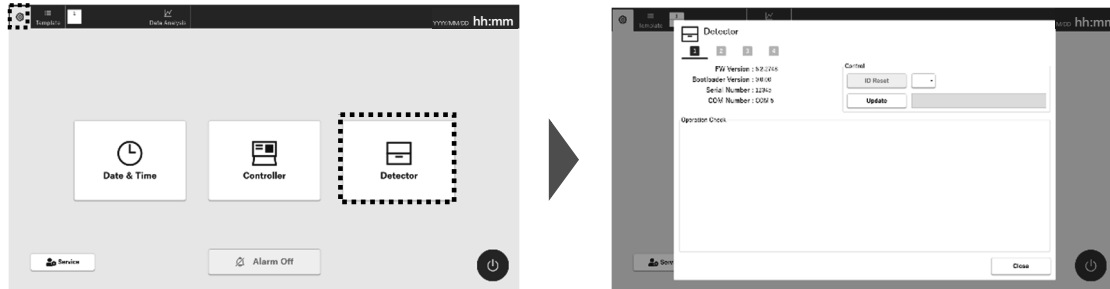
7. Tap the **Close** button.
▶ The screen returns to the system menu.

DETECTOR SETTINGS

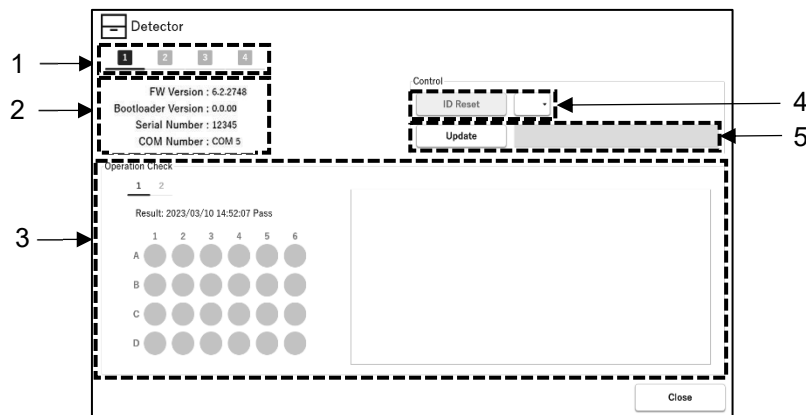
Detector information and settings

On the Detector dialog, you can check the information of the detector, change the detector ID number, and view the result of the operation check.

1. Tap the system menu tab to display the system menu and tap the **Detector** button.
▶ The Detector dialog is displayed.



2. Refer to the information or configure each setting.



No.	Item	Details
1	Detector ID number	Detector ID number. You can switch the ID tab to see the information of the selected detector ID number.
2	Detector information	FW Version/Bootloader Revision: Version and revision number of the detector software for the detector with the above selected ID number. Serial Number: Serial number of the detector COM Number: Communication port number for the detector
3	Result of the detector operation check	In this area, you can view up to 5 last operation check results. Tapping another number above the “Result” indication can switch the display to another result.
4	Detector ID number change	You can change the detector ID number to an unused ID number by the steps below. 1. From the pull-down list next to the ID Reset button, select the number you want to change to (for example, “3”). 2. Tap the ID Reset button. ▶ The detector ID has been changed to the selected number (this case, “3”). Note: You cannot change the ID number to the detector ID number currently connected to the controller. If you need to change the current ID number to the one currently connected, first, disconnect the USB plug of the detector connected to the controller.
5	Detector software update button	The user cannot use the Update button. The button is provided for support staff use.

3. Tap the **Close** button.
▶ The screen returns to the system menu.

ROUTINE MAINTENANCE

In order to obtain precise data, it is necessary to clean the products regularly. Follow the sections below to clean the controller, detector, plate adapters (top and bottom), and access port heater (option). Also, yearly maintenance by the manufacturer is recommended. Contact our sales representative or agent for maintenance requests.

Notes:

- Clean the exterior of the detector, detector tray, cables, and access port heater (option) using 70% ethanol once a month.
- Contact our sales representative or agent to disassemble and clean the inside of the detector once a year. Do not take apart the detector yourself because it may lead to an accident or failure of the detector.
- Contact our sales representative or agent when the products are too dirty.
- Do not use brushes, acid, alkaline or chlorine-based detergents, disinfectants, volatile chemicals such as thinner, soap powder, polishing powder (cleansers), or boiling water. It may cause discoloration, corrosion, and rust.
- Do not clean the products unit using peracetic acid or hydrogen peroxide, or do not disinfect the products by formalin fumigation.
- Never pour water onto or into the products. Doing so can damage the electric insulation and cause failure.
- Turn off the product before cleaning.

Cleaning the controller

Display

When cleaning the display, do not damage the surface of it.

To clean it, wipe it with a gauze moistened with a diluted neutral detergent (follow the directions on the detergent for details of dilution). After that, be absolutely sure to wipe the surfaces using a cloth moistened with clean water to remove traces of the detergent and wipe the surfaces with a dry cloth.

Outer panel

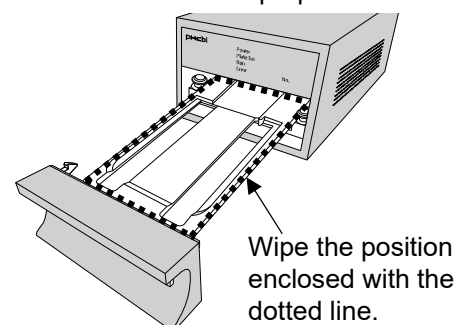
If any outer panel of the controller are dirty, clean it by wiping it with a gauze moistened with a diluted neutral detergent (using an undiluted solution of detergent may cause the panel plastic to crack. Follow the directions on the detergent for details of dilution). After that, be absolutely sure to wipe the surface using a cloth moistened with clean water to remove traces of the detergent and wipe the surface with a dry cloth.

Cleaning the detector



Do not put your hands into the inside of the detector when the tray is pulled out.
You may get injured by touching the interior parts.

1. Turn off the power to the CO₂ incubator and take the humidifying pan out of the incubator by following the operating instructions for the CO₂ incubator.
2. Put on rubber gloves, and then disinfect the surface of the rubber gloves with 70% ethanol.
3. Open the incubator doors to cool down the incubator and reduce humidity in the chamber. Wipe the housing, front panel, tray trigger, and detector cable using a gauze moistened with a proper amount (the amount that cannot form droplets) of 70% ethanol. Do not spray 70% ethanol on the detector directly.
4. Fully pull out the tray of the detector and thoroughly wipe the area shown in the following figure.
5. After cleaning the detector, turn on the controller and perform operation check for the detector (pages 30-33).



Cleaning the plate adapters (top and bottom)

The plate adapters (top and bottom) need to be autoclaved.

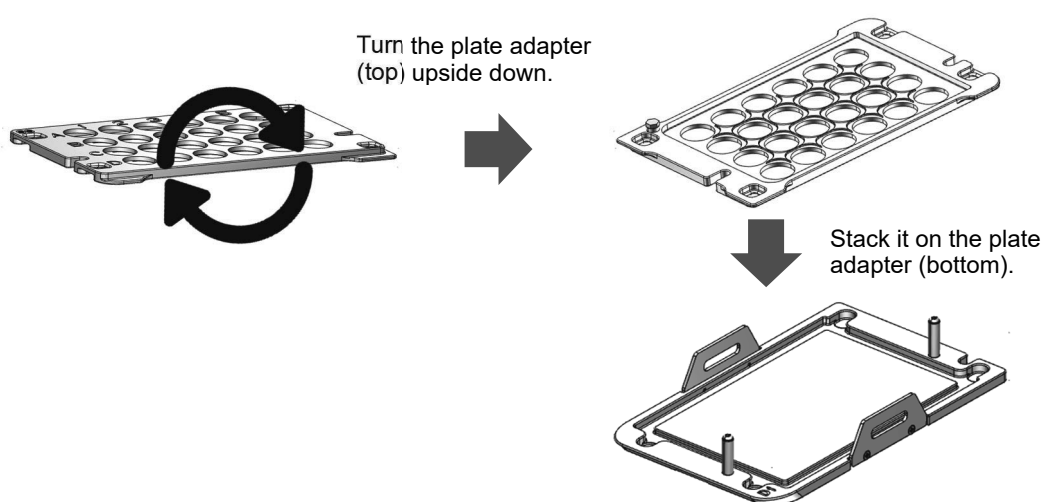
Note:

When using the plate adapters (top and bottom), always autoclave them before use. If not, contamination may occur.

1. Put on rubber gloves, and then disinfect the surface of the rubber gloves with 70% ethanol.
2. Wipe the plate adapters (top and bottom) using a gauze moistened with a proper amount (the amount that cannot form droplets) of 70% ethanol.
3. Stack the plate adapter (top) on the plate adapter (bottom) with the plate adapter (top) upside down. Then, put them into an autoclave bag and autoclave it (121°C for 20 minutes).

Note:

If the plate adapter (top) is not set upside down and receives pressure from above, the plate adapter (top) may be deformed.



4. After autoclave sterilization, put the autoclave bag into a drying machine and dry the plate adapters (top and bottom).

STORING THE PRODUCT

When the product is not used for a long time, store it by following the steps below. Storing the detector for a long time in the experimental condition may cause failure.

Controller


When storing the controller, avoid the locations exposed to direct sunlight or splashed with water. Otherwise, it may be distorted, discolored, or damaged.

Detector

Before storing the detector, take the detector out of the incubator and clean it.

Note:


Check that the sensor module assembly (or check module assembly) is not left inside the detector. If the sensor module assembly is left in the detector, take it out of the detector.

	Caution	Wear gloves and a mask during work. Without them, you may get injured by edges of internal parts. Contacting chemicals and inhaling dust are bad for your health.
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1. Wear rubber gloves and sterilize their surfaces with 70% ethanol.
2. Confirm that the temperature and humidity in the CO₂ incubator have dropped and turn off the incubator. Then, take the humidification pan out of the incubator and dispose of the water in the pan.
3. Pull out the power plug of AC power cable for the controller from the outlet (turn off the detector).
4. Pull the waterproof connector connecting the detector and the controller to the front side.
5. Turn the outer ring of the waterproof connector counterclockwise to remove the connector.
6. Hold the detector with both hands tightly and take it out of the incubator.
7. Clean the detector by following the steps for cleaning (page 126).
8. After the ethanol has evaporated completely, put the detector in the plastic bag that came with the detector and store the detector (if you cannot find the plastic bag, use a clean store-bought plastic bag for storage).

DISPOSAL OF PRODUCTS

When disposing of the products, ask a qualified contractor.

	WARNING	Ask a qualified contractor to carry out disassembly/disposal of the products and do not leave the product in a location that can be accessed by third parties. This may result in unexpected accidents (e.g., the products may be used for unintended purposes).
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Notes:

- Before disposing of the products, decontaminate the products to the extent possible by the user.
- The controller includes a coin-type lithium battery. When asking for disposal, notify the qualified contractor about it.
- For details on risks during storage, transportation, and disposal of the products, contact our agent listed on the separate information list.

TROUBLESHOOTING

If the product does not seem to be working properly, check the following solutions before calling for service.

Problem	Cause/Solution
The incubator does not operate at all.	<ul style="list-style-type: none"> • The product is not connected to the power supply properly. • The capacity and voltage of the power supply is not sufficient. • A power failure has occurred, or the circuit breaker has interrupted the power. • The circuit breaker has tripped. The fuse has blown.
The detector is not recognized.	<ul style="list-style-type: none"> • The detector cable and the connection cable are not connected properly. • The connection cable and the controller hub are not connected properly. • The hub is not connected to the USB port properly.
Cannot operate the detector.	<ul style="list-style-type: none"> • The detector ID number displayed on the detector and the detector ID number indicated on the detector tab on the controller monitor are not the same number.
Cannot set the sensor module assembly into the detector.	<ul style="list-style-type: none"> • The 24-well plate is from the manufacturer's not supported or models not supported for the plate adapter (top). • The 24-well plate is not placed on the plate adapter (bottom) in a correct orientation. • The plate adapter (top) is not placed on the 24-well plate in a correct orientation.
Data cannot be exported to the USB flash drive.	<ul style="list-style-type: none"> • The USB flash drive is not inserted properly. • The remaining space of the USB flash drive is 1 GB or less. • The USB flash drive that requires password is used.
Contamination has occurred.	<ul style="list-style-type: none"> • Clean the designated positions of the equipment regularly. • The plate adapter was not autoclaved before use. • The aluminium package for the sensor module has been torn.
CE sensor error has occurred.	<ul style="list-style-type: none"> • The measurement has been performed in a low-oxygen environment. • The substrate concentration is not within the measurement range. • Contamination has occurred.

Notes:

- If the problem is not still solved after trying the above solutions, or for any problems not covered here, contact our sales representative or agent.
- If the product needs to be repaired, data saved in the product may be lost depending on the types of repair work (e.g., replacement of the circuit board). In such a case, we will ask you to back up the data by exporting it to a USB flash drive beforehand.

6. SPECIFICATION

SPECIFICATION

Controller

Product name	Controller
Model number	MLC-AC0-PA
Dimension	Width: 371 mm, Depth: 200 mm, Height: 295 mm
Weight	2.5 kg (excluding accessories)
Screen	15.6 inches (1920 x 1080), projected capacitive (PCAP) model
PC	Intel Core i3-1115G4E 3.00 GHz, Memory 8 GB SSD (256 GB/TLC) Windows 10 IoT Enterprise 2021 LTSC 64 bit
Communication with detector	USB 2.0 (max. 4 units) (can be expanded using the accessory hub)
External interface	USB 2.0 x 1 (data acquisition and application update) Access port heater (1 unit)
Power source (AC adapter)	100 to 240 V AC \pm 10% / 50 - 60 Hz
Power consumption (AC adapter)	65 W
Input (display)	20 V / 3.25 A
Environmental condition	Controller: Temperature: 15°C to 35°C, Humidity: 10 to 80% RH Check module: Temperature 15°C to 37°C, no condensation
Detector connection	Max. 4 units
Access port heater connection	Max. 1 unit
External data export	USB 2.0
Accessories	AC power cable, AC adapter, hub, hub cable, and check module

Options

Detector

Product name	Detector
Model number	MLC-AD240A-PW
Dimension	Width: 162 mm, Depth: 290 mm, Height: 118 mm
Weight	4.7 kg
LED display	Status LED: POWER (green), PlateSet (white), RUN (white), and ERROR (red) Detector ID indication: For displaying detector ID number
Applied voltage	RE voltage: 700 mV, WE voltage: 800 mV
Power source	USB bus power: 5 V DC
Maximum current consumption	65 mA
Environmental condition	Temperature: 37°C, CO ₂ concentration: 5%, Humidity: 95% RH \pm 5% RH *Expected to be used in a CO ₂ incubator. Operation in other environments is not guaranteed.
Recommended number of units to be installed in a CO ₂ incubator	MCO-50: Max. 1 unit MCO-170: Max. 4 units* MCO-230: Max. 4 units* *When placing two detectors on one shelf, use a reinforced shelf. Note: When using a CO ₂ incubator other than ours, the performance of the detector and incubator may be affected. If you wish to install the detectors in an incubator other than ours, please check the impact on the performance by yourself in advance.
Cleaning	Wipe with a cloth moistened with 70% ethanol. Hydrogen peroxide sterilization and dry-heat sterilization are not supported.
Accessories	Connection cable, plate adapter (bottom)

Sensor module

Product name	Sensor module
Model number	MLC-AS240A-PW
Quantity	AS240A sensor: 3 pcs
External dimensions	Width: 95 mm, Depth: 160 mm, Height: 27.4 mm (1 pc)
Storage environment	2°C to 8°C
Expiration date	Printed on the label on the aluminum package. This product is a single-use item. Do not use it repeatedly.
Environmental condition	Same as the detector's environmental condition. The measurement values are influenced by temperature changes. Cannot be used in a low-oxygen environment.
Measurement range*	Glucose: 1 to 27 mM (0.18 to 4.86 g/L) Lactate: 1.5 to 15 mM (0.14 to 1.35 g/L)
Measurable period*	12 days (calibration period included)
Cultivation performance*	γ ray dose of 25 kGy applied. No toxicity was identified in a cell toxicity test by referring to ISO 10993-5:2009.

* This performance was verified in the usage environment of the detector by PHC Corporation using an RPMI 1640 medium and DMEM medium. The performance is not guaranteed for all culture media and cells.

Access port heater

Product name	Access port heater
Model number	MLC-APH0-PW
External dimensions	Heater unit: ϕ 24 mm x 45 mm (excluding cables) Switch box: Width: 80 mm, Depth: 50 mm, Height: 30 mm (excluding cables)
Power source	USB bus power: 5 V DC
Environmental condition	Temperature: 15 to 35°C, Humidity: 10 to 80% RH
Maximum current consumption	500 mA
Cleaning	Wipe with a cloth moistened with 70% ethanol. The silicone plug can be autoclaved.
Supported CO ₂ incubators	MCO-50 series, MCO-170 series, and MCO-230 series
Heater specification	PTC heater
	Heater output P= 2.5 W

Plate adapter (top)

Product name	Plate adapter (top)
Model number	MLC-ATAD2410-PW: For Corning Costar MLC-ATAD2420-PW: For Corning Falcon MLC-ATAD2430-PW: For Greiner CELLSTAR MLC-ATAD2440-PW: For Thermo NUNC MLC-ATAD2450-PW: For SUMILON of Sumitomo Bakelite
Cleaning	Wipe with a cloth moistened with 70% ethanol. Can be autoclaved.

Note:

The product data has been measured based on the PHC standard.

SAFETY ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe at least under the following conditions (based on the IEC 61010-1):

- Indoor use;
- Altitude up to 2,000 m;
- Applicable pollution degree of the intended environment (POLLUTION DEGREE 2);

SAFETY CHECK SHEET



CAUTION

Please copy and fill out this form before servicing.
Hand over the form to the service engineer for their
and your safety.

Safety check sheet

1. Stored material

Risk of infection: Yes No Maybe

Risk of toxicity: Yes No Maybe

Risk from radioactive sources: Yes No Maybe

List all potentially hazardous materials that have been stored in this unit:

2. Contamination in the unit

a) Contamination Yes No Maybe

Types of contamination (if any): _____

b) Decontaminated Yes No

Methods used for the decontamination work:

3. Status of the unit

a) The unit is now safe to work on Yes No

b) If the answer is "No,"

Details on the danger: _____

Measures we should take to reduce the danger:

Date:

Signature:

Address, Division:

Telephone:

Product name:

Controller

Model No.

MLC-AC0

Serial number:

Date of Installation:

Please decontaminate the unit yourself before calling the service engineer.

MEMO

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