All for Living cells for your imaging

ThermoPlate®

Microscope-Stage Automatic Thermocontrol System

TPi

TPi series Instruction Manual

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TOKAI HIT®

1. For safe and comfortable use

Be sure to read this instruction manual carefully before using, and please use the device correctly. Also, please keep this instruction manual.

For your safety

If device is used in manner other than specified in instruction manual, safety cannot be assured and may result in damage to device which will not be covered under warranty. Please follow the instructions.

About symbols

These warnings enable safe and correct usage, and prevent dangerous situations. Please follow them at all times.
We will not be responsible in the unlikely event of death, serious injury or property damage by using deviating from the original purpose and not following the displayed symbols.

Symbol meanings

	Injury or damage to equipment is possible
	Must not be done
	Must be done
	Electric shock is possible

When shipping

 Please treat this precision instrument with care. Impacting it is forbidden.

 Do not put any heavy things on the box.

 Please store and transport under specified storage conditions.

 Do not turn the box upside down.

 Do not let the unit moisten.

Regarding on the environment for usage and storage

Do not use this equipment in the below conditions.

Flammable or corrosive gas or oil mist that can damage electrical insulation
Intense vibration or impact
High voltage power lines, inductive interference
Place where dew drops are present or with direct sunlight
Dusty place
Outside the designated use environment and storage environment

Points to pay attention when installing to a microscope

Use only the specified electricity and cables. If other cables are used this might result in electric shocks. Using a non-specified voltage might result in equipment damage.

Please install this device by the method recommended by our company.

Do not place this device near a heat source or a combustible material around this device. Abnormal temperature control or fire may be caused.

Please do not give a shock to the glass part. Glass may break.

In case of glass breakage, do not touch the glass. It might result in injury and electric shock.

Please do not touch the glass as much as possible. It may cause a malfunction or abnormal heating.

Do not place heavy objects on this device or add strong force. It may cause a malfunction.

The heating range of the plate is only the heater part. Please keep in mind that other part part will not be warmed.

When rotating the revolver, turn the aiming handle and retract the objective lens. The objective lens may contact with this device, possibly damaging the lens or device. It may cause abnormal heating.

Do not handle the device with wet hands. It might cause damage to electric equipment.

Do not touch the electrical contacts such as the connector for the plate cable.

Please observe the below in order to avoid focus drift during microscope observations.

Keep the room temperature at 25°C ± 2 °C.
Do not let air flow directly over the device.

In an emergency pull out the plug from the outlet. Do not place any things near the outlet.

Please be careful not to catch the power cord, various cables, etc. on the human body such as limbs.

To avoid the risk of electric shock, connect this device to a commercial power supply equipped with a protective installation.

Do not modify the equipment or disassemble each part. It may cause a malfunction.

Blackout

Please use the uninterruptible power supply if you want to operate the equipment without interruption even during blackout.

Connected PC

Please be sure to use a PC that conforms to the EMC standard of information and communication equipment.

Maintenance

Turn off power supply while performing maintenance.

Do not use volatile materials such as benzene or thinner for cleaning. Use of such materials will discolor and/or damage key device surfaces.
Clean device with soft cloth using small amount of diluted neutral detergent. Do not use organic solvents. Also, please do not scrape strongly during cleaning.

Avoid cleaning with hard or sharp objects.

Do not wash the devise with water.

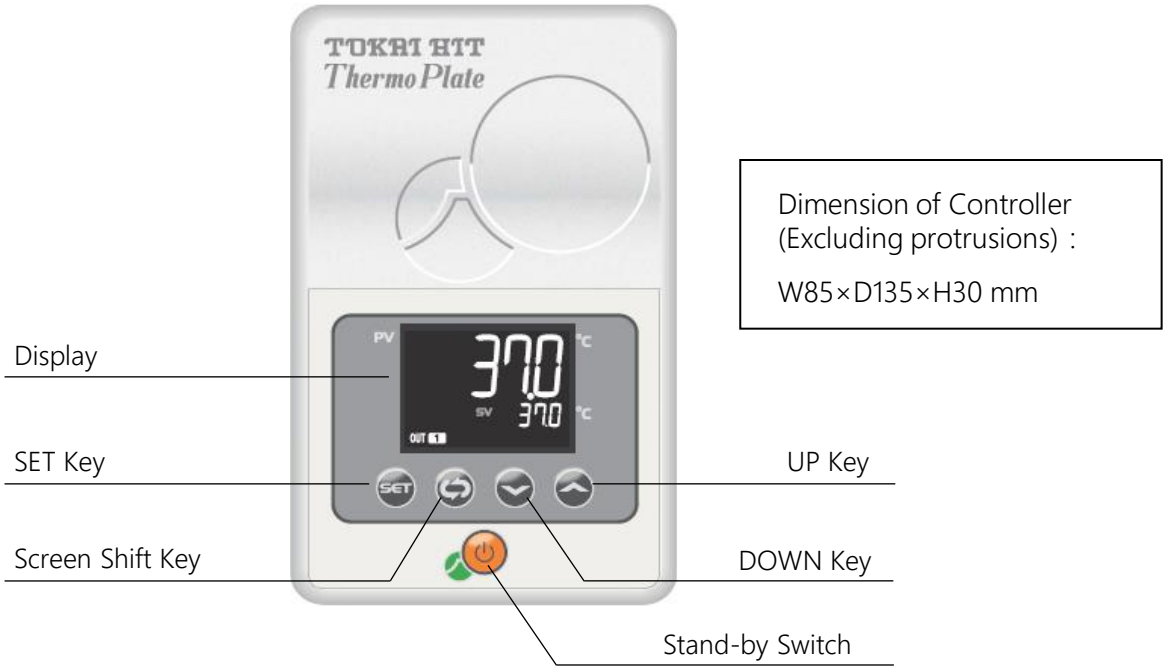
Please keep at our storage condition specified. It may cause a malfunction.

2. Components and names

Components	Qty	Image	Description
Controller	1		Controller that regulates the Heating Plate
Heating Plate * Orange line: Strengthen glass No line: standard glass	1		Designed to install on microscope stage to maintain specimen temp.
External Temp. Sensor (Length : 300mm)	1		Temp. sensor to be used for checking the temperature of the heating plate (p.14) or Shift Calibration (p.20)
Extension Wire for Sensor (Length : 1800mm)	1		For extending the length of the External Temp. Sensor
AC Adapter (Length : 1800mm)	1		Supplies power to the controller * Must use in original pairs
Power Cable (Length : 1800mm)	1		
TEM (Temp. logging software) Installation CD	1		Installs Tokai Hit original data logging software. The data will be saved as CSV format
USB Cable (Length : 2000mm)	1		Cable connected between the controller and the PC when using the above software
Mounting Hook	1		Use it for standing or hanging the controller

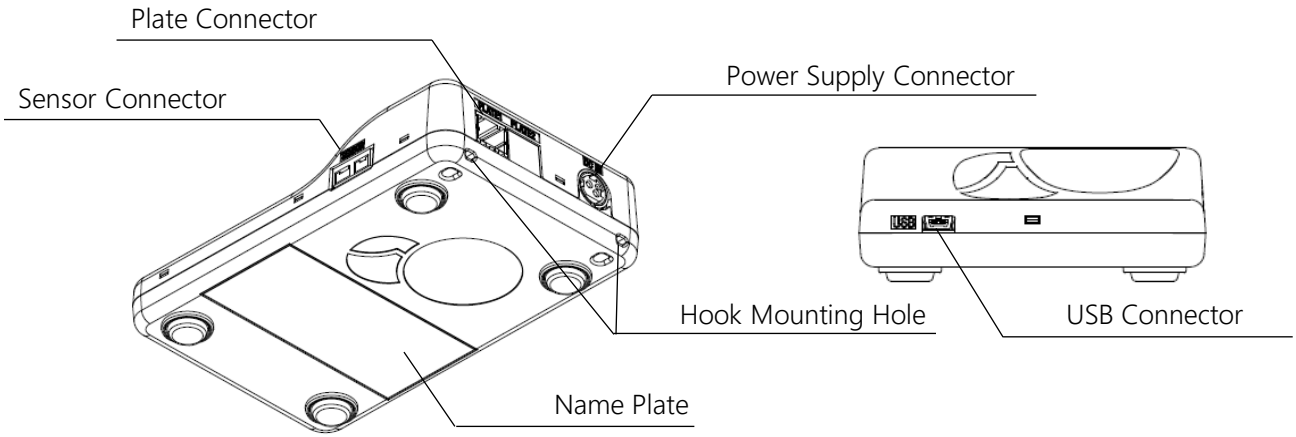
Depending on the type of heating plate, fixing screws, hexagonal wrenches, etc. may be included in the package.

Controller



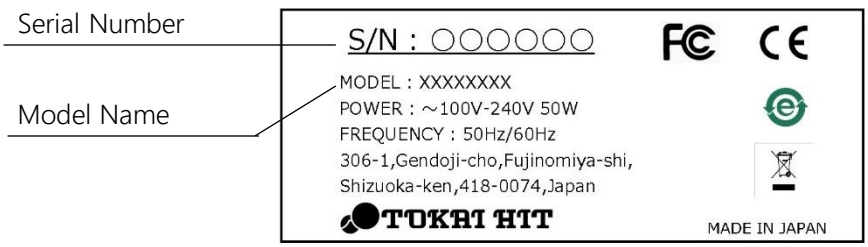
Dimension of Controller
(Excluding protrusions) :

W85×D135×H30 mm



Name Plate (Sample)

For details, please refer to the actual name plate attached on the product.



Glass Heater

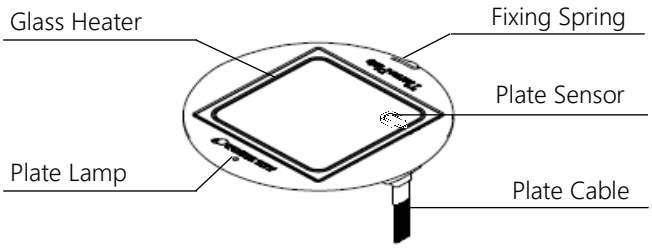
* Plate Lamp is attached to some major models.

Inverted **TPi-110RX** Plate Dimension : φ110mm

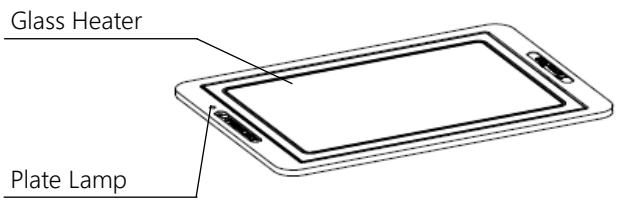
TPi-108RX Plate Dimension : φ108mm

TPi-URI2X * Plate Dimension : φ110mm

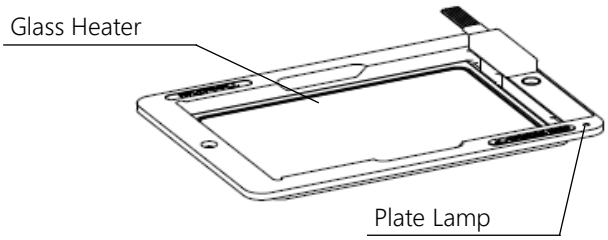
* Exclusively designed for Integra 3
(not compatible to use with Integra Ti)



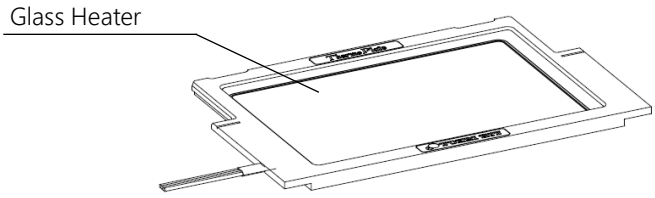
Inverted **TPi-SQFTX** Plate Dimension : 160×110mm



Inverted **TPi-SQX** Plate Dimension : 160×110mm

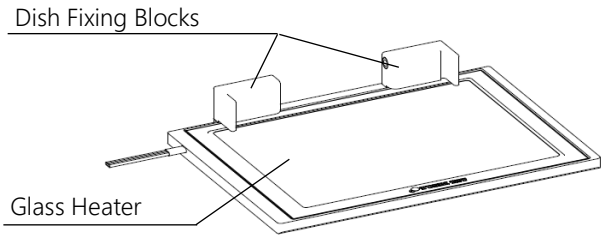


Inverted **TPi-SQMX** Plate Dimension : 165×105mm

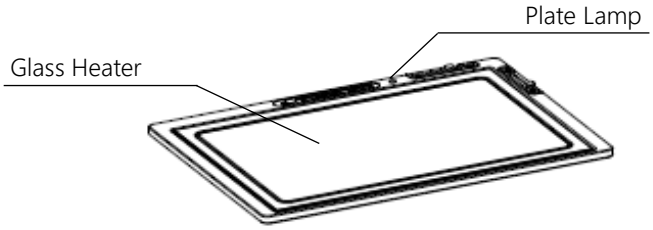


Inverted **TPi-CKX53X**

Plate Dimension : 190×138mm

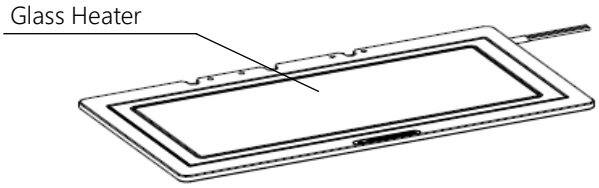


Inverted **TPi-TCSX** Plate Dimension : 127.5×85.5mm

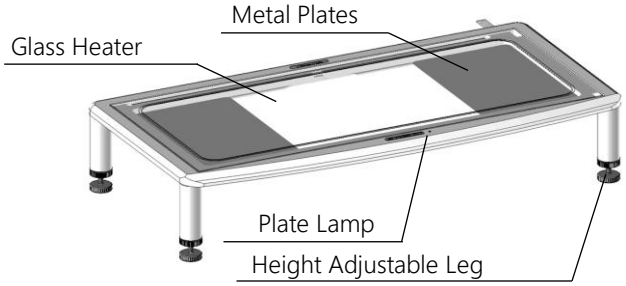


* Incl. : Fixing Springs

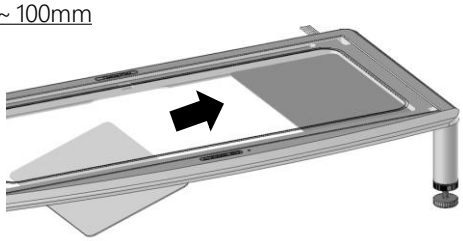
Inverted **TPi-TS2X** Plate Dimension : 238×122mm



Stereo **TPi-UNIX** Plate Dimension : 435×220mm, Leg Adjustable Range : 75 ~ 100mm



(Adjust the screws for height adjustment)



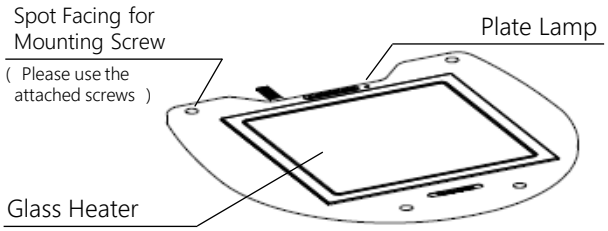
Depending on the illuminator base design and size, the glass heater is too large and some of the glass area will be protruded from the base. To maintain Heating Plate temp. uniformly, it is recommended to install the metal plate at the bottom of plate.

Glass Heater

* Plate Lamp is attached to some major models.

Stereo TPi-SZX2AX

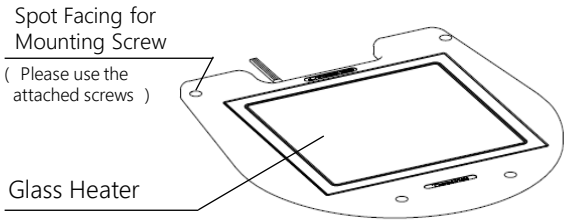
Plate Dimension : 238×227mm



* Incl. : Fixing Screws (M4×6) ×4, Hexagonal Wrench

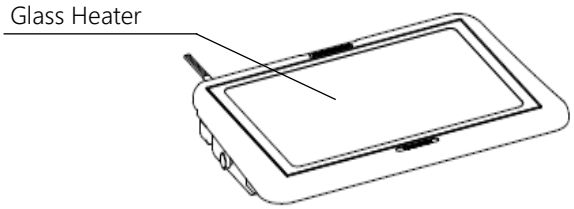
Stereo TPi-SZX2BX

Plate Dimension : 222×240mm



* Incl. : Fixing Screws (M4×6) ×4, Hexagonal Wrench

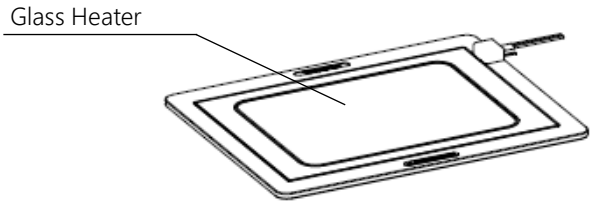
Stereo TPi-SZ2 Plate Dimension : 278×175mm



* Incl. : Fixing Screws (M4×20) ×2, (M4×15) ×4,
Hexagonal Wrench, Slider

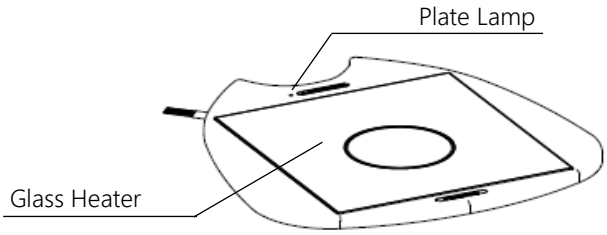
Stereo TPi-TLBaseX

Plate Dimension : 219.5×169.5mm



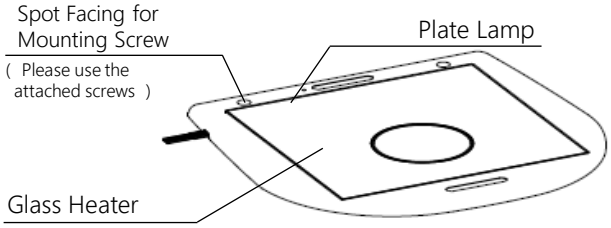
Stereo TPi-SMZSLX

Plate Dimension : 254×263mm



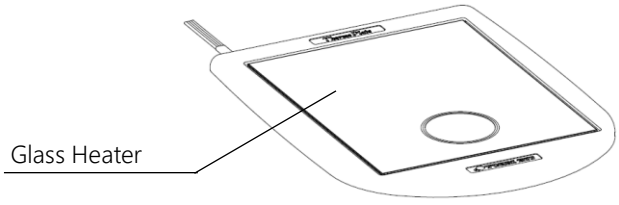
Stereo TPi-SMZ25X

Plate Dimension : 251×238mm

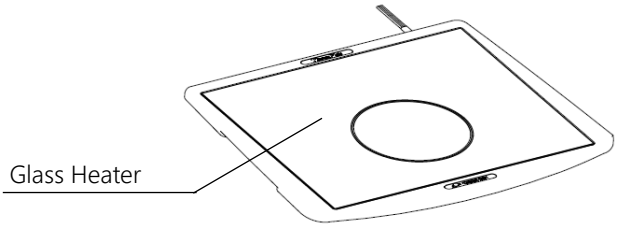


* Incl. : Fixing Screws (M4×6) ×2, Hexagonal Wrench

Stereo TPi-STKX Plate Dimension : 155×204mm

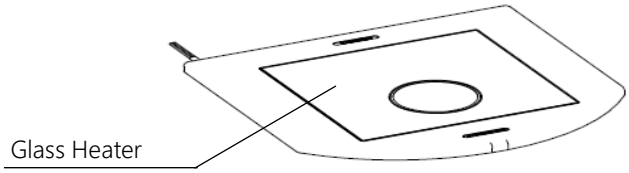


Stereo TPi-STMX Plate Dimension : 272×227mm

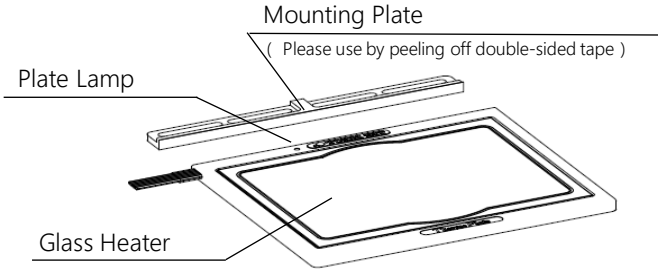


Stereo TPi-TB300X

Plate Dimension : 280×266mm



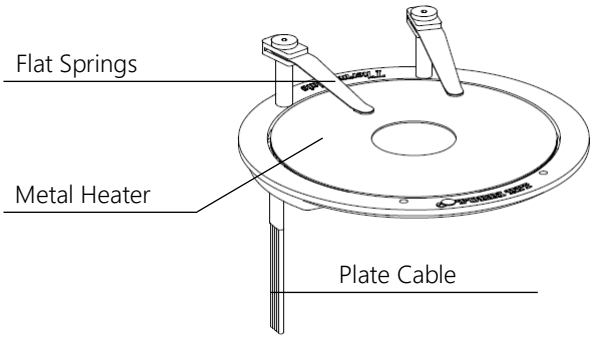
Upright TPi-SX Plate Dimension : 142×115mm



Metal Heater (with a hole)

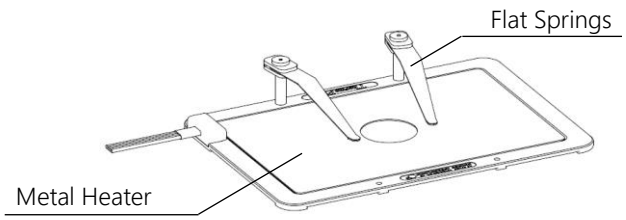
Inverted **TPi-110RH26** Plate Dimension : φ110mm

TPi-108RH26 Plate Dimension : φ108mm



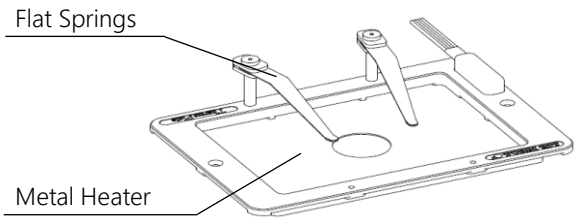
Inverted **TPi-SQH26FT**

Plate Dimension : 160×110mm



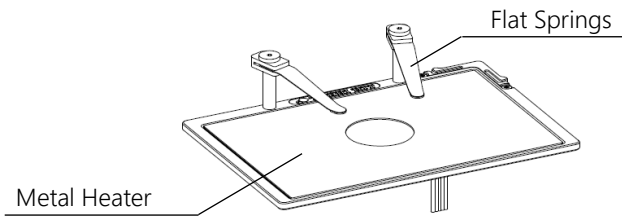
Inverted **TPi-SQH26**

Plate Dimension : 160×110mm



Inverted **TPi-TCSH26**

Plate Dimension : 127.5×85.5mm

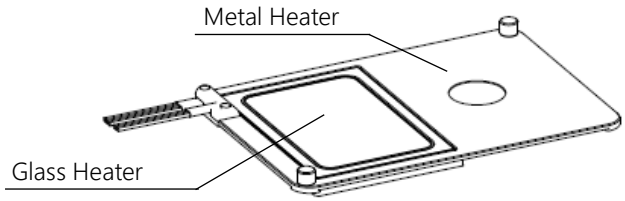


* Flat Springs are included to the Metal Heater as standard
* The hole diameter at the center of the Metal Heater is 26mm as a standard, but you can specify the hole diameter between 10 and 26 mm.

Ex) TPi-110RH○○, TPi-SQH○○FT
⇒ Hole diameter is 10mm
Model : TPi-110RH10, TPi-SQH10FT

2 in 1 Heater

Inverted **TPiD-I2X** Plate Dimension : 160×110mm

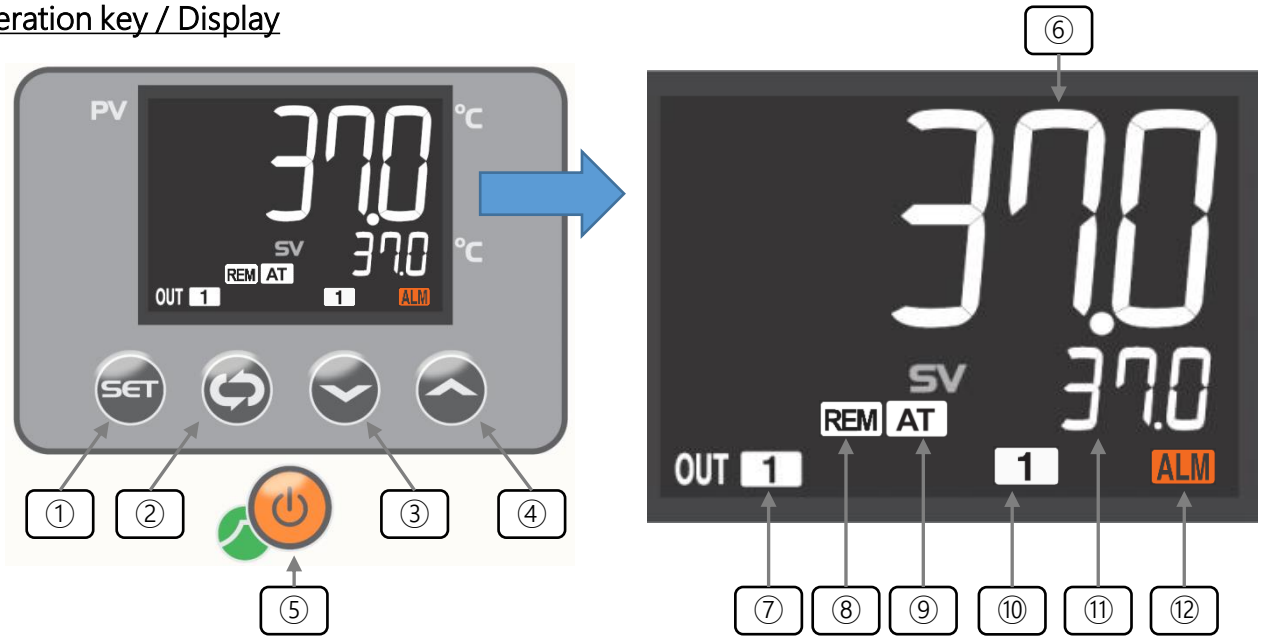


* 2 channel controller is included

Some models are not listed in this manual.
For details, please contact Tokai Hit.

3. Display and parameter

Operation key / Display



1	SET Key	1) SET enter button 2) Starts PID Calibration by pressing and holding the button For details, refer to 6. PID Calibration (p.19).
2	Screen Shift Key	1) Shift the screen 2) Starts Shift Calibration by pressing and holding the button For details, refer to 7. PID Calibration (p.20).
3	DOWN Key	Decreases the Setting Value (SV) lower than its setting. By holding the key, the value will be dropping continually.
4	UP Key	Increases the Setting Value (SV) higher than its setting. By holding the key, the value will be increasing continually.
5	Stand-by Switch	ON/OFF switch of the controller. Temp. control starts from the moment pressed the Stand-by Switch. Please follow the procedures in this manual and use it correctly.

6	Plate Temp. (Process Value)	The process value is displayed on the temp. display screen. On setting mode, character strings of contents are displayed.
7	OUT Lamp	Lights up when the controller is outputting to the plate.
8	REM Lamp	Lights up when using the optional TEM-i (Temp. Management Software) and running automatic operation at the set temp. program pattern.
9	AT Lamp	Lights up during PID calibration or Shift calibration. For details, refer to 6. PID Calibration (p.19) and 7. Shift Calibration (p.20).
1 0	CH Lamp	Displays current CH (Channel) e.g. Lights up [1] : Heating Plate channel No light: External Temp. Sensor channel
1 1	Plate Temp. (Setting Value)	The setting value is displayed on the temp. display screen. On setting mode, setting value for each contents are displayed.
1 2	ALM Lamp	Lights up when an error occurs. Refer to 11. Troubleshooting (p.25).

Plate Lamp condition

* Plate Lamp is attached to some major models.

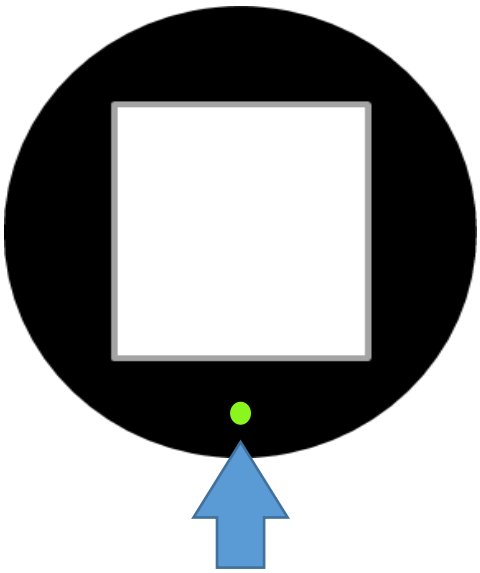
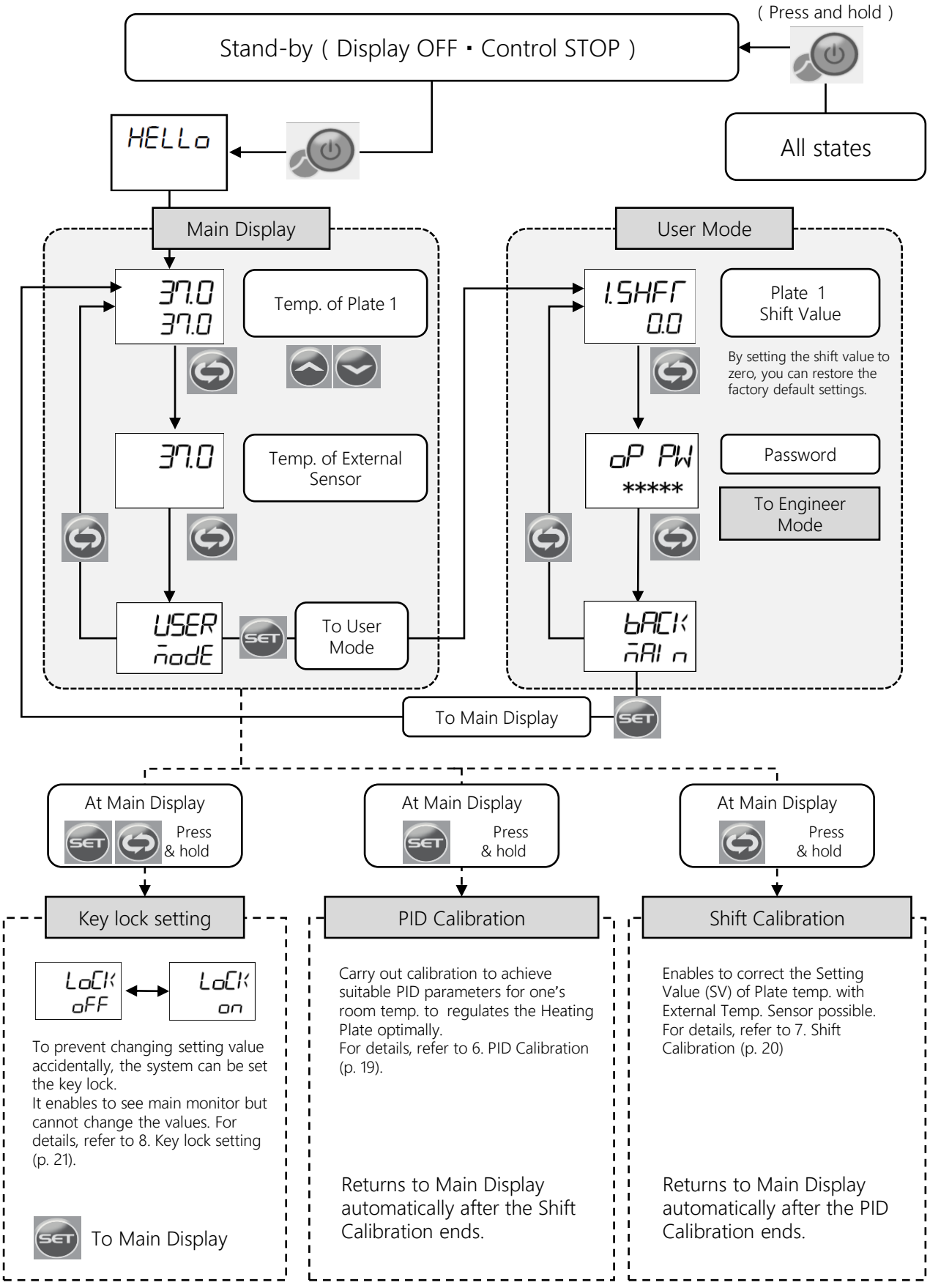


Plate Lump

Lights up	Plate temp. process value (PV) = Plate temp. setting value (SV). Lights when"the plate temp. process value (PV) = plate temp. setting value (SV)"condition lasts longer than 5 seconds. Turns off when the plate temp. process value (PV) is outside the ± 0.3℃ range of the plate temp. setting value (SV) for 5 seconds or longer.
Blinks per 1.0 sec	Shift calibration or PID Calibration is running.
Blinks per 0.2 sec	An error occurred.
Lights off	Temperature is rising or preparing.

Parameter


(Press and hold)
Stand-by (Display OFF ▪ Control STOP)
All states
HELLo
Main Display
User Mode
37.0
37.0
Temp. of Plate 1
37.0
Temp. of External Sensor
USER
nodE
To User Mode
To Main Display
1.SHFT
0.0
Plate 1 Shift Value
By setting the shift value to zero, you can restore the factory default settings.
oP PW
*****
Password
To Engineer Mode
bACK
nAI n
At Main Display
Press & hold
At Main Display
Press & hold
At Main Display
Press & hold
Key lock setting
PID Calibration
Shift Calibration
LoCK
oFF
LoCK
on
To prevent changing setting value accidentally, the system can be set the key lock.
It enables to see main monitor but cannot change the values. For details, refer to 8. Key lock setting (p. 21).
To Main Display
Carry out calibration to achieve suitable PID parameters for one's room temp. to regulates the Heating Plate optimally.
For details, refer to 6. PID Calibration (p. 19).
Returns to Main Display automatically after the Shift Calibration ends.
Enables to correct the Setting Value (SV) of Plate temp. with External Temp. Sensor possible.
For details, refer to 7. Shift Calibration (p. 20)
Returns to Main Display automatically after the PID Calibration ends.

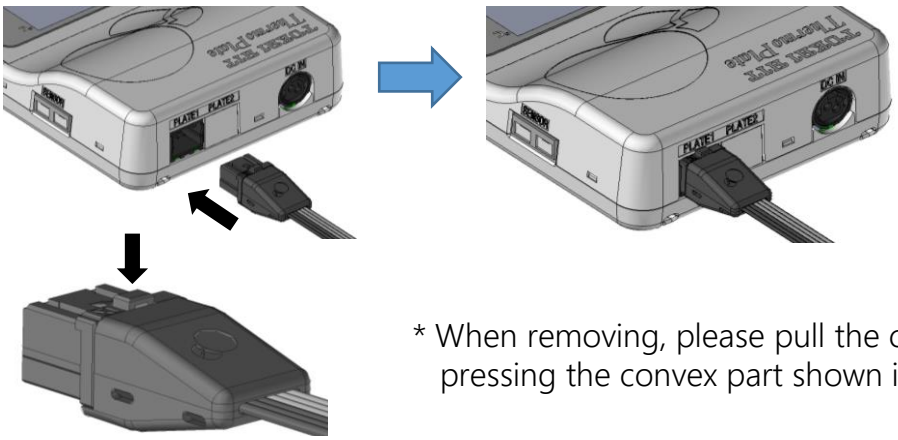
4. Preparation for use

Installation

① Place the heating plate on the microscope stage.

* For inverted microscopes, please be careful not to entangle the plate cable with objective lens.

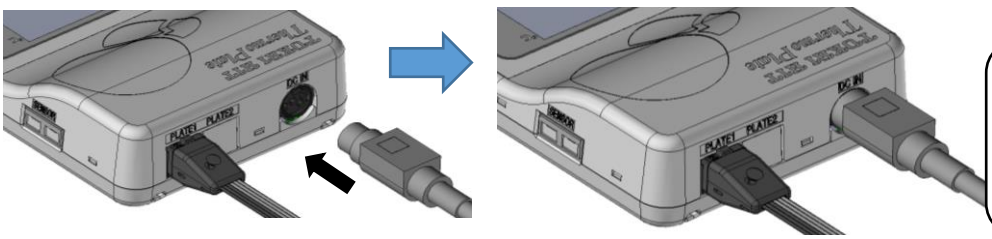
② Connect the heating plate to the plate connector of controller.



Since it is a lock type connector, please insert it deeply.

* When removing, please pull the cable while pressing the convex part shown in the left figure.

③ Connect the AC adapter to the power connector of controller and connect the power cord.

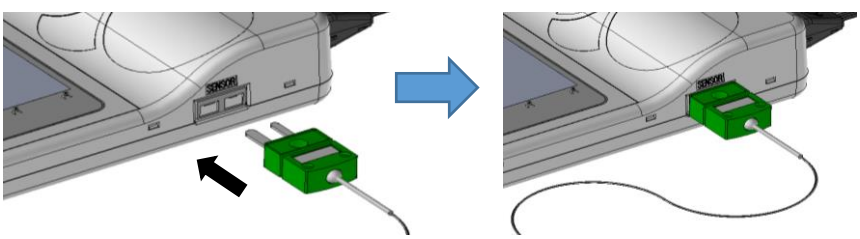


Since it is a lock type connector, please insert it deeply.

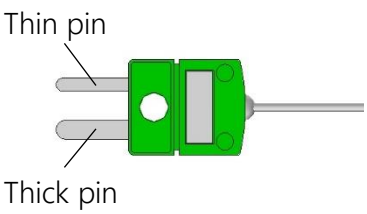
④ When using TEM (temperature logging software), connect the USB cable which is included in the package to the controller.

⑤ If the glass part of the heating plate gets dirty, please clean it up.

⑥ Connect the External Temp. Sensor to the Extension Wire and connect the Extension Wire to the sensor connector of controller.

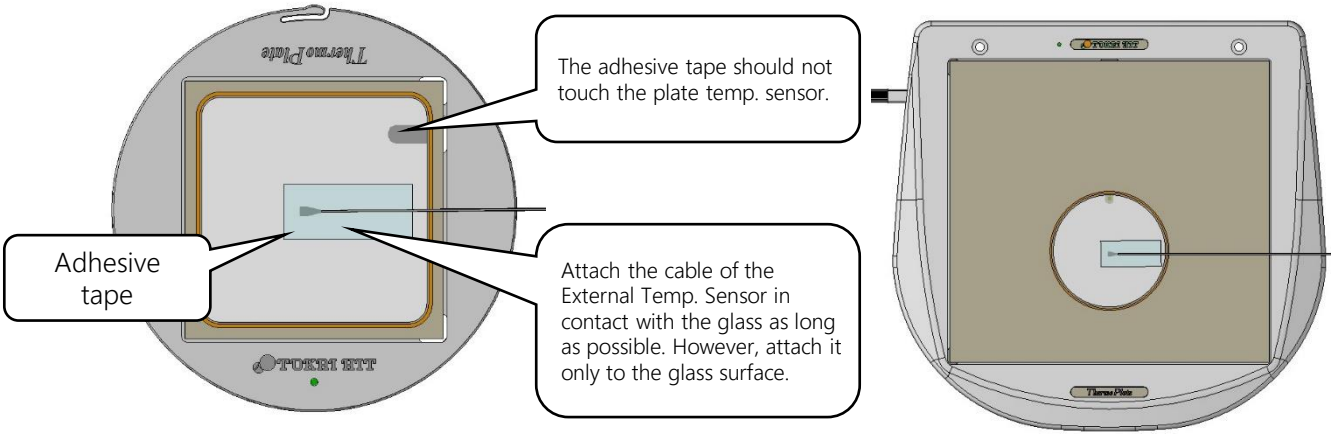


* Please note that the connector of the Sensor and Extension Wire have thick pins and thin pins and the direction of insertion is decided.



For measuring temperature

Attach the External Temp. Sensor to the glass part of the Heating Plate.
Please be sure to follow the procedure as follows:



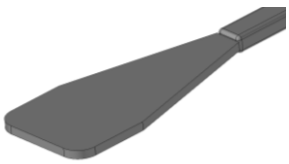
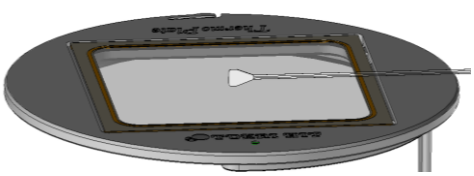


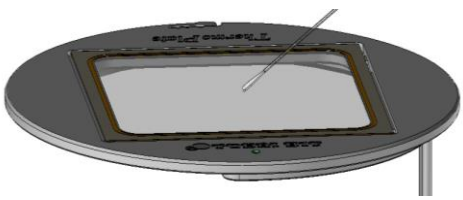
Image of sensor tip shape

In order to improve the temp. acquisition property by pasting it on the glass, it has the shape as shown in the left.

! Please attach the flat surface sensor tip to center of glass plate with adhesive tape for accurate temp. measurement. Remove the remaining air between the tape and glass to make sure the top is in closed contact with glass.



The flat surface of the External Temp. Sensor tip is not in close contact with the glass. **NG**



The flat surface of the External Temp. Sensor tip is not in close contact with the glass. **NG**

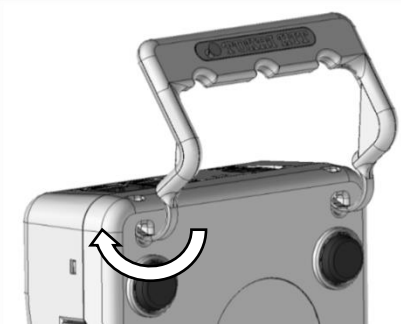
External Temp. Sensor is not attached to the center of plate. **NG**

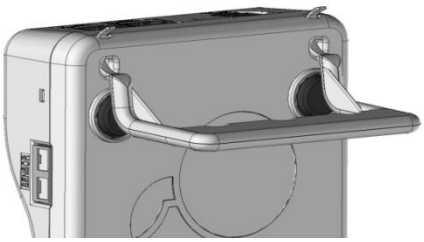
External Temp. Sensor is attached over the plate sensor. **NG**

How to use the Mounting Hook

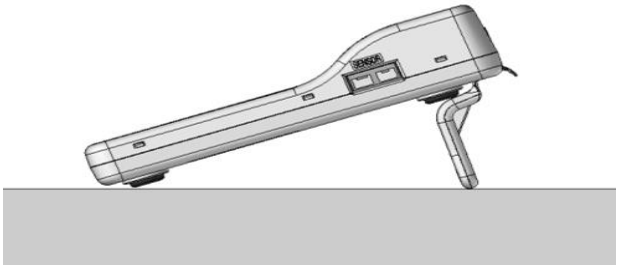
You can use the controller as it is on the flat surface, or use in the following way with the attached Mounting Hook.

◎When placing the controller on the flat surface



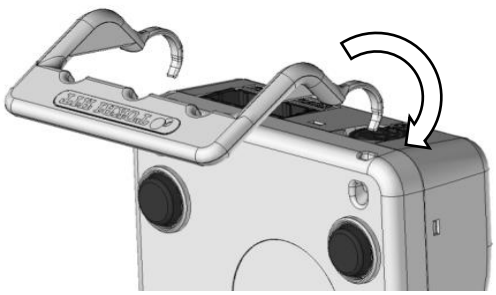


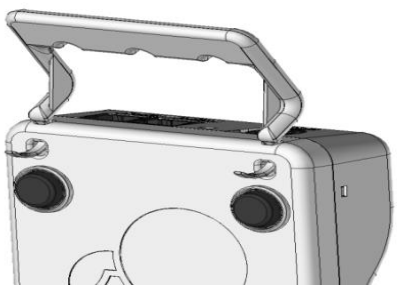
Attach the Mounting Hook as shown above.



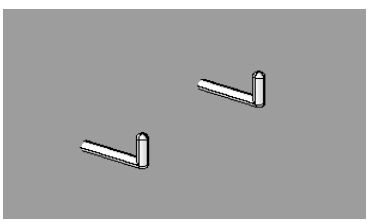
Please use it on a flat surface.

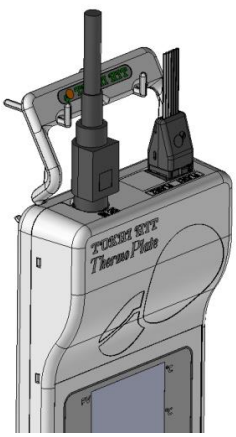
◎When using the controller by hanging on the wall





Attach the Mounting Hook as shown above.



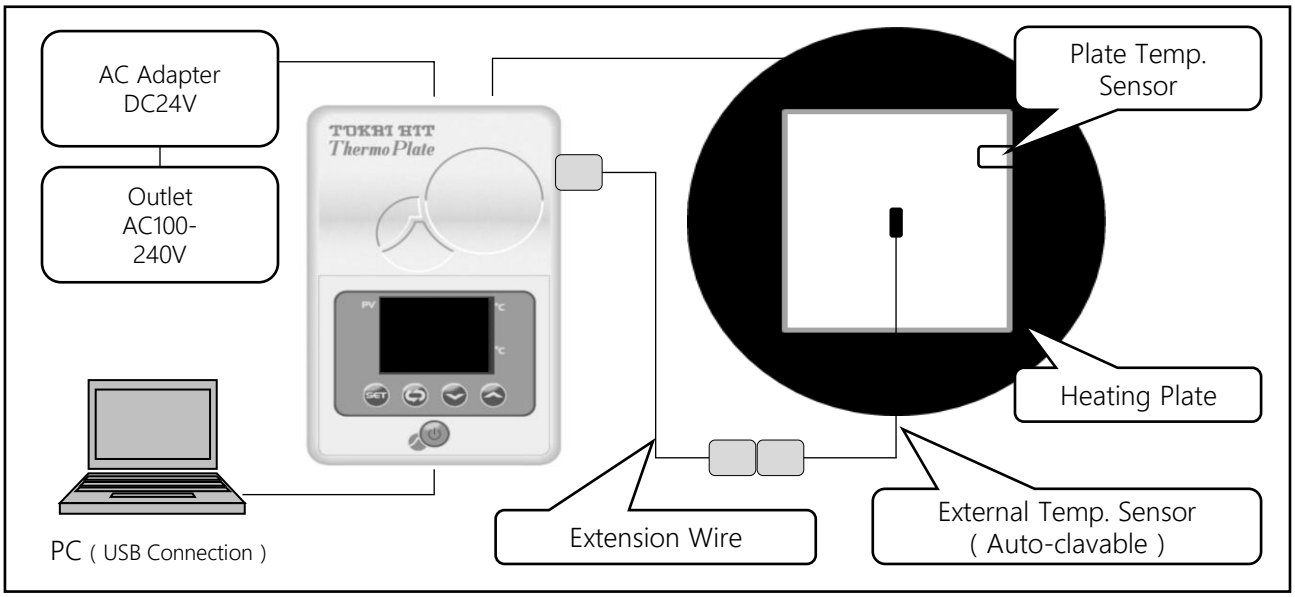


Please prepare a wall hook shown above and hang the controller.

(Recommended: at intervals of 40 mm, diameter about 5 mm)

Please do not stress the Mounting Hook more than necessary, it may damage the system. (e.g. prohibited to pull the wall-hanged controller, push the controller from above while controller is placed on the table.)

Setting Image (For measuring temp.)



For accurate temp. control

Before using, be sure to confirm that the serial number stated in the product name plate on the back of the controller: ○○○○○○ 6 digits matches the cable on the Heating Plate (near the connector) .

Please do not combine controller and Heating Plate with different serial number. There is a possibility that temp. may not be controlled correctly.

Please do not let air flow directly over Heating Plate surface. An error may occur in the Heating Plate surface temp..

Please use a thermometer that can be traced to international or national weighing standards and check that the temp. indicated by the attached External Temp. Sensor is correct. Please ensure this confirmation at least once a year. Be sure to use this thermometer which has a small and thin tip shape. A large thermometer may cause abnormal heat heating or malfunction of the Heating Plate.

Be sure to check that the temp. at the central part of the Heating plate is near the setting value with the attached External Temp. Sensor before placing the dish on the Heating Plate. If there is a phenomenon such as a difference between the Heating Plate temp and the External Temp. Sensor, refer 6. Procedure for PID Calibration (p.19) or 7. Shift Calibration (p.20) and do temp. correction.

Be careful not to spill the specimen or the medium in the dish when placing the dish on the Heating Plate.

5. How to use

① 

Please turn on the Stand-by Switch and run preliminary operation. For the preliminary operation, please leave it for about 30 minutes to 1 hour.

When you press the Stand-by Switch, heating starts. Do not touch the heater part beyond necessity while heating. It may cause burns.

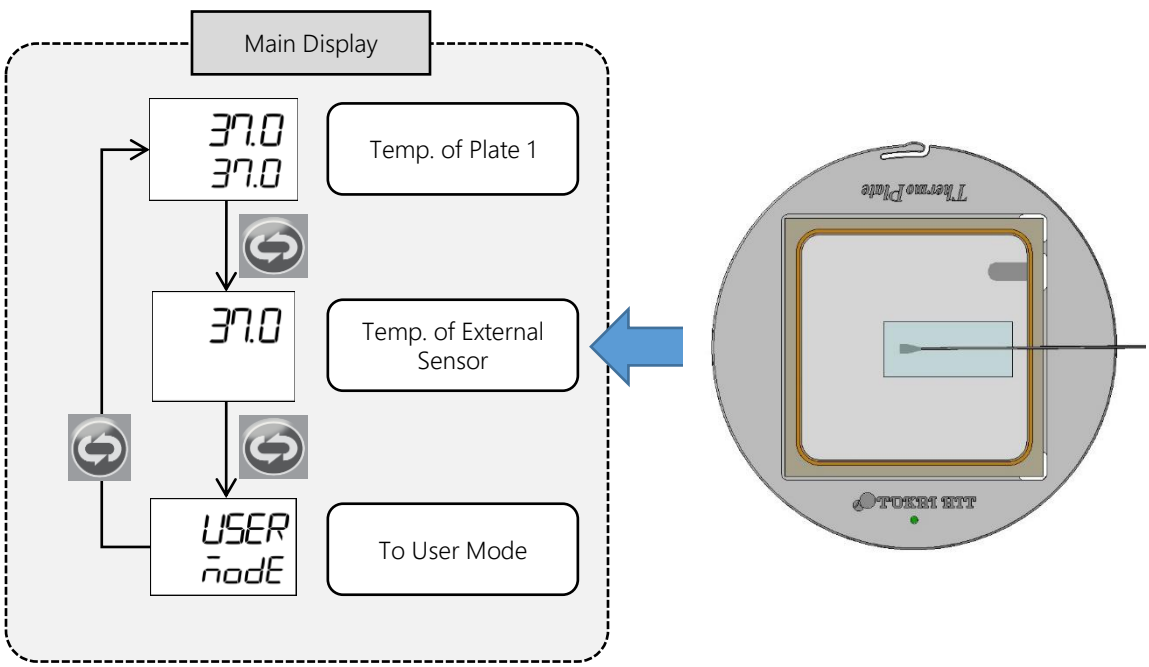
② 

Use the UP or DOWN Key to input the setting temp. of Heating Plate. Refer to 3. Display and parameter (p.10) for the operation.

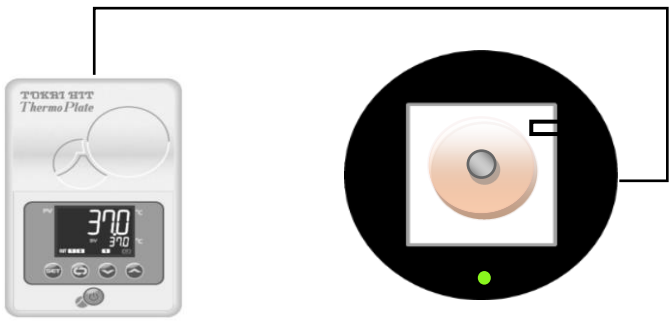
The Heating Plate temp. will be stable in about 10 minutes after inputting the temp. setting value.
* Temp. stabilization time varies depending on the plate model.

③ Before placing the dish on the Heating Plate, please run temp. check (p.14) as necessary. Measure the Heating Plate temp. with the attached External Temp. Sensor and confirm that it matches the setting temp..

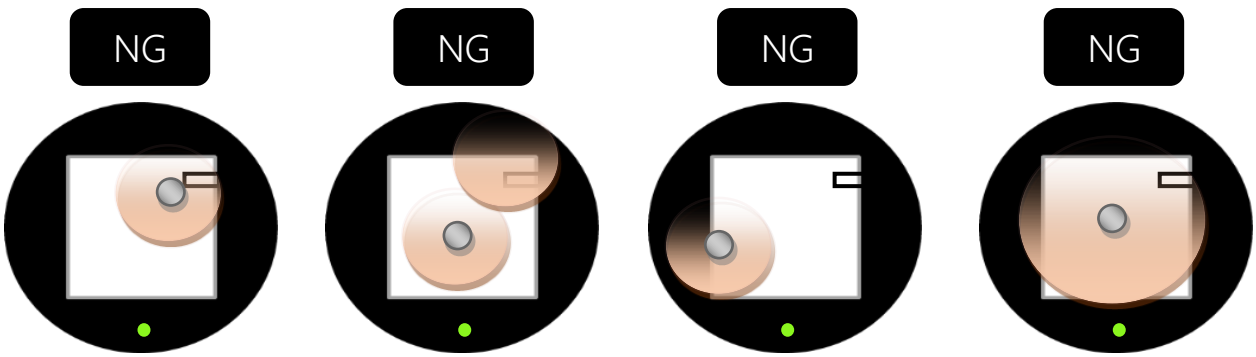
⚠ As a result of checking the temp., if the Heating Plate temp. does not stabilize in your environment, please correct the temp.. For temp. correction, refer to 6. PID Calibration (p.19) or 7. Shift Calibration (p.20).



④ Set a dish on the Heating Plate and start observation.



Examples of dish INCORRECT installation



Dish is on the Sensor

There is an object on the Sensor

Dish protrudes beyond the heating surface

It may cause sensor false detection, which may affect temperature control.

There is a risk that the sample is not heated properly.

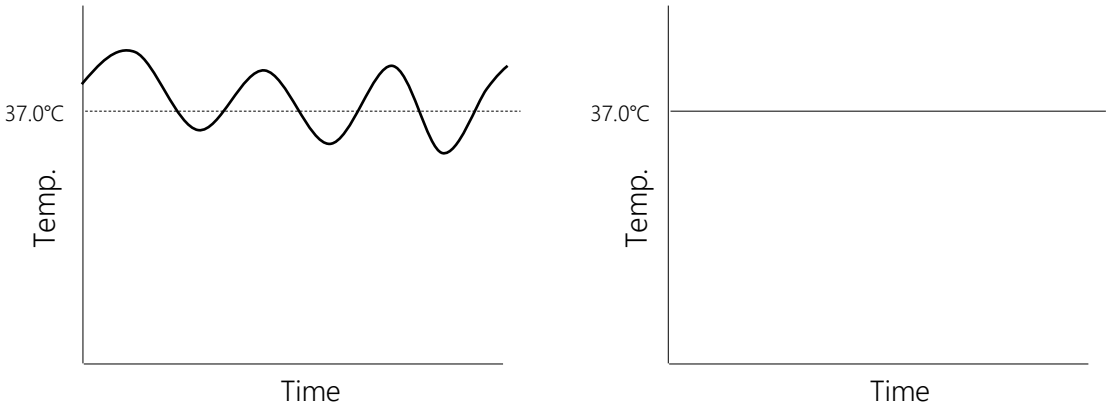
* When installing a dish on the Harming Plate, please be careful not to spill the specimen and the medium.

⑤ When finishing, turn off the controller by pressing and hold the Stand-by Switch. Disconnect the plug of Power Cord from power socket after controller is turned off completely.

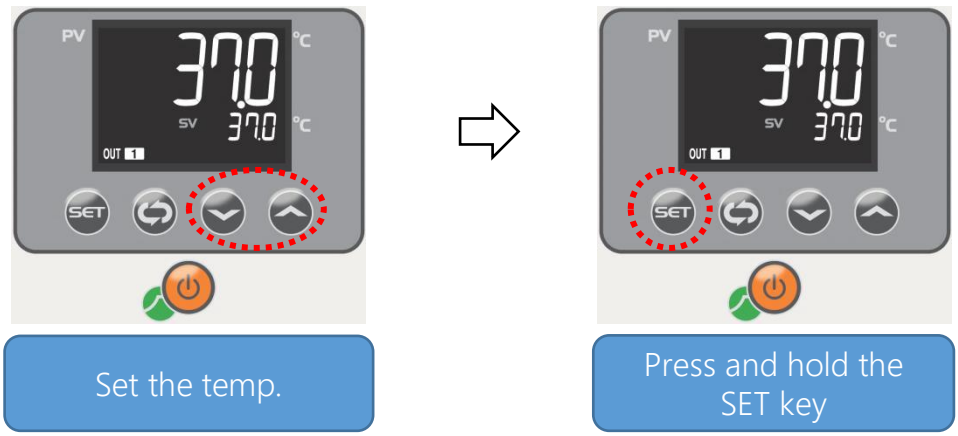
⑥ If the glass part of the Heating Plate gets dirty, please clean it.

6. PID Calibration

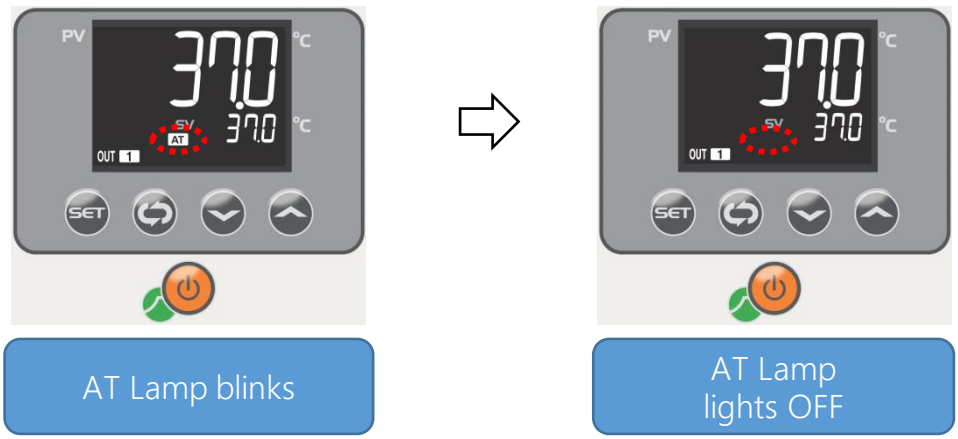
This system adopts PID control for stable temp. control, and the controller is calibrated under the environment of room temperature 25 ± 2℃ before shipping. If the temp. of the Heating Plate is not stable in your environment, the controller can calculate the optimum parameters according to your environment by carrying out PID calibration so that the Heating Plate temp. becomes stable.



① Display the heating plate temperature from the main screen, set the temp. to be used with the UP/DOWN key, and press and hold the SET key.



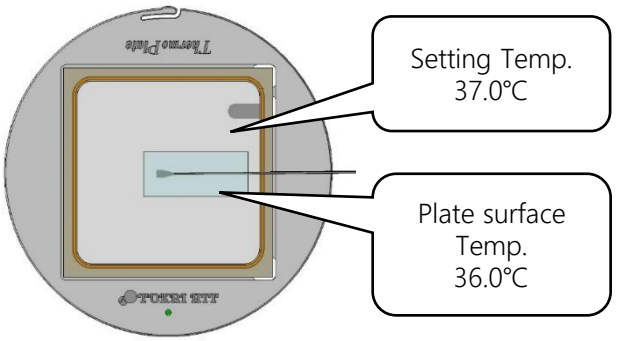
② PID calibration starts when the AT Lamp blinks, and it ends when the AT Lamp lights off.

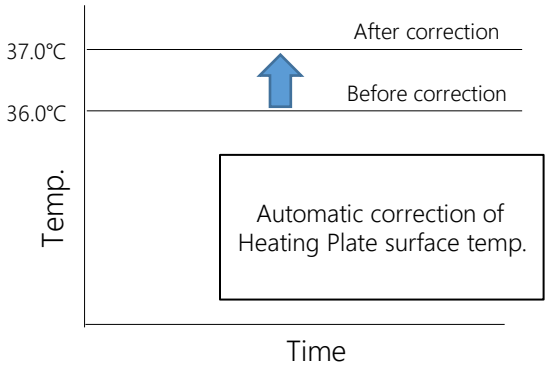


7. Shift Calibration

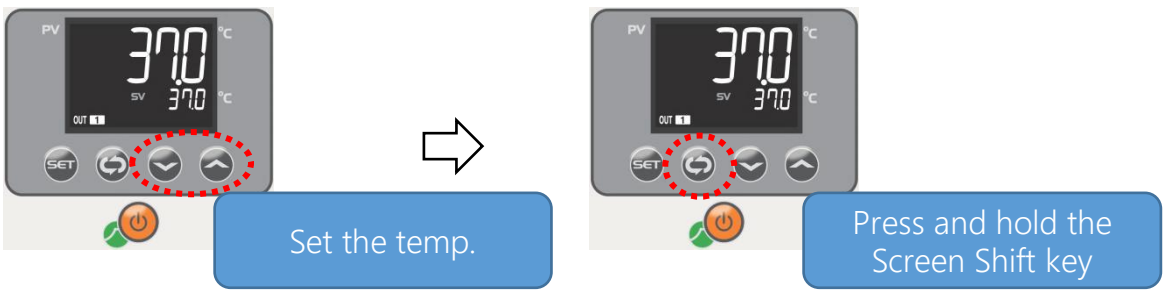
The Shift Calibration is for correcting temp. so that the surface temp. of the Heating Plate is equal to the temp. of the External Temp. Sensor measures.

* Since the External Temp. Sensor is not included in the Economy Type, this operation can not be carried out.

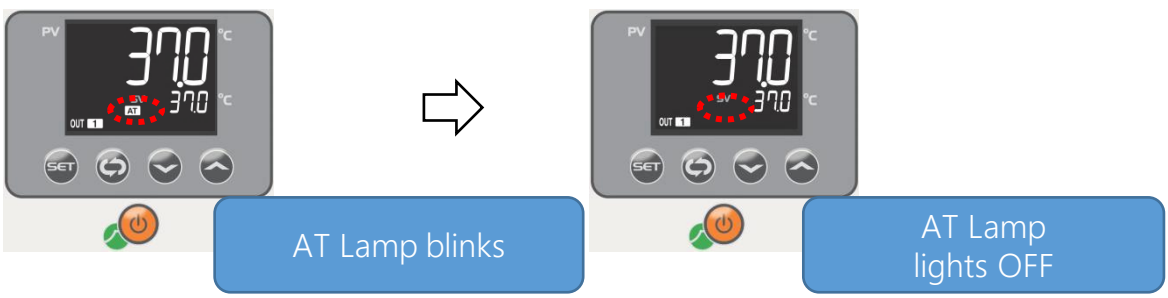




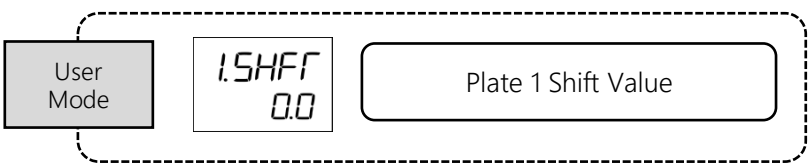
① Display the heating plate temperature from the main screen, set the temp. to be used with the UP/DOWN key, and press and hold the Screen Shift key.



② Shift calibration starts when the AT Lamp blinks, and it ends when the AT Lamp lights off.



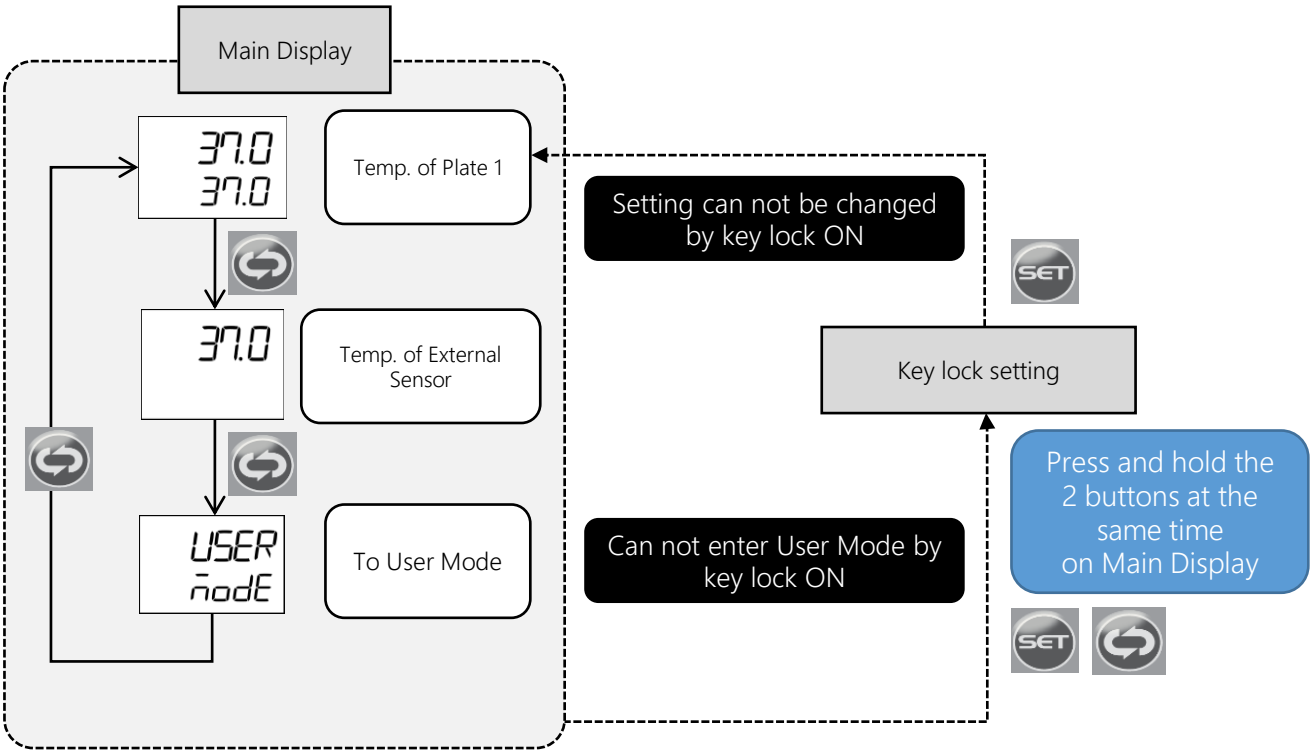
You can check how much correction was made from the Plate Shift Value in the User Mode. You can also manually do the Shift Calibration by directly inputting the correction value to this Shift Value.



Please check the stability of the Heating Plate temp. before carrying out Shift Calibration. The operating environment is stable within the range of 25 ± 2℃, and the air blowing should not hit the surface of the Heating Plate. It may cause sensor temp. false detection and the Shift Calibration program may not be finished. Shift calibration takes at least 30 minutes or more.

8. Key lock setting

To prevent changing setting value accidentally, the system can be set the key lock. It enables to see main monitor but cannot change the values.



① Press and hold the SET Key and Screen Shift Key together on the Main Display.

② Following key lock display will be shown on the display.
Use UP / Down Key to Lock ON or OFF setting.

③ When the setting is completed, press SET key to return to the Main Display.

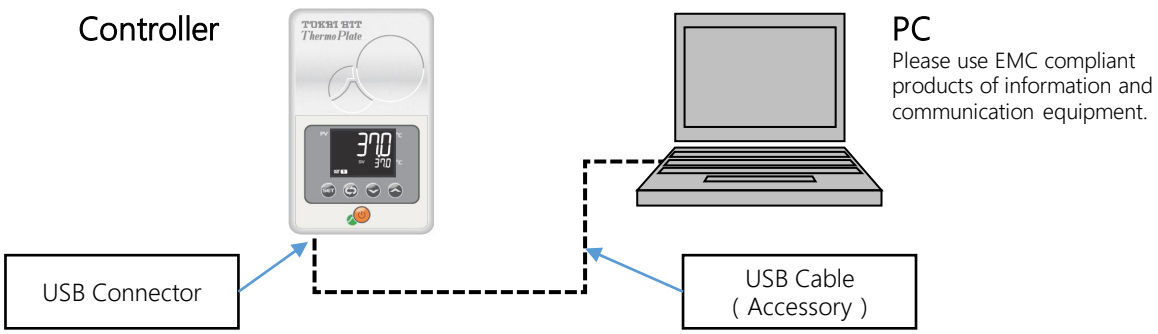
9. TEM - Installation

TEM (Temperature Logging Software) connects the controller and the PC by USB and graphically displays the measured values. In addition, since the measured data can be saved as CSV data, it can be used for quality control.

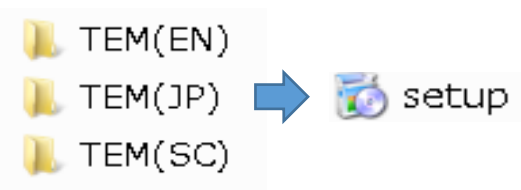
① Operating environment

1) OS : Windows 7 (32bit/64bit)　Windows 8.1 (32bit/64bit)
: Windows 10 (32bit/64bit)
2) Firmware : .NET Framework 4.0 or higher
3) USB : 2.0 / 1.1
4) Display : 1024×768 or more recommended
5) Required input / output device : USB, Keyboard,
Pointing Device (Recommendation)
6) Required memory: 100 MB or more recommended
7) Required disk space: 100 MB or more recommended

Device connection image



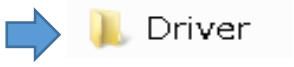
② Installation



Double-click the“setup”file in the folder of the language you want to install (English ⇒ EN, Japanese ⇒ JP, Chinese (simplified) ⇒SC) and install according to the procedure.
* For PCs that do not have ".NET Framework" installed, installation will start automatically.

③ Driver Installation

The icon on the left appears in the device manager, and double-click it and push the “Update Driver”button from the property.
Select the "Driver" folder on the installation CD and follow the instructions to install the driver.

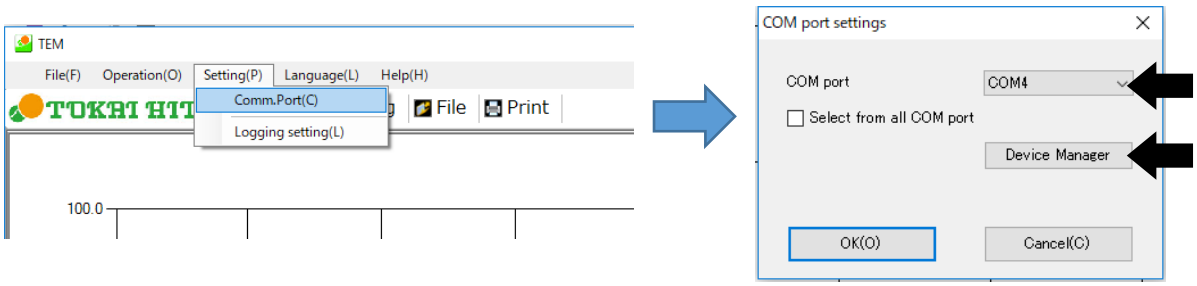


10. TEM – How to operate

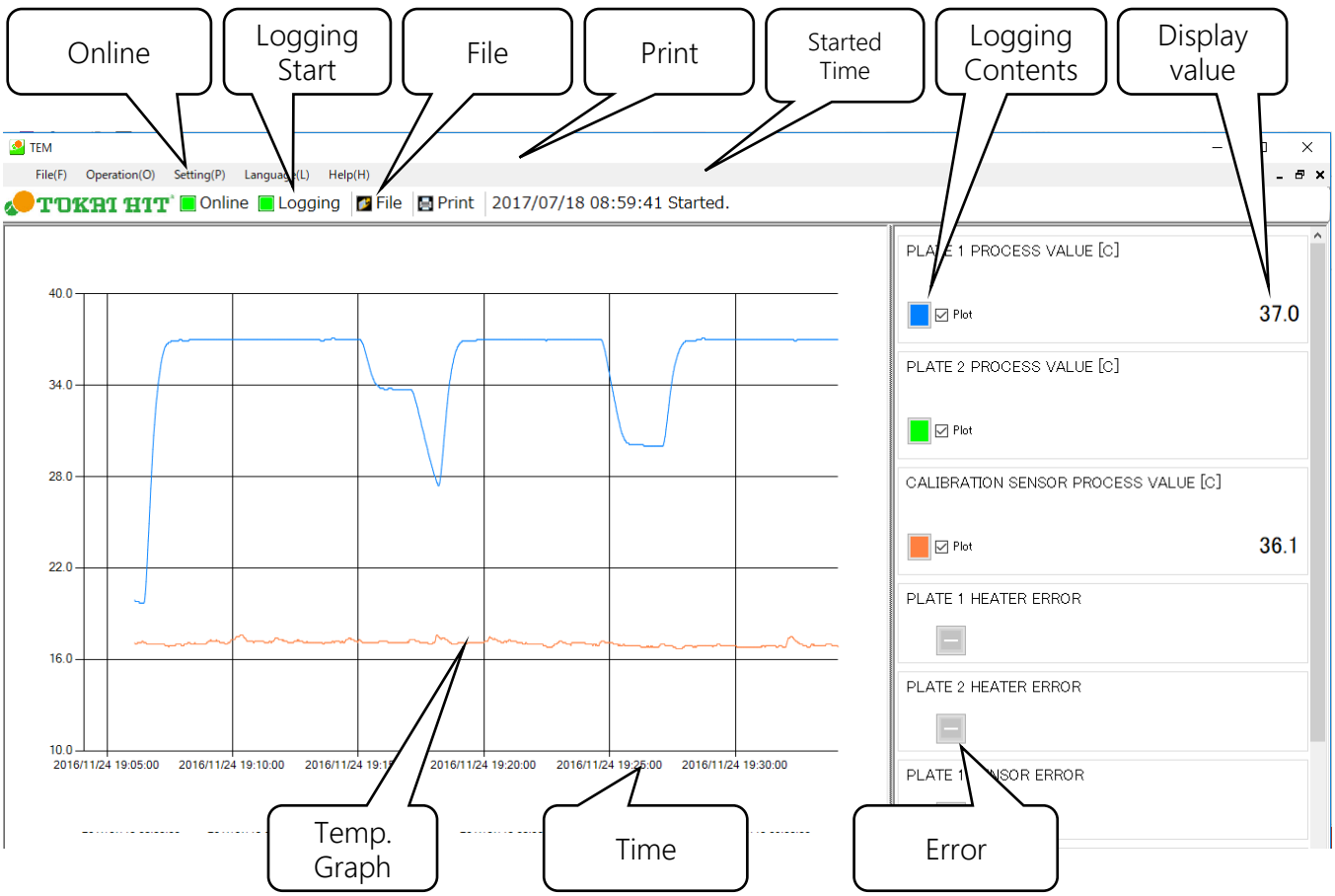
① Start the TEM (Temp. Logging Software) .

TEM

② Select“Port setting”from“Setting”on the screen, select the communication port to which the device is connected, and click“OK”.
* The communication port can be checked from“Device Manager”.



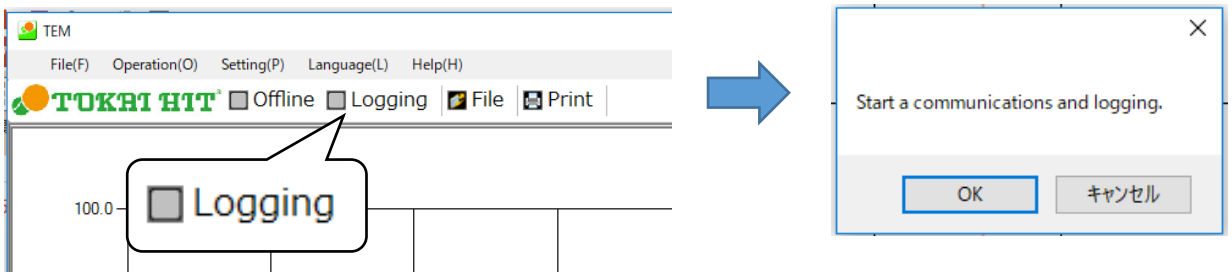
③ When connecting successfully, the following image will be displayed.



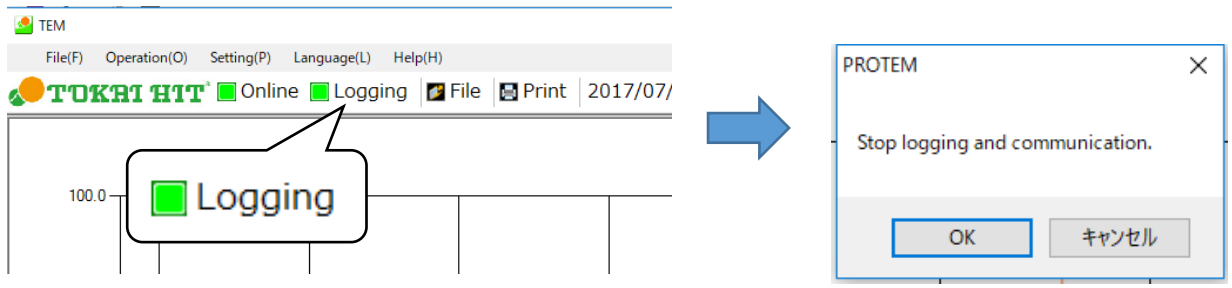
Lights red when an error occurs

Logging method

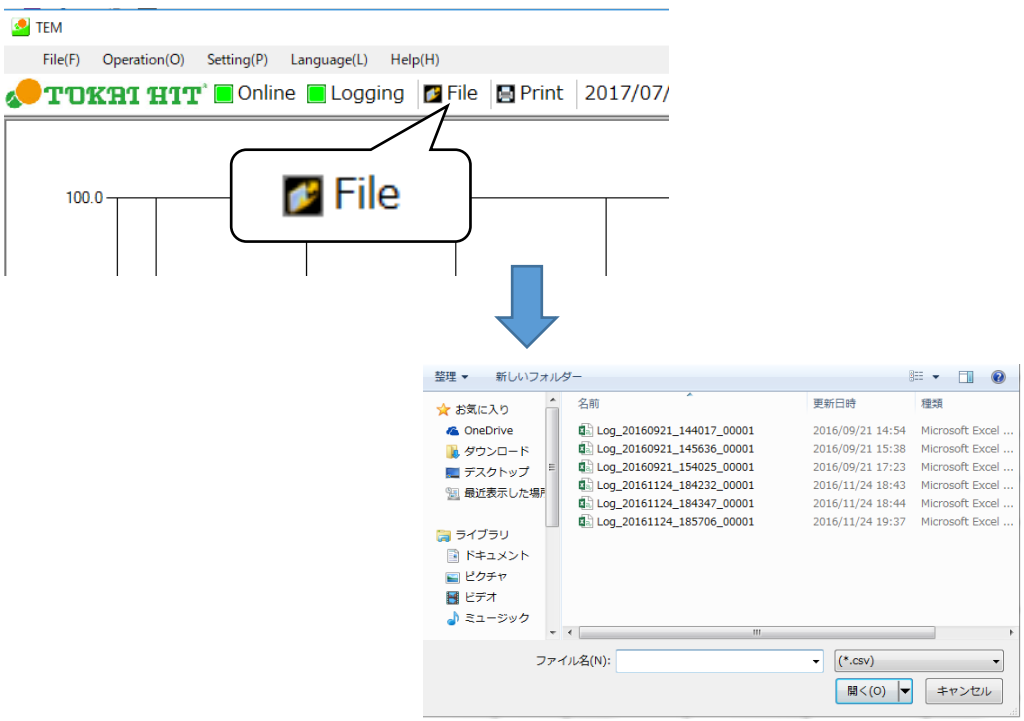
③ Select"logging"button on the toolbar, you will get a dialog saying"Start logging". Click"OK"to start logging.



⑤ If you want to stop logging, select the"logging"button on the toolbar will bring up the dialog"Stop logging". Click"OK"to stop logging.

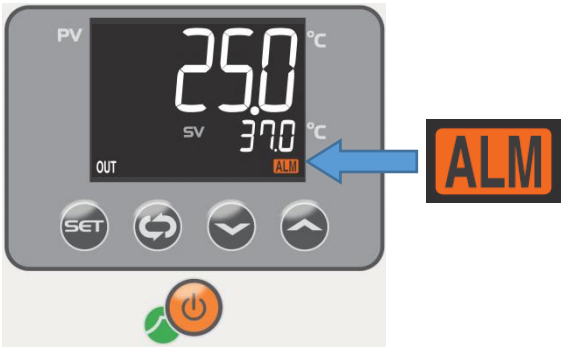


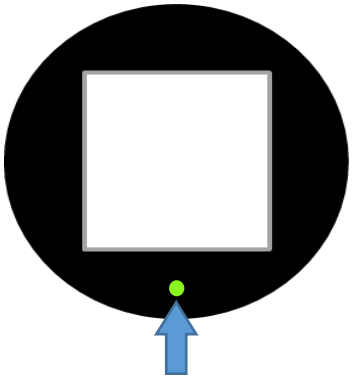
⑥ To check the logged data, click the"File"button on the toolbar to display a list of saved files.



11. Trouble shooting

The following alarm indication may appear on the display or Plate Lamp.
If device does not operate normally, please stop using it immediately and check the alarm.





ALM Lamp lights on display

Plate Lamp flashes quickly
(0.2 sec. period)

* Specific plate equip with Plate Lamp (not all of plate has this lamp). When the plate does not have lamp, please check the monitor of controller for alarm check.

Error Contents	Condition	Alarm output	Restoration Method
Abnormal heating detection	The Heating Plate sensor does not detect temp. elevation when controller OUT Lamp is ON.	Temp. control : STOP Plate Lamp : Blinking	Immediately turn off the controller and check if there is abnormality on the Heating Plate. If abnormality is found, DO NOT use the plate and contact Tokai Hit . In case of false detection, it will recover by turning on the power again.
	The Heating Plate sensor detect temp. elevation when controller OUT Lamp is OFF.		
Controller Internal circuit fault	Detect a problem/error during controller automatic internal circuit check.		Turn OFF and ON the main power of controller. If the system still under error, please contact Tokai Hit or our distributor.
Abnormal Temp. detection	When the sensor detection temp. of the heating plate falls out of the specified range.		
Controller Internal voltage fault	Digital power supply voltage inside the controller drops below a certain value.	Temp. control : STOP Plate Lamp : OFF	
Controller Internal timer fault	When the controller can not execute necessary processing within a certain period of time.		
Controller Display fault	Detecting error in controller circuit board and occurs error in device communication.	Temp. control : STOP Plate Lamp : Blinking	

Apart from the above, please refer to the following when not working properly.

Plate temp. process value (PV) is not correct	Follow the procedure of 7. Shift Calibration (p.20) and make correction.
Plate temp. process value (PV) is not stable	Follow the procedure of 6. PID Calibration (p.19) and make correction.

After trying the above method, please contact us or our distributor if not improved.

Basic Specification

Temperature Control	Method	PID Control
	Increments	0.1℃
	Setting method	Digital switch using UP and DOWN key
	Maximum temp. setting	60.0℃
	Minimum temp. setting	0.0℃
	Controllable temp.	Ambient + 5℃ ~ 60.0℃ (TPi-UNIX : ~ 50.0℃)
	Temp. accuracy	Within 0.1℃ (Under room temp. 25℃, in our terms and conditions)
	Sensor	Platinum resistance thermometer (Pt100Ω)
Power source		100-240VAC
Current rating		1.6A
Maximum Power Consumption		50W

Power Code Cable

For use in areas with 100V-120V power	Use only power Supply Cable described below: Detachable cord set, 3-conductor grounding type, AC 125V7A minimum, listed in UL. In case of using with extension cord, use only Power Supply Cord with PE (protective Earth) wire.
For use in areas with 220V-240V power	Use only 3-pole Power Supply Cable, with plug and outlet complying with EU/EN standards in EU territory. Class 1 equipment must be connected to PE (Protective Earth) terminal. On case of using with extension cord, use only Power Supply Cord with PE (Protective Earth) wire.

Use Conditions

Location	Indoor only
Temperature	25℃ ±2℃
Relative Humidity	5 ~ 70%RH (no condensation)
Altitude	Up to 2000m maximum
Environment Conditions	Installation category II of IEC60664-1, Pollution degree 2

Storage Conditions

Temperature	-10 ~ 50℃
Relative Humidity	5 ~ 70%RH (no condensation)
Altitude	Up to 2000m maximum

Safety

Safety device	Disables over 60.0℃ setting
	Prevent abnormal heat generation

Warranty

Warranty coverage	1. 10 years warranty for glass breakage from the date of shipment. (only for the models applied strengthen glass)
	2. Other repairs except glass breakage are not covered by 10 years warranty.
	3. Intentional glass breakage is not covered by warranty.

306-1, Gendoji-cho,
Fujinomiya-shi, Shizuoka
Japan 418-0074
TEL: 0544(24)6699
FAX: 0544(24)6641
http://www.tokaihit.com
Email: solution@tokaihit.com