

# Thermal shock test controller

Operation Manual

## TS510



# Notice

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# Before start

Thank you for purchasing Han Young Knocks Thermal Shock Test Controller (Model: TS510). The thermal shock test controller (Model: TS510) is a controller of a thermal shock test equipment that artificially implements a rapid temperature environment of high and low temperature to evaluate reliability.

It consists of a display unit and a control unit. The display can be mounted on a panel or VESA mountable, and communicated with the control unit. The control unit consists of a power module, a control module, and an I / O module. It can be mounted on a DIN standard rail or attached to a panel using a screw.

The user's manual explains the functions of the product, how to install it, precautions, and how to use it.

Please read it carefully beforehand.

In addition, the instruction manual should be sent to the end user for use and kept in a place that can be seen at any time.

(The contents of the User's Manual are subject to change without prior notice due to product improvements and changes in functionality.)

## 1. Identification of product

When you purchase the product, first check whether it is the desired specification, Please check.

### ▶ Accessories

					
Display unit (TS510-1)	Power module (TM-PWR)	Control module (TS510-MAIN)			
					
Input Module (TM-DI)	Output Module (TM-DO)	Input / Output Module (TM-DIO)			
					
Communication cable (1.5 m) Display unit → control module	4 Holders	250 Ω 2 resistors	3P connector for communication	SD Card	User's Manual

## ► Type name configuration

Type	Code	Contents
TS510-	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Thermal shock test controller
Display section	1	Display section (5.7" TFT LCD)
	N	None
Input • output	1	Input 16 points • Output 8 points (2 modules) + Power module + Control module
	2	Inputs 16 points and output 16 points (3 modules) + Power module + control module
	3	Inputs 16 points and output 24 points (4 modules) + Power module + control module
	N	No input / output
Language	S	Korean, English, Chinese (simplified)
	T	Korean, English, Chinese (Traditional)




※ This product basically consists of display part and control part (power module, control module, input module, output module). (Up to 32 points of contact input configuration and up to 32 points of contact output configuration)

## ► Product Configuration

Product name	Model	Contents
Display	TS510-1N <input type="checkbox"/>	Display (5.7" TFT LCD)
Control module	TS510-MAIN	Temperature 3-channel control module
Power Module	TM-PWR	Power Module
Input Module	TM-DI	Input 16 point module
Output module	TM-DO	Output 8 point module
I / O module	TM-DIO	Input 8 points, output 6 points module

## 2. Safety cautions

The cautions are categorized into Danger, Warning, and Caution according to seriousness.

 <b>Danger</b>	If not followed, it may lead to death or serious injury.
 <b>Warning</b>	If not followed, it might lead to death or serious injury.
 <b>Caution</b>	If not followed, it may lead to minor injury or damage to assets.

- The operation manual may be subject to changes for improvement without prior notice.
- To protect and secure the product and system connected, use the product according to the safety instructions of this manual.
- We are not liable for any damage caused by negligence or not following the instructions.
- To protect and secure the product and system connected, install any separate or external circuit outside of the product.
- Do not remove, repair, or modify it without prior consent. It may cause electric shock, fire, and malfunction.
- Avoid any strong impact. It may cause damage or malfunction to the product.
- To disconnect the main power, install a switch or circuit breaker.

## 3. Warranty

- We are not liable for any condition other than those specified warranty conditions.
- If a user or third party is damaged in using this product due to unforeseeable defect or natural disaster, we are not liable for any loss or indirect damage.
- The warranty is valid for 1 year from the date of purchase and it is applicable to any failure that occurs in normal use conditions, as specified in this manual.
- For any failure found after the warranty period, paid service may be provided according to our regulations.
- In any of the following circumstances, the product will be repaired at a cost even during the warranty period
  - Failure attributable to user (e.g. Initialization due to lost password)
  - Failure attributable to a natural disaster (e.g. fire, flood, etc.)
  - Failure attributable to relocation after installation
  - Failure attributable to unauthorized modification or damage
  - Failure attributable to unstable power supply
- If you require A/S, contact your dealer or Hanyoung Nux Co., Ltd..

# Installation

## 1. Installation site & cautions

- It may cause electric shock so install in on the panel first.
- Avoid following locations.
  - Where people might unintentionally contact a terminal
  - Where there is strong vibration, impact, or electromagnetic field
  - Where it is exposed to a corrosive or inflammable gas
  - Where the temperature changes sharply or there is much humid, dust, or salt
  - Where it is directly exposed to direct sunlight or the temperature is extreme
  - places with combustibles and flammable objects
- The case and front section are made of fire-retardant polycarbonate but do not install the product directly on a flammable object.
- Keep away any device or wire that may cause noise. Enough preheating is required especially under 0°C. Keep away any heat-radiating device.
- For wiring, disconnect the entire power.
- This product works at 100 – 240 V a.c. / 50 – 60 Hz without special setting. Please make sure that the power is within the rating to avoid any product damage leading to fire or electric shock.
- Do not touch it with wet hand. You may be electrically shocked.
- Follow conventional cautions in order to reduce the risk of fire, electric shock, and injury.
- For grounding, refer to how to install. (Grounding resistance : 100 Ω or less)
- Keep ventilation and the radiating hole free.
- The overvoltage protection degree is Category II(IEC 60664–1) and the usage environment is Pollution Degree II.
- Do not use sharp objects or excessive force when operating the touch screen
- The external terminals(sensor input, communication, and control output terminals) must be connected to separate circuits with at least reinforced insulation from dangerous voltage sections.
- To disconnect the main power, install a switch or circuit breaker.

## 2. How to install



**Danger** Before installing it, disconnect the power. Do not touch a terminal because it may lead to electric shock.

- Use 2–5mm thick panels.
- Insert this device from the front of panel.
- Connect dedicated clamps to the clamping grooves and fix them with bolts.  
(Before fully tightening the clamps, position them in place).

## ► Display

### (1) How to install the panel

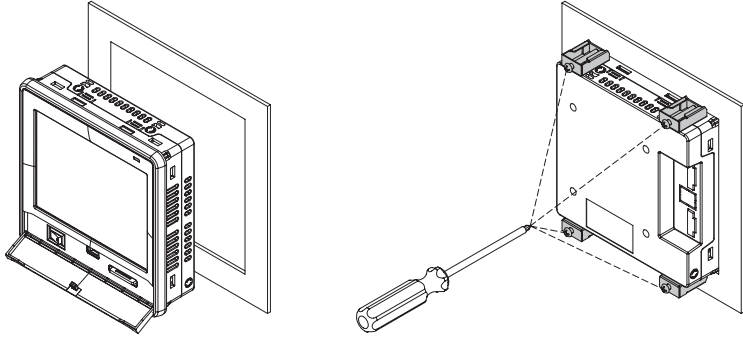


Fig. 1) How to install the panel

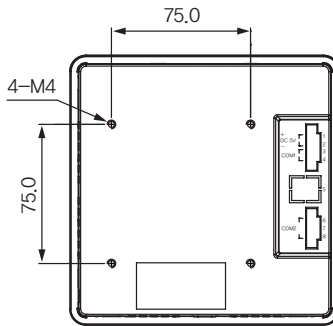


Caution

The tightening torque must be 0,5 N·m or less for clamping.  
Forcible tightening may lead to deformation or damage.

### (2) How to install VESA mount

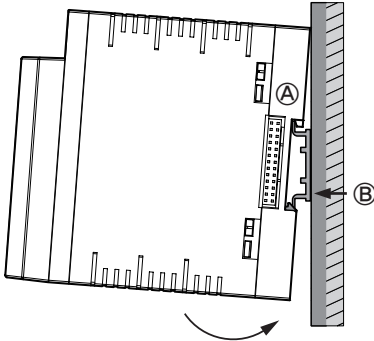
Connect an M4 X 7L bolt into a VESA hole.



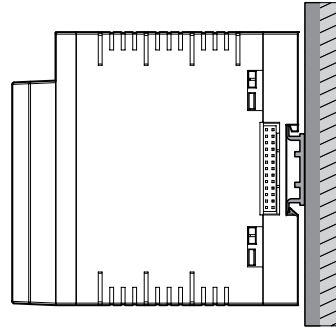


## ▶ Control

### 1) How to install DIN rail



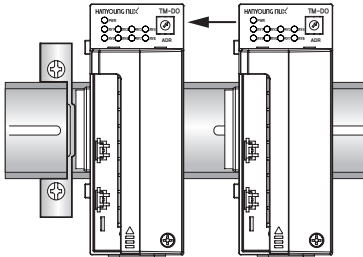
- ① Connect the top hook(A) of bottom of floor to the DIN rail and press it(B) in order to install it.



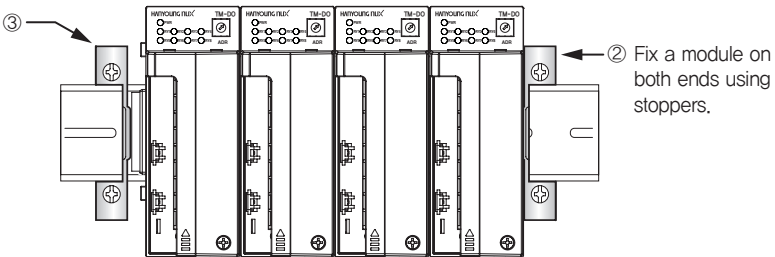
- ② Check if it is fixed by pushing up the mounting bracket.

### ● How to install module

TH510 series module can connect up to 7 units. Any module must be installed vertically.



- ① Push a module aside in order to connect it to a connector.

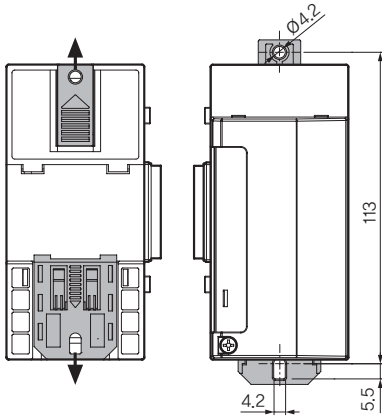


- ② Fix a module on both ends using stoppers.

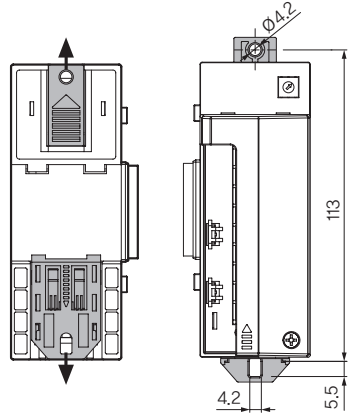
## 2) How to attach panel

- ① Referring to the hole dimensions on the left, find where to install it.
- ② Push outside the top and bottom hooks for fixing screws at the bottom of modules.
- ③ Fix it with an M3 screw.

● POWER

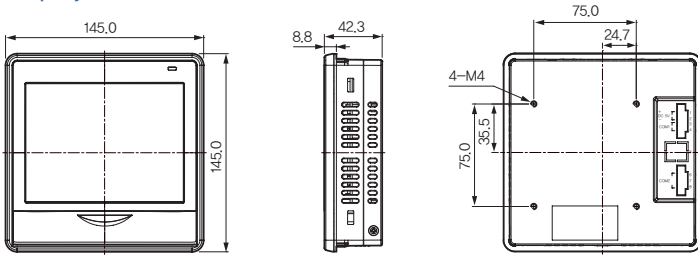


● Main, input/output, input, and output

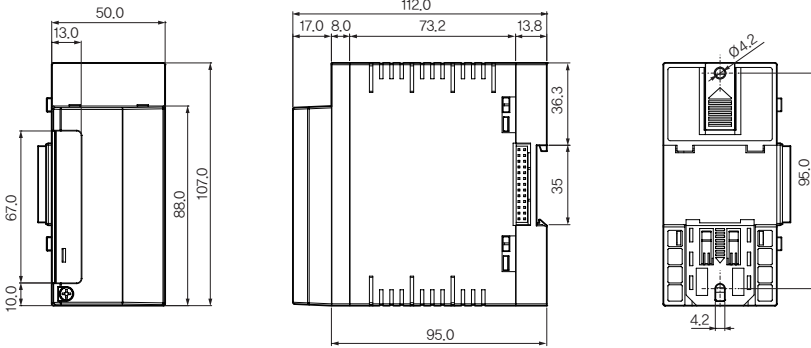


## 3. Exterior & panel dimensions

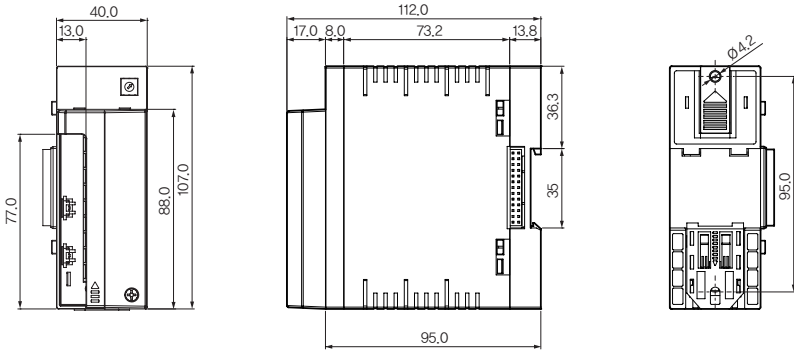
▶ Display (Unit : mm)



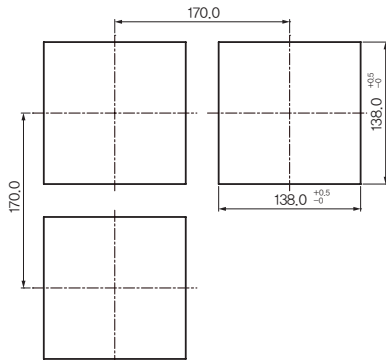
► Power module (Unit : mm)



► Control, input, output, and input/output modules (Unit : mm)



► Panel dimensions (Unit : mm)



## 4. Wiring



Before wiring, disconnect the power.  
Do not touch a terminal because it may lead to electric shock.

### ▶ Power connection

Vinyl-insulated wire(0.9 – 2.0 mm<sup>2</sup> (KSC 3304)) must be used.



Too much noise may lead to damage or malfunction to the device.  
Use line filter to remove the noise.

### ▶ FG wiring

Vinyl-insulated wire(2.0 mm<sup>2</sup> (KSC 3304)) must be used. It must be grounded at 3 points or more with 100 Ω or less resistance.

### ▶ Relay output wiring



Inductive load(L) including motor, solenoid, and external relay may lead to malfunction.  
The CR filter for AC circuit and the diodes for DC circuit should be connected in parallel with the inductive load

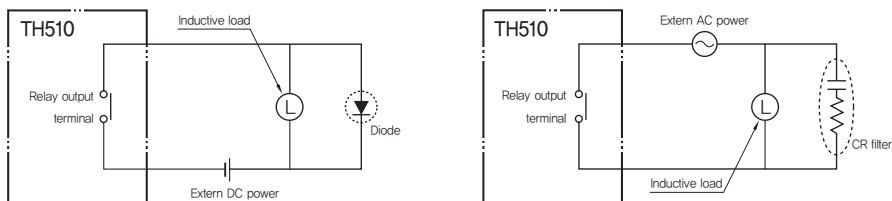


Fig. 2) Connection of relay

### ▶ Input wiring



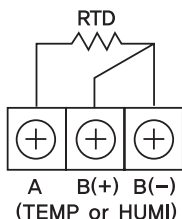
Input wire must use shielded cable and be wired with certain distance from the power and ground circuits. RTD sensor must be 3-wire type with the same wiring resistance.



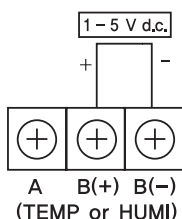
- Enclosure must be grounded at 3 points or more(100 Ω or less of grounding resistance) using 2 mm<sup>2</sup> or bigger cable.
- Input signal and output lines must be of shielded cable with 1 grounding point.
- Thermoresistor input must be wired with no resistance difference between 3 wires.
- Input/output signal line must be isolated from power line.
- To use current input, attach 250 Ω 0.1 % resistor at both ends of input terminal.

#### ● Sensor input

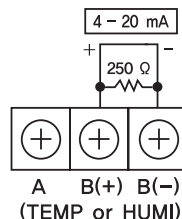
##### ● Thermoresistor input



##### ● DC voltage input

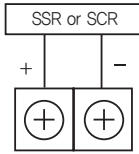


##### ● DC current input

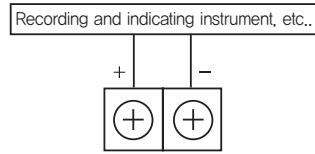


● Temperature / Humidity control and transmission output wiring

● Temperature/Humidity control output



● Temperature/Humidity transmission output



▶ Communication wiring

Connect terminating resistors(100 – 200 Ω, 0.25 W) at both ends of communication cable.

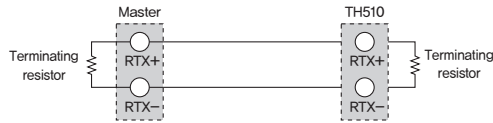


Fig. 3) How to wire for communication

▶ Terminal specifications

Power/Input/Output - M3 screw

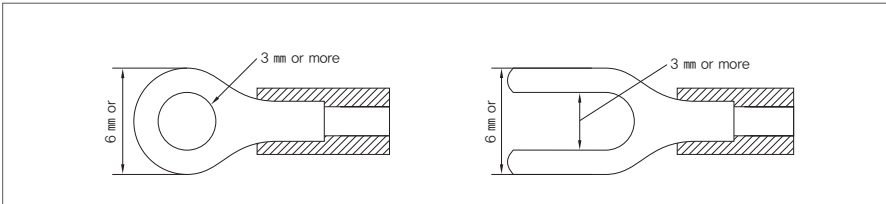
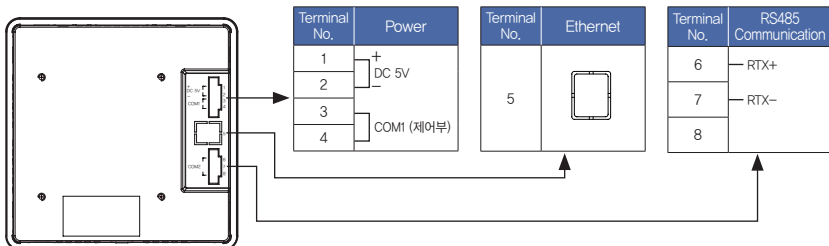


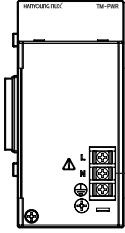
Fig. 4) Solderless terminal

## 5. Terminal connection diagram

▶ Display

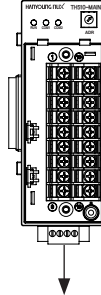


▶ Power module



Terminal No.	Power	
L	L	 100 - 240 V ~ 50 - 60 Hz 22 VA
N	N	
	F,G	

▶ Control module

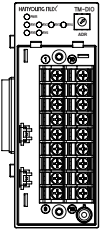


Power	
1	2
3	4

POWER L- TRX+ TRX-  
5 V d.c.

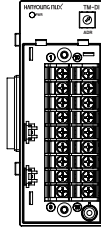
Terminal No.	Temperature	Terminal No.	Humidity
1	 SSR/SCR	10	 SSR/SCR
2		11	
3	 RET	12	 RET
4		13	
5	 RTD	14	 RTD
6		15	
7		16	
8	 mV/V	17	 mV/V
9		18	

▶ Input module



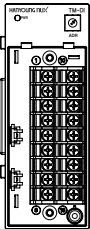
Terminal No.	Input(1~8)	Terminal No.	Input(9~16)
1	DI 1	10	DI 9
2	DI 2	11	DI 10
3	DI 3	12	DI 11
4	DI 4	13	DI 12
5	DI 5	14	DI 13
6	DI 6	15	DI 14
7	DI 7	16	DI 15
8	DI 8	17	DI 16
9	COM	18	COM

▶ Output module



Terminal No.	Output(1~4)	Terminal No.	Output(5~8)
1	 RY1	10	 RY5
2		11	
3	 RY2	12	 RY6
4		13	
5	 RY3	14	 RY7
6		15	
7	 RY4	16	 RY8
8		17	
9		18	

▶ Input/output module



Terminal No.	Input(1~8)	Terminal No.	Output(1~6)
1	DI 1	10	 RY1 COM RY2
2	DI 2	11	
3	DI 3	12	 RY3 COM RY4
4	DI 4	13	
5	DI 5	14	 RY5 COM RY6
6	DI 6	15	
7	DI 7	16	
8	DI 8	17	
9	COM	18	

# Operation

## 1. Name of each part

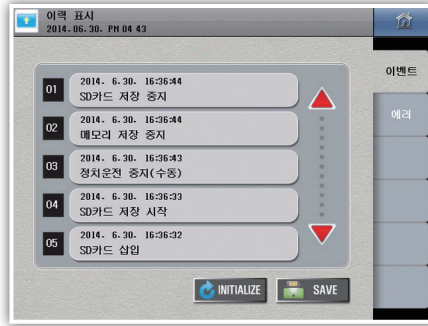


Figure 5) Main Menu

### [ Front LED ]

When backlight is OFF	STOP (Red lamp light ON), RUN (Red lamp blinking)
When backlight is ON	STOP (Green lamp light ON), RUN (Green lamp blinking)

## 2. Operation of the button



SAVE COPY INITIALIZE DELETE	Run button	Execute the action corresponding to the button immediately.
	Select button	Choose one of the suggested ones.
	Input box	Displays and sets numbers or letters. Press to display the Numeric Entry or Text Entry tab.

※ If the button is disabled or the setting is prohibited, a beep (beep) sounds and execution is denied

## 3. How to Operate the Numeric Input Panel

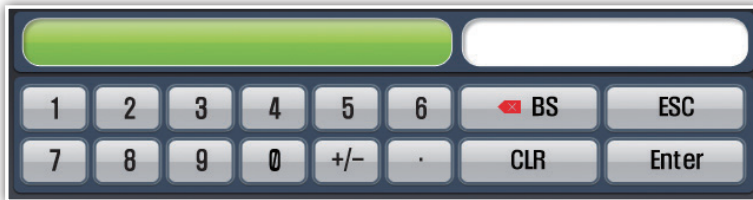


Figure 6) Number Input Panel

	Displays the parameter name and setting range.
	Displays the set value.
	Register the set value.
	Clears the last digit of the set value.
	Clears the entire set value.
	Cancel setting and hide Input Panel.

※ If you input beyond the setting range, the setting will be rejected together with the error sound (beep).



## 4. How to Operate the Character Entry Panel



Figure 7) Character entry board

	Displays the name of the parameter.
	Displays the set character.
	Register the set character.
	Clears the last character of the set character.
	Clears the entire set value.
	Cancel setting and hide Input Panel.
	Change the characters to Korean, English capital letter and English small letter
	Blank

## 5. Name of control unit

### ▶ Control module



#### [ LED Specifications ]

RUN	The lamp lights up when the power is turned on. The lamp blinks when starting operation.
COM1	Displays the communication status of the display unit and control unit. (When it is normal, the lamp will blink.)
COM2	Displays the control unit and IO communication status. (When it is normal, the lamp will blink.)

### ▶ I / O module

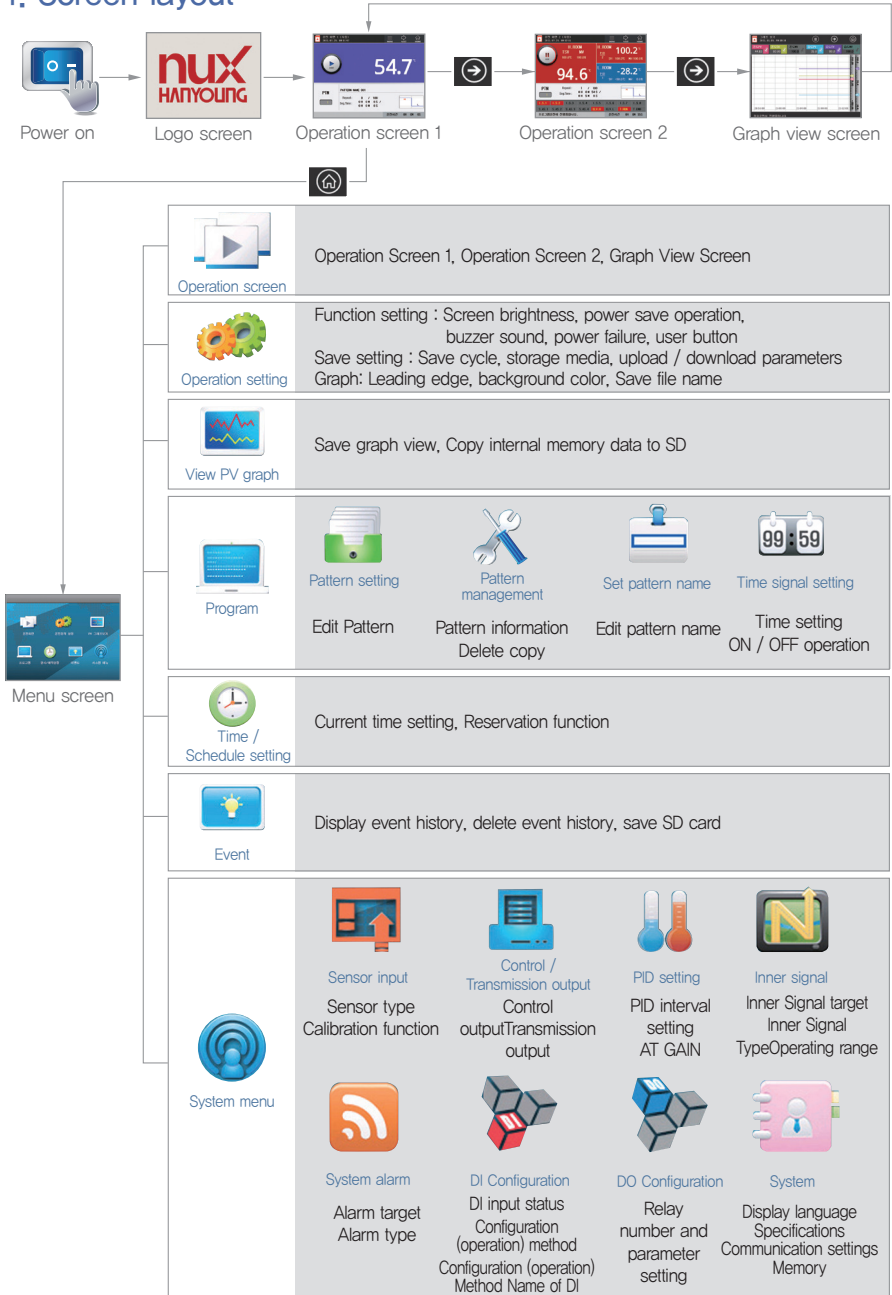


#### [LED Specifications]

PWR	The lamp lights up when the power is turned on.
RLY1 ~ RLY8	The lamp lights when the corresponding DO operation is performed.

# Screen layout

## 1. Screen layout



Before start

Install

Operation

Screen layout

Function setting

Program

System settings

Specification

# Function setting



Figure 8) Main Menu

NO.	Name	Description
1	Operation screen	Move to operation screen
2	Operation Setting	Move to the Operation Setting Screen.
3	View PV graph	Moves to the screen where you can check stored PV graph.
4	Program	Moves to the program setting (pattern setting, pattern management, etc.) screen.
5	Pause / Schedule Setting	Moves to the current time and schedule setting screen.
6	Event	Go to the screen to check the event and error history.
7	System menu	Go to the system setting screen [Sensor input, Control output, PID, etc.] screen.

# 1. Operation Screen

Control the system according to the test pattern that you programmed in advance. The signals of the preheating / test target value and test time, fan (fan), elevator, damper, freezer, valve etc. of each room are automatically generated according to the determined pattern. Starting and ending of operation can be performed only on operation screen 1 and operation screen 2.

- \* The operation screen can be displayed differently depending on the system configuration of each chamber.
- \* Until power off of the product, the operation screen number is memorized and the operation screen is entered.

## ▶ Operation screen 1

You can check the test room temperature (Test Room PV) greatly.

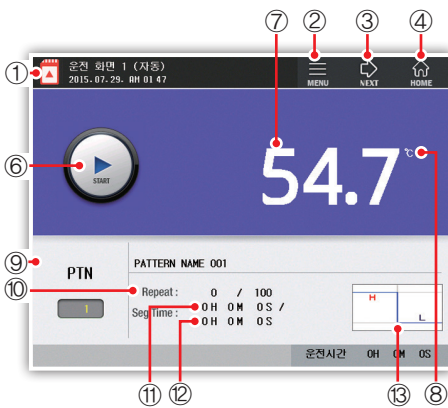


Figure 9) Program operation 1 Stop screen

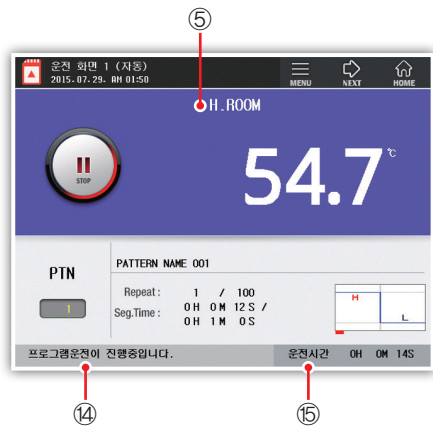


Figure 10) Program operation 1 Operation screen

NO.	Description
1	Displays the SD card status.
2	Button Launches the menu window. To remove the menu window, click on the same part again.
3	Move to Run screen 2.
4	Go to the main menu screen.
5	Indicates the operation status of the test room. (Ex: PRE, H,ROOM, LOW A,T, etc.)
6	Start / stop button.
7	Displays the test room temperature (Test Room PV).
8	Displays the laboratory unit.
9	Indicates the test pattern number and test name. (The start pattern can only be changed while the operation is stopped.)
10	Indicates the number of test repetitions.
11	Indicates the segment time in progress.
12	Indicates the total time of the segment in progress.
13	Displays the type of test pattern and operating segment.
14	Displays status information about operation.
15	Displays the program run time.

## ▶ Operation screen 2

You can check the measured values of the high temperature room, low temperature room, test room, setup value, output amount and operation information, and output status for each signal.

The output status for each signal can be changed in the Status Lamp tab of [System Menu] – [System].

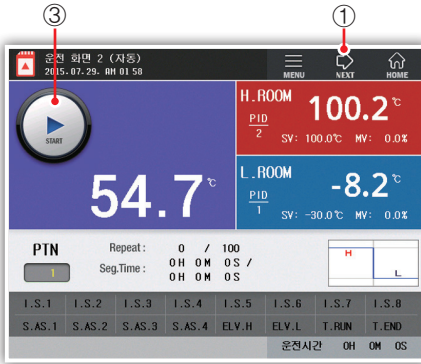


Figure 11) Program operation 2 Stop screen

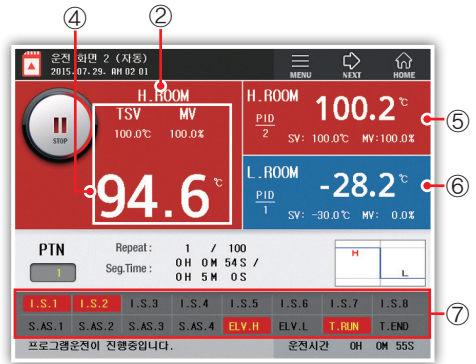


Figure 12) Program Operation 2 Operation Screen

No.	Description
1	Go to Run Screen 3.
2	Indicates the operation status of the test room. (Ex: PRE, H.ROOM, LOW A.T, etc.)
3	Run / Stop button.
4	Displays measured values, set values, output amount, and units in the test room. (The set value and the output amount are displayed only during operation.)
5	Displays the measured value, set value, output amount, and unit PID number of the high-temperature chamber.
6	Displays measured value, set value, output amount, unit PID number in low temperature room.
7	Displays the status lamp for I / O signals. When you press the display part, the second status lamp window appears. (16 images on one screen, up to 32 images can be displayed)

### ▶ Operation Screen 3 (Graph View)

The graph view screen is a graph showing the measured values and target values of the current test. The X axis represents the time, and the Y axis represents the temperature range.

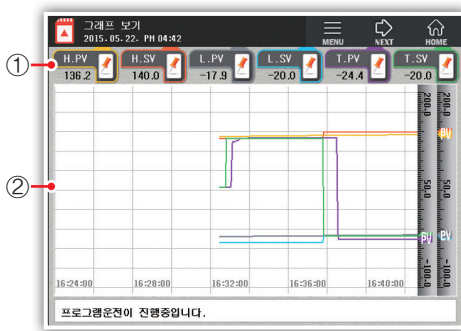


Figure 13) Program Operation 3 Screen (Graph View Screen)

No.	Description
1	The check box indicates whether the data is displayed and the current value. When OFF, graph and current value are not displayed.
2	Displays measured value and set value of current channel in graph.

The user can set the background color (white / black), drawing style (line / dot) and leading edge (1 pixel / 2 pixels) of the graph. This can be changed in the Graph tab of [Operation Setting].

\* When the operation starts, the graph progresses and the flow rate of the graph changes according to the storage cycle. The saving interval can be changed in the [Saving Settings] tab of [Operation Setting].

## ▶ Button menu window

Hold, Step, Auto Tuning, Manual Defrost, User Button 1, 2, and DI Status Button.



Figure 14) Program operation 1 screen menu window



Figure 15) Program operation 2 screen menu window

NO.	Name	Explanation
1	Hold	Hold button. It is only active during driving. Pressing the hold button maintains the set value of the point pressed at any time regardless of the segment setting time and controls it indefinitely. If you press the Hold button again during hold, the hold function is canceled and the program proceeds.
2	Step	Step button. It is only active during driving. Stops the operation of the current segment and proceeds to the next segment operation. If you step during WAIT or HOLD, release the wait or hold and proceed to the next segment immediately.
3	Auto tuning	Auto tuning button. It is only active during driving. However, it cannot be executed during preheating / precooling.
4	User buttons 1, 2	User button. It is activated only when the operation is stopped. The manual defrosting temperature and time setting and whether or not the button is displayed can be changed in the Manual Defrost tab in [Operation Setting].
5	DI status	Enter the screen to display the DI status (if DI occurs, it will enter automatically).
6	Manual defrosting	Manual defrost button. It is activated only when the operation is stopped. The manual defrosting temperature and time setting and whether or not the button is displayed can be changed in the Manual Defrost tab in [Operation Setting].
7	Ambient	Ambient button. It is activated only when the operation is stopped. Ambient temperature and time can be changed in the Manual Defrost tab in [Operation].

### ● Step / Hold

It is activated only during program operation. You can type the key directly, or after set the hold / step in [System Menu] – [DI Configuration] – [Configuration], when the external contact input 5 (DI5) is turned on, it is hold, And when the external contact input 6 (DI6) is turned on, the sept is executed.

Parameter	Contents
스텝	Stops the operation of the current segment and proceeds to the next segment operation. If you step in the current WAIT state or hold, release the wait or hold and proceed to the next segment.
홀드	Pressing the hold button during operation keeps the set value of the point pressed at any time regardless of the set time and controls it indefinitely. If you press the Hold button again during hold, the hold function is canceled and the program proceeds.



- Auto tuning method

- Auto tuning is a function that automatically sets the optimum PID constant by measuring and calculating the characteristics of the controlled object.

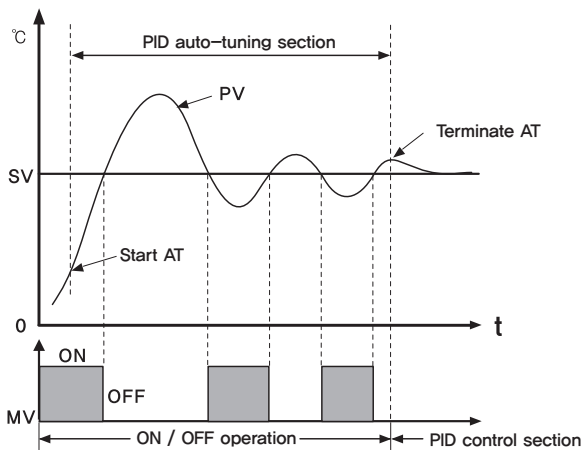
- PID value is obtained by ON / OFF control for 2.5 cycles by its cycle and amplitude.

- Auto tuning is performed for the place where the laboratory is currently operating.

If auto-tuning is performed while operating the high-temperature chamber, auto-tuning proceeds based on the target temperature of the high-temperature chamber. When auto-tuning is performed during operation of the low-temperature chamber, auto-tuning proceeds based on the target temperature of the low-temperature chamber.


- If you need to stop auto tuning in progress, press Auto tuning button again to stop auto tuning.

If auto-tuning is stopped halfway, all calculated values related to the current auto-tuning are not stored. Auto-tuning can be performed for up to 24 hours, and auto-tuning stops automatically if the time is exceeded



### ▶ SD card recording

To record using an SD card, first insert the SD card as shown.



- You can check that the SD card is recognized as shown in the figure.
- If the SD card is not recognized, it can not be recorded using the SD card



## ▶ DI status screen

It is the screen that the DI status button is pressed in the button menu of the operation screen, or it enters automatically when DI occurs. You can check the current DI status.

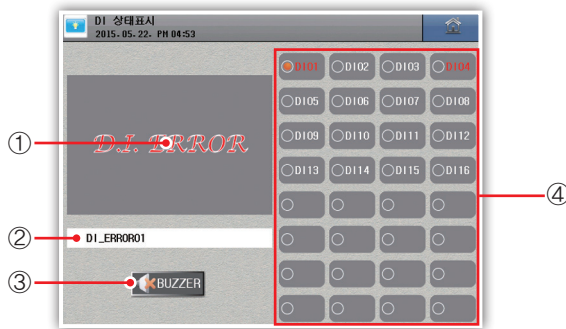


Figure 16) DI status screen

NO.	Description
1	Display the selected DI image. You can copy images from the Error Image tab in [System Menu] – [DI Configuration]. The deletion is possible in the [Delete Image] tab in [System Menu] – [DI Configuration].
2	Displays the selected DI name. ⇒ This can be set on the DI Name tab in [System Menu] – [DI Configuration].
3	Turn off buzzer that sounds when DI occurs.
4	This is the screen to select DI. If DI is displayed in red, it indicates that DI contact is ON.

When you copy an image, the size of the image is 310 X 210.

※ Start operation after DI error

If the operation is stopped due to a DI error during operation, you can select Start from the beginning or Start by pressing the Operation button again.

● Operation screen display message

Message	Description
Program operation is in progress.	—
[High temperature room] Auto tuning is in progress.	—
[Low temperature room] Auto tuning is in progress.	—
HOLD is operating.	—
WAIT operation is in progress.	—
Parameter loading.	—
Manual defrost in progress.	—
Control unit communication error	Communication with control unit is not possible. Check the connection and address.
[High temperature room] Input communication error	High temperature room temperature value of control part Communication is not possible.
[Low temperature room] input communication error	Low temperature room temperature of control part Communication is not possible.
[Laboratory] Input communication error	Control room temperature value communication is not possible.
IO [0] Module communication error	Communication with I / O address 0 module is not possible.
IO [1] Module communication error	Communication with I / O address 1 module is not possible.
IO [2] Module communication error	I / O address No communication with module # 2.
IO [3] Module communication error	I / O address No communication with module # 3.
IO [4] Module communication error	I / O address No communication with module # 4.
IO [5] Module communication error	I / O address No communication with module # 5.
PWM communication error	Communication with PWM module is not possible.
Control section FRAM error	The parameter can not be read from the FRAM of the control section.
Parameter error (CONFIG)	An error has occurred in the general parameter value.
Parameter error (PROG)	Pattern, segment parameter value has an error.
PWM Calibration Error	The PWM calibration value is out of range.

## 2. Operation setting

### ▶ Function setting



Figure 17) Function setting

- 1) Adjust the LCD screen brightness in 8 steps. Press "◀" to make it darker and press "▶" to brighten it.
- 2) It is a function to turn off the back light after a certain period of time if there is no touch input for LCD protection. The time can be set up in minutes.  
If not used, "0" can be set. (It is not related to control and turns on when the screen is touched)
- 3) Select the operation method when returning to power failure.

Parameter	Description
STOP	Operation stopped
COLD	Start operation again from the beginning
HOT	Start operation in the state before power failure

- 4) Turn buzzer sound ON / OFF when touching screen and checking operation.
- 5) Used to limit the touch panel input. It can not be input except the move button.
- 6) It is used to restrict entry to main menu. If you set a password, the password input window appears when you enter the main menu. "0" can be set when not in use.
- 7) Button on the operation screen Set the name of the user button displayed in the menu window.

### [Function setting parameter]

Parameter	Setting Range	Initial Value
Adjust the brightness of the screen	Step 8	Step 3
Power saving operation	0 ~ 99 [min]	30 [min]
Power failure recovery processing	STOP/COLD/HOT	STOP
BEEP sound	Cancellation / setting	setting
Unlock / Unlock Touch Input	Cancellation / setting	Cancellation
Enter Main Menu Password	0 ~ 9999	0
User button 1	Up to 14 letters	-
User button 2	Up to 14 letters	-

- Password input screen

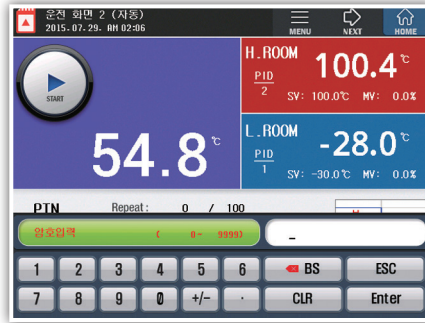


Figure 18) Password input screen

## ▶ Save Settings



Figure 19) Save Settings

- 1) Set the storage period of data.
- 2) Select the data storage medium.
- 3) Select the setting item to be transferred to the SD card.
- 4) Upload / download settings.

### [Save Setting Parameter]

Parameter	Setting Range	Initial Value
Storage cycle (sampling time)	1 ~ 360 [sec]	2 [sec]
Storage medium	Inside, SD, All in all	All in all
Transfer item	Pattern, Para, All	Para
Download	-	-
Upload	-	-

● Upload / download screen

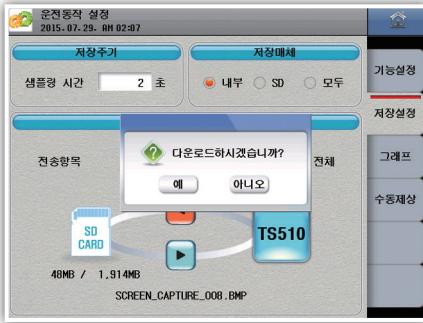


Figure 20) Download screen

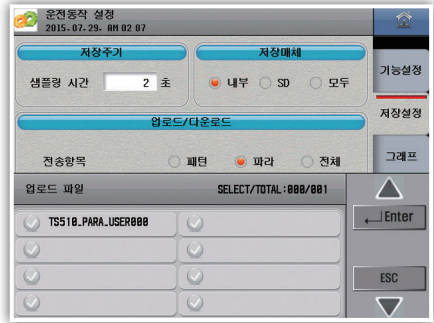


Figure 21) Upload screen

▶ Graph

This setting is related to the graph display on the operation screen 3 and the PV graph view screen.



Figure 22) Graphs

- 1) Select graph display from line and point.
- 2) Select the leading edge of the displayed graph.
- 3) Select the background color of the graph.
- 4) Change the name of file stored in internal memory or SD card.

Parameter	Setting range	Initial Value
Drawing	line, dot	line
Leading	1 pixel, 2 pixels	2 pixels
Background color	Black, White	White
Save file name	Up to 6 characters (alphanumeric, symbol)	TS510_

● Screen according to selection

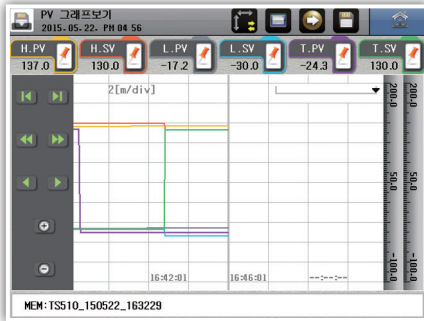


Figure 23) Leading edge -2 pixels

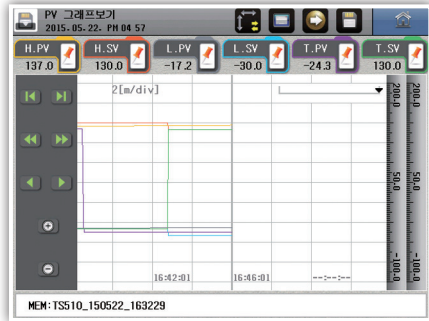


Figure 24) Leading edge -1 pixel

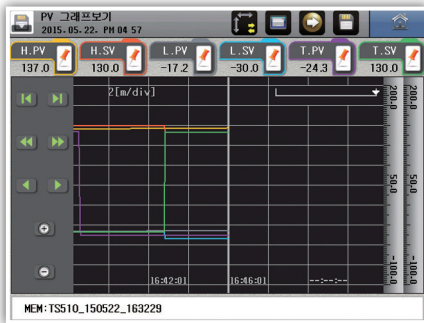


Figure 25) Background color - black

▶ Manual defrosting

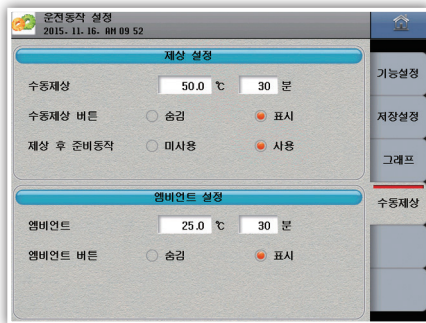


Figure 26) Manual defrosting

- 1) Set the set temperature and operation time in manual defrost operation.
- 2) Set the manual defrost button on / off in the operation screen.
- 3) Set whether to use ready operation after defrosting operation.
- 4) Ambient operation is to control the chamber internal temperature to the set temperature for safety after shutdown.

Parameter	Setting Range	Initial Value
Manual defrost set temperature	Defrost setting temperature lower limit ~ defrosting setting upper limit	50
Manual defrosting operation time	0 to 9999 minutes	30 minutes
Manual defrost button display	Hidden, Display	Hidden
Preparatory operation after defrosting operation	Not used, Use	Use
Ambient setting temperature	Defrost setting temperature lower limit ~ defrosting setting upper limit	25 °C
Ambient operating time	0 to 9999 minutes	30 minutes
Ambient button display	Hidden, Display	Hidden

### 3. View PV graph

It is a screen to check the files saved in internal memory or SD card by graph and to transfer files stored in internal memory to SD card.

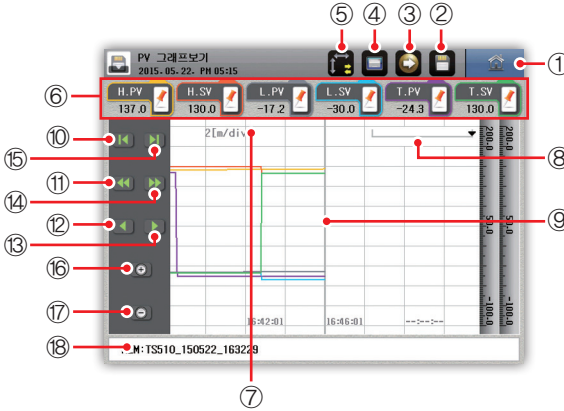


Figure 27) PV graph view – Time axis

No.	Description
1	Go to the menu screen
2	Display the files recorded on the SD card. Up to 512 files (enabled if not saved to SD card)
3	Transfer the data recorded in the internal memory to the SD card. (Enabled if not in internal memory)
4	Displays files recorded in internal memory (Enabled if not in internal memory)
5	Select the time axis, size axis.
6	Shows or hides the graph of the selected value
7	Displays the time per second.
8	Displays the location of the data pointed by the baseline.
9	The baseline on which the values are displayed.
10	Move to the beginning of the data.
11	Moves forward one page.
12	Moves back one pixel. Press and hold to move 10 pixels by 20 pixels.
13	Moves one pixel forward, Press and hold to move 10 pixels by 20 pixels.
14	Go to the next page.
15	Move to the end of the data.
16	Zoom in on the time axis. It is impossible to enlarge beyond the storage period.
17	Zoom out on the time axis. The reduction magnification is x1, x2, x4, x8, x16.
18	Displays the storage location and name of the displayed file. Ex) MEM: TS510_150522_163229 – Displays TS510_150522_163229 file stored in the internal memory.



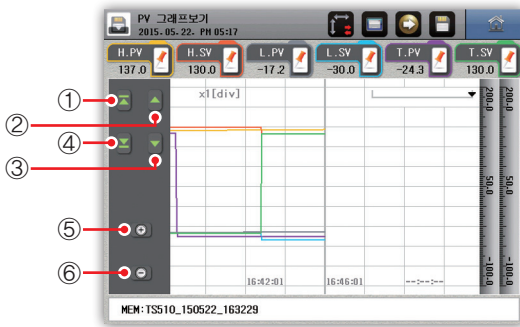


Figure 28) PV graph view – Size axis

No.	Description
1	Moves to the maximum value of the data.
2	Moves back one pixel. Press and hold to move 10 pixels by 20 pixels.
3	Move one pixel forward. Press and hold to move 10 pixels by 20 pixels.
4	Move to the minimum value of the data.
5	Magnify the size axis. The magnification factor is x1, x2, x4, x8.
6	Reduce the size axis. Scaling down to x1 or less is not possible.

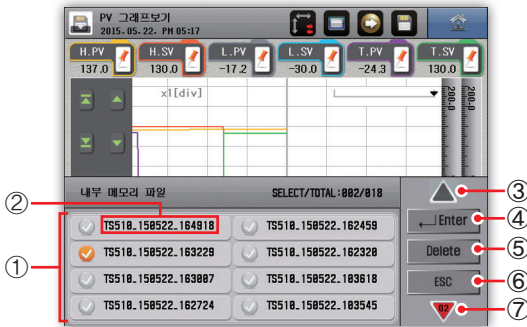


Figure 29) PV graph view – File selection window

No.	Description
1	Select the file.
2	The Saved file name. You can change the file name to save in the graph tab of [Operation Setting].
3	Go to the previous page.
4	Displays the graph of the selected file on the screen.
5	Delete the selected file.
6	Cancel the selection.
7	Go to the next page.

Before start  
Install  
Operation  
Screen layout  
Function setting  
Program  
System settings  
Specification

## 4. Date / time setting

This screen is to set current time and reservation time.



Figure 30) Time setting

NO.	Description
1	Set the current time. Can not be changed while saving.
2	Set the reservation time. If you are stopped at the scheduled time, the driving will start automatically.

### [Current time setting parameter]

Parameter	Setting Range	Initial Value
Year	2000 ~ 2099	-
Month	1 ~ 12	-
Day	1 ~ 31	-
AM / PM	AM, PM	-
Hour	1 ~ 12	-
Min	0 ~ 59	-

### [Reserved Time Setting Parameter]

Parameter	Setting Range	Initial Value
Year	2000 ~ 2099	-
Month	1 ~ 12	-
Day	1 ~ 31	-
AM / PM	AM, PM	-
Hour	1 ~ 12	-
Min	0 ~ 59	-

## 5. Events

It shows the date and time of event history and error history.

The history is stored in the internal memory and can be initialized or copied to the SD card.

### ▶ Events

Up to 80 event histories are displayed. If the event history exceeds 80, the oldest history will be deleted and saved

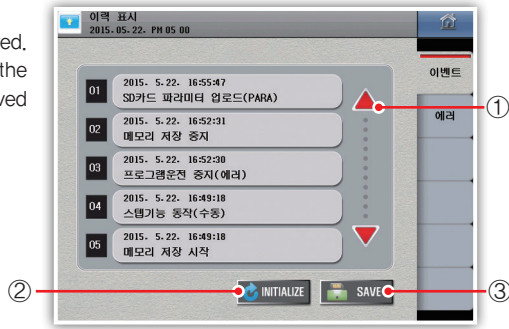


Figure 31) Event history

NO.	Description
1	Moves the page. A total of 80 histories are checked in rotation.
2	Initialize the event history (Activate if not saving).
3	Save the event history to the SD card (Activate if not saving).

Event message	Description
Power on	The TS510 is powered on.
Power off	The TS510 is powered off.
Insert SD card	SD card recognized.
Remove SD card	The SD card has been removed.
Program operation start (manual)	Operation started with RUN button.
Program operation start (communication)	Operation started by communication.
Program operation start (D.I 1)	Operation started by contact input (D.I 1).
Program operation start (D.I 2)	Operation started by contact input (D.I 2).
Program operation stop (manual)	Operation has been stopped with the STOP button.
Program operation stop (communication)	Operation has been stopped by communication.
Program operation stop (D.I 1)	Operation has been stopped by contact input (D.I 1).
Program operation stop (D.I 2)	Operation has been stopped by contact input (D.I 2).
Program operation stop (error)	Operation has been stopped due to an error.
Program operation normal stop	Operation has been completed normally.
Start hold function (manual)	Hold has been started with the HOLD button.
Hold function start (communication)	Hold was started by communication.
Start hold function (D.I 6)	Hold has been started with contact input (D.I 6).
Start hold function (D.I 7)	Hold has been started by contact input (D.I 7).
Hold function disabled (manual)	Hold has been stopped with the HOLD button.
Hold function disabled (communication)	Hold has been stopped by communication.
Stop hold function (D.I 6)	Hold has been stopped by contact input (D.I 6).
Hold function disabled (D.I 8)	Hold has been stopped by contact input (D.I 8).
Step Function Operation (Manual)	The step has been performed with the STEP button.

Event message	Description
Step function Operation (communication)	Step by step communication was carried out.
Step function operation (D,I 5)	The step has proceeded with contact input (D,I 5).
Start high temperature room auto tuning (manual)	High temperature room auto tuning started with the auto tuning button.
High temperature room auto tuning started (communication)	High-temperature room auto tuning started by communication.
High temperature room auto tuning stopped (manual)	High-temperature room auto-tuning has been stopped with the auto-tuning button.
High temperature room auto tuning stopped (communication)	High temperature room auto tuning has been stopped by communication.
High temperature room auto tuning terminated normally	High-temperature room auto-tuning terminated normally.
Low temperature room auto tuning started (manual)	Auto temperature tuning started with the auto tuning button.
Low temperature room auto tuning started (communication)	Low-temperature room auto-tuning started by communication.
Low temperature room auto tuning stopped (manual)	Auto temperature tuning has been disabled by the auto tuning button.
Low temperature room auto tuning stopped (communication)	Low temperature room auto tuning has been stopped by communication.
Low temperature room auto tuning terminated normally	Low-temperature room auto-tuning has been completed normally
Manual Defrost Start (Manual)	Manual Defrost button has triggered manual defrost.
Manual defrost start (communication)	Manual defrosting started by communication.
Manual defrost stop (manual)	Manual defrost has been stopped with manual defrost button.
Manual defrost stop (communication)	Manual defrosting has been stopped by communication.
Start program operation (reservation)	Operation started with reservation function.
Start saving SD card	Saving to SD card has started.
Stop saving SD card	Saving to SD card has stopped.
Stop saving SD card (no memory)	The SD card has been removed and the SD card storage has stopped.
Stop saving SD card (over capacity)	SD card storage has been stopped due to over capacity.
Stop saving SD card (exceeding number of files)	The number of files created on the SDD card has been exceeded and the storage of the SD card has stopped. (Up to 512)
Start saving memory	Saving to internal memory has started.
Stop storing memory	Saving to internal memory has been stopped.
Stop storing memory (over capacity)	The internal memory is over capacity and storage has stopped.
Stop storing memory (exceeding the number of files)	The number of files created in internal memory exceeded and storage stopped. (Up to 512)
Initialize internal memory	The internal memory has been initialized.
Parameter initialization	The parameter has been initialized.
SD card parameter upload (PTN)	Pattern data uploaded to SD card.
Upload SD card parameters (PARA)	You have uploaded parameters to the SD card.
Upload SD card parameters (ALL)	Pattern data and parameters have been uploaded to the SD card.
Parameter initialization (SUM ERROR)	The parameter has been initialized due to an error.
Initialize event history	Event history has been initialized.
Error history initialization	The error history has been reset.
Upload user logo	I uploaded the user log.
User Button 1 Action	User button 1 has been activated.
User Button 2 Action	User button 2 has been activated.
Off User Button 1	User button 1 has been off
User button 2 off	User button 2 has been off

## ▶ Error

Up to 40 error histories are displayed.

If the error history exceeds 40, the oldest history will be deleted and saved.

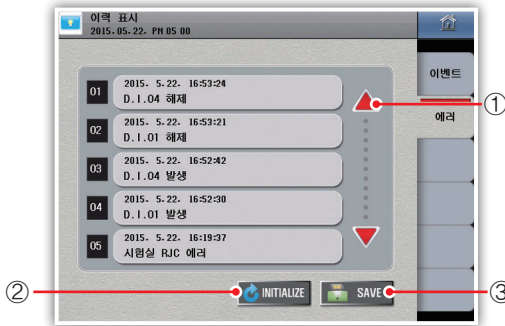


Figure 32) Error History

NO.	Description
1	Moves the page. A total of 40 histories are checked in rotation.
2	Initialize the error history. (Activate if not saving)
3	Save the error history to the SD card. (Activate if not saving)

Error message	Description
High-temperature chamber sensor disconnection.	High temperature room sensor disconnected.
High-temperature room RJC error.	High temperature chamber RJC sensor error occurred.
High Temperature Room ADC Error.	A high temperature room AD converter error has occurred.
High temperature room calibration error	High temperature room calibration is incorrect.
High temperature room input connection error	The controller does not communicate with the high-temperature room sensor value.
Low temperature chamber sensor break	Cold room sensor is disconnected.
Low temperature room RJC error	Low temperature chamber RJC sensor error occurred.
Low temperature chamber ADC error	Low temperature room AD converter error occurred.
Low temperature room calibration error	The cold room calibration is incorrect.
Low temperature chamber input connection error	Communication between control unit and low-temperature room sensor value is not possible.
Laboratory sensor break	The laboratory sensor is disconnected.
Laboratory RJC error	Laboratory RJC sensor error has occurred.
Laboratory ADC error	A laboratory AD converter error has occurred.
Laboratory calibration error	The laboratory calibration is incorrect.
Laboratory input connection error	The control unit and the laboratory sensor value can not communicate.
I / O [n] connection error	I / O [n] is not connected.
PWM connection error	No communication with the PWM module.
D.I.n occurrence	Contact input (D.I n) has occurred.
D.I.n off	Contact input (D.I n) has been released.
S. Alarm occurrence	System alarm (alarm n) has occurred.
S. Alarm n off	The system alarm (alarm n) has been cleared.
FRAM error in control unit	A FRAM error occurred in the control unit.
Parameter error (CONFIG)	A parameter error has occurred.
Parameter error (PROG)	Pattern parameter error occurred.

PWM calibration error	Incorrect PWM calibration.
Elevator error occurred	An elevator signal error has occurred.
High temperature chamber damper error occurred	High Temperature Room damper opening signal error occurred.
High Temperature Room closing damper error occurred	High Temperature Room damper closing signal error occurred.
Laboratory Open Damper Error	A test damper open signal error has occurred.
Laboratory closed damper error	A laboratory damper close signal error has occurred.
Low temperature chamber open damper error	Low temperature chamber damper open signal error occurred.
Cold Room Closed Damper Error	Low temperature chamber damper closing signal error occurred.

## Program

This screen is used to set parameters related to program control.  
 It is composed of the following groups when you click [Program] in [Main Menu Screen].



Figure 33) Main menu



Figure 34) Program menu

NO.	Setting range	Initial value
1	Pattern setting	Go to the screen to set the pattern.
2	Pattern management	Move to the screen to set pattern standby, auto defrost, pattern copy / delete.
3	Pattern name setting	Moves to the screen for setting the pattern name.
4	Time signal setting	Go to the screen for setting the time signal.

# 1. Pattern setting

Set Pattern Type, Repeat, Connection Pattern, End Mode, Preheat / Preheating, Temperature Value, Time, Wait Use, and Time Signal according to pattern number.

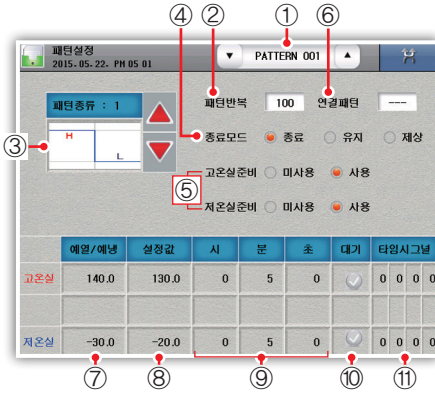


Figure 35) Pattern setting – elevator method



Figure 36) Pattern setting – Damper method

- 1) Set the pattern number. You can change the pattern number by using "▼", "▲" or directly input.
- 2) Set the repeat count of the set pattern. Setting "9999" will repeat indefinitely.
- 3) Change the test type of the pattern.

Chamber Type	Pattern Test Type
Elevator system (2 zones)	1 ~ 2 times (2 kinds)
Damper system (3 zones)	1~ 10 times (10 kinds)

\* The chamber type can be changed in the Memory & Specifications tab of [System Menu] – [System].

Code	Test Type	Code	Test Type
①		⑥	
②		⑦	
③		⑧	
④		⑨	
⑤		⑩	

- 4) Set the operation after the operation is finished.

Off mode	Description
End	Operation stops after the set number of repetitions
Maintain	Held in last test state
Defamation	Defrosting operation after the set number of repetitions

- 5) Set the use of operation preparation operation for high temperature room and low temperature room.
- 6) Connection Set test pattern number to operate.

Before start

Install

Operation

Screen layout

Function setting

Program

System settings

Specification

- 7) Set the preheating / preheating temperature of the segment.
- 8) Set the temperature of the segment.
- 9) Set the operation time of the segment.
- 10) Set whether or not to use wait operation of the segment. When activated, it compares the measured value at the start of the segment with the preset temperature and waits for the maximum waiting time if it is not within the waiting range. The standby temperature and time can be set in the Pattern Information tab of [Program] – [Pattern Management]. (Seg time is stopped)
- 11) Displays the time signal setting status. You can set the detailed time signal by pressing the corresponding position. Select the time signal set in [Program] – [Time signal setting].  
Time signals can be assigned 4 points per segment.



Figure 37) Pattern setting – Time signal

[Pattern setting parameter]

Parameter	Setting range	Initial Value
Pattern number	1 ~ 100	1
Pattern type	1 ~ 10	1
Pattern repeat	1 ~ 9999	100
Connection pattern	0 ~ 100	0
Off mode	Off / Maintenance / Defrost termination	Off
Prepare a high-temperature room	Not use / use	Use
Prepare the cold room	Not use / use	Use
High temperature preheating temperature	High Temperature Room Temperature Range (Sensor Input – Input Limit)	0 [°C]
High temperature room temperature setting	High Temperature Room Temperature Range (Sensor Input – Input Limit)	0 [°C]
High Temperature Room Operating Time - Hour	0 ~ 9999 [hour]	0 [hour]
High Temperature Room Driving Time - Minutes	0 ~ 59 [min]	0 [min]
High Temperature Room driving time - sec	0 ~ 59 [sec]	0 [sec]
High Temperature Room hold	Inactive / Active	Inactive
High-Room Time Signal	Each 0 ~ 19	0/0/0/0
Laboratory setting temperature	Test set temperature range (sensor input – input limit)	0 [°C]
Laboratory hours - hours	0 ~ 9999 [hour]	0 [hour]
Laboratory hours - minutes	0 ~ 59 [min]	0 [min]
Laboratory hours - sec	0 ~ 59 [sec]	0 [sec]
Laboratory room hold	Inactive / active	Inactive
Laboratory time signal	Each 0 ~ 19	0/0/0/0
Cold room preheat temperature	Cold room set temperature range (sensor input – input limit)	0 [°C]
Cold room set temperature	Cold room set temperature range (sensor input – input limit)	0 [°C]
Low temperature room operation time - hour	0 ~ 9999 [hour]	0 [hour]
Low temperature room operating time - minute	0 ~ 59 [min]	0 [min]
Low temperature room operation time - sec	0 ~ 59 [sec]	0 [sec]
Cold room standby	Inactive / active	Inactive
Cold room time signal	Each 0 ~ 19	0/0/0/0



## 2. Pattern management

### ▶ Pattern information

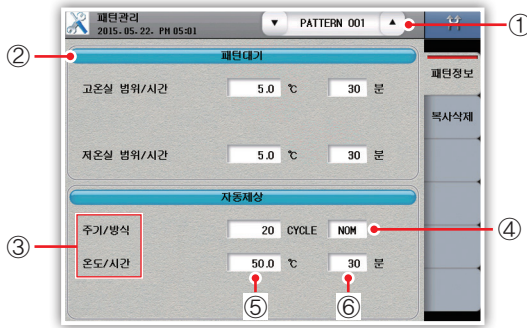


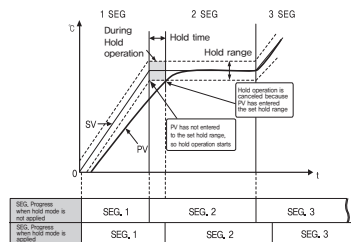
Figure 38) Pattern information

- 1) Set the pattern number. You can change the pattern number by using "▼", "▲" or directly input. Pattern standby and automatic defrosting can be set for each pattern.
- 2) In [Program] – [Pattern Setting], set the temperature and time to use for comparison operation when standby operation is activated. Waiting indefinitely when "9999" is entered.
- 3) Set defrosting cycle for defrosting in low temperature room. Automatic defrosting is not performed when "0" is input.
- 4) Set the automatic defrosting method.

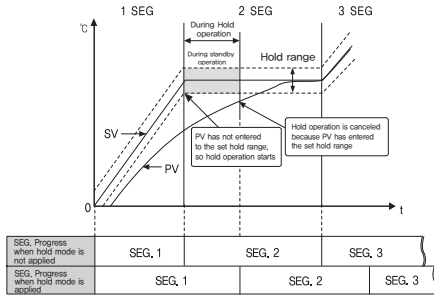
Automatic defrosting method	Description
FST	Proceed with the next segment (non-low temperature operation) test during defrost operation. While the defrost operation is complete and the temperature of the low temperature chamber is warmed up again to the preheating temperature, the high temperature room wait time of the test sample may be prolonged. At the start of the test, the test is started as soon as the first segment is warmed (or pre-cooled).
NOM	It does not move to the next segment until it performs the defrosting operation and returns to the pre-cooling temperature. At the start of the test, both preheating and preheating must be done before the test starts. (The test sample during the defrosting operation is located in the cold chamber or the test chamber)

- 5) Set the target temperature of low temperature room for automatic defrosting operation.
- 6) Set the automatic defrost time. The defrost time is applied after reaching the defrost target temperature value.

- Hold operation



If the process value (PV) is not entered to the hold range, wait for the process value (PV) to enter the hold range during the set hold time



After the waiting time has elapsed, proceed to the next segment even if the measured value (PV) is not within the standby range.

▶ Delete copy



Figure 39) Copy / Delete pattern

- 1) Select the original pattern to be copied.
- 2) Select the target pattern to be copied.
- 3) Copy the pattern.
- 4) Select one pattern number to delete.
- 5) Delete the selected pattern.
- 6) Delete the entire pattern

[Copy delete parameter]

Parameter	Setting Range	Initial Value
Original pattern number	1 ~ 100	1
Copy pattern number	1 ~ 100	1
Delete pattern number	1 ~ 100	1

### 3. Pattern name setting



Figure 40) Pattern name

- 1) Move the page. You can set up to 8 pattern names per page.
- 2) Change the pattern name. If your language is Korean, you can change "Korean → English capital letter → English small letter" through Caps. If your language is English / Chinese, you can enter "English capital letter → English small letter."

#### [Pattern name parameter]

Parameter	Setting Range	Initial Value
Pattern name nn	Up to 23 characters	PATTERN NAME nn

nn : 1 ~ 100

## 5. Time signal setting

Time signal has ON / OFF action and time action, and total 20 can be set. TS0 can be set to OFF, TS1 can be set to ON, TS2 to TS19 to set time.

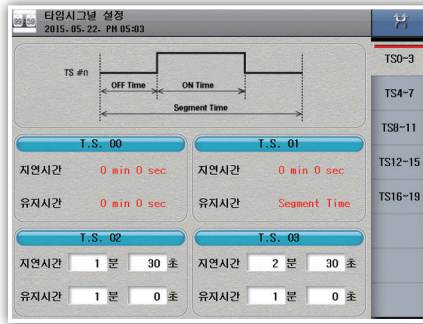


Figure 41) Time signal

- 1) Set the delay time (OFF Time). The time signal is turned ON after a delay of the set time from the start point of the segment.
- 2) Set the ON time. The time signal is turned on for the set time from the time the corresponding segment is turned on.

### [Time signal parameter]

Parameter	Setting Range	Initial Value
Delay time	0 ~ 9999 minutes 59 seconds	0 minutes 0 seconds
Holding time	0 ~ 9999 minutes 59 seconds	0 minutes 0 seconds

#### ● Time signal operation

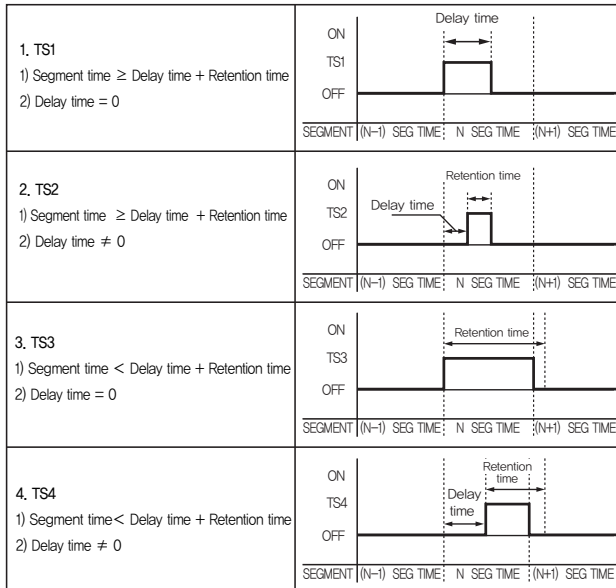


Figure 42) Time signal operation

# System settings

## ▶ Enter system setting



1. The system setting does not need to be set by the operator.
2. Special care must be taken when the operator changes the system setting value, which may cause malfunction of the device.



Figure 43) Enter system settings

- The initial value of the password is set to "0".
- To restrict general user access, press system icon to enter system setting screen and change user password.

# 1. Sensor input setting

## ▶ Input setting

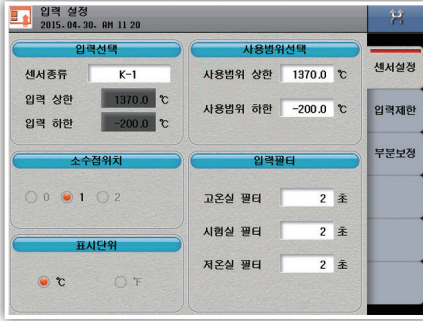


Figure 44) Sensor configuration (TC-K)



Figure 45) Sensor change

- 1) Sensor type
  - Select the sensor type. Can not be changed while saving.
  - When changing the type of sensor, related parameter (usage range) is initialized.
- 2) Range of use
  - Enter the value of the range you want to use. Can not be changed while saving.
- 3) Decimal point position
  - If the sensor is DCV, set the decimal point position.
  - When the sensor is RTD or TC, the decimal point position is fixed according to the sensor.
- 4) Input filter
  - Input the digital filter value of the input.
- 5) Display unit
  - Set the display unit. (°C, Ω, V, mV, %, user)
  - You can select a user and input characters directly. Can not be changed while saving.

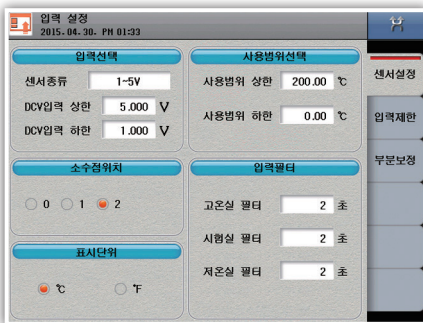


Figure 46) Sensor configuration (DCV)



Figure 47) Sensor change

- 1) DCV input upper / lower limit
  - If the sensor is DCV, set the DC voltage input value. Can not be changed while saving.

Parameter	Setting Range	Initial Value
Sensor type	Refer to range table by sensor type	K-1
TC / RTD upper limit DCV input upper limit	TC / RTD is not input Within DCV sensor range	Input upper limit
TC / RTD lower limit DCV input lower limit	TC / RTD is not input Within DCV sensor range	Input lower limit
Usage range upper limit	EU (0.0 % ~ 100.0 %)	EU (100 %)
Usage range lower	EU (0.0 % ~ 100.0 %)	EU (0 %)
Decimal point position	0, 1, 2	1
Input filter	0 ~ 120 [sec]	0 [sec]
Display unit	℃, Ω, V, mV, %, user	℃
User	Character input (up to 6 characters)	UNITnn

## ▶ Input limit



Figure 48) Input limits

- 1) Set the high temperature room setting temperature input range. [Refer to range table by sensor type]
- 2) Set the test room temperature input range [Refer to range table by sensor type]
- 3) Set the low temperature room set temperature input range [Refer to range table by sensor type]
- 4) Set defrost set temperature input range [Refer to range table by sensor type]
- 5) Correct the sensor input value in the test room, high temperature room, and low temperature room.

Parameter	Setting Range	Initial Value
High temperature room temperature upper limit	EU (0.0 % ~ 100.0 %)	EU (100.0 %)
High temperature room temperature lower limit	EU (0.0 % ~ 100.0 %)	EU (0.0 %)
Laboratory set temperature upper limit	EU (0.0 % ~ 100.0 %)	EU (100.0 %)
Laboratory setting Temperature Lower limit	EU (0.0 % ~ 100.0 %)	EU (0.0 %)
Low temperature room set temperature upper limit	EU (0.0 % ~ 100.0 %)	EU (100.0 %)
Low temperature room set temperature Lower limit	EU (0.0 % ~ 100.0 %)	EU (0.0 %)
Defrost setting temperature upper limit EU	EU (0.0 % ~ 100.0 %)	100.0 [℃]
Defrost setting temperature lower limit EU	EU (0.0 % ~ 100.0 %)	-10.0 [℃]
High-temperature room correction value	EUS (-100.0 % ~ 100.0 %)	EUS (0.0 %)
Laboratory calibration value	EUS (-100.0 % ~ 100.0 %)	EUS (0.0 %)
Low temperature room correction value	EUS (-100.0 % ~ 100.0 %)	EUS (0.0 %)

## ▶ Partial correction

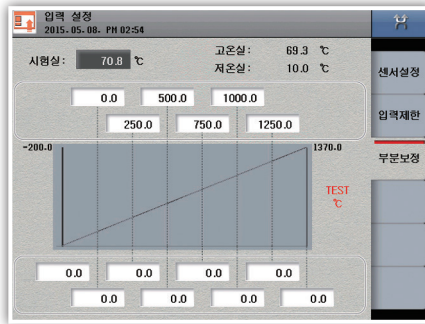


Figure 49) Partial compensation

- 1) Correction value
  - Correct the deviation that may occur in the temperature measurement.
- 2) Interval correction
  - It is used when error correction is required for each section.
  - Set the temperature for the reference point for which you want to calibrate the temperature.
  - Set the correction temperature at each reference point.

Parameter	Setting Range	Initial Value
Partial correction value	-50.0 ~ 50.0	0 [°C]



- Since the partial correction changes the slope of the section, it is necessary to set the section according to the purpose.



## 2. Setting control / transmission output

### ▶ Control output



Figure 50) Control output

- 1) Output type
  - Set the control output type.
- 2) SSR cycle
  - When the control output is "SSR", set the cycle for control output operation.
- 3) Output direction
  - Set positive action or negative action.
- 4) Overload protection
  - You can set the overload protection ratio.

#### [Control output parameter]

Parameter	Setting Range	Initial Value
Output type	SSR, SCR	SSR
SSR cycle	1 ~ 1000	2
Output direction	Forward operation, Reverse operation	Reverse operation
Anti Reset Windup value	50 % ~ 1000 %	100 [%]

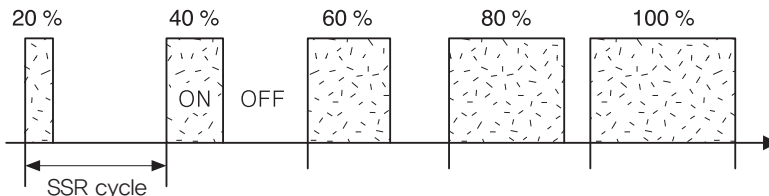


Figure 51) SSR Output Operation

This is an example of output from 20% to 100% when voltage pulse output [SSR] is selected. Depending on the voltage pulse output period, the control output turns on for a certain time and the remaining time turns off.

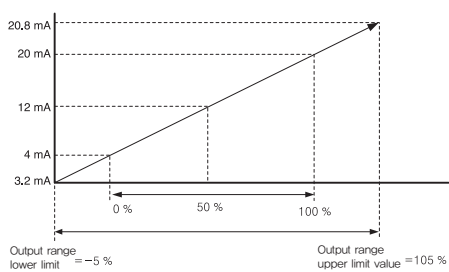


Figure 52) Current Output (SCR)

Show the relation between manipulated value (MV) and output range when current output is selected. When inputting  $-5\%$  to the lower limit,  $3.2\text{ mA d.c.}$  is output. If you enter  $105\%$  in the upper limit value,  $20.8\text{ mA d.c.}$  is output. The control output value within that range is linearly converted and output.

► Transmission output



Figure 53) Transmission output

- 1) Output type
  - Set the transmission output type. The output signal is  $4 - 20\text{ mA d.c.}$  It can be selected from PV, laboratory SV, high temperature room PV, low temperature room PV.
- 2) Output range
  - Set the upper and lower limits of the temperature transmission output range.
- 3) Temperature disconnection output
  - Select either  $0\text{ mA}$  or  $4\text{ mA}$

[Transmission output parameter]

Parameter	Setting Range	Initial
Output type	Laboratory PV / SV, High temperature room PV, Low temperature room PV	Laboratory PV
Output range upper limit	EU(0.0 % ~ 100.0 %)	EU (100.0 %)
Output range Lower limit	EU(0.0 % ~ 100.0 %)	EU (0.0 %)
Disconnection output	0 mA, 4 mA	0 mA

### 3. PID Setting

#### ▶ PID setting



Figure 54) PID setting

#### 1) A.T. GAIN

– It is used to finely optimize manually the P,I,D values automatically calculated by the constant value applied to each item of P,I,D during PID operation.

#### 2) ON/OFF HYS

– Set the hysteresis (width) for auto-tuning or ON / OFF control.

#### 3) Set whether to use auto tuning on the operation screen.

Parameter	Setting Range	Initial Value
High temperature room / low temperature room A.T. GAIN	0,1 ~ 10,0	1.0
High temperature room / low temperature room HYS.	EUS(0,0 % ~ 100,0 %)	2.0 [°C]
AT display	Hidden, Display	Display

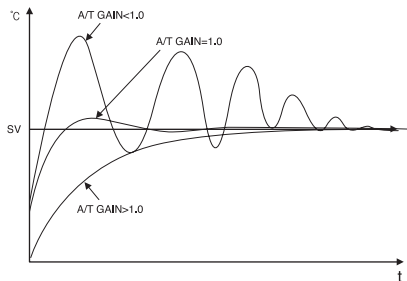


Figure 55) Change of control characteristic according to auto tuning gain (PV)

#### ● Auto tuning gain (A / T Gain)

Condition	Unit
GAIN < 1,0	Differential and integral control operation that is stronger than the auto-tuned PID value makes the overall response speed faster, but hunting can be severe.
GAIN = 1,0	The auto-tuned PID value is used as is.
GAIN > 1,0	It performs differential and integral control operation less than auto-tuned PID value, which slows overall response speed, but can reduce overshoot and become more stable.

▶ PID area



Figure 56) PID area

- 1) Temperature range value
  - Press the number to go to the corresponding PID group setting screen
- 2) Set the boundary value to distinguish the zone PID for the whole range.
- 3) High temperature room deviation value
  - Set to use Deviation PID when operating in high temperature room (Not operating if deviation value is 0). Set value - temperature value) Controlled by PID4 group when the value is high temperature room deviation value.
- 4) Low temperature room deviation value
  - Set to use Deviation PID when operating in low temperature room (Does not work if deviation value is 0) Set value - Temperature value) Control in PID4 group when the value is in the low temperature room deviation value.

▶ PID value

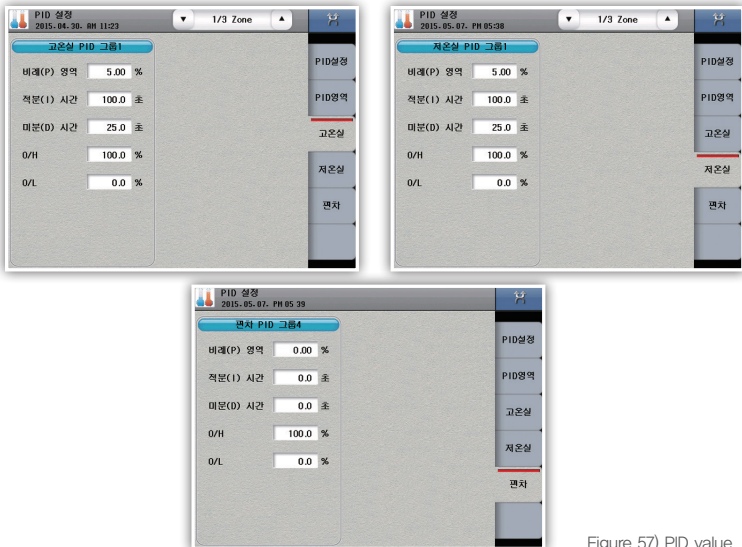


Figure 57) PID value

1) Proportional (P) region

– Set the proportional band. If the proportional band is large, the control output amount for the deviation is small and the time to reach the set value is slow. If the proportional band is small, the control output is large and reaches the set value quickly, but if it is too narrow, hunting occurs.

2) Integral (I) time

– Set the integral time. The proportional control only produces a deviation (Offset). In this case, If the integration time is too long, it will reach the latter. The shorter the integration time, the more hunting will occur.

3) Differential (D) time

– Set differential time. The control output proportional to the slope of the temperature change due to the correction operation against the sudden temperature change. The longer the derivative time, the stronger the correction.

4) Output upper limit (O / H)

– Set upper limit of output range.

5) Output lower limit (O / L)

– Set the lower limit of the output range.

Parameter	Setting Range	Initial Value
Proportional (P) area	0.00 ~ 100.00	5.00 [%]
Integral (I) time	0.0 ~ 3000.0	100.0 [sec]
Differential (D) time	0.0 ~ 3000.0	25.0 [sec]
Output upper limit	0.00 ~ 100.00	100.0 [%]
Output lower limit	0.00 ~ 100.00	0.0 [%]

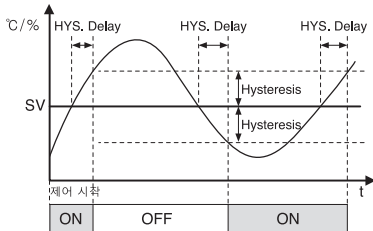


Figure 58) ON / OFF control

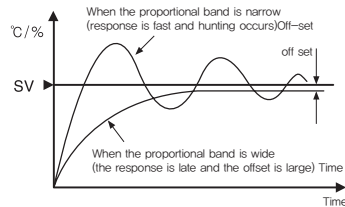


Figure 59) Proportional control (P control)

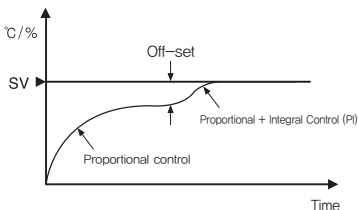


Figure 60) Proportional / proportional and integral control (P control / P.I) control

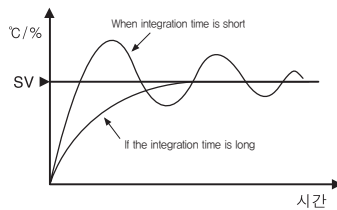


Figure 61) Proportional Integral Control (P.I Control)

## 4. Inner Signal

### ▶ Inner signal setting

- Set the target, range direction, and type for each inner signal.
- A total of 16 inner signals can be set.

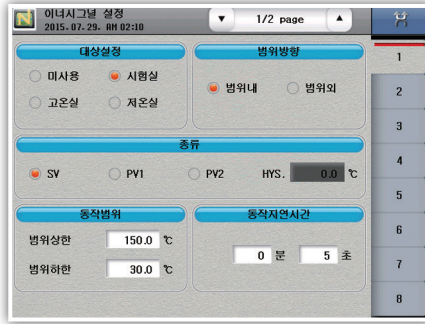


Figure 62) Inner signal

- 1) Target setting
  - Sets the application of the inner signal.
- 2) Range direction
  - Set the operating range of the temperature to use the inner signal.
- 3) Type
  - Sets the application type of inner signal.
  - S.V: It operates based on target set value.
  - P.V1: It operates based on the operating range of "L" and "H" for measured value.
  - P.V2: It operates based on the set value and hysteresis value of measured value.
- 4) Operating range
  - Set the upper and lower limits of the operating range of the applicable object.
- 5) Operation delay time
  - Set the operation delay time of the applicable target.

Parameter	Setting Range	Initial Value
Target setting	Unused, Laboratory, high temperature room, low temperature room	Unused
Range direction	Within range , Out of range	Within range
Type	SV, PV1, PV2	SV
Hysteresis	EUS(0.0 % ~ 100.0 %)	EUS (0.0%)
Operating range Upper limit	Channel EU (0.0 % ~ 100.0 %)	EU (0.0 %)
Operating range Lower limit	Channel EU (0.0 % ~ 100.0 %)	EU (0.0 %)
Operation delay time	0 ~ 9999 minutes 59 seconds	0 minutes 0 seconds

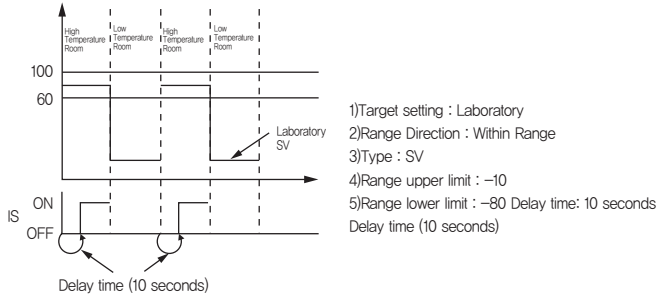


Figure 63) Inner1 inner signal setting example

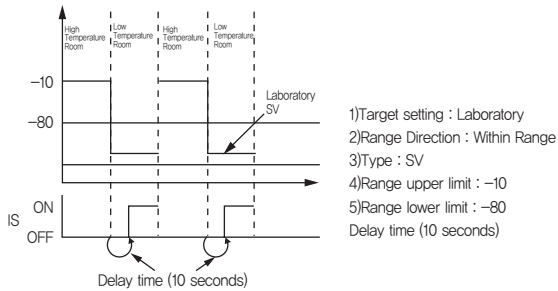


Figure 64) Inner2 inner signal setting example

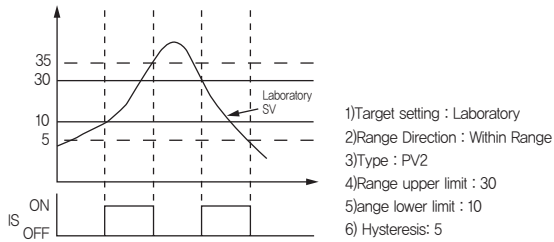


Figure 65) Inner3 inner signal setting example

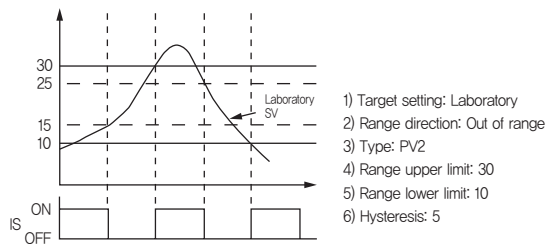


Figure 66) inner4 inner signal setting example

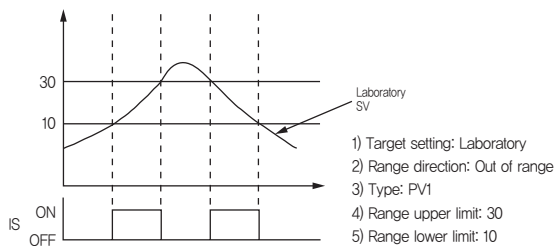


Figure 67) inner5 inner signal setting example

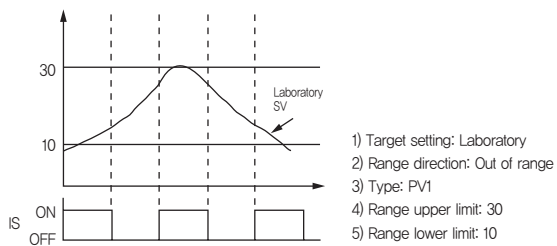


Figure 68) inner6 inner signal setting example)



# 5. System alarms

## ▶ Alarm setting

Total of 8 alarm signals can be set.

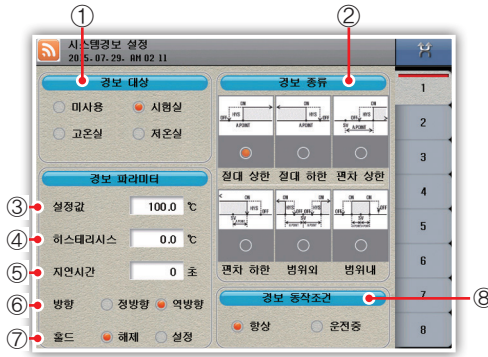
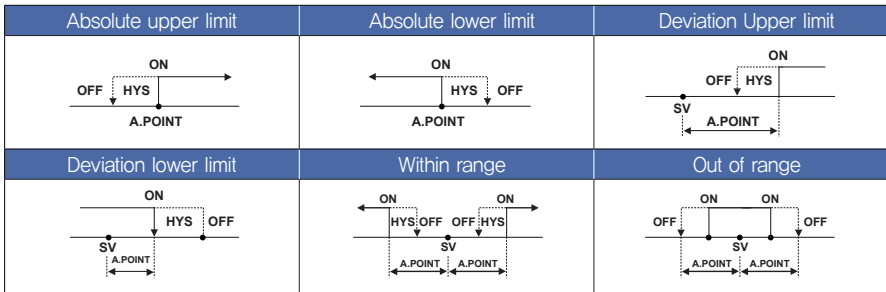


Figure 69) System alarms

- 1) Select the alarm target
- 2) Select the alarm type.
- 3) Set the set value (Deviation value).
- 4) Set the hysteresis.
- 5) Set the delay time.
- 6) Set the alarm direction, NORMAL OPEN, NORMAL CLOSE
- 7) Set the Hold function
- 8) Alarm operation condition
  - Set alarm operation condition.
  - Always: Always execute alarm action.
  - During operation : Execute the alarm operation only when it is in operation



### [System alarm parameter]

Parameter	Setting Range	Initial Value
Alarm target	Unused, laboratory, high temperature room, low temperature room	Unused
Alarm type	Absolute upper limit, absolute lower limit, deviation upper limit, deviation lower limit, Out of range, within range	0
Setting value (deviation value)	Absolute upper limit, absolute lower limit Deviation upper limit, Deviation lower limit Out of range, within range: EUS	0.0 [°C]
Hysteresis	EUS(0.0 % ~ 100.0 %)	EUS (0.0%)
Delay time	0 ~ 9999[sec]	0
Direction	Forward, Reverse	Forward
Hold	Unhold, Set	Unhold

Before start  
 Install  
 Operation  
 Screen layout  
 Function setting  
 Program  
 System settings  
 Specification

## 6. DI Configuration

The DI configuration consists of a total of 7 tabs, which set the DI function and the behavior of each DI signal. TS510 has IO specification as option and the number of DIs that can be set according to the option is limited. Please check the IO specification of the product.

### ▶ Common

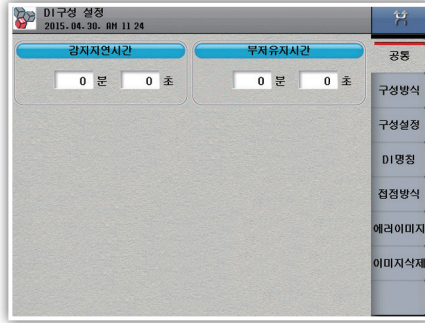


Figure 70) DI common

- 1) Detection delay time
  - Enter the delay time after DI occurs.
- 2) Buzzer holding time
  - Enter the time for the buzzer to be maintained when a DI error occurs.

Parameter	Setting Range	Initial Value
Detection delay time	0 ~ 9999 minutes 59 seconds	0 seconds
Buzzer holding time	0 ~ 9999 minutes 59 seconds	0 seconds

## ▶ Configuration



Figure 71) D1 Configuration 1

### 1) D1 operation method

- Set the function for D1 operation.
- Error: Use D1 operation as an error
- Run / Stop (RUN / STOP): ON point: Operation start, OFF point: Operation stop

### 2) D12 operation method

- Set the function for D12 operation.
- Error: Use D12 operation as an error
- Toggle operation (RUN\_Toggle): Each time the contact is attached, the operation is stopped. → Stop → Run → Stop repeated

### 3) Operation method of D13

- Set the function for D13 operation.
- Error: Use D13 operation as an error
- High-temperature room ELV (ELV,H): Elevator high-temperature room position detection input, elevator maximum travel time setting function

### 4) D14 operation method

- Set the function for D14 operation.
- Error: Use D14 operation as an error
- Low temperature room ELV (ELV,L): Elevation low temperature room position detection input, elevator maximum movement time setting function

### 5) D15 operation method

- Set the function for D15 operation.
- Error: Use D15 operation as an error
- Step (STEP): STEP action

### 6) D16 operation method

- Set the function for D16 operation.
- Error: Use D16 operation as an error
- Hold (HOLD): ON point: Hold start, OFF point: Hold release

## [D1 configuration method parameter]

Parameter	Setting Range	Initial Value
D1 operation method	Error, operation / stop	Error
D12 operation method	Error, toggle operation	Error
D13 operating method	Error, high temperature room ELV	Error
D14 operating method	Error, cold room ELV	Error
D15 Operation method	Error, step	Error
D16 Operation method	Error, hold	Error



Figure 72) DI Configuration Method 2

1) DI7 operation method

- Set the function for DI7 operation,
- Error: Use DI7 operation as an error
- Hold ON (HOLD\_ON): Hold contact once

2) DI8 operation method

- Set the function for DI8 operation,
- Error: Use DI8 operation as an error
- Hold OFF (HOLD\_OFF): Hold is released once contact is closed

3) Operation method of DI9 / DI10

- Set the function for DI9 / DI10 operation,
- Error: Use DI9 / DI10 operation as an error
- PS,0 / PS,1: Test pattern selection (0 or PTN1 ~ 3 selection) Operation stopped, reflected at the time when DI9 & DI10 input state changes

[DI configuration method parameter]

Parameter	Setting Range	Initial Value
DI7 operation method	Error, hold ON	Error
DI8 Operation method	Error, hold OFF	Error
DI9 Operation method	Error,	Error
DI10 Operation method Error	test pattern selection (1 ~ 3) Error	Error



Figure 73) DI Configuration Method 3

1) DI11 operation method

- Set the function for DI11 operation.
- Error: Use DI11 operation as an error
- High greenhouse damper ON (DMP,H OPEN): High temperature greenhouse damper position detection input, maximum operation time setting function

2) Operation method of DI12

- Set the function for DI12 operation.
- Error: Use DI12 operation as an error
- High temperature room damper OFF (DMP,H CLOSE): High temperature room closed damper position detection input, maximum operation time setting function

3) Operation method of DI13

- Set the function for DI13 operation.
- Error: Use DI13 operation as an error
- Test room damper ON (DMP,R OPEN): Input of test room open damper position detection, maximum operation time setting function

4) Operation method of DI14

- Set the function for DI14 operation.
- Error: Use DI14 operation as an error
- Laboratory damper OFF (DMP,R CLOSE): Closed damping position detection input, maximum operation time setting function

5) DI15 operation method

- Set the function for DI15 operation.
- Error: Use DI15 operation as an error
- Low temperature chamber damper ON (DMP,L OPEN): Low temperature chamber open damper position detection input, maximum operation time setting function

6) DI16 operation method

- Set the function for DI16 operation.
- Error: Use DI16 operation as an error
- Low temperature chamber damper OFF (DMP,L CLOSE): Low temperature chamber closed damper position detection input, maximum operation time setting function

[DI configuration method parameter]

Parameter	Setting Range	Initial Value
DI11 operation method	Error, high temperature chamber damper ON	Error
DI12 operation method	Error, high temperature chamber damper OFF	Error
DI13 Operation method	Error, Laboratory damper ON	Error
DI14 Operation method	Error, Laboratory damper OFF	Error
DI15 Operation method	Error, low temperature chamber damper ON	Error
DI16 operating method	Error, low temperature chamber damper OFF	Error

## ▶ Configuration Settings

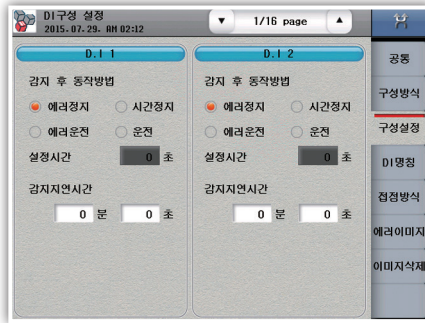


Figure 74) DI Configuration Settings

### 1) How to operate after detection

- Error stop: If a DI error occurs, a DI error screen is generated and operation stops.
- Time stop: If a DI error occurs, a DI error screen is generated and operation stops after the set time has elapsed.
- Error operation: If DI1 error occurs, DI error screen is generated and operation continues.
- Driving: If a DI error occurs, DI error screen is not generated and operation continues.
- Setting time: If the time is stopped, the operation stops after the set time has elapsed.
- Detection delay time: Set delay time for each DI.

Parameter	Setting Range	Initial Value
Operation method after detection	Error stop, time stop, error operation, operation	Error stop
Setting time	0 ~ 9999 sec	0 sec
Detection delay time	0 min 0 sec ~ 9999 min 59 sec	0 min 0 sec

### ▶ DI Name



Figure 75) DI name

- 1) Enter the DI error name directly. (Korean, English, numbers, symbols)
- 2) Input DI error name is displayed on DI error screen when error occurs.
- 3) The DI error name can be entered up to 24 characters (up to 12 characters)

Parameter	Initial Value	Setting Range	Unit
DI Error Name	DI_ERRORnn	Korean, English, Number, Symbol	

## ▶ Contact method



Figure 76) DI contact method

- 1) Set the DI contact method.
  - A contact: DI is activated when DI contact occurs (Normal Open)
  - B contact: DI is activated when DI contact is released (Normal Close)

## ▶ Error Image

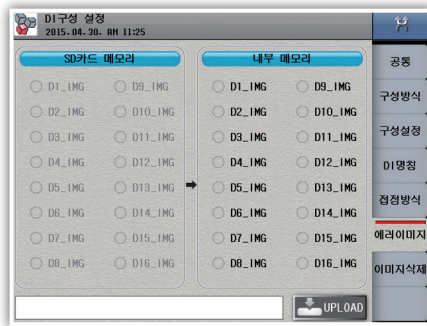


Figure 77) DI Error Image Setting

In case of DI error, user image uploaded to internal memory is displayed. If there is no user image in the internal memory, the default image is displayed.

- 1) Status display window : It shows upload progress status.
- 2) Upload (UPLOAD) : Uploads the selected image from the screen to the internal memory among the image files stored on the SD card (Not available during storage)



Danger

The error image file must be in resolution 310 x 210 and file name Dnn\_IMG.bmp (eg D1\_IMG.bmp, D12\_IMG.bmp). The file must be placed in the "TS510 \ DI\_IMG" folder in the SD card root directory. Otherwise, the upload will not run.

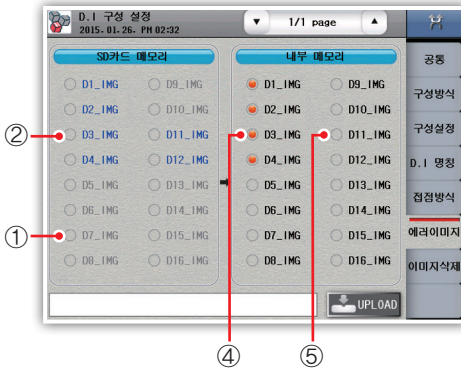


Figure 78) Upload DI error image



Figure 79) DI error Check image upload

- 1) There is no user image on the SD card.
- 2) There is a user image on the SD card.
- 3) Select the user image to be uploaded from the SD card to the internal memory.
- 4) There is a user image that was previously uploaded to the internal memory.
- 5) There is no user image in the internal memory.

### ▶ Delete image

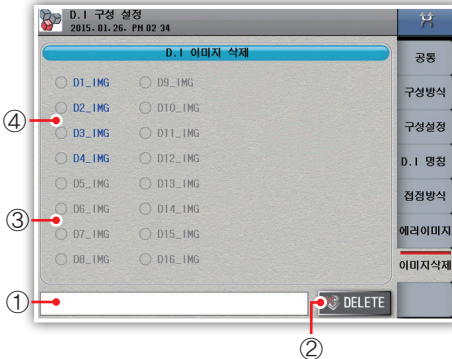


Figure 80) Delete DI error image

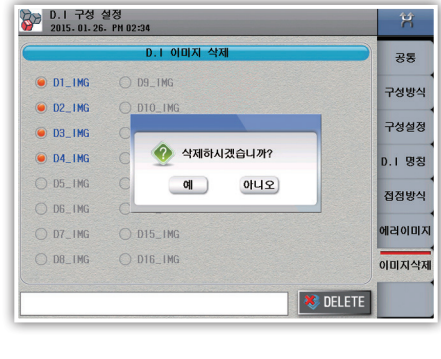


Figure 81) DI Error Image Confirmation

- 1) Status display window: Displays the progress of image deletion.
- 2) DELETE : Deletes the selected image from the screen among the picture files stored in the internal memory.
- 3) There is no user image in the internal memory.
- 4) User image exists in internal memory.
- 5) Deleted images can not be restored.



## 7. DO Configuration

The DO configuration settings consist of a total of eight tabs, and the DO configuration settings assign various signals in the system to the relay outputs.

If the set relay number is duplicated, the relay will operate when one of the two signals is output. TS510 has IO specification as option. Relay number that can be set according to option is limited, please check IO specification of product

### ▶ Chamber setting 1

– It is the screen to set relay for damper / elevator signal.



Figure 82) Chamber setting 1

- 1) H. Open: Set relay and hold time when operating in high temperature room.
- 2) H. Closed: Set the relay and holding time when operating in a zone other than the high-temperature room.
- 3) T. Open: Sets the relay and hold time when operating the test room.
- 4) T. Closed: Set the relay and holding time when operating in the interval other than the test room.
- 5) L. Open: Set relay and holding time when operating in low temperature room.
- 6) L. Closing: Set the relay and holding time when operating in a section other than the low temperature room. (When the retention time is set to 60000 seconds, it is output continuously for the segment time)
- 7) ELV\_H / L: Set the operation relay according to the test pattern when setting as the elevator chamber.
- 8) Preparation: Set relay for preheat operation.
- 9) Hold: Set the relay in hold status during operation.
- 10) User button 1/2: Sets the relay for the user button on the operation screen.

Parameter	Setting range		Initial value	
	Relay No.	Time	Relay No.	Time
H. Open signal	0 ~ 32	0 ~ 60000 sec	0	60000 sec
H. Closed signal	0 ~ 32	0 ~ 60000 sec	0	60000 sec
T. Open signal	0 ~ 32	0 ~ 60000 sec	0	60000 sec
T. Close signal	0 ~ 32	0 ~ 60000 sec	0	60000 sec
L. Open signal	0 ~ 32	0 ~ 60000 sec	0	60000 sec
L. Closed signal	0 ~ 32	0 ~ 60000 sec	0	60000 sec

Parameter	Setting range		Initial value	
	Relay No.	Time	Relay No.	Time
ELV_H	0 ~ 32	0	0	60000 sec
ELV_L	0 ~ 32	0	0	60000 sec
User button 1	0 ~ 32	0	0	60000 sec
User button 2	0 ~ 32	0	0	60000 sec

## ▶ Chamber setting 2

– This is the screen to set relay for damper / other signal.



Figure 83) Chamber setting 2

- 1) H,FAN: Sets relay for high-temperature room fan drive (Always ON during operation).
- 2) T,FAN: Set the relay for driving the test room fan (ON only when the test room is operating).
- 3) L,FAN: Set the relay for low temperature chamber fan drive (Always ON during operation).
- 4) Defrost: Set the relay when defrosting.
- 5) H. STANDBY: Set high temperature room standby relay.
- 6) T. Wait: Sets the laboratory waiting status relay.
- 7) L. Standby: Sets the low temperature room standby state relay.
- 8) T. Drive: Set the relay and delay time in test operation.
- 9) Chiller 1 / Chiller 2: Set the relay and delay time to control the freezer chiller during operation.
- 10) T. End: Set the relay and hold time when test operation is completed.
- 11) Sensor disconnection: It sets relay and retention time when sensor input disconnection state.
- 12) DI Error: Set the relay and hold time when an error occurs during stop and operation.  
(When the retention time is set to 60,000 seconds, the output continues until the DI error is cleared)
- 13) Solenoid Valve: Sets the relay and hold time of the automatically generated signal when the temperature of the low temperature chamber falls below a certain temperature.

Parameter	Setting Range	Initial Value
H. Fan	0 ~ 32	0
T. Fan	0 ~ 32	0
L. Fan	0 ~ 32	0
Defrost	0 ~ 32	0
H. Atmospheric	0 ~ 32	0
T. Wait	0 ~ 32	0
L. Standby	0 ~ 32	0

Parameter	Setting Range		Initial Value	
	Relay No.	Time / Range	Relay No.	Time / Range
T. Operation	0 ~ 32	0 ~ 9999초	0	1 sec
Freezer 1	0 ~ 32	0 ~ 9999초	0	3 sec
Freezer 2	0 ~ 32	0 ~ 9999분	0	1 min
T. End	0 ~ 32	0 ~ 9999초	0	10 sec
Sensor disconnection	0 ~ 32	0 ~ 9999초	0	3 sec
DI error	0 ~ 32	0 ~ 60000초	0	60 sec
Sol valve	0 ~ 32	EU(0.0% ~ 100.0%)	0	-70.0 °C

## ▶ Inner Signal

– It is the screen to set relay for inner signal.



Figure 84) DO Configuration – Inner Signal

### [Inner signal parameter]

Parameter	Setting Range	Initial Value
Inner signal 1 ~ 16	0 ~ 32	0

## ▶ Time / alarm signal

– It is the screen to set relay for time / alarm signal.

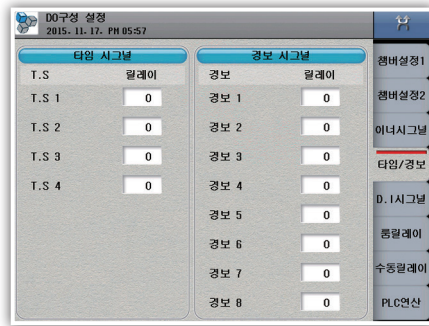


Figure 85) DO Configuration – Time / Alarm Signals

### [Time / alarm signal parameter]

Parameter	Setting Range	Initial Value
Time signal 1 ~ 4	0 ~ 32	0
Alarm signal 1 ~ 8	0 ~ 32	0

## ▶ DI signal



Figure 86) DO Configuration – DI Signal

1) When DI signal is generated, set relay turns on.

Parameter	Setting Range	Initial Value
DI signal 1 ~ 32	0 ~ 32	0

## ▶ Room Relay

The relay operates when the temperature of the selected laboratory is within the setting range regardless of the operation status (operation stop / operation).

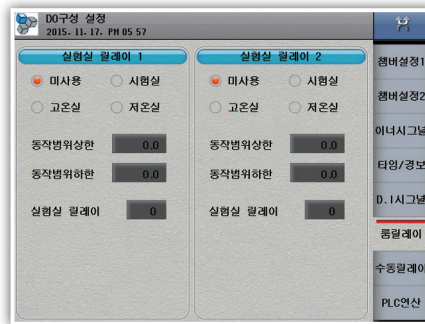


Figure 87) DO Configuration – Room Relay

Parameter	Setting Range	Initial Value
Target	Unused, Laboratory, High temperature room, Low temperature room	Unused
Operating range upper limit	EU (0.0% ~ 100.0%)	0.0 [°C]
Operating range Lower limit	EU (0.0% ~ 100.0%)	0.0 [°C]
Relay	0 ~ 32	0

## ▶ Manual relay



Figure 87) DO Configuration – Manual Relay

1) Set relay for manual signal.

Parameter	Setting Range	Initial Value
Manual signal 1 ~ 16	0 ~ 32	0

## ▶ PLC operation



Figure 88) DO Configuration – PLC Operation

– Input / output signal logic operation function setting screen, maximum 30 line program is available.  
Logic operation is performed in order from line 1 to line 30 (Pressing the numbered button activates the corresponding line)

1) Logical operator (LOGIC)

Parameter	Initial value
AND	PARA1, PARA2 ON when both signals are ON, otherwise OFF output
OR	ON when PARA1 or PARA2 is ON, OFF when both are OFF
NOT	When PARA1 is ON, it is OFF output. If it is OFF, it is ON output (reversing)
BYPASS	Outputs the signal of PARA1 as it is
XOR	PARA1, PARA2 ON when the two signals are different, otherwise OFF output

2) Logical operation Input parameters (items subject to logical operation, PARA1, PARA2)

Parameter	Initial value
IN	Contact input (D,I) 1 to 32
OUT	Contact output (D,O) 1 to 32
M	Temporary variables that are stored in the system (1 ~ 32). Stay on while system is powered up
T1 to T4	Software delay timer

3) Logical operation output parameter (OUT1 result of logic operation result)

Parameter	Initial value
OUT	Contact input (D,O) 1 ~ 32
M	Temporary variables stored in the system (1 to 32) Stay on while the system is on
T1 ~ T4	Software delay timer

Before start

Install

Operation

Screen layout

Function setting

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System settings

Specification

## 8. System

### ▶ System

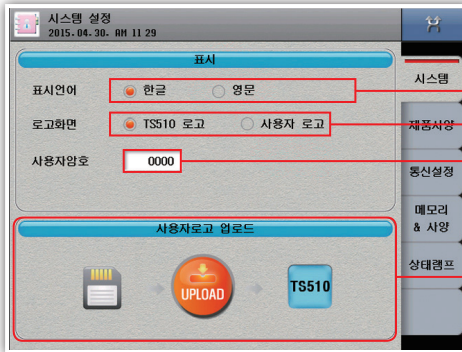


그림 89) 시스템 화면

- Select your language (Korean / English / Chinese).
- Select the logo displayed at boot time.
- After setting the user password, confirm the password when entering the system setting screen. (However, if the user password is "0", the password is not checked.)
- Upload the user's logo using the SD card (can not be operated during storage)



**Danger**

Logo image files should work with resolution 640 \* 480 and file name TS510\_LOGO.bmp. And the file should be put in the TS510\_LOGO folder of the SD card root directory. Otherwise, the upload will not run.

### [System parameters]

Parameter	Setting Range	Initial Value
Display language	Korean, English, Chinese (simplified)	English
Logo Screen	TS510 Logo, User Logo	TS510 Logo
User password	0 ~ 9999	0000

### ▶ Specification

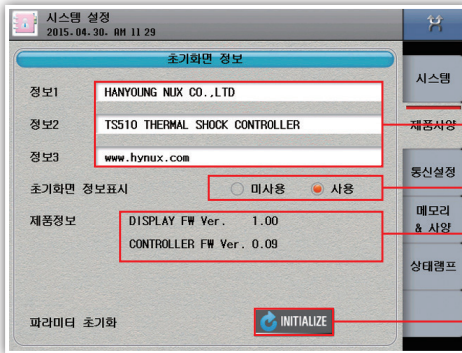


Figure 90) Product specification screen

- Enter the information displayed at boot time.
- Select whether or not to display the product information at boot time.
- Displays version information of the product.



**Danger**

Initializes the parameters. The event or error history is not initialized. (Not available during storage)

### [Product specification parameters]

Parameter	Setting Range	Initial Value
Information 1	Character input board (up to 30 characters)	HANYOUNG NUX CO.,LTD
Information 2	Character input board (maximum 30 characters)	TS510 THERMAL SHOCK CONTROLLER
Information 3	Character entry board (up to 30 characters)	www.hynux.com
Display initial screen information	Unused, Use	Use

## ▶ Communication setting

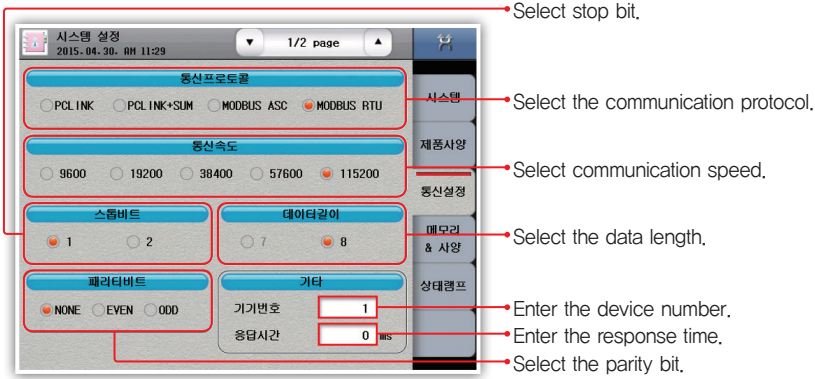


Figure 91) Communication setting screen

### [Communication setting parameter]

Parameter	Setting Range	Initial Value
Communication protocol	PCLINK, PCLINK+SUM, MODBUS ASC, MODBUS RTU	MODBUS RTU
Communication speed	9600, 19200, 38400, 57600, 115200	115200
Stop bit	1,2	1
Data length	7,8	8
Parity bit	NONE, EVEN, ODD	NONE
Device number	1 ~ 99 (Up to 32 units can be connected, including master)	1
Response time	0 ~ 100ms	0ms

## ▶ Hardware address setting

- This is the screen to set the hardware status of control module.
- It is necessary to match the hardware settings of the control module and I / O module for normal operation.
- If the address setting of the output module is not correct, it may cause malfunction.

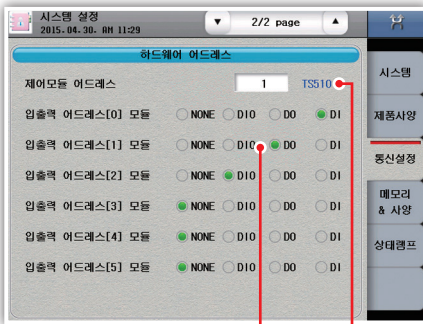


Figure 92) Hardware address 1

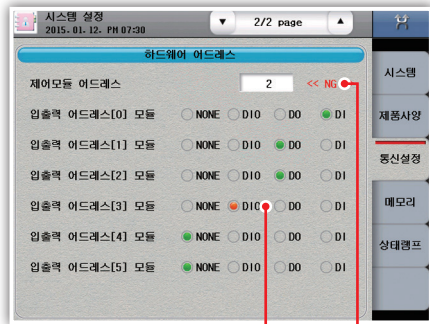


Figure 93) Hardware address 2

- 1) Communication with TS510 display is normal
- 2) Communication with TS510 display is bad
- 3) Communication with I / O module is normal
- 4) Bad communication with I / O module

Before start

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## ▶ Memory

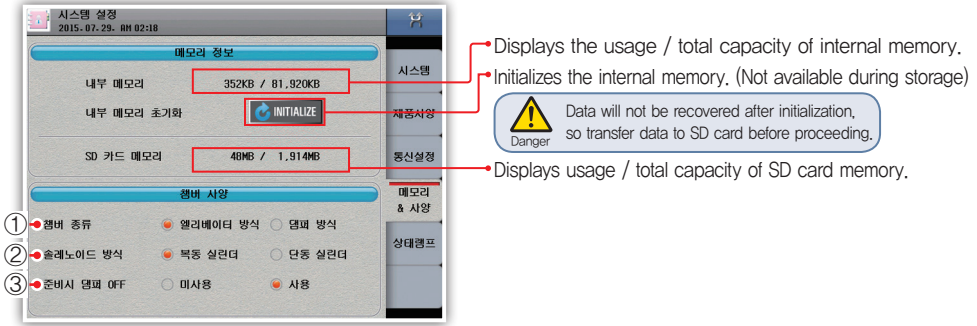


Figure 94) Memory screen 1

## ▶ Chamber Specifications

- 1) Set the chamber type
- 2) Set the solenoid type.
  - Double room cylinder: The method of canceling the output when the corresponding input contact is attached
  - Single room cylinder: It keeps the output regardless of the corresponding input contact point.
- 3) Set whether to use the damper OFF output operation for operation preparation operation.

Parameter	Setting Range	Initial Value
Chamber type setting	Damper, Elevator	Elevator
Solenoid type	Double room cylinder, single room cylinder	Double acting cylinder
When preparing damper OFF	Unused, use	Use



## ▶ Status lamp

- This is the screen to set the lamp to be displayed on the operation screen.
- You can select up to 32 lamps. Up to 16 screens can be displayed on one screen. If you select more than 16 screens, touch the operation screen status lamp area to switch the screen



Picture 95) Status lamp

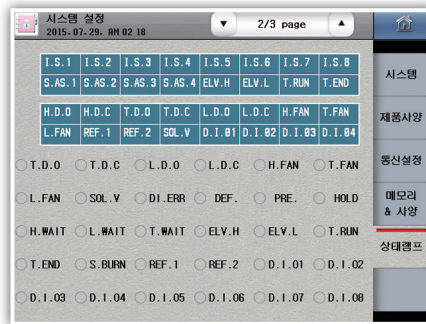


Figure 96) Status lamp setting



Figure 97) Status lamp indication

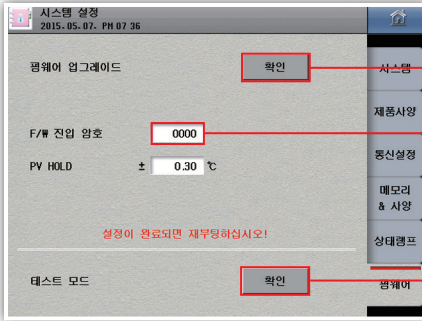
- 1) Touch the part you want to display in the status lamp table at the top
- 2) Select the desired lamp type.

## ▶ Firmware Upgrade

Firmware upgrade and test mode. This screen is not accessible during operation. In order to enter, you must enter the set password. (Initial password: 0)



- If you enter this screen, you can not exit the screen. Be sure to reboot the display and control module.
- Firmware upgrade requires user's attention, so be sure to set a password.  
The initial value of the password is "0". You can get upgrade file from our homepage.  
Be careful not to change the file name in the TS510\_FWUP folder in the root directory of the SD card. The parameters are initialized when upgrading the firmware.



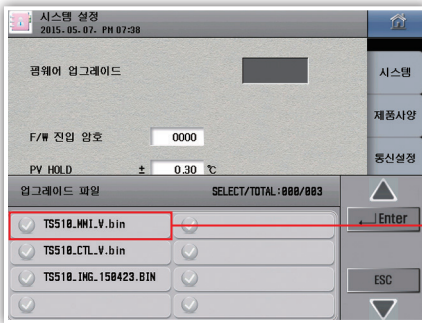
Firmware upgrade window will be entered.

Set the password to enter the F/W window.



Test mode is a calibration test screen before deliver

Figure 98) Firmware upgrade



Indicates the upgrade file name.

Figure 99) Firmware upgrade input window

# Specifications

## 1. Input specifications

[ Range configuration by input type ]

Input type		Measuring range (°C)	Degree
Thermoresistor (RTD)	Pt100 Ω Pt-1	-200.0 ~ 640.0	±0.1 % of FS ±1 Digit
	KPt100 Ω KPt-1	-200.0 ~ 500.0	
thermocouple (TC)	K	K-0	±0.15 % of FS ±1 digit
		K-1	±0.15 % of FS ±1 digit(*2)
	J	-200.0 ~ 1200.0	±0.15 % of FS ±1 digit(*2)
	E	-200.0 ~ 1000.0	±0.15 % of FS ±1 digit(*2)
	T	-200.0 ~ 400.0	±0.15 % of FS ±1 digit(*3)
	R	0.0 ~ 1700.0	±0.15 % of FS ±1 digit(*4)
	B	0.0 ~ 1800.0	±0.15 % of FS ±1 digit(*1)
	S	0.0 ~ 1700.0	±0.15 % of FS ±1 digit(*4)
	L	-200.0 ~ 900.0	±0.15 % of FS ±1 digit(*2)
	N	-200.0 ~ 1300.0	±0.15 % of FS ±1 digit(*3)
	U	-200.0 ~ 400.0	±0.15 % of FS ±1 digit(*3)
	Wre 5-26	0.0 ~ 2300.0	±0.15 % of FS ±1 digit(*4)
DC voltage (VDC)	-10 - 20 mV	-10.00 ~ 20.00	±0.1 % of FS ±1 Digit
	0 - 100 mV	0.00 ~ 100.00	
	1 - 5 V	1.00 ~ 5.00	
	0 - 30 V	0.00 ~ 30.00	

(\*1) 0 ~ 400 °C : ±5 % of FS ±1 digit

(\*2) -200 ~ -150 °C : ±0.2 % of FS ±1 digit

(\*3) -200 ~ -150 °C : ±0.4 % of FS ±1 digit, -150 ~ -100 °C : ±0.2 % of FS ±1 digit

(\*4) 0 ~ 200 °C : ±0.2 % of FS ±1 digit

## 2. Hardware specifications

### ▶ Power input

Power voltage	100 - 240 V a.c. Voltage regulation ±10 %
Power frequency	50 - 60 Hz
Power consumption	30 VA max
Max. rating of internal fuse	250 V a.c.
Dielectric strength	Between 1st and 2nd terminals : Min, 1500 V AC for 1 min Between 1st and FG terminals : Min, 1500 V AC for 1 min Between 2nd and FG terminals : Min, 1500 V AC for 1 min
Insulation resistance	20 MΩ or 500 V DC between power and FG terminals

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### ▶ Sensor input

Input type	2 types of RTD (Pt-100, KPt-100), 11 thermocouples (K, J, E, T, R, B, S, L, N, U, Wire 5-26) 4 types of DC voltage (-10 - 20 mV, 0 - 100 mV, 1 - 5 V, 0 - 30 V)
Sampling cycle	250 ms
Measured current of thermoresistor(RTD)	Approx. 0.21 mA
Input resistance	thermocouple : 1 M $\Omega$ or more, DC voltage : 1 M $\Omega$ or more
Allowable wire resistance	RTD : MAX. 100 $\Omega$ /wire (Except for RTDs in the range of -100.00 to 150.00, up to 10 $\Omega$ / wire) Thermoresistor : 200 $\Omega$ or less DC voltage : 2 k $\Omega$ or less
Influence of wire resistance	RTD: $\pm 0.3$ $^{\circ}$ C / 10 $\Omega$ (note that the wiring resistance of the three wires must be the same)
Allowable input voltage	Thermocouple : $\pm 10$ V d.c. or less, DC voltage : $\pm 33$ V d.c. or less
Reference junction compensation (RJC) Temperature error	$\pm 1.5$ $^{\circ}$ C (0 ~ 50 $^{\circ}$ C)
Detection of sensor disconnection(Burn-out)	UP-Scale for disconnection

### ▶ Output specifications

Contact output(DO)	Up to 32 relay	A Contact	30 V d.c. 3 A max, 250 V a.c. 3 A
		B Contact	NO : 30 V d.c. 5 A max, 250 V a.c. 5 A
Control output	SSR output	ON : 18 V DC Pulse voltage(800 $\Omega$ or more load resistance)	
	SCR output	4 - 20 mA DC (600 $\Omega$ or less load resistance)	
전송출력	Current output	4 - 20 mA d.c.	
	Load resistance	600 $\Omega$ or less load resistance	
	Output limit	-5.00 - 105.00 %	
	Output type	Specific value(PV), Setting value(SV), Output(MV), and random	
	Refresh interval	250 ms	

### ▶ Contact input

Max. number of input	32 Contacts
Input type	No-voltage contact input
ON/OFF sensing resistor	Minimum 1k $\Omega$ and less: On, maximum 10k $\Omega$ and more: Off recognition
Min. sensing time	0.25 sec
Operational conditions	During operation/Always
Contact function	Operation and stop/hold/step by DI ; User can define error screen.

## ► Communication specifications

Applied standard	RS485
Max. connection number	1:32 (address 1 ~ 99)
Communication type	2-wire
Synchronization	Asynchronous
Communication distance	Approx. 1.2 km or less
Communication speed	9600, 19200, 38400, 57600, 115200 bps
Data Length	7/8 bits
Parity Bit	NONE / EVEN / ODD
Stop Bit	1/2 bit(s)
Protocol	PC-Link / PC-Link+SUM / MODBUS ASC / MODBUS RTU
Response Time	0 – 100 ms

## ► Control function

Input	Input calibration	EUS(0 ~ 100 %)
	Input filter(LPF)	0 ~ 120 sec
Support chamber	type	Elevator type, damper type
Control operation	Pattern	Up to 100, Select the test type (10 types) for each pattern
	PID Group	4 groups of high temperature room / low temperature room, deviation PID
	Auto tuning	Auto tuning according to target setting value
	Proportional band	0.00 ~ 100.00 % (For 0.00 %, ON/OFF control)
	Integral time	0.0 ~ 3,000 sec (OFF when 0 sec)
	Derivative time	
	ON/OFF control	Set 0.0 to proportional band(PB)
	Normal Open/ Normal Close	According to selection of Normal Open/ Normal Close for control output
	Prevent overloading	ARW zone setting (50 to 1000% of proportional band)
A,T GAIN	0.0 ~ 10.0	
Alarm setting	Alarm setting	System alarm : 8 points
	Alarm type	Absolute high/low limit, deviation high/low limit, in range/out of range (alarm direction, hold)
	Absolute alarm setting range	EU(0 ~ 100 %)
	Offset information setting range	EUS(-100 ~ 100 %)
	Hysteresis	EUS(0 ~ 100 %)

### 3. Display specifications

Display	TFT color LCD (115.2 × 86.4 mm)
Number of Pixels	640 × 480 pixel
Back light	LED Back light
Life cycle of back light	Approx. 40,000 h
Touch type	Resistive type (4 Wires)
Language	Korean/English/Chinese(Simplified)

### 4. Memory specifications

Internal memory	Non-volatile memory : 80 MB - Saving of 15 days at 1 S interval
External memory	SD card(2 GB) : Saving of 1 year at 1 S interval
Saving interval	1 ~ 360 sec
Memory information	Program information, setting value, recovery, and temperature setting/ specific/output value

### 5. Installation environment

#### ▶ Use environment

Ambient temperature	0 ~ 50 °C
Temperature fluctuation	10 °C/h or less
Ambient humidity	20 ~ 90 % RH (Without condensation)
Magnetic field	400 A/m or less
Altitude	2,000 m or less from the sea
Weight	Approx. 1.32 kg

#### ▶ Storage environment

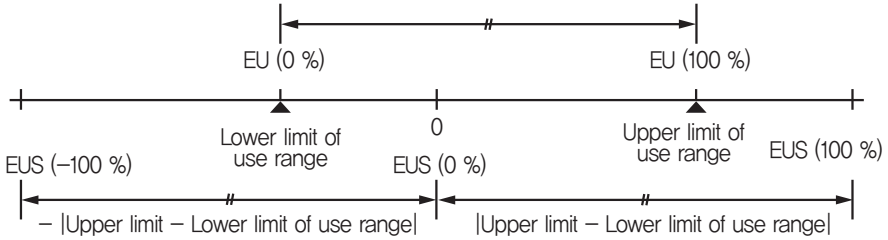
Ambient temperature	-20 ~ 70 °C
Temperature fluctuation	20 °C/h or less
Ambient humidity	5 - 95 % RH (Without condensation)

#### ▶ Influence of ambient temperature

DC voltage, Thermoresistor sensor	± 0.003% / °C of maximum range
RTD sensor	±0.03 °C/°C

## 6. Engineering Units

- EU : Engineering unit value according to the range of product
- EUS : Engineering unit value according to the difference of upper and lower limits(span) of product



	Range	E.g.(Pt-1: -200.0 ~ 640.0)
EU (0 ~ 100 %)	Lower limit - Upper limit of use range	-200.0 ~ 640.0
EUS (0 ~ 100 %)	0 -  Difference between upper and lower limits	0 ~ 840.0
EUS (-100 ~ 100 %)	-  Difference between upper and lower limits  ~ + Difference between upper and lower limits	-840.0 ~ 840.0



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