Programmable
Temperature Controller

Operation Manual
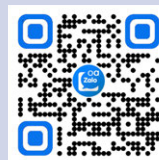
TD510

HANYOUNG NUX

Notice

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Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

Before starting

Thank you for purchasing Hanyoung Nux programmable temperature controller(Model: TD510).
This programmable temperature controller(Model: TD510) is a unit to control temperature consisting of display and control. The display can be attached to a panel or VESA-mounted and is connected to the control for communication. The control consists of power, control, and input/output modules and can be fixed on DIN rail or attached on a panel using screws.
The operation manual describes product functions, how to install, cautions, and how to use. Read and understand this document before starting the product.
Make sure that this operation manual will be delivered to an end user and kept in an accessible location (This operation manual may be subject to changes for improvement and functional changes without prior notice).

1. Checking of components

First of all, check the specifications referring to your order and see if there is any exterior damage or missing component.

▶ Component

Display(TD510-1)	Power module(TM-PWR)	Control module(TD510-MAIN)
Input module(TM-DI)	Output module(TM-DO)	Input/output module(TM-DIO)

Communication cable(1.5 m)	Bracket 4EA	250-Ω resistor 2EA	3P communication Connector	SD card	Operation manual

▶ Model name

Model	Code			Description
TD510–	☐	☐	☐	Programmable temperature controller
Display	1			Display(5.7" TFT LCD)
	N			None
Input/output		1		8 input points/6 output points(1 module)+Power module +Control module
		2		8 input points/14 output points(2 modules)+Power module +Control module
		3		16 input points/16 output points(3 modules)+Power module +Control module
		N		No input/output
Language			S	Korean, English, and Chinese(Simplified)
			T	Korean, English, and Chinese(Traditional)

※ This product consists of the display and control(power, control, input, and output modules). (Up to 32 contact input/output points, respectively)

▶ Components

Product	Model	Description
Display	TD510–1N☐	Display(5.7" TFT LCD)
Control module	TD510–MAIN	Temperature 2–channel control module
Power module	TM–PWR	Power module
Input module	TM–DI	Module with 16 input points
Output module	TM–DO	Module with 8 output points
Input/output module	TM–DIO	Module with 8 input and 6 output points

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

2. Safety cautions

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

⚠️ Danger	If not followed, it may lead to death or serious injury.
⚠️ Warning	If not followed, it might lead to death or serious injury.
⚠️ Caution	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. Warning

- 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 a date of purchase and is applicable to any failure found in normal use conditions.
- For any failure found after the warranty period, paid service may be provided according to our regulations.
- Any of followings will be repaired at a cost even if it is fund in 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
  - Where there are combustibles around
- The case and front section are made of fire–retardant polycarbonate but do not install it directly on a combustible.
- Keep away any device or wire that may cause noise. Enough preheating is required especially under 0℃. Keep away any heat–radiating device.
- For wiring, disconnect the entire power.
- This product works at 100 − 240 V a.c. / 50 − 60 ㎐ without special setting. Apply rating only.
  It may lead 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 over voltage protective level is Category II(IEC 60664–1) and use environment is Pollution Degree.
- Do not use a sharp object or force to touch the 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).

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Display
(1) How to attach panel
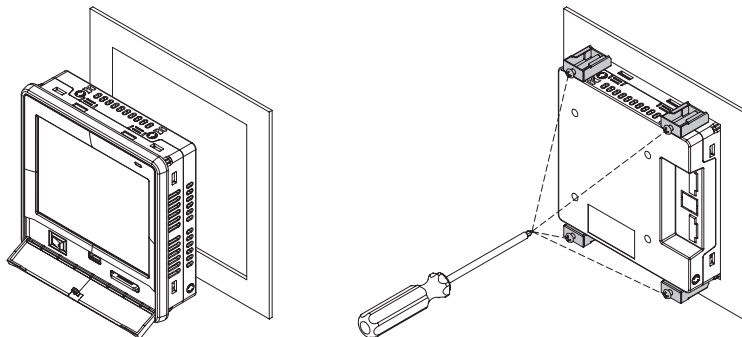
Fig. 1) How to attach a panel

⚠ 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.
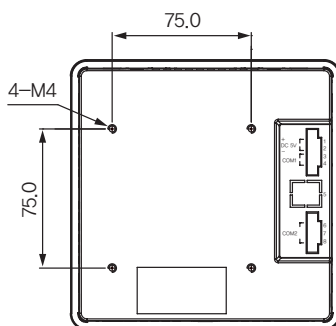
▶Control
1) How to install DIN rail
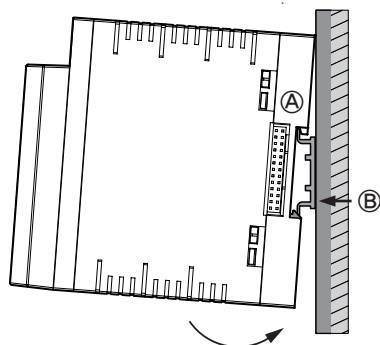
① Connect the top hook(A) of bottom of floor to the DIN rail and press it(B) in order to install it.
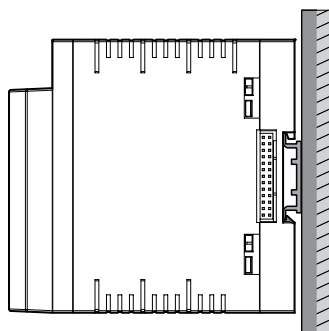
② Check if it is fixed by pushing up the mounting bracket.

● How to install module

TD510 series module can connect up to 7 units. Any module must be installed vertically.
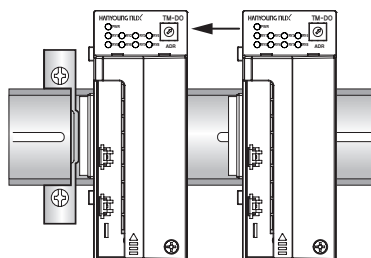
① Push a module aside in order to connect it to a connector.
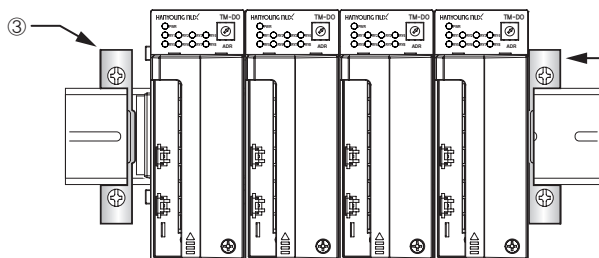
② Fix a module on both ends using stoppers.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

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
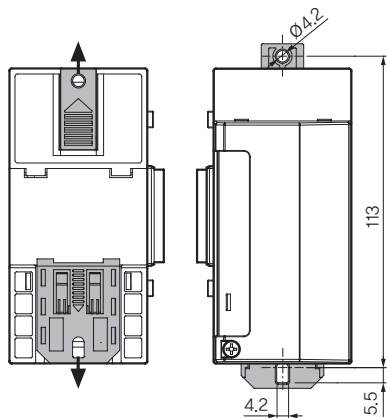
● Main, input/output, input, and output
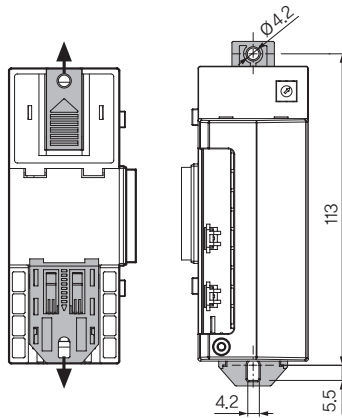
3. Exterior & panel dimensions

▶Display (Unit : ㎜)
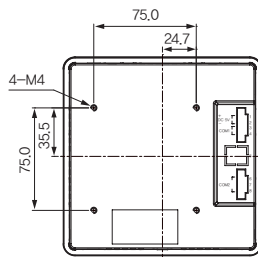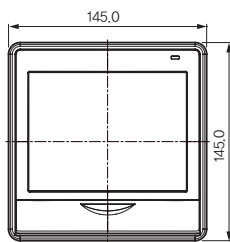
▶Power module (Unit：㎜)
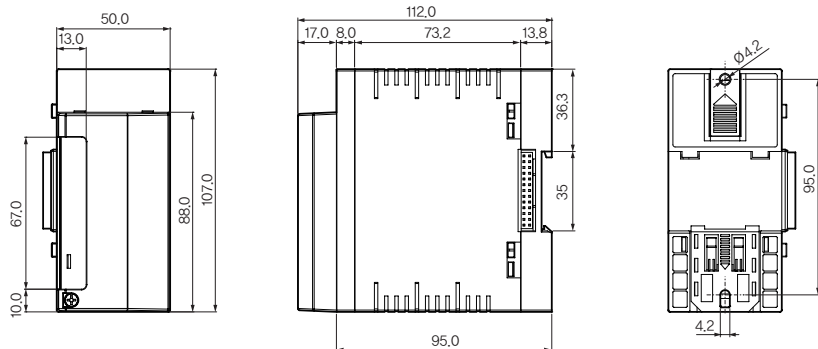
▶Control, input, output, and input/output modules (Unit：㎜)

▶Panel dimensions (Unit：㎜)

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications
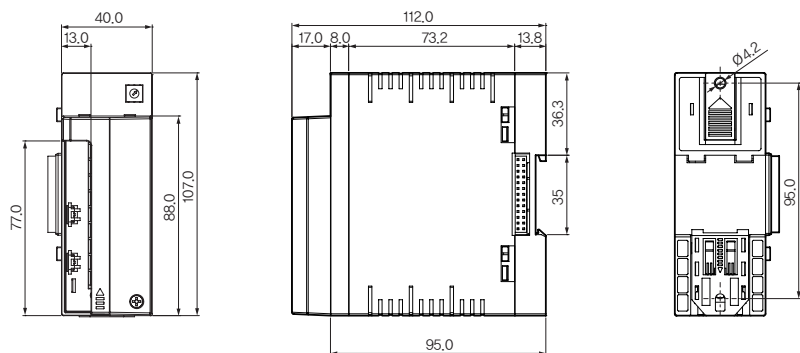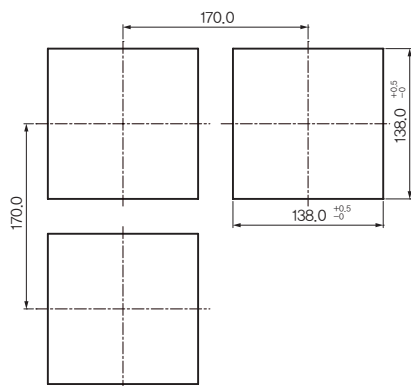
4. Wiring

Danger 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 ㎟ (KSC 3304)) must be used.

Caution 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 ㎟ (KSC 3304)) must be used. It must be grounded at 3 points or more with 100 Ω or less resistance.

▶ Relay output wiring

Caution Inductive load(L) including motor, solenoid, and external relay may lead to malfunction. It must be connected in parallel with CR filter for AC circuit and diodes for DC circuit.
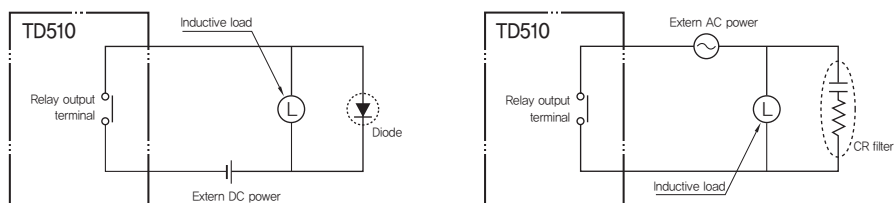
Fig. 2) Connection of relay

▶ Input wiring

Caution 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.

Caution
· Enclosure must be grounded at 3 points or more(100 Ω or less of grounding resistance) using 2 ㎟ 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 ● Thermocouple input ● DC voltage input ● DC current input

Before starting

Installation

Operation

Screen block
diagram

Function setting

Program

System setting

Specifications
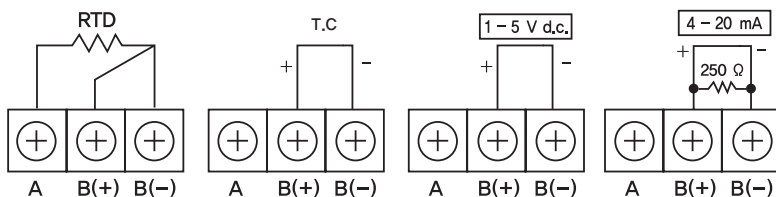
● Wiring of temperature control and transmission output

● Temperature control output

SSR or SCR

+   −

● Temperature transmission output

Recording and indicating instrument, etc..

+   −
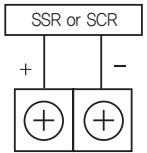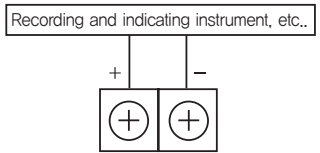
▶ Communication wiring

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

Master   TD510

Terminating resistor

RTX+   RTX+

RTX−   RTX−

Terminatir resistor
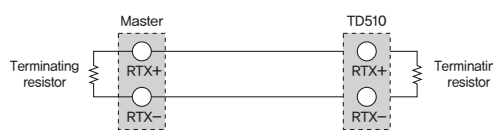
Fig. 3) How to wire for communication

▶ Terminal specifications

Power/Input/Output - M3 screw

3 mm or more

6 mm or

3 mm or more

6 mm or
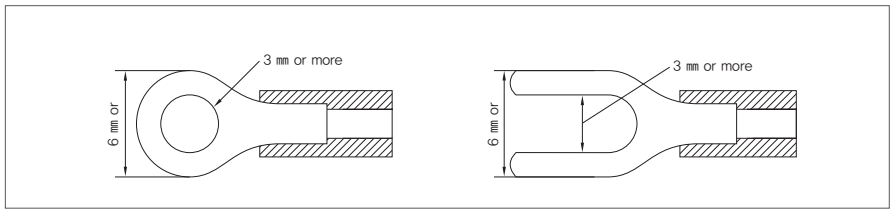
Fig. 4) Solderless terminal

5. Terminal connection diagram

▶ Display

Terminal No.	Power
1	+ DC 5V
2	−
3	COM1 (control)
4	

Terminal No.	Ethernet
5	

Terminal No.	RS485 communication
6	RTX+
7	RTX−
8	
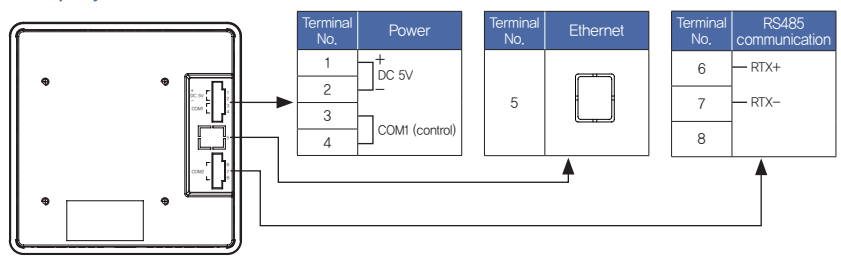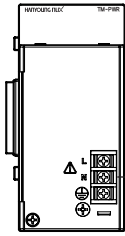
▶ **Power module**

Terminal No.	Power	
L	L	100 – 240 V a.c.
N	100 – 240 V ~ 50 – 60 Hz 22 VA	50 – 60 Hz
⏚	F.G	22 VA

▶ **Control module**
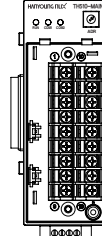
Terminal No.	CH1	Terminal No.	CH2
1	+ H.OUT	10	+ H.OUT
2	- (SCR/SSR)	11	- (SCR/SSR)
3	+ C.OUT/RET	12	+ C.OUT/RET
4	-	13	-
5		14	
6		15	
7	A RTD	16	A RTD
8	+ B	17	+ B
9	T.C - B mV/V	18	T.C - B mV/V

Power			
1	2	3	4
POWER 5 V d.c.		TRX+	TRX-

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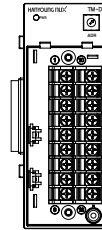
Terminal No.	Output(1~4)	Terminal No.	Output(5~8)
1		10	
2	RY1	11	RY5
3		12	
4	RY2	13	RY6
5		14	
6	RY3	15	RY7
7		16	
8	RY4	17	RY8
9		18	

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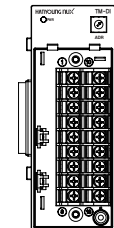
Terminal No.	Input(1~8)	Terminal No.	Output(1~6)
1	DI 1	10	RY1
2	DI 2	11	COM
3	DI 3	12	RY2
4	DI 4	13	RY3
5	DI 5	14	COM
6	DI 6	15	RY4
7	DI 7	16	RY5
8	DI 8	17	COM
9	COM	18	RY6

Operation

1. Name of section

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specification

Front LED

Display

SD card slot

Power switch

Fig. 5) Main menu

[Front LED]

Back light OFF	STOP (Red lamp ON), RUN (Red lamp OFF)
Back light ON	STOP (Green lamp ON), RUN (Green lamp OFF)

2. Button operation
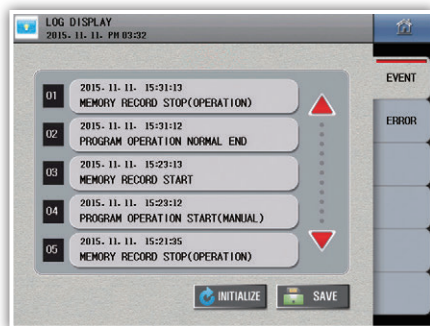
SAVE / COPY / INITIALIZE / DELETE	Run button	Runs corresponding operation immediately.	
⚪ 🔴	Select button	Selects one of items.	
[input box]	Input box	Displays ansets numbers and characters. Press it to display the numeric or character input panel.	

※ If the button is not active or can't be set, it sounds buzzer(beep) and doesn't run.

3. How to control numeric input panel
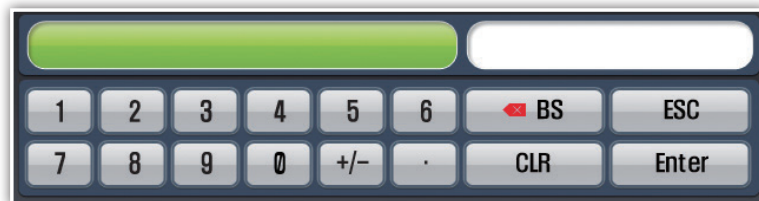
Fig. 6) Numeric input panel

[green bar]	Displays parameter names and setting ranges.
[input box]	Displays setting values.
Enter	Registers setting values.
BS	Remove the last digit of setting value.
CLR	Remove the entire setting value.
ESC	Cancel setting and hide input panel.

※ If a setting range is exceeded, it sounds buzzer(beep) and doesn't run.

4. How to control character input panel
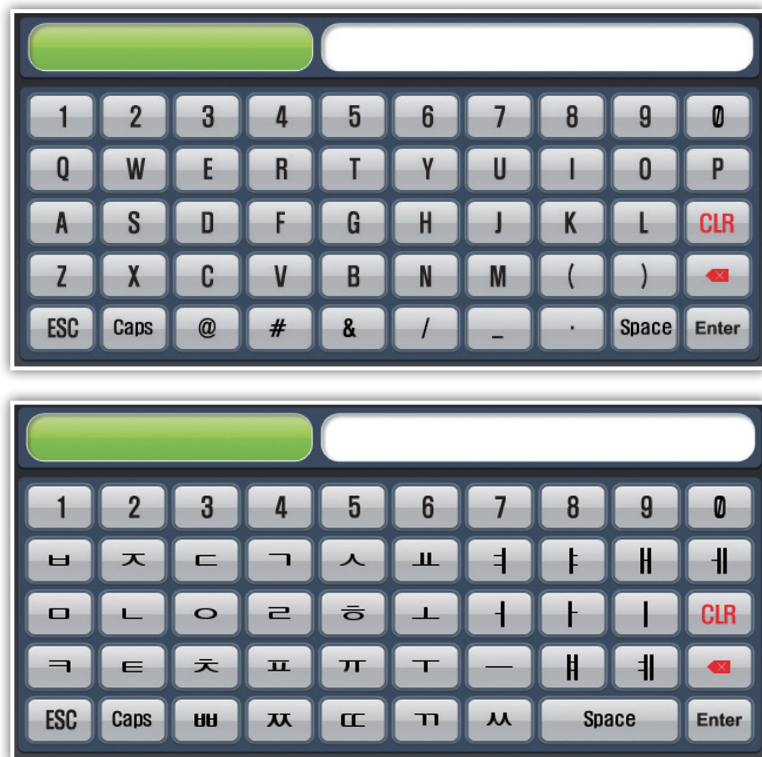
Fig. 7) Character input panel

	Displays parameter names.
	Displays setting characters.
Enter	Registers setting characters.
⌫	Remove the last digit of setting characters.
CLR	Remove the entire setting value.
ESC	Cancel setting and hide input panel.
Caps	Switches between Korean and English upper or lower cases.
Space	Blank.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specification

5. Name of control

▶ Control module

[LED specifications]

RUN	Lamp ON with power connected. Lamp OFF with power disconnected.
COM1	Displays communication state of the display and control. (OFF when OK.)
COM2	Displays communication state of the control and I/O. (OFF when OK.)

▶ Input/output module

[LED specifications]

PWR	Lamp ON with power connected.
RLY1 ~ RLY8	Lamp ON with corresponding DO operation.

Screen block diagram

1. Screen block diagram

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

Power ON	Splash	Operation screen1	Operation screen2		Graph view screen

Operation screen		Operation screen1, Operation screen2, and Graph view screen
Operation setting		Operation setting : Constant-value/program, change rate, fuzzy, and channel tag settings Function setting : Power saving operation, buzzer, recovery of power failure, operation screen, and switch time settings Save setting : Save interval, media, and parameter upload/download settings Graph : Background color and file save name
PV graph view		Saved graph view and copy data from internal memory to SD card

Program

Pattern setting	Pattern management	Pattern name setting	Pattern alarm setting	Time signal setting	Pattern graph
Edit pattern	Copy/Delete pattern information	Edit pattern name	Target, type, and parameter	Time setting ON/OFF	

Menu screen

Time/schedule setting	Current time setting and weekly scheduling
Event	Display/Delete event history and save to SD card

System menu

Sensor input	Control/ transmission output	PID setting	Inner signal	ON/OFF signal
Sensor type calibration	Control output Transmission output	PID section setting at gain	Target, type, and operation range	ON/OFF signal

System alarm	DI configuration	DO configuration	System
Target and type	Input state, operation type, operation method, and name	Relay No. and parameter settings	Language, product specifications, communication setting, and memory

Function setting

Fig. 8) Main menu

No.	Name	Description
1	Operation screen	Go to operation screen[Constant−value/Program].
2	Operation setting	Go to operation setting screen.
3	PV graph view	Go to saved PV graph screen.
4	Program	Go to program setting(pattern setting, graph, etc.) screen.
5	Time/schedule setting	Go to current time and schedule setting screen.
6	Event	Go to event and error history screen.
7	System menu	Go to system setting[sensor input, control output, and PID] screen.

1. Operation screen

1-1. Constant-value operation screen

1) Constant-value operation 1 screen

- Constant-value/program operation may be changed in [Main menu] - [Operation setting] - [Operation setting].
- Start and end of operation may be run in the operation screen 1 and 2.

▶ Concurrent control

- Concurrent/individual operation may be changed in [Main menu] - [System menu] - [System] - [Memory&Specifications].
- Press Run button in the center left of stop screen of constant-value screen 1 in order to switch to the constant-value operation 1 operation screen.
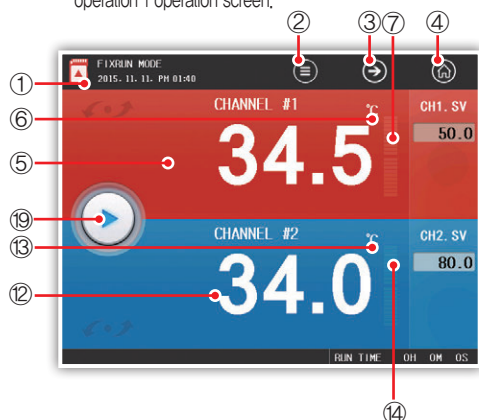
Fig. 9) Stop screen of constant-value operation screen 1(Concurrent control)　　Fig. 10) Operation screen of constant-value operation screen 1(Concurrent control)

No.	Description
1	Displays state of SD card.
2	Runs hidden menu pane. Click the same to hide menu pane.
3	Go to operation 2 screen.
4	Go to main menu screen.
5	Displays temperature measurement(PV).
6	Displays unit of channel 1.
7	Displays heating control output(H.MV) of channel 1. (For heating/cooling control)
8	Displays cooling control output(C.MV) of channel 1. (For heating/cooling control)
9	Enter target setting value(TSV) for channel 1.
10	Enter current setting value(NSV) for channel 1. (Displayed during operation only).
11	Displays ascending/descending/holding state of channel 1.
12	Displays measurement(PV) of channel 2.
13	Displays unit of channel 2.
14	Displays heating control output(H.MV) of channel 2. (For heating/cooling control)
15	Displays cooling control output(C.MV) of channel 2. (For heating/cooling control)
16	Enter target setting value(TSV) for channel 2.
17	Enter current setting value(NSV) for channel 2. (Displayed during operation only).
18	Displays ascending/descending/holding state of channel 2.
19	Run/stop button.
20	Displays general operation state messages.
21	Displays operation time.

Before starting

Installation

Operation

Screen block diagram

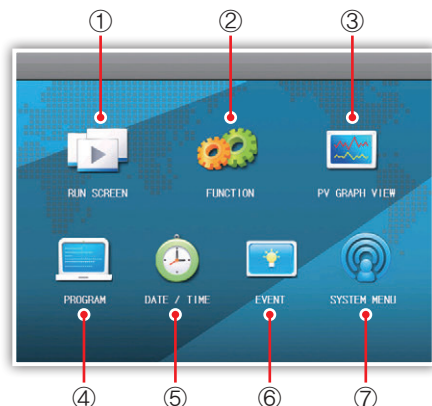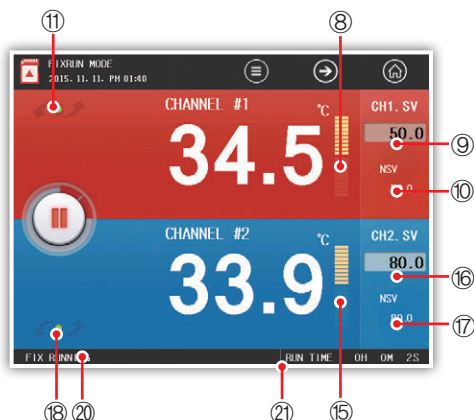Function setting

Program

System setting

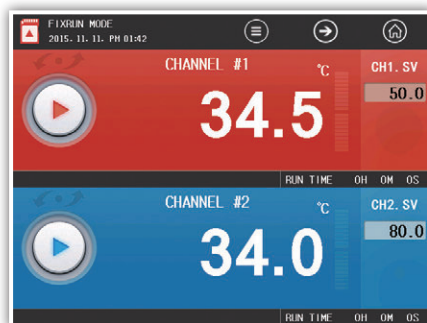Specifications

▶ Individual control

Fig. 11) Stop screen of constant-value operation screen 1
(Individual control)
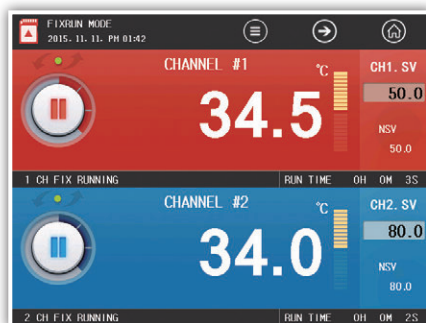
Fig. 12) Operation screen of constant-value operation screen 1
(Individual control)
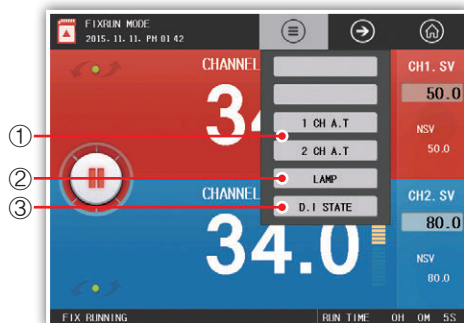
▶ Menu pane

Fig. 13) Menu pane of constant-value operation screen 1
(Concurrent control)

Fig. 14) Menu pane of constant-value operation screen 1
(Individual control)

No.	Description
1	Auto tuning is enabled during constant-value control operation and run with current setting values.
2	Press User-defined button to run assigned relay in [Main menu] - [System menu] - [DO configuration].
3	Go to DI state check screen.

2) Constant–value operation 2 screen

▶ Concurrent control

– Press Run button in the center left of stop screen of constant–value screen 2 in order to switch to the constant–value operation screen 2 operation screen.
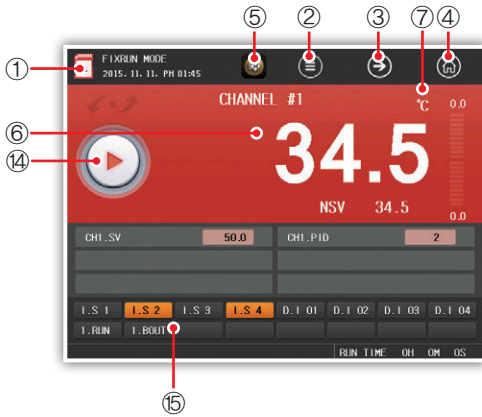

Fig. 15) Stop screen of constant–value operation

Fig. 16) Operation screen of constant–value operation 2(Ch.1)

Fig. 17) Stop screen of constant–value operation 2(Ch.2)

Fig. 18) Operation screen of constant–value operation 2(Ch.2)

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

21

No.	Description		
1	Displays state of SD card.		
2	Runs hidden menu pane. Click the same to hide menu pane.		
3	Go to operation 3 screen.		
4	Go to main menu screen.		
5	Switch channel (Ch.1 ↔ Ch.2)		
6	Displays measurement(PV) of channel.		
7	Displays unit of channel.		
8	Displays heating control output(H.MV) of channel. (For heating/cooling control)		
9	Displays cooling control output(C.MV) of channel. (For heating/cooling control)		
10	Enter target setting value(TSV) for channel.		
11	Enter current setting value(NSV) for channel. (Displayed during operation only).		
12	Displays ascending/descending/holding state of channel.		
13	Enter PID No. for channel.		
14	Run/stop button.		
15	Indicates input/output signal state. Press it to display 2nd indicator pane. (Up to 16 in 1 screen so up to 32 in total). * Indicators of operation screen can be set in [Main menu] – [System menu] – [System] – [Indicator].		No indicator setting.
		I.S.1	Set IS1 to indicator. IS1 disabled.
		I.S.1	Set IS1 to indicator. IS1 enabled.
16	Displays general operation state messages.		
17	Displays operation time.		

▶ Individual control

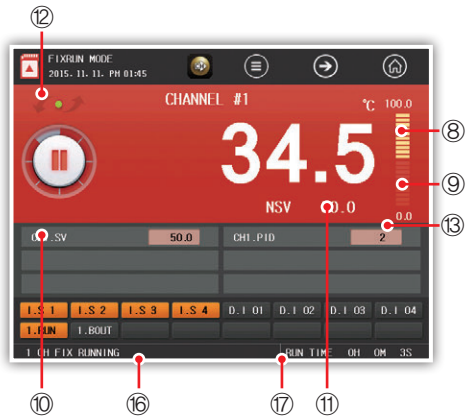Fig. 19) Stop screen of constant–value operation 2(Ch.1)
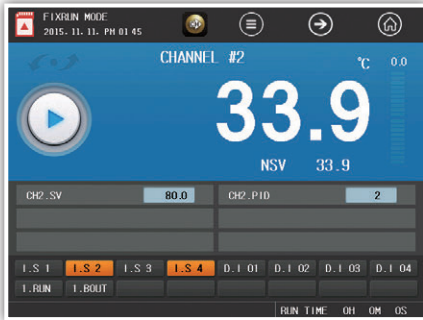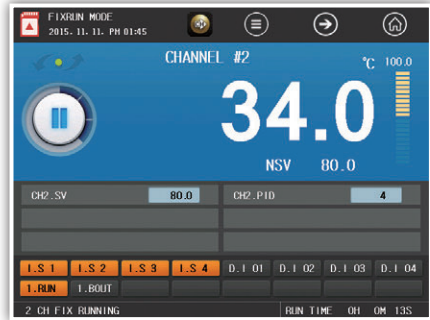

Fig. 20) Operation screen of constant–value operation 2(Ch.1)

Fig. 21) Stop screen of constant–value operation 2(Ch.2)

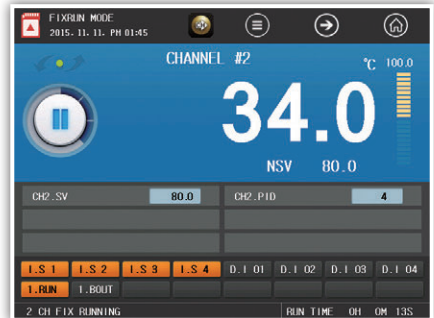Fig. 22) Operation screen of constant–value operation 2(Ch.2)

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Menu pane

Fig. 23) Menu pane of constant–value operation 2 screen(Ch.1)

Fig. 24) Menu pane of constant–value operation 2 screen(Ch.2)

No.	Description
1	Auto tuning is enabled during constant–value control operation and run with current setting values.
2	Press User–defined button to run assigned relay in [Main menu] – [System menu] – [DO configuration].
3	Go to DI state check screen.

3) Constant–value operation 3 screen (Graph view screen)

▶ Common
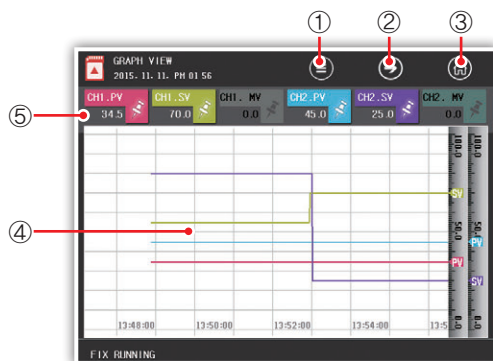
Fig. 25) Constant–value operation 3 screen
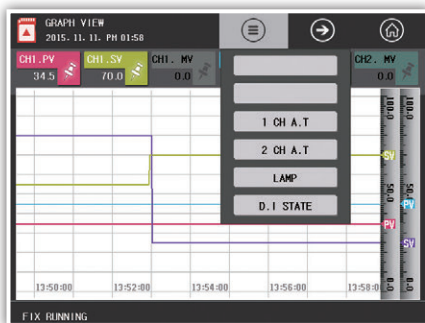
Fig. 26) Menu pane of constant–value operation 3 screen

No.	Description
1	Runs hidden menu pane. Click the same to hide menu pane.
2	Go to constant–value operation 1 screen.
3	Go to main menu screen.
4	Displays measurement, setting value, and output of current operation channel in a graph.
5	Set the data display with the check box. Graph is not displayed with OFF selected.

User can set background color(white/black), drawing(line and dot), and line thickness(1 or 2 pixels) of graph. It can be changed in [Main menu] – [Operation setting] – [Graph].

※ Once the operation is started, the graph is being drawn accordingly. The flow of graph depends on the save interval.

● How to Auto Tuning

PID auto tuning is a function for the controller to automatically measure characteristics of control target in order to calculate and set best PID values. Auto tuning gives ON/OFF control output based on the setting values and calculates PID integer by measuring hunting cycle and amplitude.

Enter setting values(SV) in the constant−value control mode; run; press button pane; and press temperature or humidity auto tuning button to run auto tuning. With the auto tuning setting, if zone selection is set to AUTO, the calculated PID value of zone is automatically saved.

If zone selection is set to MANUAL, it is saved to a specified PID zone.

> ⚠ Caution
> − If the auto tuning is not completed within 24 hours, it is abandoned. However, the control operation is continued.
> − If the auto tuning is forcibly ended, PID value is maintained same as before the forcible end.
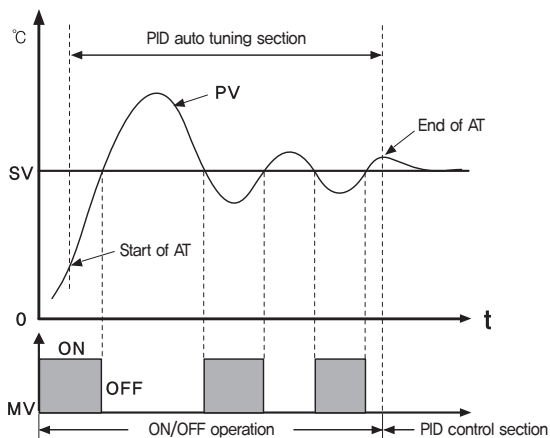
▶ Recording to SD card

Firstly, insert an SD card as shown.

· SD card is recognized as shown.
· If the SD card is not recognized, you can't record to it.

1–2. Program operation screen

1) Program operation 1 screen

▶ Concurrent control

– Press Run button in the center left of stop screen of program operation screen 1 in order to switch to the program operation 1 operation screen.

Fig. 27) Stop screen of program operation screen 1
(Concurrent control)

Fig. 28) Operation screen of program operation screen 1
(Concurrent control)

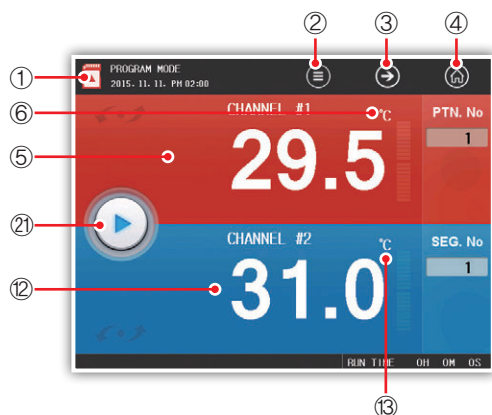| No.	Description
1	Displays state of SD card.
2	Runs hidden menu pane. Click the same to hide menu pane.
3	Go to operation 2 screen.
4	Go to main menu screen.
5	Displays measurement(PV) of channel 1.
6	Displays unit of channel 1.
7	Displays heating control output(H.MV) of channel 1.
8	Displays cooling control output(C.MV) of channel 1. (For heating/cooling control)
9	Enter current setting value(NSV) for channel 1. (Displayed during operation only).
10	Displays ascending/descending/holding state of channel 1.
11	Displays tag name of channel 1 (which may be changed with operation setting).
12	Displays measurement(PV) of channel 2.
13	Displays unit of channel 2.
14	Displays heating control output(H.MV) of channel 2.
15	Displays cooling control output(C.MV) of channel 2. (For heating/cooling control)
16	Enter current setting value(NSV) for channel 2. (Displayed during operation only).
17	Displays ascending/descending/holding state of channel 2.
18	Displays tag name of channel 2 (which may be changed with operation setting).
19	Enter pattern No. for operation.
20	Enter seg No. for operation.
21	Run/stop button.
22	Displays general operation state messages.
23	Displays operation time.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ **Individual control**

Fig. 29) Stop screen of program operation 1(Individual control)
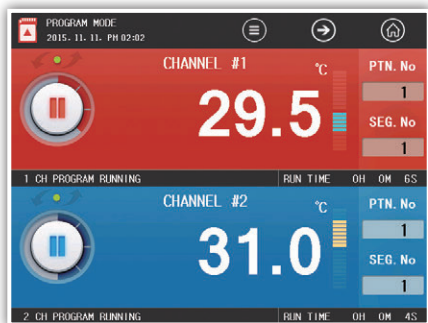
Fig. 30) Operation screen of program operation 1(Individual control)
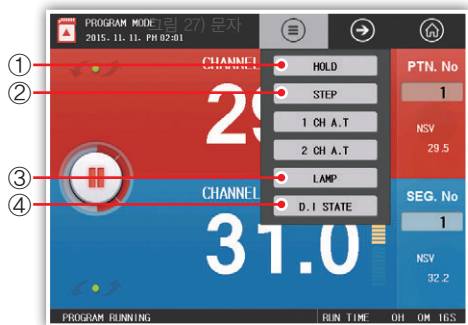
▶ **Menu pane**

Fig. 31) Menu pane of program operation 1 screen(Concurrent control)
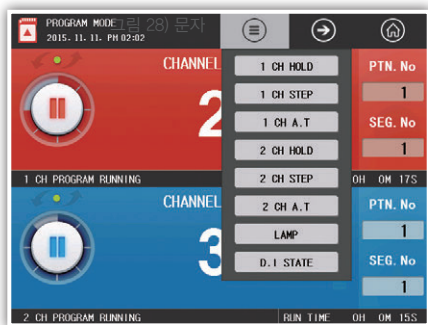
Fig. 32) Menu pane of program operation 1 screen(Individual control)

No.	Description
1	Hold is enabled only during program operation and current setting value is maintained when executing.
2	Step is enabled only during program operation, and it ends current segment and then forcibly goes to next segment.
3	Press User-defined button to run assigned relay in [Main menu] - [System menu] - [DO].
4	Go to DI state check screen.

2) Program operation 2 screen

▶ **Concurrent control**

– Press Run button in the center left of stop screen of program operation screen 2 in order to switch to the program operation 2 operation screen.
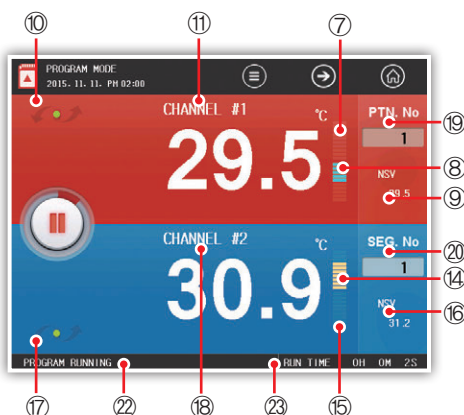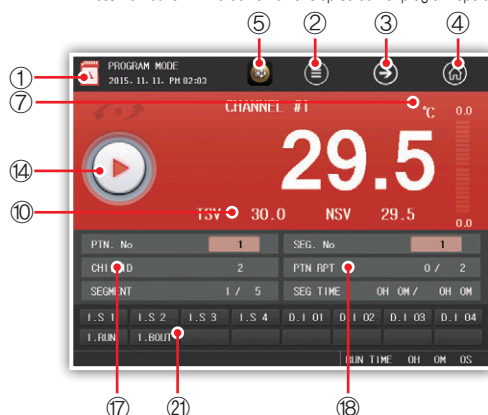

Fig. 33) Stop screen of program operation 2(Ch.1)

Fig. 34) Operation screen of program operation 2(Ch.1)

Fig. 35) Stop screen of program operation 2(Ch.2)

Fig. 36) Operation screen of program operation 2(Ch.2)

No.	Description
1	Displays state of SD card.
2	Runs hidden menu pane. Click the same to hide menu pane.
3	Go to operation 3 screen.
4	Go to main menu screen.
5	Switch channel (Ch.1 ↔ Ch.2).
6	Displays measurement(PV) of channel.
7	Displays unit of channel.
8	Displays heating control output(H.MV) of channel. (For heating/cooling control)
9	Displays cooling control output(C.MV) of channel. (For heating/cooling control)
10	Displays target setting value(TSV) for channel.
11	Displays current setting value(NSV) for channel.
12	Displays ascending/descending/holding state of channel.
13	Displays tag name of channel (which may be changed with operation setting).
14	Run/stop button.

No.	Description
15	Enter pattern No. for operation.
16	Enter seg No. for operation.
17	Displays applied PID No. of channel.
18	Displays pattern cycle state (Number of actual cycles/Number of set cycles).
19	Displays current segment and total number of segs of current pattern. (Current segment No./Number of segments)
20	Displays elapsed and set time of current segment. (Elapsed time of segment/Se time of segment).

21	Indicates input/output signal state. Press it to display 2nd indicator pane. (Up to 16 in 1 screen so up to 32 in total). * Indicators of operation screen can be set in [Main menu] – [System menu] – [System] – [Indicator].		
			No indicator setting.
		I.S.1	Set IS1 to indicator. IS1 disabled.
		I.S.1	Set IS1 to indicator. IS1 enabled.

| 22	Displays general operation state messages.
23	Displays operation time.

▶ Individual control

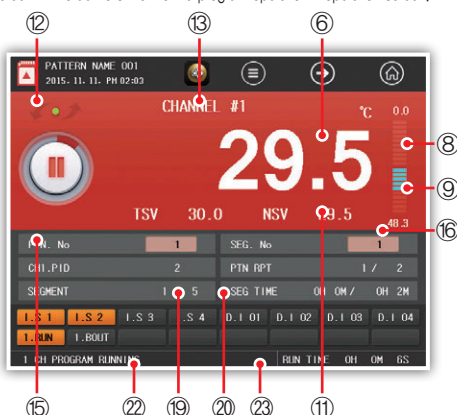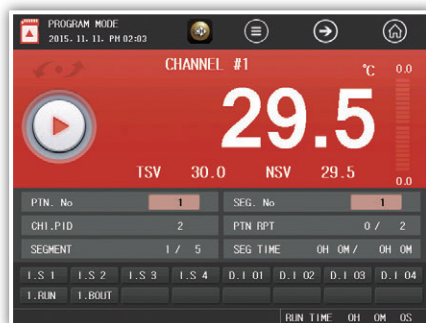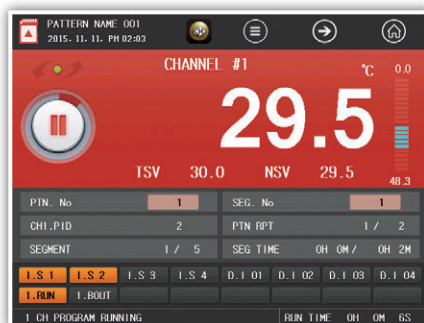Fig. 37) Stop screen of program operation 2(Ch.1)

Fig. 38) Operation screen of program operation 2(Ch.1)
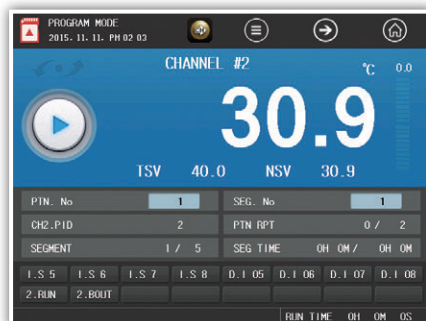
Fig. 39) Stop screen of program operation 2(Ch.2)

Fig. 40) Operation screen of program operation 2(Ch.2)

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Menu pane

Fig. 41) Menu pane of program operation 2 screen(Ch.1)

Fig. 42) Menu pane of program operation 2 screen(Ch.2)

No.	Description
1	Hold is enabled only during program operation and current setting value is maintained when executing.
2	Step is enabled only during program operation, and it ends current segment and then forcibly goes to next segment.
3	Press User-defined button to run assigned relay in [Main menu] - [System menu] - [DO].
4	Go to DI state check screen.

3) Program operation 3 screen (Graph view screen)

▶ Common
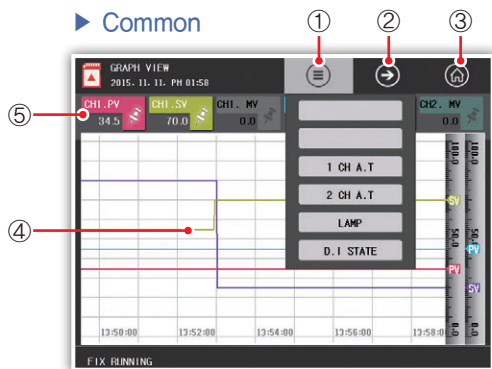
Fig. 43) Program operation 3 screen
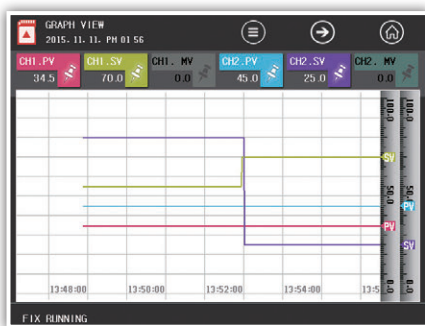
Fig. 44) Menu pane of program operation 3 screen

No.	Description
1	Runs hidden menu pane. Click the same to hide menu pane.
2	Go to program operation 1 screen.
3	Go to main menu screen.
4	Displays measurement, setting value, and output of current operation channel in a graph.
5	Set the data display with the check box. Graph is not displayed with OFF selected.

User can set background color(white/black), drawing(line and dot), and line thickness(1 or 2 pixels) of graph.

It can be changed in [Main menu] – [Operation setting] – [Graph].

※Once the operation is started, the graph is being drawn accordingly. The flow of graph depends on the save interval.

● Step/Hold

It is enabled only during program operation. Enter a key or set Hold/Step in [System menu] – [DI configuration] – [Configuration type] and then set external contact input2(DI2) to ON in order for Hold or external contact input3(DI3) to ON for Step.

Parameter	Description
STEP	Stop the operation of current segment and continue with next segment operation. Run Step in Wait or Hold state to cancel it and continue with next segment.
HOLD	During operation, press Hold button to maintain the momentary setting value for unlimited control regardless of the setting time. Press Hold button again to cancel it and run the program.

▶ DI state screen

Fig. 45) DI state screen

No.	Description
1	Displays selected DI image. The image can be copied in [System] – [Main menu] – [System menu]. Image is sized to 310 X 210.
2	Displays selected DI name. It can be set in [System] – [Main menu] – [System menu].
3	Turns off buzzer for DI.
4	Select DI. If DI is colored in red, DI contact is ON.

● Messages on operation screen
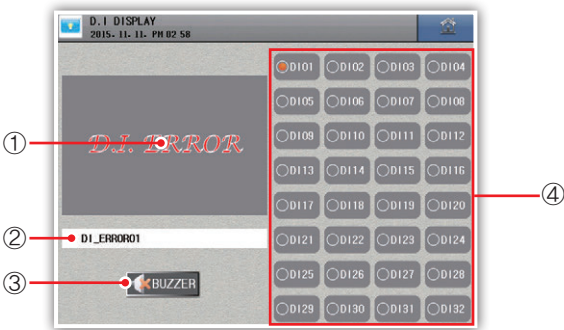
Message	Description
Constant−value operation is running.	−
Program operation is running.	−
Auto− tuning [Ch.1].	−
Auto−tuning [Ch.2].	−
It is in Hold operation.	−
It is in Wait operation.	−
Loading parameters.	−
Control communication error	Communication is unavailable with the control. Check the connection and address.
[Ch.1] input communication error	Ch.1 temperature value of control is not communicated.
[Ch.2] input communication error	Ch.2 temperature value of control is not communicated.
IO[0] module communication error	Communication is unavailable with I/O module No.0.
IO[1] module communication error	Communication is unavailable with I/O module No.1.
IO[2] module communication error	Communication is unavailable with I/O module No.2.
IO[3] module communication error	Communication is unavailable with I/O module No.3.
IO[4] module communication error	Communication is unavailable with I/O module No.4.
IO[5] module communication error	Communication is unavailable with I/O module No.5.
PWM communication error	Communication is unavailable with PWM module.
Control FRAM error	Parameters can't be loaded from FRAM of control.
Parameter error(CONFIG)	A parameter value has an error.
Parameter error(PROG)	Pattern or segment parameter value has an error.
PWM calibration error	PWM calibration value is out of range.
Constant−value operation is running for Ch.1.	−
Program operation is running for Ch.1.	−
It is in Hold operation for Ch.1.	−
It is in Wait operation for Ch.1.	−
Loading parameters for Ch.1.	−
Constant−value operation is running for Ch.2.	−
Program operation is running for Ch.2.	−
It is in Hold operation for Ch.2.	−
It is in Wait operation for Ch.2.	−
Loading parameters for Ch.2.	−

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

2. Operation setting

Screen for operation screen, operation, and data save settings.
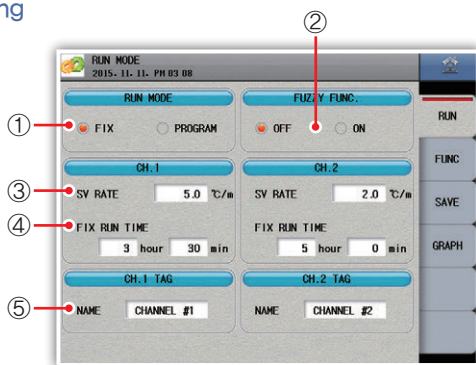
▶ Operation setting

Fig. 46) Operation setting

1) Select a control method.

Parameter	Description
Constant	To control temperature with certain setting value(SV).
Program	To control measurement with change of setting values over time. It is controlled according to a pattern set in [Program] - [Pattern setting].

2) With an initial operation, a measurement may exceed the setting value, which is called Over Shoot. Select the fuzzy function to control the over shoot. With the fuzzy function selected, there may be Under Shoot that the ascending time is delayed according to the load or measurement doesn't reach the setting value.
3) For constant–value control, set temperature change rate by time(minute). (Enabled for constant–value control)
4) For constant–value control, it operates for set time and then stops. (Enabled for constant–value control)
5) Set tag names for Ch.1 and Ch.2. Up to 10 English characters(5 Korean characters) can be entered, and set tag is displayed on the operation screen.

[Temperature setting parameter]

Parameter	Setting range	Default
Operation type	Constant value, Program	Constant value
Fuzzy function	Cancel, Set	Cancel
SV change rate for Ch.1	0.0 – 3000.0[℃/min]	0.0
Constant–value operation time for Ch.1	0 – 9999[min]	0
SV change rate for Ch.1	0.0 – 3000.0[℃/min]	0.0
Constant–value operation time for Ch.1	0 – 9999[min]	0
Ch.1 tag	Up to 10 English characters	CHANNEL #1
Ch.2 tag	Up to 10 English characters	CHANNEL #2

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

● Fuzzy function

It is to control over shoot using fuzzy inference and useful for the followings.

– To start control at where target setting value and measurements show big difference
– To reduce warming–up time
– Significant load change in normal operation
– Frequent changes of setting values
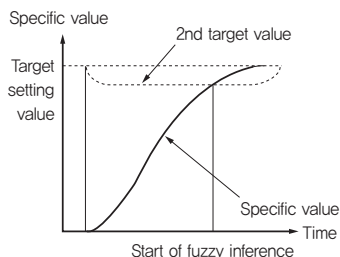
▶ Function setting

Fig. 47) Function setting

1) Control brightness of LCD screen in 8 steps. Press "◀" to dim it and "▶" to brighten it.
2) Function to turn off the back light after set time in order to protect the LCD. Time can be set by minute and set "0" to disable it. In the energy–saving mode, touch the screen to wake it up.
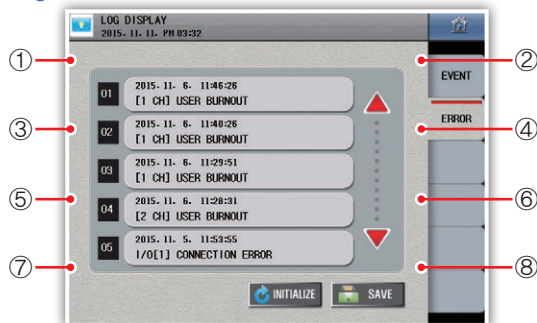3) Select an operation type to recover from power failure.

Parameter	Constant–value control	Program control
STOP	Stopped	Stopped
COLD	Start operation with	Start operation from the 1st segment.
HOT	existing setting value.	Start operation from the segment that was selected before blackout.

4) Turn on/off buzzer for input and operation confirmations.
5) Use to limit the touch panel input. Only operation screen and move buttons enabled.
   If password set in [System setting] – [System], enter the password to change it.
6) Use to limit entering to main menu. When trying to enter the main menu, password input box is prompted if any. Set "0" to disable it.
7) Operation 2 screen is automatically switched by time setting.
8) Change the name of user–defined button. If the language is Korean,
   use Caps to enter "Korea –〉 English upper case –〉 English lower case".
   If the language is English/Chinse, "English upper case –〉 English lower case" can be entered.

[Function setting parameter]

Parameter	Setting range	Default
Screen brightness control	8 steps	Step 3
Energy–saving operation time	0–99 [min]	30 min
Recovery from blackout	STOP, COLD, and HOT	STOP
Beep sound	Cancel, Set	Setting
Touch input lock	Cancel, Set	Cancel
Main menu password	0–9999	0
Operation screen switch time	0–9999	0
Name of user–defined button	Up to 14 characters	User–defined button

● Operation screen switch time setting

Switches operation screen for Ch.1 and Ch.2.
– Set "0" to switch time in order to disable the operation screen switch function.
– With the screen switch time setting, the operation screens of Ch.1 and Ch.2 are repetitively switched with set interval and beep sound when the operation 2 screen is maintained for 1 min without any touch.
– To cancel the screen switch operation, touch any part of screen. It only works with the operation 2 screen.

● Password input screen

Fig. 48) Password input screen

▶ Save setting
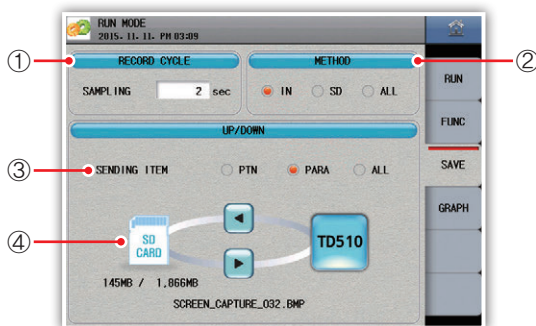
Fig. 49) Save setting

1) Set data save interval.
2) Select data storage.
3) Select setting items to be sent to SD card.
4) Upload/download setting values.

[Function setting parameter]

Parameter	Setting range	Default
Save interval (Sampling time)	1–360 [sec]	2
Storage media	Internal, SD, and All	All
Item to send	Pattern, Parameter, and All	All
Download	–	–
Upload	–	–

● Upload/Download screen
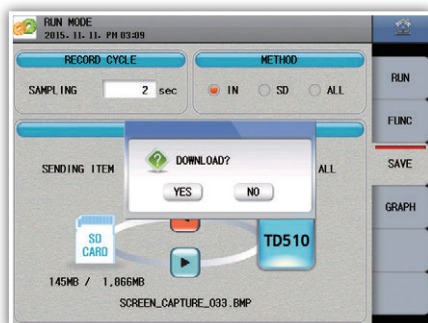
Fig. 50) Download screen
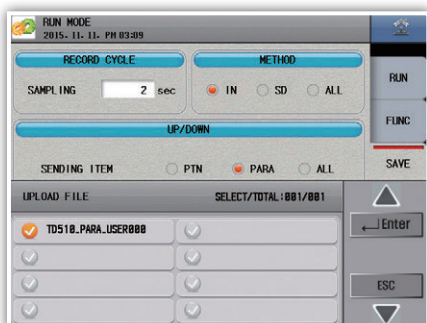
Fig. 51) Upload screen

▶ Graph
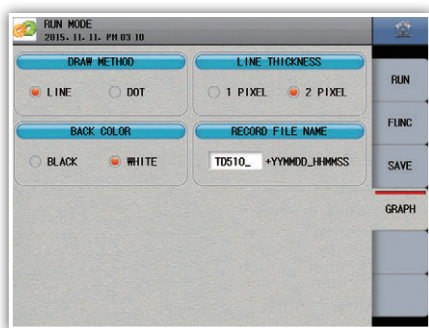
Fig. 52) Graph

1) Select line or dot graph shown in Operation screen 3 and PV graph view screen.
2) Select the thickness of line of graph shown in Operation screen 3 and PV graph view screen.
3) Select background colors for the operation screen 3, PV graph view, and pattern setting screen.
4) Set names of files saved in the internal memory or SD card.

Parameter	Setting	Default
Drawing type	Line and dot	Line
Line thickness	1 pixel and 2 pixels	1 pixel
Background color	Black and white	White
Name of saved file	Up to 6 characters (English, numeric, and symbol)	TD510_

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

● Screen by selection

Fig. 53) Line thickness-2 pixels

Fig. 54) Line thickness-1 pixel

Fig. 55) Background color-Black

3. PV graph view

Screen to check graph of files saved in the internal memory or SD card.
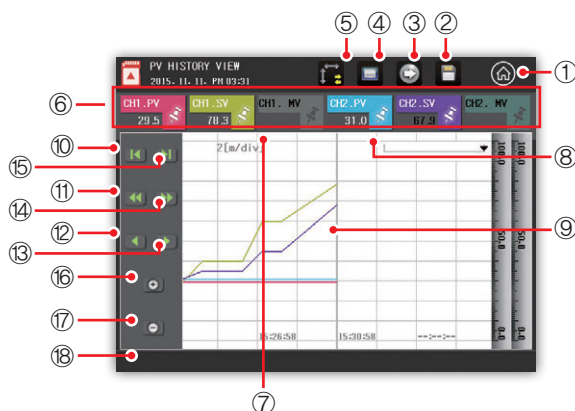
Fig. 56) PV graph view - Time scale

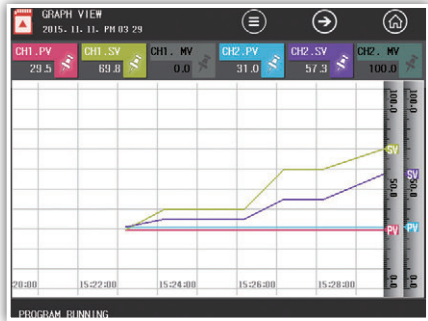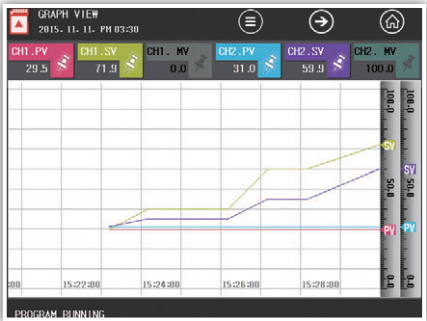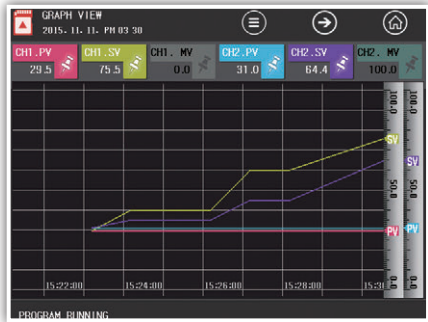| No.	Description
1	Go to menu screen.
2	Displays files saved in an SD card. Up to 512 files (enabled when not saved in SD card)
3	Transfers recorded data to SD card. (enabled when not saved in the internal memory)
4	Displays files saved in the intern memory. (enabled when not saved in the internal memory)
5	Select time and size scales.
6	Displays or hides graph of selected value. For heating/cooling control, MV values are shown in the order of H.MV −〉 C.MV −〉 Hide.
7	Displays time by gradation.
8	Displays position of data specified by the base line.
9	Base line to display values.
10	Go to beginning of data.
11	Go to previous page.
12	Go to previous pixel. Press and hold it to move by 10 and 20 pixels.
13	Go to next pixel. Press and hold it to move by 10 and 20 pixels.
14	Go to next page.
15	Go to end of data.
16	Scale up time scale. It can't exceed the save interval.
17	Scale down time scale. Scale factors are x1, x2, x4, x8, and x16.
18	Displays storage position and name of displayed files. Ex) SD : TD510_140905_110812 − TD510_140905_110812 file stored in SD card

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications
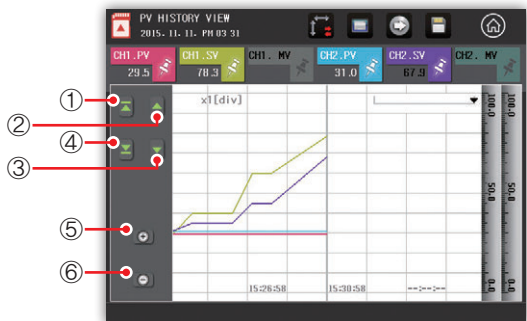
Fig. 57) PV graph view - Size scale

No.	Description
1	Go to max value of data.
2	Go to previous pixel. Press and hold it to move by 10 and 20 pixels.
3	Go to next pixel. Press and hold it to move by 10 and 20 pixels.
4	Go to min value of data.
5	Scale up size scale. Scale factors are x1, x2, x4, and x8.
6	Scale down size scale. The smallest scale factor is x1.
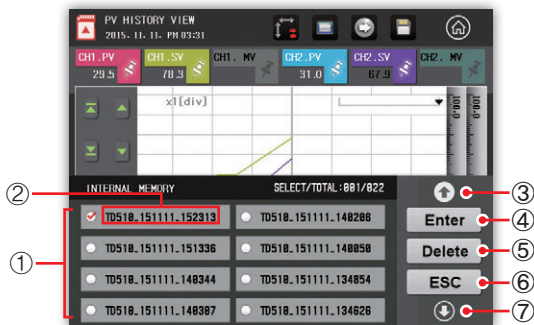
Fig. 58) PV graph view - File selection pane

No.	Description
1	Select a file.
2	This is the name of saved file. The name can be changed in "Graph of operation setting."
3	Go to previous page.
4	Displays graph of selected file.
5	Deletes a selected file.
6	Cancels selection.
7	Go to next page.

4. Time/schedule setting

Screen to set current time and schedule. Schedule can be repeated by day.
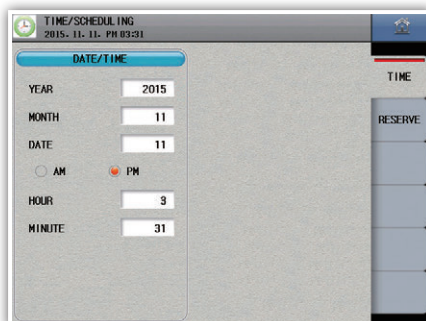
Fig. 59) Time setting
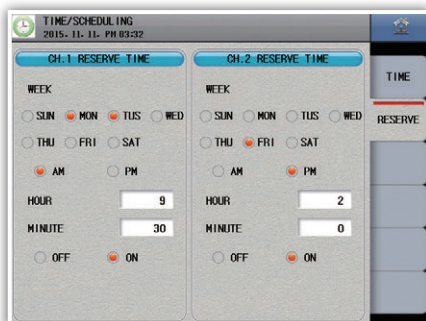
Fig. 60) Schedule setting

No.	Description
1	Set current time. It can't be changed when it is being saved.
2	Select a day to operate. One or more days can be selected.
3	Set operation start time.

[Current time setting parameter]

Parameter	Setting range	Default
Year	2000 – 2099	–
Month	1 – 12	–
Date	1 – 31	–
Morning/Afternoon	Morning and Afternoon	–
Hour	1 – 12	–
Minute	0 – 60	–

[Schedule time setting parameter]

Parameter	Setting range	Default
Operation day	Mon, Tue, Wed, Thu, Fri, Sat, and Sun	–
Morning/Afternoon	Morning and Afternoon	Morning
Hour	1 – 12	12
Minute	0 – 60	0
Schedule check	Cancel, Set	Cancel

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

5. Event

Screen to show event or error history.

▶ Event

Displays history of up to 80 events.
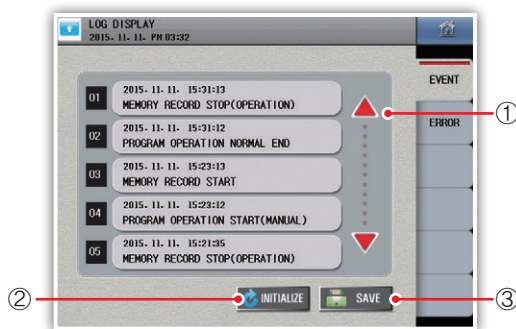
Fig. 61) Event history

No.	Description
1	Go to other pages. History of up to 80 items can be checked.
2	Initialize event history. (enabled when it is not being saved)
3	Save event history to SD card. (enabled when it is not being saved)

Event message	Description
Power on	TD510 is turned on.
Power off	TD510 is turned off.
SD card inserted	SD card is recognized.
SD card removed	SD card is removed.
Constant-value operation started (Manual)	Constant-value operation is started with Run button.
Constant-value operation started (Communication)	Constant-value operation is started by communication.
Constant-value operation started (DI1)	Constant-value operation is started with contact input(DI1).
Constant-value operation stopped (Manual)	Constant-value operation is stopped with Stop button.
Constant-value operation stopped (Communication)	Constant-value operation is stopped by communication.
Constant-value operation stopped (DI1)	Constant-value operation is stopped with contact input(DI1).
Constant-value operation stopped (Error)	Constant-value operation is stopped due to an error.
Constant-value operation normal stop	Constant-value operation is normally stopped.
Program operation started (Manual)	Program operation is started with Run button.
Program operation started (Communication)	Program operation is started by communication.
Program operation started (DI1)	Program operation is started with contact input(DI1).
Program operation stopped (Manual)	Program operation is stopped with Stop button.
Program operation stopped (Communication)	Program operation is stopped by communication.
Program operation stopped (DI1)	Program operation is stopped with contact input(DI1).
Program operation stopped (Error)	Constant-value operation is stopped due to an error.
Program operation normal stop	Program operation is normally stopped.
Hold function started (Manual)	Hold is started with Hold button.
Hold function started (Communication)	Hold is started by communication.
Hold function started (DI2)	Hold is started with contact input(DI2).
Hold function stopped (Manual)	Hold is stopped with Hold button.
Hold function stopped (Communication)	Hold is stopped by communication.

Event message	Description
Hold function stopped (DI2)	Hold is stopped with contact input(DI2).
Step function operation (Manual)	Step is conducted with Step button.
Step function operation (Communication)	Step is conducted by communication.
Step function operation (DI3)	Step is conducted with contact input(DI3).
Ch.1 auto tuning started (Manual)	Auto tuning is started with Ch.1 auto tuning button.
Ch.1 auto tuning started (Communication)	Ch.1 auto tuning is started by communication.
Ch.1 auto tuning stopped (Manual)	Auto tuning is stopped with Ch.1 auto tuning button.
Ch.1 auto tuning stopped (Communication)	Ch.1 auto tuning is stopped by communication.
Ch.1 auto tuning normal stop	Ch.1 auto tuning is normally stopped.
Ch.2 auto tuning started (Manual)	Auto tuning is started with Ch.1 auto tuning button.
Ch.2 auto tuning started (Communication)	Ch.1 auto tuning is started by communication.
Ch.2 auto tuning stopped (Manual)	Auto tuning is stopped with Ch.1 auto tuning button.
Ch.2 auto tuning stopped (Communication)	Ch.1 auto tuning is stopped by communication.
Ch.2 auto tuning normal stop	Ch.1 auto tuning is normally stopped.
Constant−value operation started (HOT)	Constant−value operation is started with recovery of power failure.
Constant−value operation started (Schedule)	Constant−value operation is started with schedule function.
Program operation started (HOT)	Program operation is started with recovery of power failure.
Program operation started (Schedule)	Program operation is started with schedule function.
SD card save started	It starts to save to SD card.
SD card save stopped	It stops to save to SD card.
SD card save stopped (No memory)	It stops to save to SD card because it is removed.
SD card save stopped (Capacity exceeded)	It stops to save to SD card because the capacity is exceeded.
SD card save stopped (Number of files exceeded)	It stops to save to SD card because the number of generated files is exceeded (up to 522).
Memory save started	It starts to save to internal memory.
Memory save stopped	It stops to save to internal memory.
Memory save stopped (Capacity exceeded)	It stops to save to internal memory because the capacity is exceeded.
Memory save stopped (Number of files exceeded)	It stops to save to internal memory because the number of generated files is exceeded (up to 522).
Internal memory initialized	Internal memory is initialized.
Parameter initialized	Parameter is initialized.
SD card parameter uploaded (PTN)	Pattern data is uploaded to SD card.
SD card parameter uploaded (PARA)	Parameter is uploaded to SD card.
SD card parameter uploaded (ALL)	Pattern data and parameter are uploaded to SD card.
Parameter initialized (SUM ERROR)	Parameter is initialized due to an error.
Event history initialized	Event history is initialized.
Error history initialized	Error history is initialized.
User logo uploaded	User logo is uploaded.
Ch.1 constant−value operation started (Manual)	Ch.1 constant−value operation is started with Run button.
Ch.1 constant−value operation started (Communication)	Ch.1 constant−value operation is started by communication.
Ch.1 constant−value operation started (DI1)	Ch.1 constant−value operation is started with contact input(DI1).
Ch.1 constant−value operation stopped (Manual)	Ch.1 constant−value operation is stopped with Stop button.
Ch.1 constant−value operation stopped (Communication)	Ch.1 constant−value operation is stopped by communication.
Ch.1 constant−value operation stopped (DI1)	Ch.1 constant−value operation is stopped with contact input(DI1).
Ch.1 constant−value operation stopped (Error)	Ch.1 constant−value operation is stopped due to an error.
Ch.1 constant−value operation normal stop	Ch.1 constant−value operation is normally stopped.
Ch.1 program operation started (Manual)	Ch.1 program operation is started with Run button.
Ch.1 program operation started (Communication)	Ch.1 program operation is started by communication.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

Event message	Description
Ch.1 program operation started (DI1)	Ch.1 program operation is started with contact input(DI1).
Ch.1 program operation stopped (Manual)	Ch.1 program operation is stopped with Stop button.
Ch.1 program operation stopped (Communication)	Ch.1 program operation is stopped by communication.
Ch.1 program operation stopped (DI1)	Ch.1 program operation is stopped with contact input(DI1).
Ch.1 program operation stopped (Error)	Ch.1 program operation is stopped due to an error.
Ch.1 program operation normal stop	Ch.1 program operation is normally stopped.
Ch.1 hold function started (Manual)	Ch.1 hold is started with Ch.1 hold button.
Ch.1 hold function started (Communication)	Ch.1 hold is started by communication.
Ch.1 hold function started (DI2)	Ch.1 hold is started with contact input(DI2).
Ch.1 hold function stopped (Manual)	Ch.1 hold is stopped with Ch.1 hold button.
Ch.1 hold function stopped (Communication)	Ch.1 hold is stopped by communication.
Ch.1 hold function stopped (DI2)	Ch.1 hold is stopped with contact input(DI2).
Ch.1 step function operation (Manual)	Ch.1 step is conducted with Ch.1 step button.
Ch.1 step function operation (Communication)	Ch.1 step is conducted by communication.
Ch.1 step function operation (DI3)	Ch.1 step is conducted with contact input(DI3).
Ch.2 constant-value operation started (Manual)	Ch.1 constant-value operation is started with Run button.
Ch.2 constant-value operation started (Communication)	Ch.1 constant-value operation is started by communication.
Ch.2 constant-value operation started (DI4)	Ch.2 constant-value operation is started with contact input(DI4).
Ch.2 constant-value operation stopped (Manual)	Ch.2 constant-value operation is stopped with Stop button.
Ch.2 constant-value operation stopped (Communication)	Ch.2 constant-value operation is stopped by communication.
Ch.2 constant-value operation stopped (DI4)	Ch.2 constant-value operation is stopped with contact input(DI4).
Ch.2 constant-value operation stopped (Error)	Ch.2 constant-value operation is stopped due to an error.
Ch.2 constant-value operation normal stop	Ch.2 constant-value operation is normally stopped.
Ch.2 program operation started (Manual)	Ch.2 program operation is started with Run button.
Ch.2 program operation started (Communication)	Ch.2 program operation is started by communication.
Ch.2 program operation started (DI4)	Ch.2 program operation is started with contact input(DI4).
Ch.2 program operation stopped (Manual)	Ch.2 program operation is stopped with Stop button.
Ch.2 program operation stopped (Communication)	Ch.2 program operation is stopped by communication.
Ch.2 program operation stopped (DI4)	Ch.2 program operation is stopped with contact input(DI4).
Ch.2 program operation stopped (Error)	Ch.2 program operation is stopped due to an error.
Ch.2 program operation normal stop	Ch.2 program operation is normally stopped.
Ch.2 hold function started (Manual)	Ch.2 hold is started with Ch.2 hold button.
Ch.2 hold function started (Communication)	Ch.2 hold is started by communication.
Ch.2 hold function started (DI5)	Ch.2 hold is started with contact input(DI5).
Ch.2 hold function stopped (Manual)	Ch.2 hold is stopped with Ch.2 hold button.
Ch.2 hold function stopped (Communication)	Ch.2 hold is stopped by communication.
Ch.2 hold function stopped (DI5)	Ch.2 hold is stopped with contact input(DI5).
Ch.2 step function operation (Manual)	Ch.2 step is conducted with Ch.2 step button.
Ch.2 step function operation (Communication)	Ch.2 step is conducted by communication.
Ch.2 step function operation (DI6)	Ch.2 step is conducted with contact input(DI6).

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Error

Displays history of up to 40 errors.
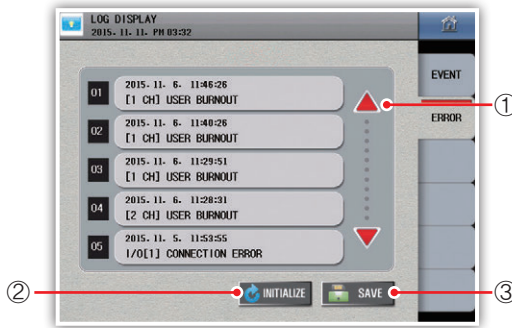
Fig. 62) Error history

No.	Description
1	Go to other pages. History of up to 40 items can be checked.
2	Initialize error history. (enabled when it is not being saved)
3	Save error history to SD card. (enabled when it is not being saved)

| Error message	Description
[Ch.1] Sensor disconnected	Ch.1 sensor is disconnected.
[Ch.1] ADC error	Ch.1 ADC converter has an error.
[Ch.1] Calibration error	Ch.1 calibration is incorrect.
[Ch.1] input connection error	Ch.1 input connection is incorrect.
[Ch.2] Sensor disconnected	Ch.2 sensor is disconnected.
[Ch.2] RJC error	Ch.2 ADC converter has an error.
[Ch.2] ADC error	Ch.2 calibration is incorrect.
[Ch.2] Calibration error	Ch.2 input connection is incorrect.
[Ch.2] input connection error	Ch.2 input connection is incorrect.
I/O[nn] connection error	I/O[nn] is not connected.
D.I.nn found	Contact input(D.I nn) is found.
D.I.nn cancelled	Contact input(D.I nn) is cancelled.
P.alarm nn found	Pattern alarm(P.alarm nn) is found.
P.alarm nn released	Pattern alarm(P.alarm nn) is released.
S.alarm nn found	System alarm(S.alarm nn) is found.
S.alarm nn released	System alarm(S.alarm nn) is released.

Program
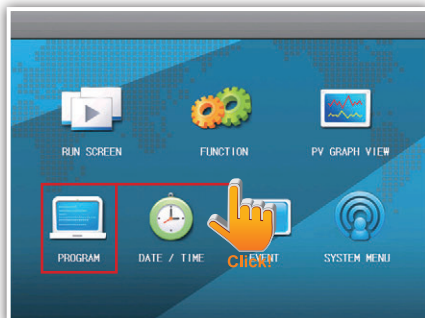
Fig. 63) Main menu
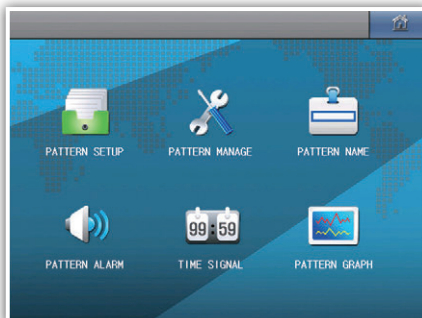
Fig. 64) Program menu

To control measurement with change of setting values over time. Program control parameters can be set in this screen.
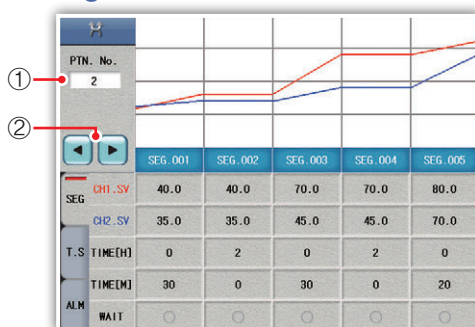
1. Pattern setting

Fig. 65) Pattern setting

1) Change the pattern No. (Pattern 1 – 100)
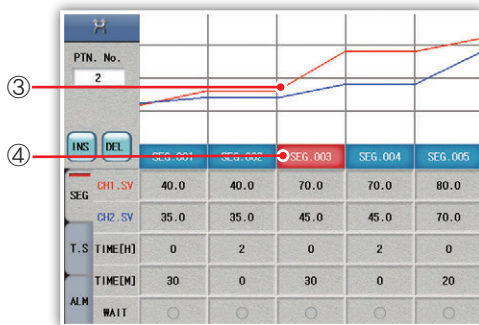2) Move by 5 segment. If a segment is selected, it is changed to Insert/Delete button.

Fig. 66) Pattern insertion/deletion

3) Pattern graph is displayed.
4) Select a segment. Selected segment can be inserted/deleted.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Seg
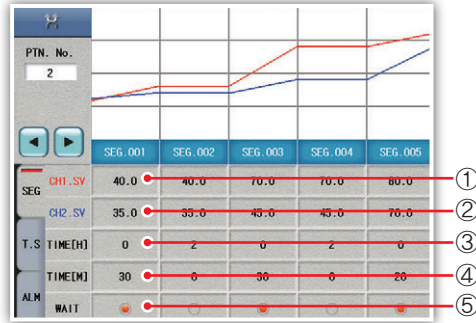

그림 67) 세그먼트 설정

1) Set Ch.1 temperature setting value of the segment.
2) Set Ch.2 temperature setting value of the segment.
3) Set operation time(H) of the segment.
4) Set operation time(M) of the segment.
5) Select the wait function set in "Pattern Management – Wait/Start."

[Seg parameter]

Parameter	Setting	Default
Ch.1.SV	EU(0 – 100) [℃]	EU(0)
Ch.2.SV	EU(0 – 100) [℃]	EU(0)
Time [H]	0 – 9999 [H]	0
Time [M]	0 – 59 [M]	0
Wait	Cancel, Set	0

▶ T.S

Fig. 68) Time signal

Among 20 time signals, up to 4 of them can be selected for a segment.

[T.S parameter]

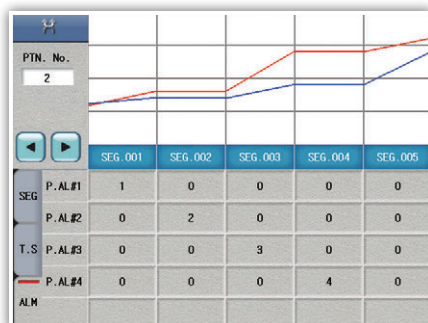| Parameter	Setting	Default
T.S #n	0~19	0

n : 1~4

▶ Alarm

Fig. 69) Alarm signal

Among 8 pattern alarms, up to 4 of them can be selected for a segment.

[Alarm parameter]

Parameter	Setting range	Default
P.AL #n	0 ∼ 8	0

n : 1∼4

2. Pattern management

▶ Pattern information
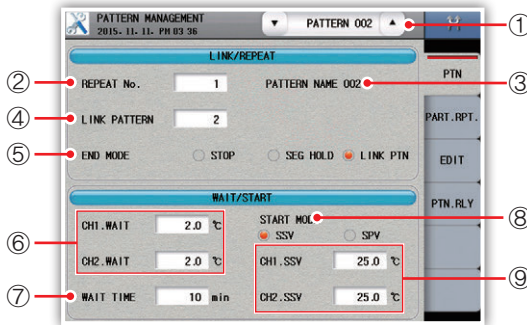

Fig. 70) Pattern information

1) Select a pattern. Parameters can be set for individual patterns in this screen.
2) Set the number of pattern cycles.
3) Displays name of selected pattern.
4) When current pattern operation is finished, set a pattern No. to continue operation.
   If End mode is selected as a connected pattern, the connected operation is conducted.
5) Set end mode.

Parameter	Description
Stop operation	Stop operation when current pattern is finished.
Holding seg	Continue operation with setting values of last segment.
Connect	Continue operation with the pattern set to the connected pattern No.

6) If a measurement is out of wait operation range of setting value, it waits for a segment to continue during set wait operation time and then moves to next segment. Wait operation may be set by segment of the pattern.
7) Set wait operation time. Set "0" to wait operation time in order to skip wait operation.
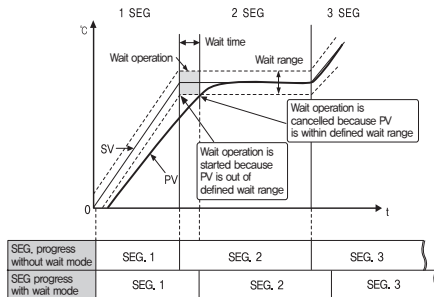8) Set Start mode.

Parameter	Description
SSV	Start operation with start setting value.
SPV	Start operation with current specific value.

9) If SSV is set to Start mode, start SV can be set by channel.

[Pattern information parameter]

Parameter	Setting range	Default
Number of pattern cycles	1 – 999	1
Connected pattern No.	0 – 100	0
End mode	Stop operation, Holding seg, and Connect pattern	Stop operation
Ch.1 Wait	EU(0 – 100) [℃]	0.0
Ch.2 Wait	EU(0 – 100) [℃]	0.0
Wait operation (M)	0 – 9999 [M]	0
Start mode	SSV and SPV	SPV
Ch.1 Start SV	EU(0 – 100) [℃]	0.0
Ch.2 Start SV	EU(0 – 100) [℃]	0.0

Before starting

Installation

Operation

Screen block diagram

Function setting

Program
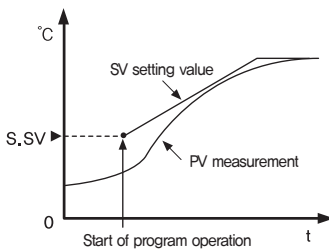
System setting

Specifications

● Wait operation

If measurement (PV) is out of wait range, it waits until the measurement(PV) enters the wait range for defined wait time.
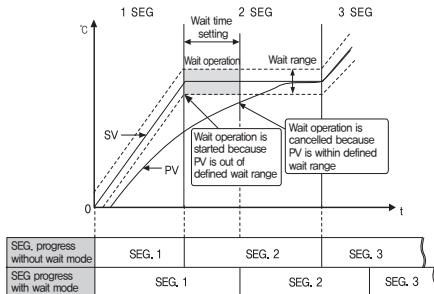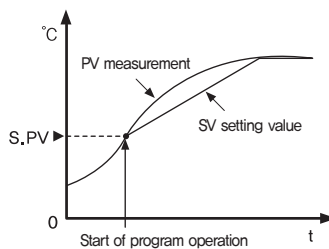

If wait time is elapsed, it moves to next segment even though measurement(PV) is out of wait range.

● Operation start mode
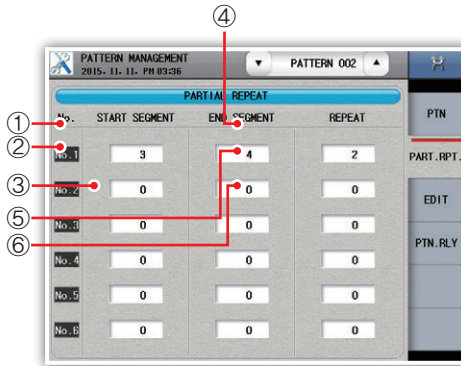

[Start mode SSV]

[Start mode SPV]

▶ Copy/Delete

Fig. 71) Pattern copy/deletion

1) Select an original pattern.
2) Select a target pattern.
3) Copy the pattern.
4) Select a patter No. to delete.
5) Delete the pattern.
6) Delete all patterns.

[Copy/Delete parameter]

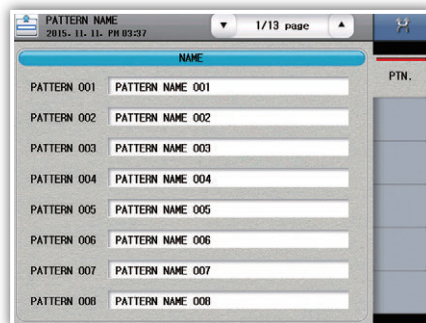| Parameter	Setting range	Default
Original pattern No.	1 ~ 100	1
Copied pattern No.	1 ~ 100	1
Deleted pattern No.	1 ~ 100	1

3. Pattern name setting

Fig. 72) Pattern name

1) Go to other page. Up to 8 pattern names can be set per page.
2) Change a pattern name. If the language is Korean, use Caps to enter
   "Korea –〉 English upper case –〉 English lower case". If the language is English/Chinse,
   "English upper case –〉 English lower case" can be entered

[Pattern name parameter]

Parameter	Setting range	Default
Pattern name nn	Up to 23 characters	PATTERN NAME nn

nn : 1 ~ 100

Before starting

Installation

Operation

Screen block diagram

Function setting

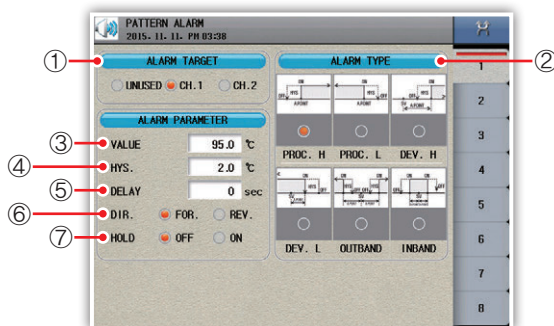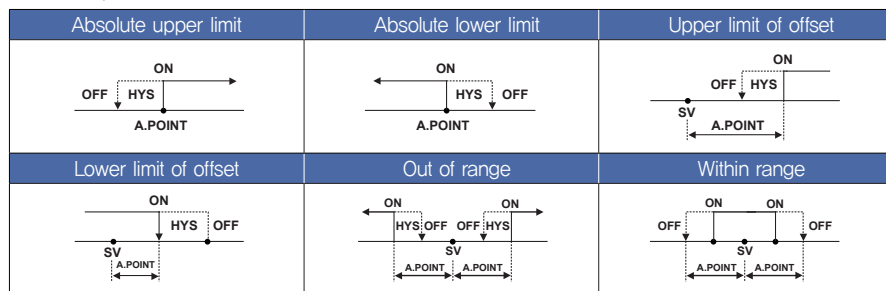Program

System setting

Specifications

4. Pattern alarm setting

Fig. 73) Pattern alarm

1) Select an alarm target.
2) Select an alarm type.
3) Set a setting value(offset).
4) Set hysteresis.
5) Set delay.
6) Set direction of alarm. NORMAL OPEN or NORMAL CLOSE
7) Set hold function.

● Alarm operation

Absolute upper limit	Absolute lower limit	Upper limit of offset
Lower limit of offset	Out of range	Within range

[Pattern alarm parameter]

| Parameter	Setting range	Default
Alarm target	None, Ch.1, and Ch.2	None
Alarm type	Absolute upper limit, Absolute lower limit, and Upper limit of offset	0
Setting value(offset)	Absolute upper and lower limits : EU(0 − 100) Upper and lower limits of offset : EUS(−100 − 100) Out of and within range : EUS(0 − 100)	0.0
Hysteresis	EUS(0 − 100)	0.0
Delay(S)	0 − 9999 [S]	0
Direction	Normal open and Normal close	Normal open
Hold	Cancel, Set	Cancel

5. Time signal setting
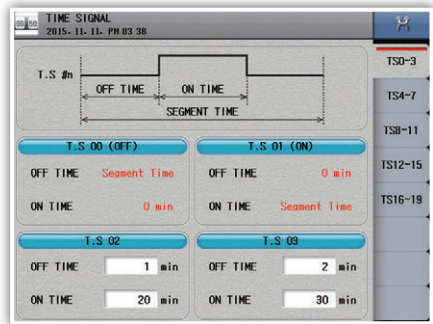
Fig. 74) Time signal

Up to 20 time signals can be set.
1) Set OFF time. Time signal is on after waiting for defined time from the start point of segment.
2) Set ON time. Time signal is on during defined time from the ON point of segment.

[Time signal parameter]

Parameter	Setting range	Default
OFF Time	0~9999 [M]	0
ON Time	0~9999 [M]	0

● Time signal operation

Fig. 75) Time signal operation

6. Pattern graph

For program operation, pattern and time are shown in a graph.
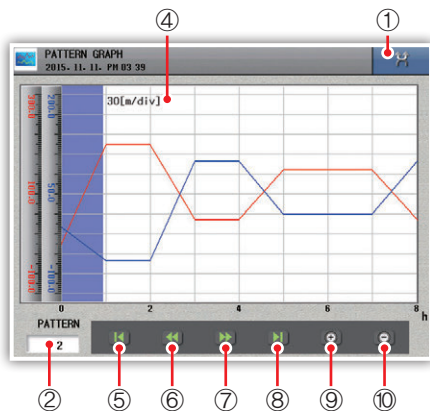
Fig. 76) Pattern graph

Fig. 77) Pattern graph – Operation

No.	Description
1	Go to program menu screen.
2	Change patter No. (No.1 – 100).
3	Blue background color is the progress of operation.
4	Displays time by gradation.
5	Go to beginning of pattern graph.
6	Go to previous screen.
7	Go to next screen.
8	Go to end of pattern graph.
9	Scale up time scale.
10	Scale down time scale.

System setting

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Access to system setting

⚠ **Danger**
1. A user is not required to define system setting.
2. Special attention is required when an operator changes system setting values because it may lead to malfunction.

Fig. 78) Access to system setting

– Default password is "0".
– To restrict access of users, press System icon to enter System setting screen and change user password. (For more details, refer to page. 77)

1. Sensor input setting

▶ **Input setting**

Fig. 79) Ch.1 sensor setting(TC-K)

Fig. 80) Ch.1 sensor change

1. Sensor type

- Select a sensor type. It can't be changed when it is being saved.
- If the type of sensor is changed, related parameters(use range) are initialized so set the type of sensor first.

2. Use range

- Enter range values to use. It can't be changed when it is being saved.

3. Position of decimal point

- If the sensor is DCV, define the position of decimal point. It can't be changed when it is being saved.
- If the sensor is RTD or TC, the position of decimal point is already fixed.

4. Input filter

- Enter a digital filter value of input.

5. Display unit

- Set the display unit. (℃, Ω, V, mV, %, or User-define)
- Select User-define to enter user-defined unit. It can't be changed when it is being saved.

Fig. 81) Ch.2 sensor setting(DCV)

Fig. 82) Ch.2 sensor change

1. DCV input upper/lower limit

- If the sensor is DCV, define the input value of DC voltage. It can't be changed when it is being saved.

| Parameter	설정범위	초기값
Sensor type	Refer to range table by sensor type.	K−1
RTD upper limit / TC upper limit / DCV input upper limit	Within DCV sensor range RTD is not entered.	Input upper limit
RTD lower limit / TC lower limit / DCV input	Within DCV sensor range RTD is not entered.	Input lower limit
Upper limit of use range	EU (0% − 100%)	EU 100 %
Lower limit of use range	EU (0% − 100%)	EU 0 %
Position of decimal point	0, 1, 2, and 3	1
Input filter	0 − 120 S	0 S
Display unit	℃, Ω, V, mV, %, and User−define	℃
User−define	Up to 6 characters	UNITnn

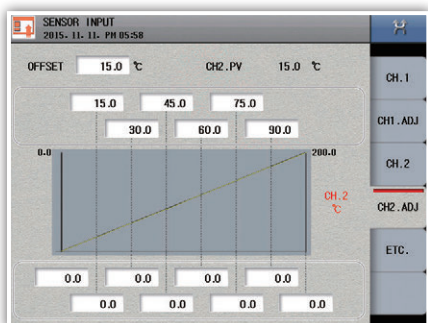## ▶ Temperature compensation
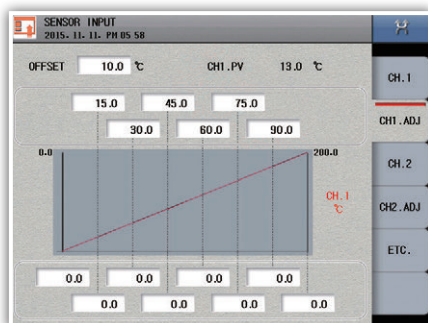
Fig. 83) Sectional compensation(Ch.1)

Fig. 84) Sectional compensation(Ch.2)

1. Compensation value
− Offset is compensated for a temperature measurement. 2. Sectional compensation
− It is used to compensate error by section.
− Set temperature for a base point to compensate temperature.
− Set compensation temperature for each base point.

● Compensation parameter

Parameter	Setting range	Default
Compensation value	EUS(0 % − 100 %)	0
Partial compensation value	−50.0 − 50.0	0

⚠ Caution
• Partial compensation changes angle of section so define sections by purpose to set the values.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications
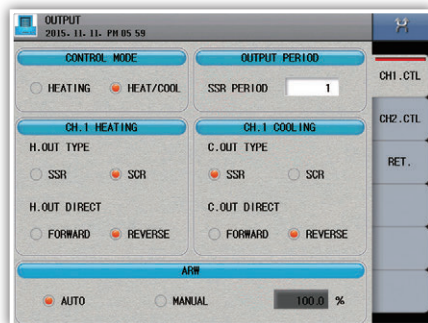
2. Control/transmission output setting

▶ Control output

Fig. 85) Control output (Heating/cooling)
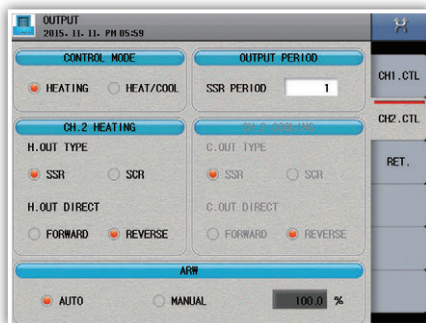

Fig. 86) Control output (Heating)

1. Control mode
– Set heating and heating/cooling controls.
2. Output cycle
– If the control output is "SSR," set the cycle for control output operation.
3. Direction of output
– Set Normal operation or Reverse operation.
4. Prevention of over integral
– Set over integral prevention function mode.
– If it is MANUAL, the over integral prevention ratio can be manually set.

[Control output parameter]

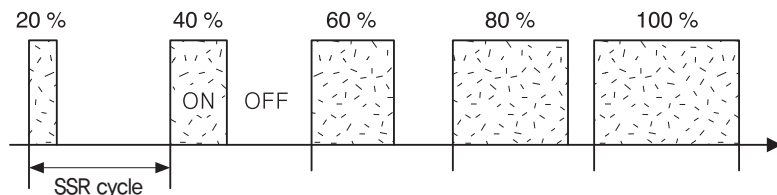| Parameter	Setting range	Default
Control mode	Heating and Heating/Cooling control	Heating control
Output cycle	1 – 1000	1
Output type	SSR and SCR	SSR
Direction of output	Normal operation and Reverse operation	Reverse operation
Prevention of over integral	50 % – 200 %	100 %

Fig. 87) SSR output operation

If Voltage pulse output[SSR] is selected, the output is 20 % – 100 %. According to the voltage pulse output cycle, control output is ON for certain time (OFF for the rest).
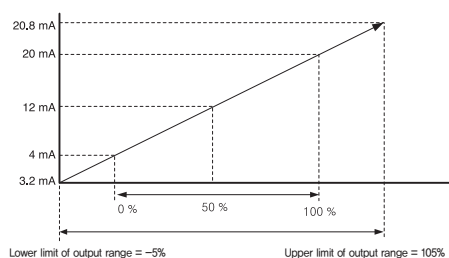
Fig. 88) Current output (SCR)

If current output is selected, it shows relation between control output(MV) and output range. If the lower limit is −5 % or upper limit is 105 %, it outputs 3.2 mA d.c. or 20.8 mA d.c., respectively. Within the range, control output value is linearly converted and output.
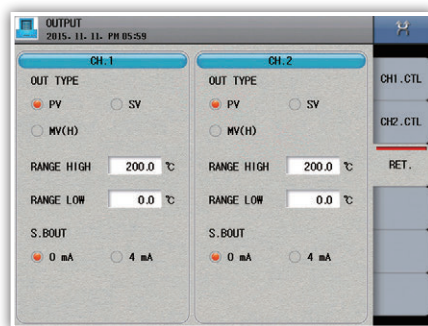
▶ Transmission output

Fig. 89) Transmission output

1. Output type
 – Set transmission output type for temperature. It is used as an input for recorder,
   and the output signal is 4 – 20 mA d.c. (Select PV(temperature measurement),
   MV(temperature control output), or SV(temperature setting).
2. Output range
 – Set upper/lower limit of temperature transmission output range.
3. Temperature disconnection output
 – Select 0 mA or 4 mA.

[Transmission output parameter]

Parameter	Setting range	Default
Output type	PV, MV, SV	PV
Upper limit of output range	EU (0 % ~ 100 %)	EU 100 %
Lower limit of output range	EU (0 % ~ 100 %)	EU 0 %
Temperature disconnection output	0 mA, 4 mA	0 mA

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

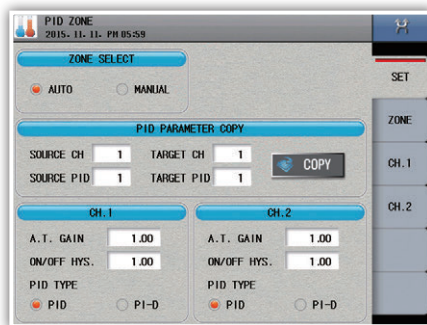Specifications

3. PID setting

▶ PID setting

Fig. 90) PID setting

1. Zone selection type
– Set PID zone selection type.
2. PID control type
3. Copy PID time constant
– Original channel : No. of original channel
– Target channel : No. of target channel
– Original PID : No. of original PID
– Target PID : No. of target PID
– Enter 0 to original PID and copy it in order to copy all PID values of it to a target channel.
4. A.T. GAIN
– Used to manually and finely optimize PID numerical values automatically calculated with constant
  values applied to individual PID items for calculating PID.
5. ON/OFF HYS.
– Set hysteresis(width) for auto tuning or ON/OFF control.

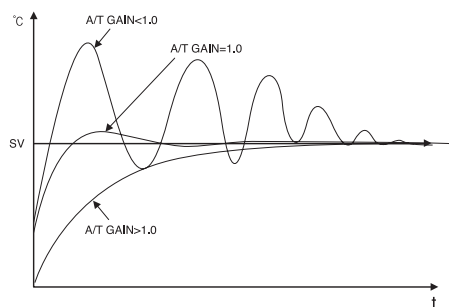| Parameter	Setting range	Default
PID zone selection type	AUTO, MANUAL	AUTO
PID control type	PID, PI–D	PID
Ch.1 A.T. GAIN	0.01 ~ 10.00	1.00
Ch.2 A.T. GAIN	0.01 ~ 10.00	1.00
Ch.1 ON/OFF HYS.	EUS(0% ~ 100%)	0.5
Ch.2 ON/OFF HYS.	EUS(0% ~ 100%)	0.5

Fig. 91) Change of control characteristics(PV) according to changed auto-tuning gain

● Auto tuning gain(A/T gain)

Condition	Unit
GAIN ⟨ 1.0	With stronger derivative and integral controls than auto-tuned PID value, overall response speed becomes faster but the hunting may be more.
GAIN = 1.0	Auto-tuned PID value is used as is.
GAIN ⟩ 1.0	With weaker derivative and integral controls than auto-tuned PID value, overall response speed becomes slower but over shoot can be reduced for more stability.

▶ PID zone

Fig. 92) PID zone

1. Temperature section value
- It is automatically set by the temperature use range.
2. Manual PID No.
- Setting range ; 1 ~ 4
- If it is set to MANUAL, it refers to setting values of manually defined PID zone only.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ PID value

Fig. 93) PID value

1. Proportion(P) zone
– Set proportional band. If the proportional band is larger, control output becomes smaller for the offset and thus the setting value is reached later. If the proportional band is smaller, control output becomes larger for the offset and thus the setting value is reached quicker but there might be hunting if it is too quick.
2. Integral(I) time
– Set integral time. There can be offset only with proportional control. Integral is used to reduce the offset. If the integral time is too long, it is changed too late but if it is too short, there might be frequent hunting.
3. Derivative(D) time
– Set derivative time. To compensate for sharp temperature change, control output is proportional to the angle of temperature change. If derivative time is longer, compensation becomes stronger.
4. Upper limit of output (O/H)
– Set upper limit of output range.
5. Lower limit of output (O/L)
– Set lower limit of output range.
6. Dead band
– Set dead zone of heating and cooling output in the heating and cooling control mode.

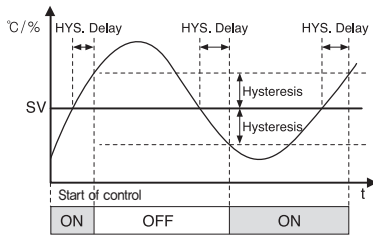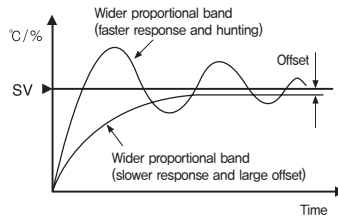| Parameter	Setting range	Default
Proportion(P) zone	0.00 ~ 100.00 %	5.00
Integral(I) time	0.00 ~ 3000.0 SEC	240.0
Derivative(D) time	0.00 ~ 3000.0 SEC	60.0
Upper limit of output (OH)	0.00 ~ 100.00 %	100.00
Lower limit of output (OL)	0.00 ~ 100.00 %	0.00
Dead band	0.00 ~ 100.00 %	50.00

Fig. 94) ON/OFF control
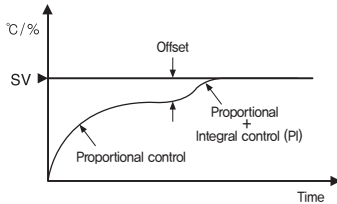

Fig. 95) Proportional control (P control)

Fig. 96) Proportional/Proportional.
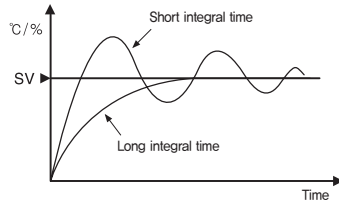Integral control(P control/P.I) control

Fig. 97) Proportional integral control (P.I control)

4. Inner signal

▶ Inner signal setting

– Set target, range direction, and type of individual inner signals.
– Up to 16 inner signals can be set

Fig. 98) Inner signal

1. Target setting
– Set a target of inner signal.
2. Range direction
– Set the operation range of temperature to use inner signal.
3. Type
– Set a target of inner signal to apply.
– T.S.V : Based on target setting value
– N.S.V : Based on current measurement
– P.V1 : Based on operation range L and H for measurement
– P.V2 : Based on setting values and their offset setting values

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

4. Operation range
− Set upper and lower limits of operation range for target.
5. Operation delay
− Set operation delay for target.

Parameter	Setting range	Default
Target setting	None, Ch.1, and Ch.2	None
Range direction	Within range and Out of range	Within range
Type	TSV, NSV, PV1, and PV2	TSV
Upper limit of operation range	Channel EU (0 % − 100 %)	0.0
Lower limit of operation range	Channel EU (0 % − 100 %)	0.0
Operation delay	0 − 9999 min 59 sec	0

▶ Inner signal name setting

− Click the icon on upper left of alarm setting screen in order to go to the inner signal name setting screen.

Fig. 99) Inner signal name

Fig. 100) Enter an inner signal name

1. Enter an inner signal name (using Korean, English, numeric, and symbol characters).
2. An inner signal name may include up to 24 characters (12 ones in Korean).

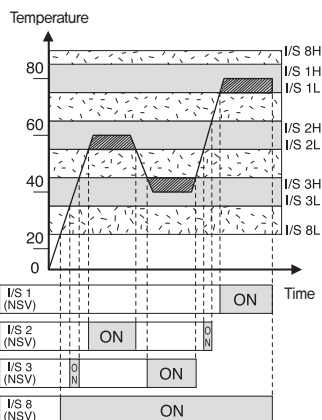| Parameter	Setting range	Default
Inner signal name	Korea, English, numeric, and symbol characters	INNER_SINGALnn

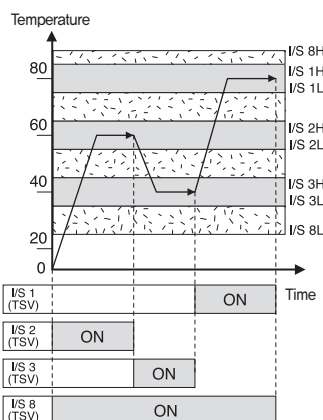Fig. 101) Example of inner signal setting (NSV)

Fig. 102) Example of inner signal setting (TSV)

Fig. 101 is an example of setting inner signal(I.S) NSV. Inner signal No. 1 ~ 3 and 8 are set with temperature, NSV, and Within range so that the inner signal is turn on or off according to change of current setting value(SV).

Fig. 102 is an example of setting inner signal No.1 ~ 3 and 8 with temperature, TSV, and Within range. Based on TSV as a target setting value, the inner signal is turned on/off to show difference with NSV.

Fig. 103 is an example of setting inner signal No.1 ~ 3 and 8 with temperature, PV1, and Within range, and Fig. 104 is an example of setting inner signal No.1 and 2 with temperature, PV2, and type to set ascending/descending.
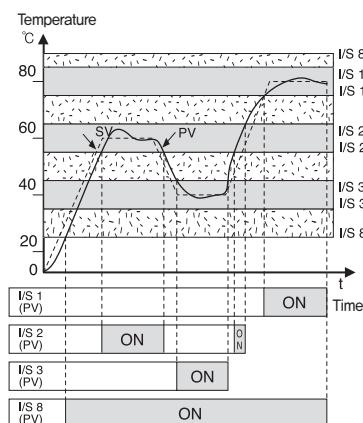

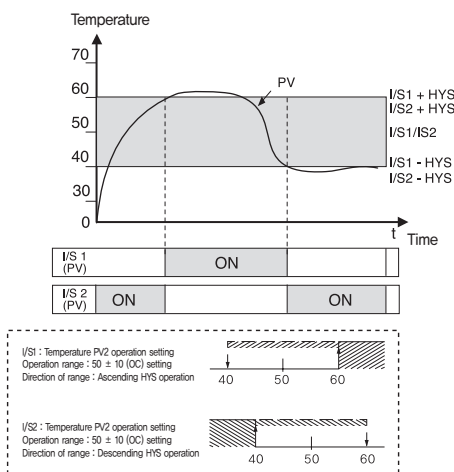Fig. 103) Example of inner signal setting (PV1)

Fig. 104) Example of inner signal setting (PV2)

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

5. ON/OFF signal

▶ Temperature setting

Fig. 105) ON/OFF

6 ON/OFF signals can be set for each channel.

1. L.SV
– Set lower limit of ON/OFF signal operation.
2. M.SV
– Set median of ON/OFF signal operation.
3. H.SV
– Set upper limit of ON/OFF signal operation.
4. LU
– Set lower limit offset of ON/OFF signal operation.
5. HD
– Set upper limit offset of ON/OFF signal operation.

[Temperature ON/OFF signal]

Parameter	Setting range	Default
L.SV	Temperature EU (0 ~ 100)	0.0
M.SV		0.0
H.SV		0.0
LU	Temperature EUS (0 ~ 100)	0.0
HD		0.0
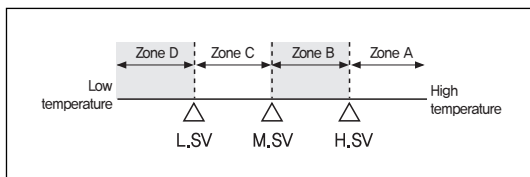
Fig. 106) ON/OFF zone separation

Setting item		Function
L.SV	Low set value	Set lower limit.
M.SV	Middle set value	Set median.
H.SV	High set value	Set upper limit.
Lu	Low limit deviation setting	Set lower limit offset.
Hd	High limit deviation setting	Set upper limit offset.
T1~T4	Temperature 1~4	Zone setting by temperature-side group (Group 4)
H1	H	Zone setting for humidity side (Group 1)

By L.SV, M.SV, and H.SV, the range has 4 zones: A, B, C, and D.
Setting condition is L.SV 〈 M.SV 〈 H.SV.

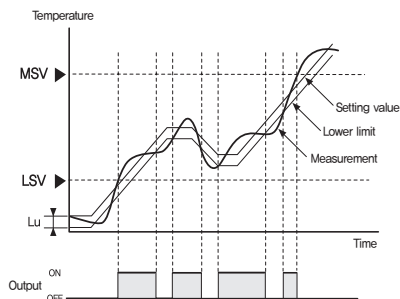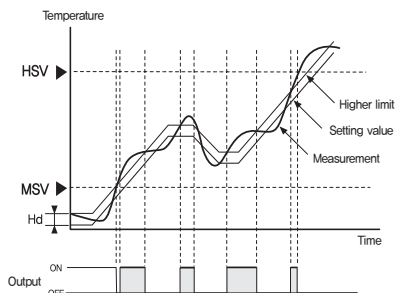| Zone separation	Description
Zone A (PV≥H.SV)	Always OFF regardless of offset
Zone B (M.SV≤PV＜H.SV)	1) Hd=0(Always OFF regardless of offset) 2) Hd≠0(Refer to Fig. 107). OFF : PV＜SV+Hd ON : PV≥SV+Hd
Zone C (L.SV≤PV＜M.SV)	1) Lu=0(Always ON regardless of offset) 2) Lu≠0(Refer to Fig. 108). OFF : PV≤SV−Lu ON : PV＞SV−Lu
Zone D (PV＜L.SV)	Always OFF regardless of offset

Fig. 107) Zone setting 1

Fig. 107) Zone setting 2

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

6. System alarm

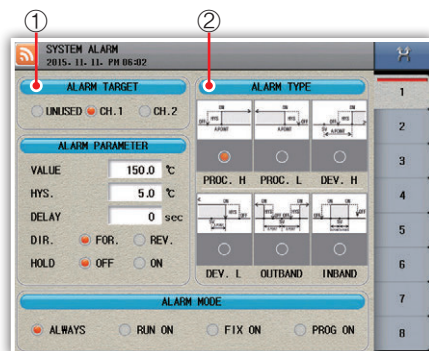## ▶ Alarm setting

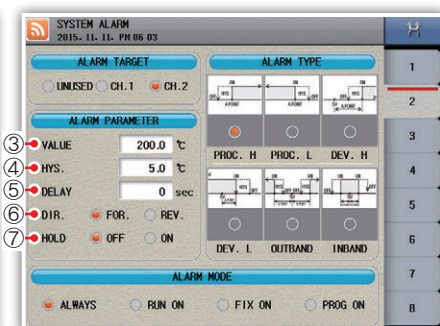8 alarm signals can be set.

Fig. 109) System alarm (Ch.1)　　　　Fig. 110) System alarm (Ch.1)

1. Select an alarm target.
2. Select an alarm type.
3. Set a setting value(offset).
4. Set hysteresis.
5. Set delay.
6. Set direction of alarm. NORMAL OPEN or NORMAL CLOSE
7. Set hold function.
8. Alarm condition
– Set alarm conditions.
– Always : Alarm is always provided.
– During operation : Alarm is provided only during operation.
– Constant value : Alarm is provided only during constant-value operation.
– Program : Alarm is provided only during program operation.

[System alarm parameter]

Parameter	Setting range	Default
Alarm target	None, Temperature, and Humidity	None, Ch.1, and Ch.2
Alarm type	Absolute upper limit, Absolute lower limit, and Upper limit of offset	0
Setting value(offset)	Absolute upper and lower limits : EU(0 – 100) Upper and lower limits of offset : EUS(–100 – 100) Out of and within range : EUS(0 – 100)	0.0
Hysteresis	EUS(0 – 100)	0.0
Delay(S)	0 – 9999 [S]	0
Direction	Normal open and Normal close	Normal open
Hold	Cancel, Set	Cancel

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ System alarm name setting

– Click the icon on upper left of alarm setting screen in order to go to the system alarm name setting screen.
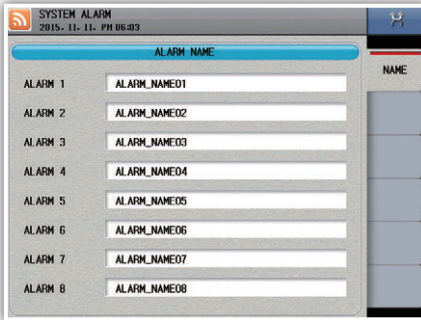

Fig. 111) System alarm name

Fig. 112) Enter a system alarm name

1. Enter a system alarm name (using Korean, English, numeric, and symbol characters).
2. A system alarm name may include up to 24 characters (12 ones in Korean).

Parameter	Setting range	Default
System alarm name	Korea, English, numeric, and symbol characters	ALARM_NAMEnn

7. DI configuration

DI configuration has 7 tabs to set DI functions and operations for individual DI signals. IO specifications are optional for TD510 and configurable DI numbers are limited by the option so make sure to check the IO specifications.
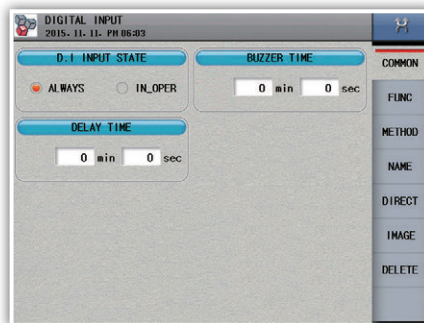
▶ Common

Fig. 113) DI common

1. DI input state
– Set DI input operation condition.
2. Buzzer ON time
– Enter time to maintain buzzer on for DI error.
– Buzzer doesn't sound if DI1 – 3 operations are set to Run/Stop, Hold, and Step.
3. Detection delay
– Enter delay time after DI is detected.

Parameter	Setting range	Default
DI input state	Always and During operation	Always
Buzzer ON time	0 – 9999 min 59 sec	0 S
Detection delay	0 – 9999 min 59 sec	0 S

▶ Configuration type
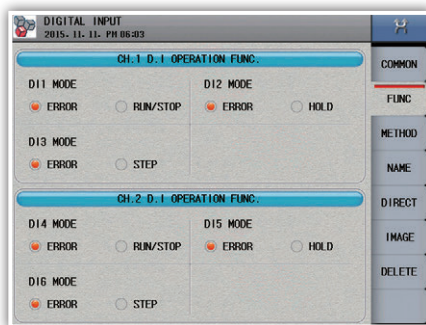

Fig. 114) DI configuration type

1. DI 1 operation type
 – Set function for DI 1 operation.
 – Error : DI 1 operation is used as an error.
 – Run/Stop : DI 1 error enables operation and release of it stops operation.

2. DI 2 operation type
 – Set function for DI 2 operation.
 – Error : DI 2 operation is used as an error.
 – Hold : DI 2 error holds current operation and release of it cancels hold. (For program operation)

3. DI 3 operation type
 – Set function for DI 3 operation.
 – Error : DI 3 operation is used as an error.
 – Step : DI 3 error forces transition from current segment to next one. (For program operation)

[DI configuration type parameter]

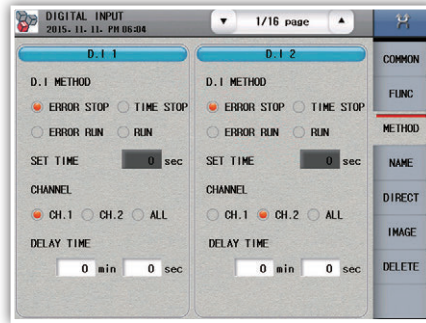| Parameter	Setting range	Default
DI1 operation type	Error and Run/Stop	Error
DI2 operation type	Error and Hold	Error
DI3 operation type	Error and Step	Error
DI4 operation type	Error and Run/Stop	Error
DI5 operation type	Error and Hold	Error
DI6 operation type	Error and Step	Error

▶ Configuration setting

Fig. 115) DI configuration setting

1. Operation after detection
- Error stop : DI error shows DI error screen and stops operation.
- Time stop : DI error shows DI error screen and stops operation after the setting time is elapsed.
- Error operation : DI error shows DI error screen and continues operation.
- Operation : DI error doesn't show DI error screen and continues operation.
- Setting time : For Time stop, it stops operation after the setting time is elapsed.

2. Detection delay : Delay after DI occurrence may be set by DI.

Parameter	Setting range	Default
Operation after detection	Error stop, Time stop, Error operation, and Operation	Error stop
Setting time	0 – 9999 S	0 S
Operation channel	Ch.1, Ch.2 and All	All
Detection delay	0 – 9999 min 59 sec	0 S

▶ DI name
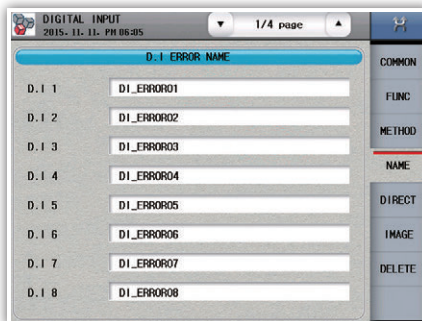
Fig. 116) DI name

Fig. 117) Enter a DI name

1. Enter a DI error name (using Korean, English, numeric, and symbol characters).
2. Entered DI error name is shown on DI error screen for the error.
3. A DI error name may include up to 24 characters (12 ones in Korean).

Parameter	Default	Setting range
DI error name	DI_ERRORnn	Korean, English, numeric, and symbol characters

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Contact type

Fig. 118) DI contact type

1. Set contact type.
– Contact A : DI runs if a DI contact is connected. (Normal Open)
– Contact B : DI runs if a DI contact is disconnected. (Normal Close)

▶ Error image
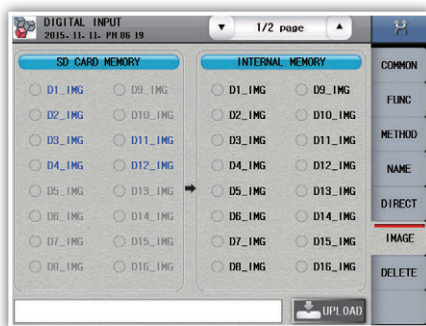
Fig. 119) DI error image setting

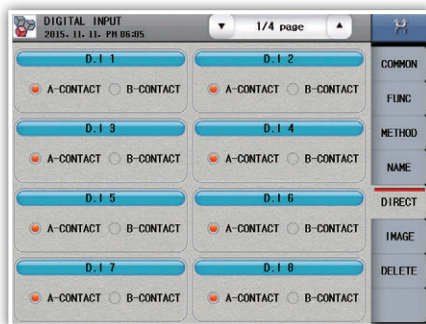For a DI error, it shows a user–defined image what was uploaded to the internal memory.
If there is no user–defined image in the internal memory, basic image is shown.
1. State display : Upload progress is shown.
2. Upload : Upload selected image files of SD card to the internal memory.
   (It can't operate when it is being saved)

⚠ Caution
An error image must have the resolution of 310X210 and name of Dnn_IMG.bmp
(e.g. D1_IMG.bmp, D12_IMG.bmp). Files must be placed in Caution "TD510\DI_IMG" folder
of root direction of SD card. Otherwise, they are not uploaded.
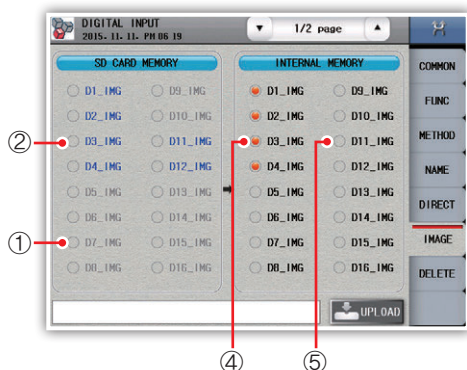
Fig. 120) DI error image upload

Fig. 121) Confirm DI error image upload

1. There is no user-defined image in SD card.
2. There is a user-defined image in SD card.
3. Select a user-defined image to upload from SD card to the internal memory.
4. There is a user-defined image already uploaded to the internal memory.
5. There is no user-defined image in the internal memory.

▶ Image deletion
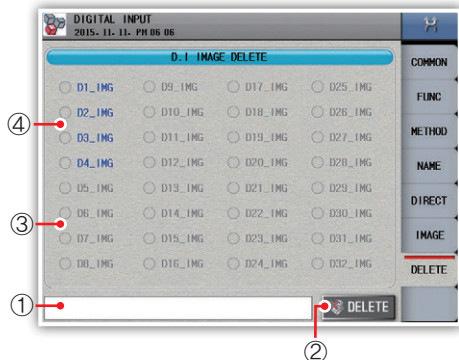
Fig. 122) DI error image deletion
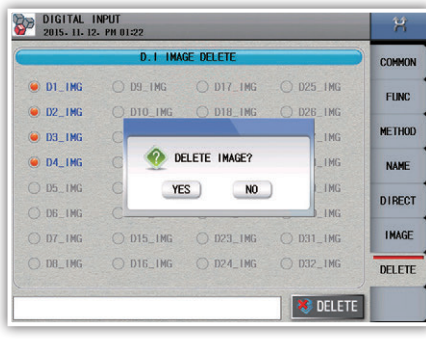
Fig. 123) Confirm DI error image deletion

1. State display : Image deletion progress is shown.
2. Delete : Delete a selected image files in the internal memory.
3. There is no user-defined image in the internal memory.
4. There is a user-defined image in the internal memory.
5. It is impossible to recover deleted images.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

8. DO configuration

DO configuration setting has 8 tabs and assigns system signals to relay outputs. If duplicate relay numbers are set, the relays works even one of them is output.

IO specifications are optional for TD510 and configurable relay numbers are limited by the option so make sure to check the IO specifications.

▶ Inner signal

– Screen to set relays for inner signals.
– If an inner signal is transmitted, defined relay is ON.
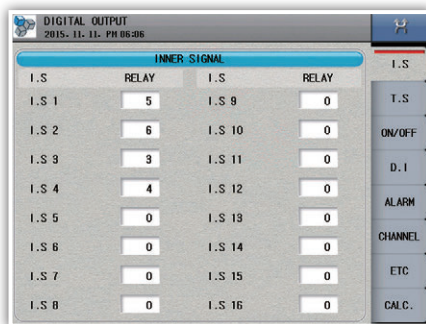
Fig. 124) DO – Inner signal

[Inner signal parameter]

Parameter	Setting range	Default
Inner signal 1 – 16	0 ∼ 32	0

▶ Time signal

– Screen to set relays for time signals.
– If a time signal is transmitted, defined relay is ON.

Fig. 125) DO – Time signal

Time signal parameter]

Parameter	Setting range	Default
Time signal 1 – 4	0 ∼ 32	0

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ ON/OFF signal

– Screen to set relays and delay for 6 ON/OFF signals for individual channels.

– With ON conditions met, defined ON/OFF signal is ON after defined time, which is applied only for the first time.
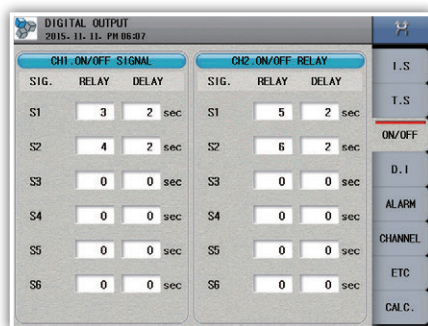
Fig. 126) DO – ON/OFF

[ON/OFF signal parameter]

Parameter	Setting range	Default
Channel#n ON/OFF signal	0 ~ 32	0

▶ DI signal

– Screen to set relays for DI signals.

– If a DI signal is transmitted, defined relay is ON.
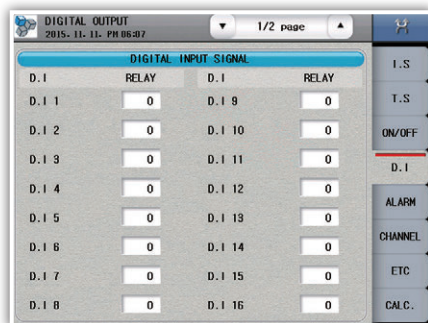
Fig. 127) DO – DI signal

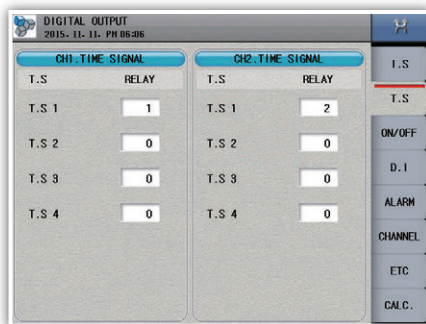### [DI signal parameter]

Parameter	Setting range	Default
DI signal 1 – 32	0 – 32	0

▶ Alarm

– Screen to set relays for pattern/system alarms.
– If an alarm signal is transmitted, defined relay is ON.
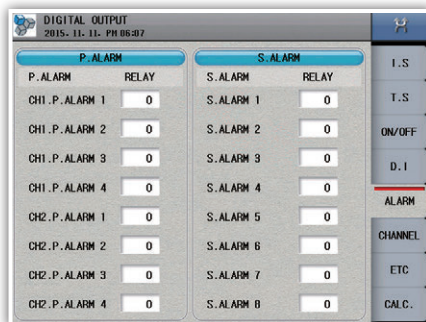
Fig. 128) DO – Alarm signal

Parameter	Setting range	Default
P. Alarm 1 – 4	Up to 0 – 32	0
S. Alarm 1 – 8	Up to 0 – 32	0

▶ Ch.1/Ch.2

– Screen to set relays for operations signals by channel.
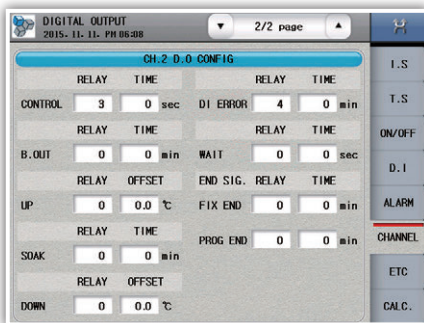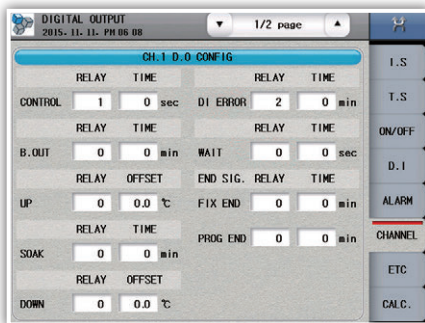
Fig. 129) DO – Operation signal

1. Control signal
– Set Ch.1 and Ch.2 operation signal relays and delay.
2. Sensor disconnection
– Set Ch.1 and Ch.2 sensor disconnection signal relays and ON time.
3. Ascending section
– Set ascending signal relay and offset.
– Offset = Target setting value - Ch.1 or Ch.2 value
4. Holding section
– Set holding section relay and ON time.
5. Descending section
– Set ascending signal relay and offset.
– Offset = Target setting value + Ch.1 or Ch.2 value

6. DI signal
- Screen to set relay and operation time for all DI signals
7. WAIT
- Set relay and holding time for wait signal.
8. Constant value
- When a constant-value operation is completed, the relay is ON for defined time.
9. Program
- When a program operation is completed, the relay is ON for defined time.

Parameter	Setting range	Default
Channel#n control signal relay	0 - 32	0
Channel#n control signal delay	0 - 9999 S	0 S
Channel#n sensor disconnection relay	0 - 32	0
Channel#n sensor disconnection holding time	0 - 9999 M	0 M
Channel#n ascending section relay	0 - 32	0
Channel#n ascending section offset	Channel #n EUS(0% - 100%)	0 ℃
Channel#n holding section relay	0 - 32	0
Channel#n holding section ON time	0 - 9999 M	0 M
Channel#n descending section relay	0 - 32	0
Channel#n descending section offset	Channel #n EUS(0% - 100%)	0 ℃
Channel#n DI signal relay	0 - 32	0
Channel#n DI signal operation time	0 - 9999 S	0 S
Channel#n wait relay	0 - 32	0
Channel#n wait holding time	0 - 9999 S	0 S
Channel#n constant-value signal relay	0 - 32	0
Channel#n constant-value signal setting time	0 - 9999 M	0 M
Channel#n program relay	0 - 32	0
Channel#n program setting time	0 - 9999 M	0 M
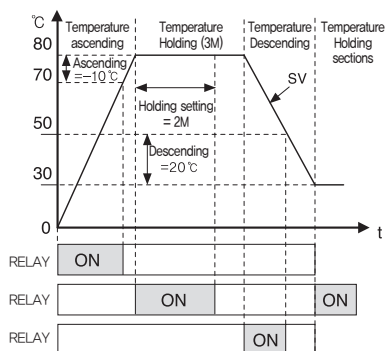
Fig. 130) DO - Ascending/Holding/Descending

Example of relay operation state by temperature ascending/holding/descending setting of setting value(SV).
Example of relay operation state with ascending section setting temperature(-10 ℃), holding section setting temperature(2M), and descending section setting temperature(+20 ℃).

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

– Screen to set relays for operations signals by channel.
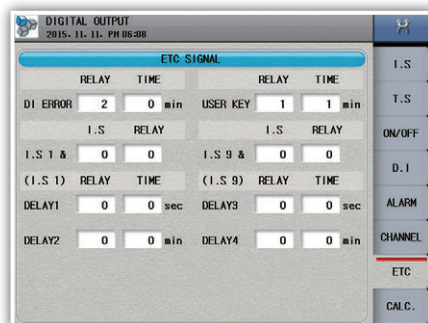
Fig. 131) DO – Other signals

1. DI signal – Set max time(M) to maintain relay and output for all DI signals.

2. IS 1 & – As a combined signal, set inner signal to use with inner signal 1 and AND condition, and operating relay. (For complex conditions such as operation condition of refrigerator is certain SV or lower and certain PV or lower)

3. Delay signal 1 and 2 – Set a relay to operate when defined delay is elapsed after operation of inner signal 1. (Units are second and minute for delay signal 1 and 2, respectively).

4. User-defined button – Set a relay for the user-defined button in operation screen.

5. IS 9 & – As a combined signal, set inner signal to use with inner signal 9 and AND condition, and operating relay.

6. Delay signal 3 and 4 – Set a relay to operate when defined delay is elapsed after operation of inner signal 9. (Units are second and minute for delay signal 3 and 4, respectively).

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ Operation signal

– Logic operation signal for output signal used to program up to 6 lines.
 Logic operation is conducted from line No.1 to 6 in order.
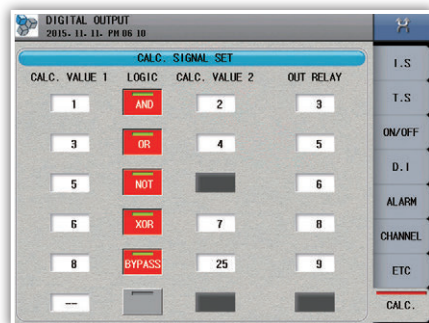
Fig. 112–1) DO – Operation signal

1) Operation value 1 and Operation value 2
– Select a relay for operation.
– If the operator is BYPASS, delay is set for the operation value 2.

2) Operator

AND	Output relay is ON if both operation value 1 and 2 are ON.
OR	Output relay is ON if either of operation value 1 and 2 is ON.
NOT	Output relay is OFF if the operation value 1 is ON. Output relay is ON if the operation value 1 is OFF.
XOR	Output relay is ON if the operation value 1 and 2 are different(ON/OFF or OFF/ON).
BYPASS	After the delay defined for the operation value 2, the signal of operation value 1 itself is output.

[Example of applying operation signal]

Fig. 112–2) Example of operation signal

1) If relay 1 and 2 are ON, relay 3 is ON.
2) If relay 1 or 2 is ON, relay 5 is ON.
3) If relay 5 is ON, relay 6 is OFF. If relay 5 is OFF, relay 6 is ON.
4) If relay 6 and 7 are different, relay 8 is ON.
5) When 25 seconds elapsed after relay 8 is ON, relay 9 is ON.

9. System

▶ System

Fig. 132) System screen

- Select a language(Korean/English/Chinese).
- Select a splash.
- If a user password is set, it needs to be entered to enter system setting screen (If the user password is "0", it is disabled).
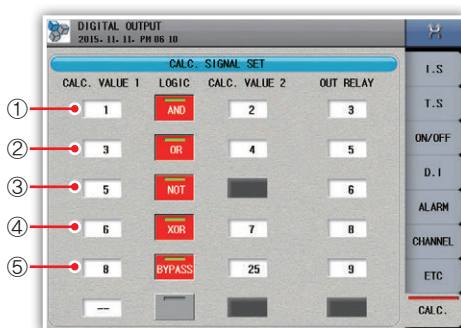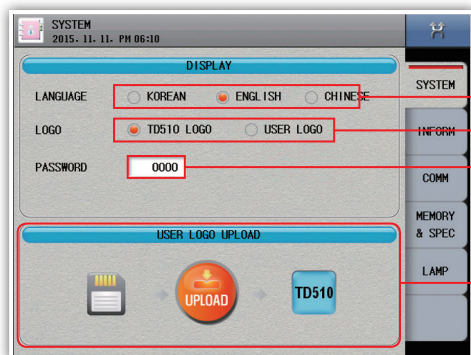- Upload a splash using a SD card (disabled when it is being saved).

⚠ Caution | Logo image file must have the resolution of 640×480 and file name of TD510_LOGO. bmp. Files must be placed in "TD510\LOGO" folder of root direction of SD card. Otherwise, they are not uploaded.

[System parameter]

Parameter	Setting range	Default
Language	Korean, English, and Chinese(Simplified)	English
Splash	TD510 logo and User-defined logo	TD510 logo
User password	0 ~ 9999	0000

▶Specifications
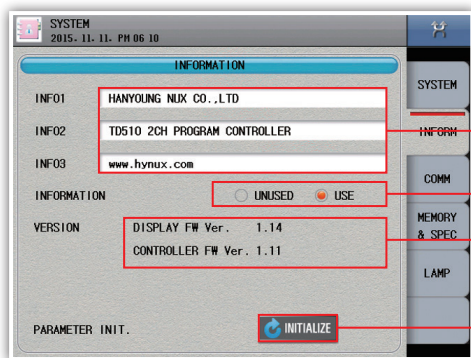
Fig. 133) Specifications screen

- Enter information to display during boot-up process.
- Select whether to display product information or not during boot-up process.
- Displays product version information.

⚠ Caution | Initializes parameters. Event or error history is not initialized. (It can't operate when it is being saved)

[Specifications parameter]

Parameter	Setting range	Default
Information 1	Character input panel(up to 30 characters)	HANYOUNG NUX CO.,LTD
Information 2	Character input panel(up to 30 characters)	TD510 2CH PROGRAM CONTROLLER
Information 3	Character input panel(up to 30 characters)	www.hynux.com
Information display on first screen	No and Yes	Yes

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶Communication setting

• Select a stop bit.

• Select a communication protocol.

• Select a communication speed.

• Select a data length.

• Enter a unit No.
• Enter response time.
• Select a parity bit.
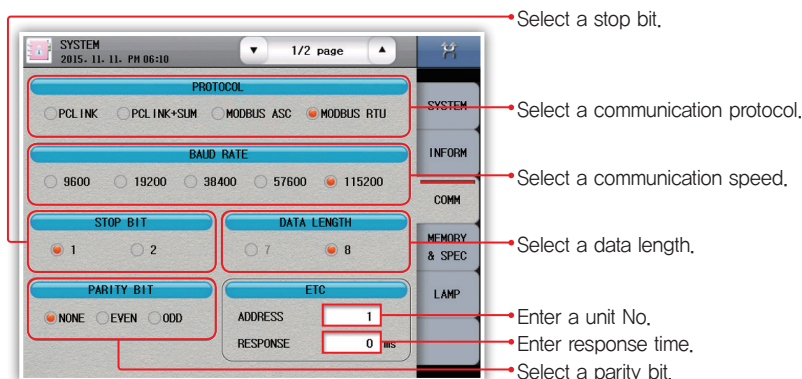
Fig. 134) Communication setting screen

[Communication setting parameter]

Parameter	Default	Setting range
Communication protocol	MODBUS RTU	PCLINK, PCLINK+SUM, MODBUS ASC, MODBUS RTU
Communication speed	115200	9600, 19200, 38400, 57600, 115200
Stop bit	1	1, 2
Data length	8	7, 8
Parity bit	NONE	NONE, EVEN, ODD
Unit No.	1	1 – 99 (Up 32 units can be connected, including master).
Response time	0 ㎳	0 ～ 100 ㎳

▶Hardware address setting

– Screen to set hardware state of control module.
– Normal operation is enabled by matching hardware settings of control and input/output modules.
If incorrect address is set for an output module, it may malfunction.

Fig. 135) Hardware address 1   ③   ①

Fig. 136) Hardware address 2   ④   ②

1. TD510 display and communication are normal.
2. TD510 display and communication are abnormal.

3. Input/output module and communication are normal.
4. Input/output module and communication are abnormal.

▶Memory
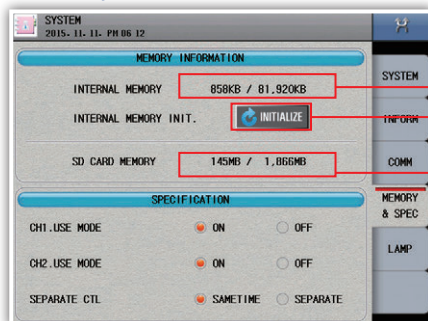
Displays used/free space of internal memory. Initialize error history. (It can't operate when it is being saved)
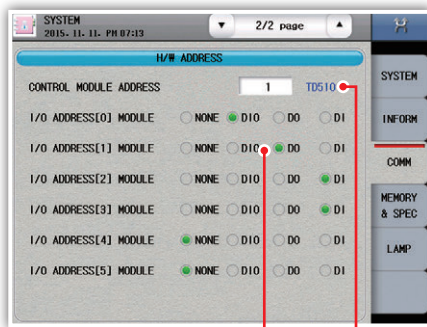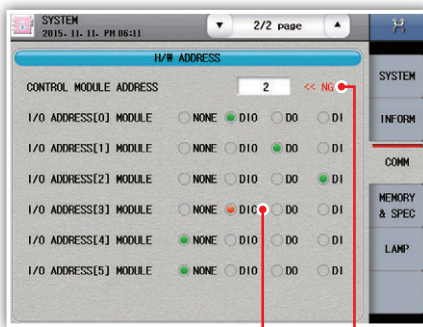
⚠ Caution If initialized, data can't be recovered so send it to an SD card before.

Displays used/total space of SD card memory.

Fig. 137) Memory screen

1. Ch.1 use mode and Ch.2 use mode
– Control –> Use as Control mode; Hide –> The channel is not used.(Both channels can't be hidden at the same time).
– If one channel is set to Control and the other is set to Hide, 1 channel operation screen is displayed.
2. Control mode
– Concurrent control : 2 channels are controlled with 1 operation signal.
– Individual control : Channels are individually controlled. (If a channel is set to Hide, it switches to the individual control).

▶Indicator

– Screen to set indicators on constant–value and program operation screens.
– Up to 32 indicators can be selected. Up to 16 of them can be displayed in 1 screen, and tap them to switch the touch screen.
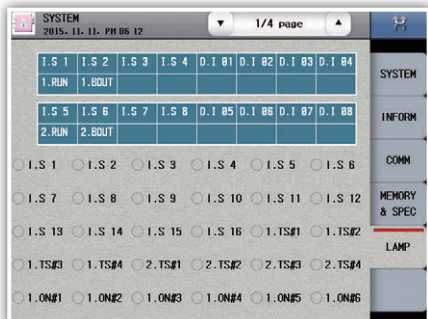
Fig. 138) Indicator
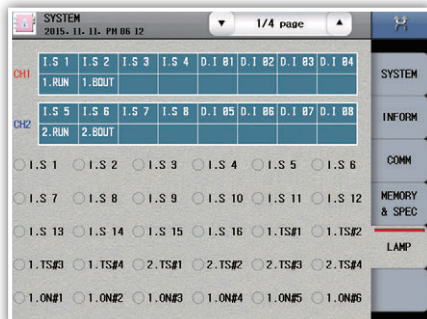
Fig. 139) Indicator setting

1. Tap a cell to display in the indicator table above.
2. Select a type of indicator.

Fig. 140) Indicator display

►Firmware upgrade

Screen for upgrading firmware and entering test mode. This screen is not available during operation. To access this screen, the password is required. (Default password : 0)

> ⚠ **Caution**
> • You may not escape from this screen. You must reboot the display and control module.
> • User attention is required for upgrading firmware so make sure to set the password.
> Default password is "0". Upgrade files can be downloaded from "Hanyoung Nux" website. Do not change a file name and place it in TD510_FWUP folder in the root directory of SD card to read it. If the firmware is upgraded, the parameters are initialized.
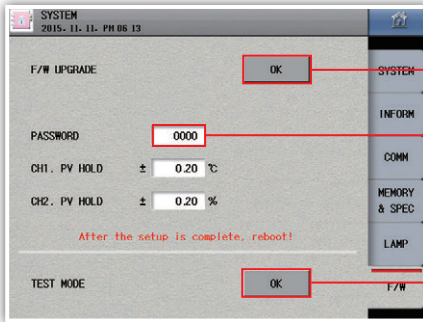
Access firmware upgrade pane.

Set a password for accessing F/W pane.

> ⚠ **Caution** Test mode is to test calibration before shipment.

Fig. 141) Firmware upgrade

Displays upgrade file name.

Fig. 142) Firmware upgrade input pane

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

Specifications

1. Input specifications

[Range configuration by input type]

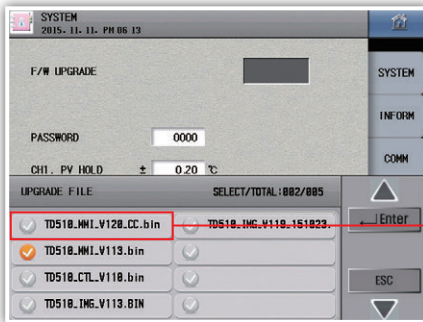| Input type			Measuring range (℃)	Level
Thermoresistor (RTD)	Pt100 Ω	Pt−1	−200.0 ∼ 640.0	±0.1 % of FS ±1 Digit
	KPt100 Ω	KPt−1	−200.0 ∼ 500.0	
Thermocouple (TC)	K	K−0	−200 ∼ 1370	±0.15 % of FS ±1 digit
		K−1	−200.0 ∼ 1370.0	±0.15 % of FS ±1 digit(*2)
	J		−200.0 ∼ 1200.0	±0.15 % of FS ±1 digit(*2)
	E		−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 ℃ : ±5 % of FS ±1 digit
(*2) −200 ∼ −150 ℃ : ±0.2 % of FS ±1 digit
(*3) −200 ∼ −150 ℃ : ±0.4 % of FS ±1 digit, −150 ∼ −100 ℃ : ±0.2 % of FS ±1 digit
(*4) 0 ∼ 200 ℃ : ±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	20 VA max
Max. rating of internal fuse	250 V a.c.
Dielectric strength	Between 1st and 2nd terminals : Min. 1500 V a.c for 1 min
	Between 1st and FG terminals : Min. 1500 V a.c for 1 min
	Between 2nd and FG terminals : Min. 1500 V a.c for 1 min
Insulation resistance	20 MΩ or 500 V d.c. between power and FG terminals

▶ Sensor input

Input type	2 types of thermoresistor (Pt–100, KPt–100), 11 types of thermocouple (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 ㏁ or more; DC voltage : 1 ㏁ or more
Allowable wire resistance	Thermoresistor : Max. 100 Ω/wire (For RTD between −100.00 and 150.00, max. 10 Ω/wire) Thermocouple : 200 Ω or less DC voltage : 2 ㏀ or less
Influence of wire resistance	Thermoresistor : ±0.3 ℃/10 Ω (3 wires must have the same wire resistance)
Allowable input voltage	Thermocouple : ±10 V d.c. or less, DC voltage : ±33 V d.c. or less
Error of reference junction contact(RJC) temperature	±1.5 ℃ (0 − 50 ℃)
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 d.c. Pulse voltage(800 Ω or more load resistance)	
	SCR output	4 − 20 mA d.c. (600 Ω or less load resistance)	
Transmission output	Current output	4 − 20 mA d.c.	
	Load resistance	600 Ω 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 points
Input type	No−voltage contact input
ON/OFF sensing resistor	Recognizes as ON for min 1㏀ or less and OFF for max. 10㏀ or more.
Min. sensing time	0.25 S
Operational conditions	During operation/Always
Contact function	Operation and stop/hold/step by DI; User can define error screen.

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

▶ 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(Sensor bias)	2 temperature points : EUS(0 − 100 %)
	Scaling	DC voltage(VDC) : Input scaling according to conversion range
	Input filter(LPF)	0 − 120 S
Control mode	Operation type	Constant−value / Program control
Control output	Temperature control output	SSR output or SCR (4 − 20 mA d.c.) output
Control operation	Pattern	100 patterns(1 pattern/100 segments)
	Segment	2000 segments
	PID group	4 groups
	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 S (OFF when 0 S)
	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
	Hysteresis	EUS (0 ~ 100 %)
Transmission output	Temperatre(Ch.1 and 2)	4 − 20 mA d.c. Specific value(PV), Setting value(SV) and Output(MV)
	Scaling	Auto scaling for defined upper/lower limit range(4 − 20 mA d.c.)
Alarm setting	Alarm setting	System alarm : 8 points Assign 4 of 8 pattern alarms to a pattern
	Alarm type	Absolute upper/lower limit, Offset upper/lower limit, and Within/Out of range
	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 S
Memory information	Program information, setting value, recovery, and temperature setting/specific/output value

5. Installation environment

▶ Use environment

Ambient temperature	0 - 50 ℃
Temperature fluctuation	10 ℃/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

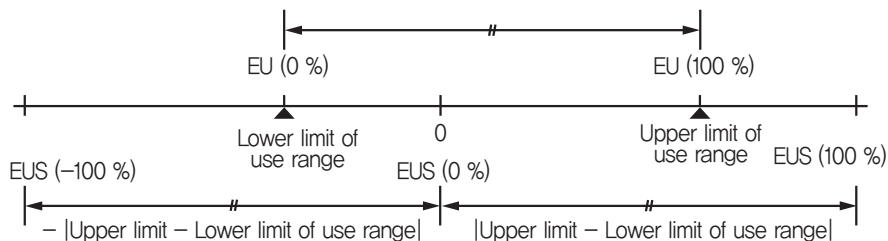▶ Storage environment

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

▶ Influence of ambient temperature

DC voltage, thermocouple sensor	±0.003 % / ℃ of max. range
Thermoresistor sensor	±0.03 ℃/℃

Before starting

Installation

Operation

Screen block diagram

Function setting

Program

System setting

Specifications

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 lmits(span) of product

EU (0 %)   EU (100 %)

Lower limit of use range   0   Upper limit of use range

EUS (−100 %)   EUS (0 %)   EUS (100 %)

− |Upper limit − Lower limit of use range| |Upper limit − Lower limit of use range|

	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

TD5IO