

TEMP2020M SERIES

Operational Manual (Multi-channel programmable controller)



WELCOME

Thank you for purchasing Furnace controller production.
Please use after read instruction manual for safety.
Free to contact to our sales Div. for
production inquiry and after service.



Various



SAMWON TECH

It is a multi-channel programmable controller which supports high-definition TFT-LCD touch screen, SD card and multi-channel control function

<http://www.samwontech.com>

Being the controller market leader in the 21st century with the best technology



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This manual is commonly used for TEMP2020M Series.

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01. Cautions (Instructions) for safety

Thank you for your choice of our programmable controller(TEMP2020M series). This manual describes the method of operation of the product.

Cautions in this instruction manual

- Please deliver for the end user to possess always and keep it in the accessible place at any time.
- Use the product after full understanding of this operation manual.
- This operation manual does not warrant any other things because it is a description of the details for the function.
- A part or whole of this manual shall not be edited or copied randomly.
- The descriptions in this manual may be changed randomly without pre-notice or warning.
- Even though this manual was made with elaboration, it will be appreciated if you inform to the purchasing point (Dealer shop and etc) or sales team in our company in case of deficiency, mistake or omission in the contents.

Cautions for the safety and modification(Change) of the product

- Please use this product after full understanding on the safety cautions in this manual for the protection and safety for this product and the system connected to this system.
- Our company is not responsible to the damages occurred by using or handling or unattended using not relying on this operation manual.
- Please install at the outside of this product when the additional protection and safety circuit is installed separately for the protection and safety for this product and the system connected to this system.
- The internal modification (Change) and addition to this product are prohibited.
- Do not disassemble, repair and modify of this product because it becomes the reasons for electric shock, fire and malfunction.
- Please contact our sales department of our company, in case of changing the part or the consumables of this product.
- Do not contact to the moisture with this product. It may cause the failure on this product.
- Do not apply the strong impact on this product. It may cause the damage and failure on the product.

With regard to the exemption for the responsibility of this product

- We are not responsible for any warranty on this product besides the defined cases in the quality assurance condition of our company.
- We are not responsible for the direct or indirect damages on the user of any third party due to the not expectable defect or the natural disaster in use of this product.

With regard to the quality assurance condition of this product

- The warranty period shall be one year from the purchasing of this product. Free of charge repair is available only for the cases of out of order occurred from normal use conditions.
- The repair due to the out of order occurred after the warranty period shall be repaired at the actual cost according to the defined condition by our company.
- For the following events, faults occurring within the warranty period must be repaired at the actual cost in spite of the warranty period.
 - (1) Out of order due to the mistake or fault of the user (Ex: Initialization by losing the password and etc.)
 - (2) Out of order due to the natural disaster (Ex: Fire and flood and etc.)
 - (3) Out of order due to the movement of product after installation.
 - (4) Out of order due to the random disassemble, change or damage on the product
 - (5) Out of order due to the electric power instability
 - (6) Others
- If it is necessary to repair the product due to a malfunction, etc, please contact the place of purchase or our sales department.

Symbol marks for safety



(A) It means "Handle with care" or "Cautions". In case of violation of this point, it may cause the death, severe injury or the extreme damage on the product.

- Product :
This symbol is displayed when certainly needed to protect the human and product.
- Instruction manual :
It describes the cautions to prevent the cases of endangered situation on the life and body of the user due to the electric shock and so on.



(B) It displays "Ground terminal"

- When installing and operating the product, be sure to ground.



(C) It displays "Supplementary explanation"

- It describes the points to supplement the explanation.

(D) It displays "References"

- It describes the information and pages of reference to be referred.



Part 01

Operation and setting


1-1. Basic operation flow chart	4
1-2. Setting button operation	5
1-3. Parameter setting method	6



01. Operation and setting

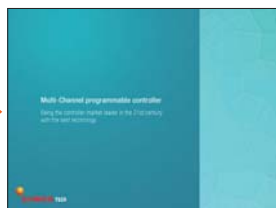
This product is a multi-channel programmable controller designed as user friendly touch screen interactive screen

1-1. Basic operation flow chart

- The logo screen and the initial screen are displayed sequentially when the electric power is switched "ON" after installation of the product and it converts to the program stationary screen.
- It takes about 20 seconds for screen loading
- When  Button is touched at the top of the program stop screen, it converts to the main screen.
- Refer to [12. System initial setting] in [Installation manual] for change in the initial screen.



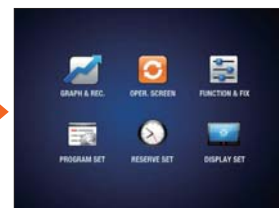
Logo screen



Initial screen


















Program stationary screen



Main screen

1-2. Setting button operation

Button type	Button operation
 	The "Set value" is touched in fixed run/stop screen and it is used for setting the set value wanted by the user.
 	The "Pattern No." is touched in program stop screen and it is used for setting the pattern number wanted by the user.
	It is used for inputting the general numbers and name.
	It is used for selecting one out of many types.
	It is used for selecting one out of 2 or 3 parameters setting. (ON/OFF/Inactive state)
	It is used for selection of Y/N for the corresponding parameter. (ON/OFF/Inactive state)
	It is used for general screen switch.
	Go to main screen (Basic screen).
	Go to pattern screen.
	It is used for increasing or decreasing of the page within the same screen.
	It is used for page switch caused by increase or decrease of the time axis on the same screen.
 	Go to channel 1 or channel 2 screen

1-3. Parameter setting method

- When is selected in [1-2 Setting button operation], the input key of the setting value is shown as followings and the necessary data can be input.
- When the data out of the setting range is input, error message ("LIMIT ERROR") is shown on the input data display window with the error sound ("Beep").



▲ Input key for setting only the numbers



▲ Input key for time signal setting



▲ Input key for setting pattern experiment name and DI error name

- Please refer to [11. DI Function and Operation] of the [Installation manual] for the DI error name input key.



▲ Input key for sub-output setting

– Please refer to [4. Control & Transmitting output] of the [Installation manual] for the sub-output setting



▲ Input key for SEG alarm setting



▲ Display when it is out of the setting range



▲ Input key for user tag name in Channel 1 and Channel 2

(1) Method for effectiveness of setting button and setting value

- This product is designed as follows when the setting data input button is touched or to check the effectiveness of the input setting data by sound.
- “Beep” : When the basic setting button is touched or the setting data is input normally.
- “Beep and beep” : When the input data setting by input key is out of the input range.
- Do not press with sharp thing (Pencil and etc) or excessive force on the input key for basic setting button or setting value.
- It may cause the mal-operation of the device or damage on the touch panel.

(2) Setting value input method

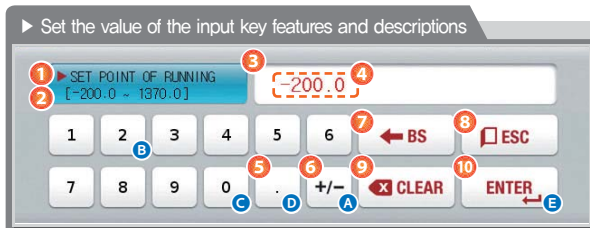
- Every input data used in this product is set by the set data input key, test name input key and time signal input key.
- The input key for set data is appeared when button is touched in [1-2 Setting button operation] and the value to be set can be input.
- Refer to [6-4 Time signal operation] for time signal input key.
- Refer to [11, DI function and operation setting] in [Installation manual] for DI error name input key.



NOTE

Unlock the touch key

- If “Key Lock” is set to “ON (Locked)”, the set value will not be input. Set “Key Lock” to OFF (Unlocked) and then input.
- Please refer to [05. Operation setting] for more detailed setting method.



Ex) Setting value input method

- Press the set value input button in the corresponding screen
- Press the corresponding number (**A** → **B** → **C** → **C** → **D** → **C**) and finally press the **ENTER** key(**E**).

①		It displays "Parameter".
②		It displays "Setting range".
③		It displays "Setting display window". <ul style="list-style-type: none"> • It displays "LIMIT ERROR" when it is out of setting range • It displays "INPUT ERROR" when there is an error in setting unit.
④		It displays the existing input values.
⑤		It is used for inputting the decimal point.
⑥		It is used for inputting the symbol (+/-).
⑦		It is used for erasing the input data by one character
⑧		It is used for returning back to original screen after stopping the input.
⑨		It is used for erasing all input values
⑩		It returns to the original screen after saving the input values

Part 02

Main screen 11



02. Main screen

[Fig. 2-1] Main menu

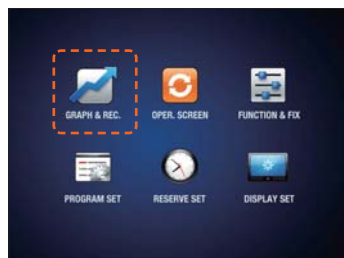


No.	Instructions	Descriptions
①	GRAPH & RECORD	Moving to the screen to set Y/N for using graph display, graph record and SD card recording.
②	OPERATION SCREEN	Moving to the run screen.
③	FUNCTION & FIX	Moving to the setting screen for additional function and operation method.
④	PROGRAM SET	Moving to the program setting menu screen.
⑤	RESERVE SET	Moving to the screen for setting current time and reserved operation time.
⑥	DISPLAY SET	Moving to the screen for setting the screen brightness, PV font, Y/N for using buzzer sound, electricity saving for backlight and channel conversion time.

Part 03

Graph display and save setting

- 3-1. Present value (PV) graph save setting 14
- 3-2. SD memory save setting 16
- 3-3. Copy & delete graph file 17



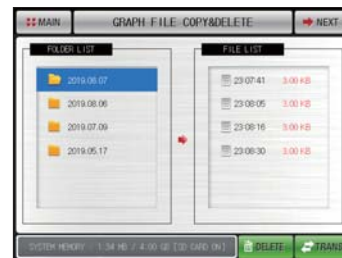
Main screen



[Fig. 3-1] Graph & save setting screen 1



[Fig. 3-2] Graph & save setting screen 2



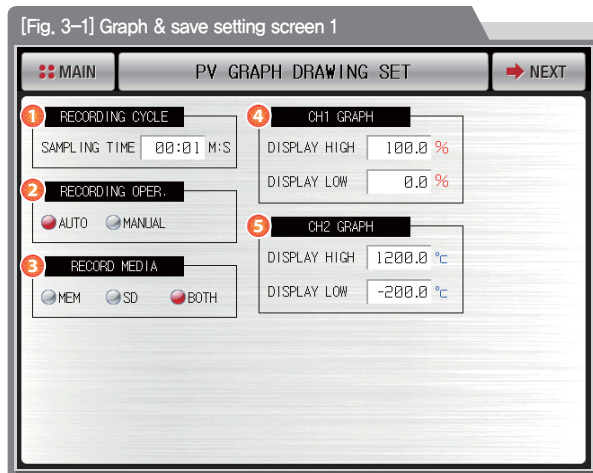
[Fig. 3-3] Graph & save setting screen 3



03. Graph display and save setting

3-1. Present value (PV) graph save setting

- This screen is to set the display range and sampling time which are necessary for graph recording in [4-1(4) fixed operation run screen 3] and [4-2, (4) Program operation run screen 3].



Setting the PV graph saving period

- ①
- It is not changeable during PV graph saving.
 - It is possible to save 5 years, when setting the sampling time to 1 second when saving the internal memory.

Setting Y/N for saving the data into the SD memory card

- ②
- AUTO : Save the data automatically by synchronized with run/stop
 - MANUAL : Save the data manually by the save key in the run screen 2

Setting the storage media where data will be stored

- ③
- MEM(Memory) : Save to internal memory
 - SD(SD card) : Save to SD card
 - BOTH : Save to internal memory and SD card

Setting the display range of channel 1 graph

- ④
- ⑤
- Setting the display range of channel 2 graph

Paramete	Setting range	Unit	Initial value
Sampling time	00.01 ~ 99.59(Min, Sec)	ABS	00.01
Saving operation setting	AUTO, MANUAL	ABS	AUTO
Saving media	MEM, SD, BOTH	ABS	BOTH
Channel 1 graph display upper limit	CH1,EU (-2.5 ~ 102.5%)	CH1,EU	CH1,EU(100.0%)
Channel 1 graph display lower limit	(Channel 1 graph lower limit < Channel 1 graph upper limit)	CH1,EU	CH1,EU(0.0%)
Channel 2 graph display upper limit	CH1,EU (-2.5 ~ 102.5%)	CH2,EU	CH2,EU(100.0%)
Channel 2 graph display lower limit	(Channel 2 graph lower limit < Channel 2 graph upper limit)	CH2,EU	CH2,EU(0.0%)

3-2. SD memory save setting

- It is a screen to set the transmitting of pattern and parameter to SD card.
- It is a screen to be displayed in SD card option only.

[Fig. 3-2] Graph & save setting screen 2



Setting the transmission items and direction of SD card and TEMP2020M.

- PTN.(Pattern)
: Download and upload pattern set in [6-1, Pattern editing]
- PARA.(parameter)
: Download and upload set parameters.

①



- ALL
: Download or upload the pattern and parameter Transmission direction
- DOWNLOAD
: Transmit the selected transmitting items out of the internal data in TEMP2020M to SD card.
- UPLOAD
: Transmit the selected transmitting item of data stored in the SD card to TEMP2020M.

②

It displays the current capacity of SD card.

- It displays only when the SD card is inserted.

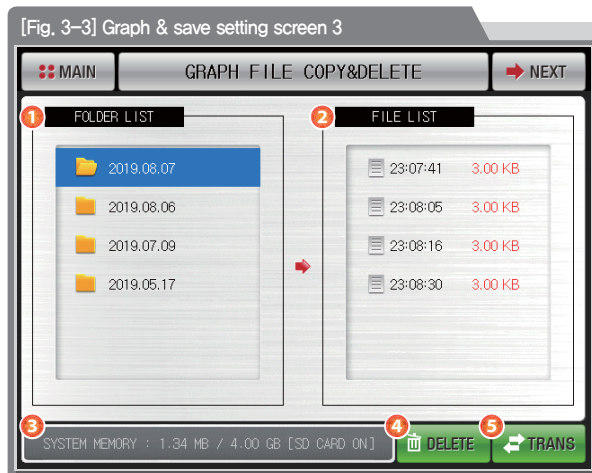
③

When the data is not in recording to SD card,  is activated and download and upload are possible when  is pressed.

Parameter	Setting range	Unit	Initial value
Transmitting item	PTN., PARA, ALL	ABS	PTN.
Transmitting direction	DOWNLOAD, UPLOAD	ABS	DOWNLOAD

3-3. Copy & delete graph file

- It is a screen to display files stored in the internal memory



① PV graph folder list

② PV graph file list

③ Display internal system memory capacity

④ Delete selected PV graph file from file list

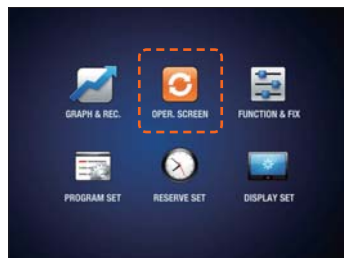
⑤ Copy the selected PV graph file from the file list to SD card

- If the SD card option is not available or the PV graph is being saved in the run screen, the selected file in the file list cannot be copied to the SD card

Part 04

Operation state screen setting

4-1. Fixed operation	20
4-2. Program operation	32
4-3. Fixed and program operation	38
4-4. Auto tuning	42
4-5. Auto tuning and tuning point	47



Main screen



[Fig. 4-1] Fixed operation stop screen 1



[Fig. 4-6] Fixed operation run screen 2




[Fig. 4-7] Fix operation run screen 3



04. Operation state screen setting

4-1. Fixed operation

(1) Fixed operation stop screen 1

- When the operation state screen is selected in [Fig.2-1] Main screen, it is converted to "[Fig.4-1] Fixed operation stop screen 1 (Asynchronous operation).
- Select the operation method of channel 1 and channel 2 as the "Fixed" in [5. Operation motion setting].
- Synchronous and Asynchronous operation can be selected in [5. Operation motion setting].
- When  at the right bottom of [Fig.4-2] Fixed operation stop screen 1 (Synchronous operation) is touched by, it converts to [Fig.4-5] Fixed operation run screen 1 (Synchronous operation).






[Fig. 4-1] Fixed operation stop screen 1 (Asynchronous operation)

Parameter	Setting range	Unit	Initial value
Channel 1 setting value (SP)	CH1.EU(0.0 ~ 100.0%)	CH1.EU	CH1.EU(0.0%)
Channel 2 setting value (SP)	CH2.EU(0.0 ~ 100.0%)	CH2.EU	CH2.EU(0.0%)

※ Channel 1, Channel 2, EU : Range of sensor input value

※ Refer to [Engineering units]

References

- ▶ When  ,  buttons are touched, It is activated like [Fig.4-3] input key screen for setting targeted value to operate. Then, channel 1 and channel 2 setting value can be inputted.
- ▶ When inputting the setting values of channel 1 and channel 2 are completed, operate the Fixed operation by selecting  button.



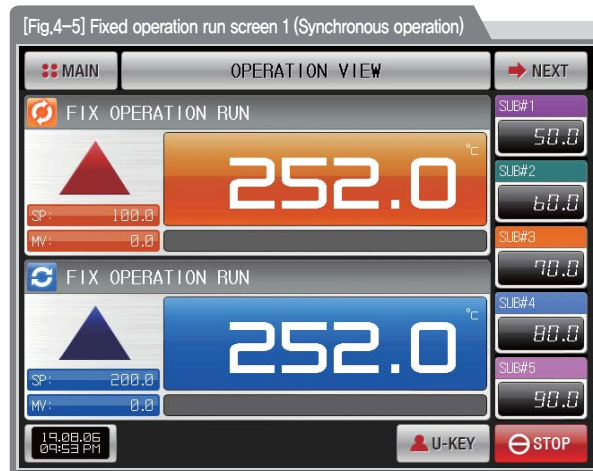
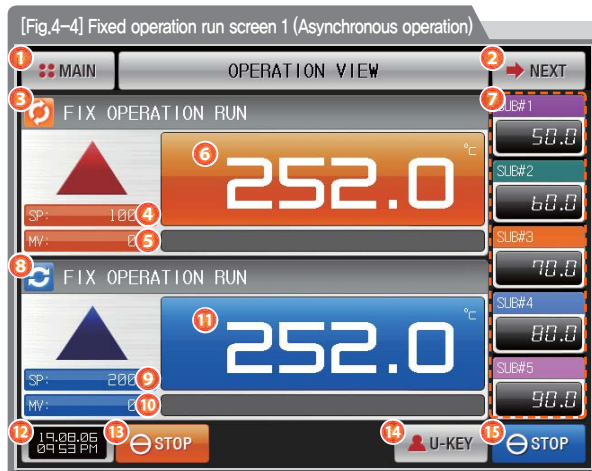
[Fig. 4-2] Fixed operation stop screen 1 (synchronous operation)



[Fig.4-3] Input key screen for setting targeted value to operate












(2) Fixed operation run screen 1









- It is a screen to display the state display lamps such as measuring value, setting value and output volume etc.
- When the "Setting value" is touched even if during the operation, input key for setting targeted value to operate is activated.
- The user can operate and stop the channel for operation since the run/stop button for channel 1 and channel 2 in Asynchronous operation are classified independently.



References

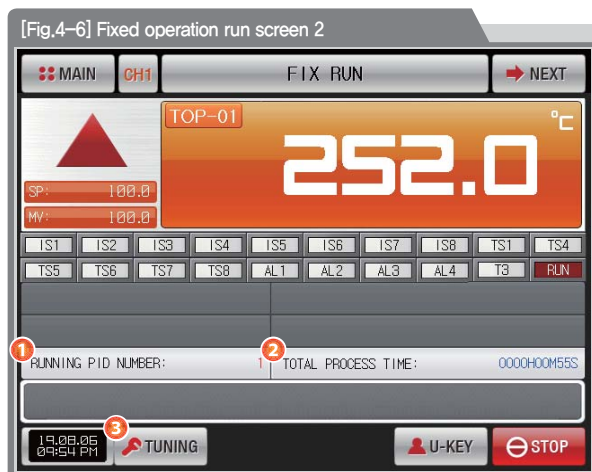
	Setting value > Measuring value is displayed in temperature increase
	Setting value = Measuring value is displayed in temperature maintaining
	Setting value < Measuring value is displayed in temperature decrease

①		<p>Move to [Fig.2-1] Main screen</p> <ul style="list-style-type: none"> It displays the keypad for entering the password when the main button constraint is set Refer to [Fig 5-2] Screen when setting main button constraint
②		Move from current screen to next screen
③		<p>It displays the operation state of channel 1</p> <ul style="list-style-type: none"> The arrow rotates clockwise during operation
④		It displays the set value (SP) to be controlled by channel 1
⑤		It displays the control output (MV) of channel 1
⑥		It displays the present value (PV)
⑦		It displays the current sub-channels
⑧		<p>It displays the operation state of channel 2</p> <ul style="list-style-type: none"> The arrow rotates clockwise during operation
⑨		It displays the set value (SP) to be controlled by channel 2
⑩		It displays the control output (MV) of channel 2
⑪		It displays the present value (PV)

⑫		<p>It displays current data/time. Press here to turn LCD backlight off</p> <ul style="list-style-type: none"> Red LED lamp at the upper right is ON when the backlight is OFF in still state Green LED lamp at the upper right is ON when the backlight is OFF in the operation of any channels
⑬	 	Channel 1 run/stop button (can be operated/stopped independently)
⑭	 	<p>User button</p> <ul style="list-style-type: none"> Y/N for use in [12, System initial setting] in [Installation manual] User uses the wanted relay in [10, DO relay setting] in [Installation manual] when the user button is used. Ex) Used for lighting the chamber lamp The set relay is operated when the "Use" button  is pressed in the fixed and program run/stop screen
⑮	 	Channel 2 run/stop button (can be operated/stopped independently)




(3) Fixed operation run screen 2

- It is a screen to display the measured value, set value, output amount and state display lamp
- Channel 1 and 2 is stopped or operated when the stop or run button is pressed during
- The following screen is an explanation for channel 1 and channel 2 screen is identical to the channel 1

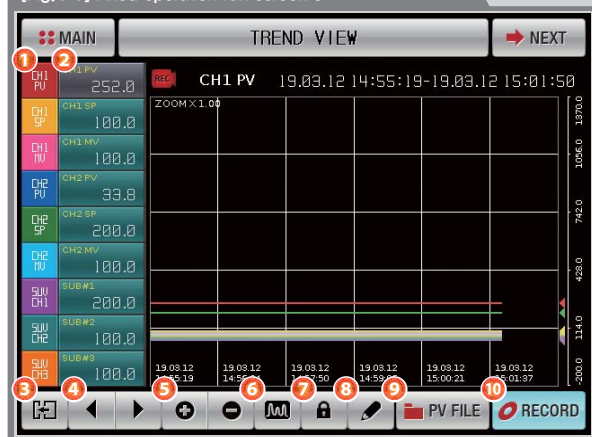













①	RUNNING PID NUMBER	It displays the currently applied PID group number • The applied PID group can be checked in [8, PID group] in [Installation manual]
②	TOTAL PROCESS TIME	It displays the total process time of fixed operation
③	TUNING	Execution or releasing the auto tuning with set value (SP) • Setting the display of tuning button Y/N in [8, PID group] in [Installation manual]

(4) Fixed operation run screen 3

- ( , ) The check box sets whether to display the data
- To save the recorded values, press the  button on the right
- Refer to [Fig.3-1 Present value (PV) Graph save setting]

[Fig.4-7] Fixed operation run screen 3



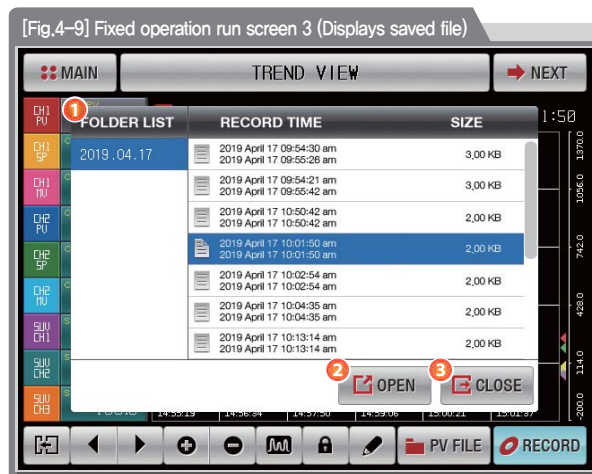
①		It displays the measured value and set value of channel 1 & channel 2 and the measured value of sub-channel
②		It displays applicable data
③		Graph partial screen / full screen
④		Shift the graph screen
⑤		Zoom in / out graph screen
⑥		View full/section graph
⑦		Screen lock
⑧		User notes
⑨		It displays file stored in internal memory • When you open PV file, it changes to  button
⑩		Store measured value and set value of channel 1 and channel 2 and the set value of sub-channel in the memory (Internal memory, SD card)



[Fig.4-8] Fixed operation run screen 3 (Graph display not selected)

References

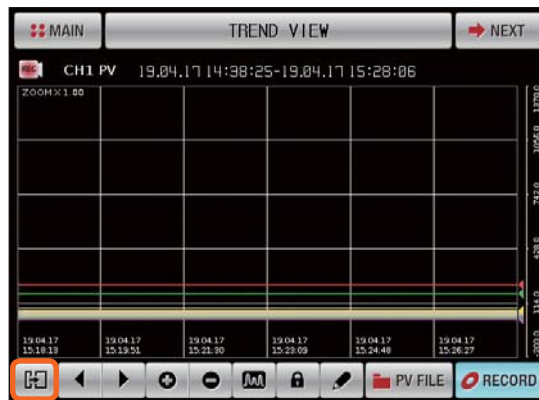
- ▶ It is a screen when there is no measured value and set value of channel 1 and channel 2 and no selection in the sub-channel item
- ▶ To save the recorded values, press the **RECORD** button on the right



- ① **PV FILE** Press button to display the file stored in internal memory
- ② Used when opening the selected PV file
 - Select the desired file, then press **OPEN** button to open
- ③ Used to return to the original screen







[Fig.4-10] Fixed operation run screen 3 (Partial screen)



[Fig.4-11] Fixed operation run screen 3 (Full screen)

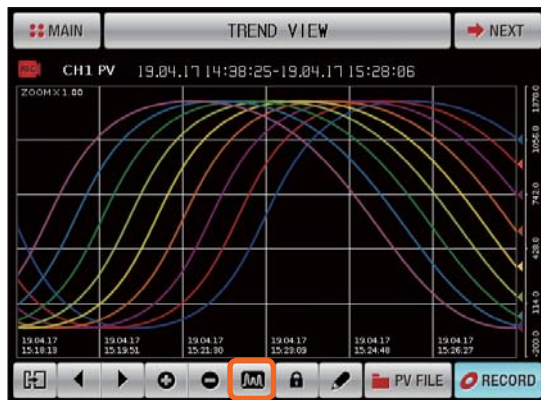
References

- ▶  : Full screen button /  : Partial screen button
- ▶  When you press this button
It switches from [Fig.4-10] Fixed operation run screen 3 (partial screen) to [Fig.4-11] Fixed operation run screen 3 (full screen)
- ▶  When you press this button
It switches from [Fig.4-11] Fixed operation run screen 3 (full screen) to [Fig.4-10] Fixed operation run screen 3 (partial screen)

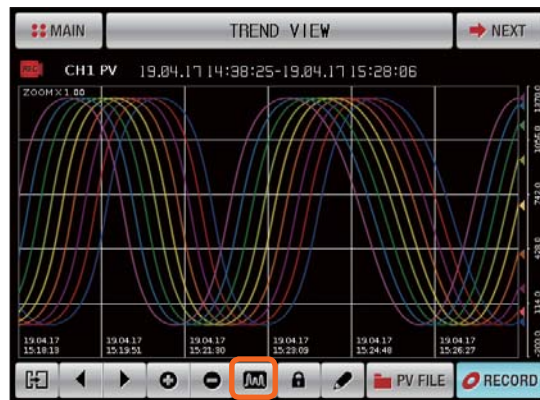
Full screen



- It can be analyzed by switching from data partial screen to full screen









[Fig.4-12] Fixed operation run screen 3 (View section)

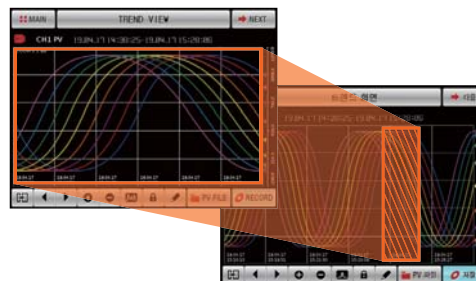


[Fig.4-13] Fixed operation run screen 3 (View all)

References

- ▶  : View all button /  : View section button
- ▶  When this button is pressed, it switches to  button
It switches from [Fig.4-12] fixed operation run screen 3 (View section) to [Fig.4-13] fixed operation run screen 3 (View all)
- ▶  When this button is pressed, it switches to  button
It switches from [Fig.4-13] fixed operation run screen 3 (View all) to [Fig.4-12] fixed operation run screen 3 (View section)

View section






- Able to enlarge and analyze desired data section in view all data

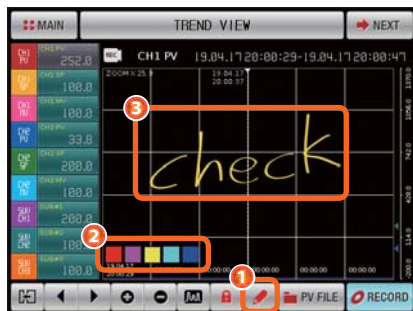


[Fig.4-14] Fixed operation run screen 3 (Note mode)

References

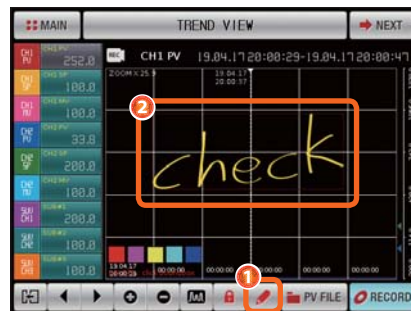
- ▶  : Note mode button /  : Button in running note mode
- ▶ Note mode does not work when in full view
- ▶ When you want to delete a created note, you can delete it by discontinuing note mode and then executing note mode again
- ▶ Note mode can be applied by opening the saved file or saving file pressing  button

Note mode (Write note)



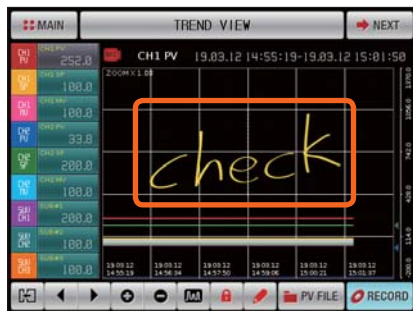
- ① (Button) ⇒ ② (Choose color) ⇒ ③ Write (Note)

Note mode (Delete note)



- ① (Button) ⇒ ① (Button) ⇒ ② (Choose note) delete

When not in a note mode after writing a note (View section)



- It displays note created when viewing section on trend screen

When not in a note mode after writing a note (View all)



- It displays note created in full view on trend screen
– Marked with a red line(M1 ~ M?) on written note

(5) Termination screen for fixed operation time setting

- When the set time of channel 1 and channel 2 set in the [5. Operation setting] has elapsed, then the message "Time setting operation is completed" is displayed as shown below and the fixed operation is terminated
- Since channel 1 and channel 2 operate independently, "Time setting operation" can be set to the same time, but the termination timing may be different
- The message is not appeared on the screen when it is forcibly terminated by pressing "Stop" button during operation
- The message indicating the operation termination at the end of operation can be disappeared by touching the corresponding part, (Identical to program operation termination)



[Fig.4-15] Fixed time setting operation end screen (Asynchronous operation)




[Fig.4-16] Fixed time setting operation end screen (Synchronous operation)

References

- It is a screen where the time setting operation of channel 1 and 2 is completed
- The timing of termination of channel 1 and 2 can be differed depending on the time setting operation

4-2. Program operation

(1) Program operation - stop screen 1

- It converts to [Fig.4-17] Program operation stop screen 1 (Asynchronous operation) when the operation state screen is selected in [Fig.2-1] Main screen
- Select the operation method of channel 1 and 2 to "Pattern" in [5. Operation motion setting]
- Synchronous operation or Asynchronous operation can be selected in [5. Operation motion setting]
- It converts to [Fig. 4-20] Program operation run screen 1 (synchronous operation) when  is pressed on the right bottom in [Fig. 4-18] Program operation stop screen 1 (synchronous operation)



[Fig.4-17] Program operation stop screen 1 (Asynchronous operation)



[Fig.4-18] Program operation stop screen 1 (Synchronous operation)



[Fig.4-19] Screen for pattern number setting input key to operate

Parameter	Setting range	Unit	Initial value
Channel #n pattern number	1~500	ABS	1

※ #n : 1 ~ 2




CAUTION Cautions in operation

- If the program is not entered in the pattern number displayed on the screen, the operation will not be executed.
- Refer to [6-1 Pattern setting]

References

- ▶ How to enter the pattern number set value to operate When

PTN NO: 1 . PTN NO: 1 are pressed,
It is activated as [Fig.4-19] Screen for pattern number setting input key to operate

- ▶ when the input of the pattern number to be operated is completed, press  button to operate the program

(2) Program operation run screen 1












- It is a screen to display measured value, set value, output amount and state display lamp.
- The pattern number cannot be set during the operation.
- The user can operate and stop the channel for operation since the run/stop button for channel 1 and channel 2 in Asynchronous operation are classified independently.











References

- It displays the direction of the current pattern processing.

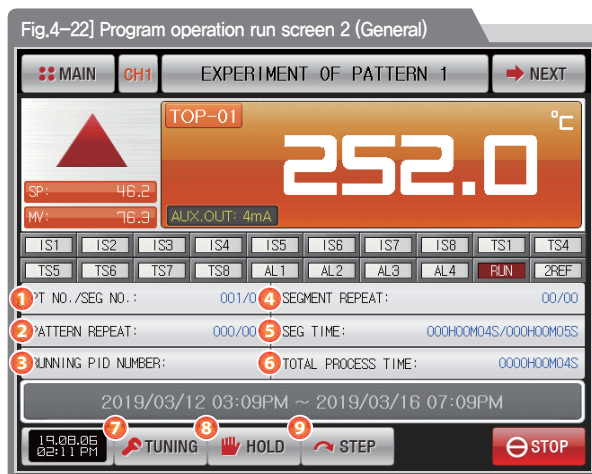
	It is displayed when the set value change is in increase
	It is displayed when the set value change is in maintaining
	It is displayed when the set value change is in decrease

①		<p>Move to [Fig. 2-1] Main screen</p> <ul style="list-style-type: none"> The keypad for entering the password is displayed when the main button constraint is set. Refer to [Fig 5-2] Screen when setting main button constraint
②		Move from present screen to next screen
③		<p>It displays the operation state of channel 1</p> <ul style="list-style-type: none"> The arrow turns clockwise during operation
④		It displays the setting value (SP) to be controlled of channel 1
⑤		It displays the control output (MV) of channel 1
⑥		It displays the present value (PV) of channel 1
⑦		It displays the current sub-channel
⑧		<p>It displays the operation state of channel 2</p> <ul style="list-style-type: none"> The arrow turns clockwise during operation
⑨		It displays the setting value (SP) to be controlled of channel 2
⑩		It displays the control output (MV) of channel 2
⑪		It displays the present value (PV) of channel 2

⑫		<p>It displays the current data/time and pressing here will turn the LCD backlight off</p> <ul style="list-style-type: none"> When the backlight is off in stop mode, the upper right LED light turns to red If at least one channel is in operation, the upper right LED light turns to green when the backlight is off
⑬	 	Operation/stop button of channel 1 (can be operated/stopped independently)
⑭	 	<p>User button</p> <ul style="list-style-type: none"> Able to set Y/N for use in [12, System initial setting] in [Installation manual] If you use the user button, you can set the relay you want to use in [10, DO Relay setting] in [Installation manual] Ex) It is used to light the chamber lamp The set relay is operated when the  button is pressed in the fixed and program run/stop screen
⑮	 	Operation/stop button of channel 2 (can be operated/stopped independently)

(3) Program operation run screen 2

- It is a screen to display measured value, set value, output amount and lamp operation state
- If you press the stop or run button during synchronous operation, channel 1 and channel 2 can be stopped or operated
- The screen below is a description of channel 1 and the screen of channel 2 is identical to channel 1



①	It displays the currently operating program pattern number and segment number
②	It displays the pattern repeat state PATTERN REPEAT: 000/001 • The number in front indicates the progress number of repetitions, and the number after it indicates the set number of repetitions.
③	It displays the currently applied number of PID group Applied PID group can be checked in [8.PID group] in [Installation manual]
④	It displays partial repeat state SEGMENT REPEAT: 00/00 • The number in front indicates the progress number of repetitions, and the number after it indicates the set number of repetitions.
⑤	It displays the progress time and set time of currently operating segment SEG TIME: 000H00M04S/000H00M05S • The number in front indicates the progress number of repetitions, and the number after indicates the set number of repetitions in [6-1. Pattern editing].
⑥	It displays the total progress time of program operation
⑦	Enables or disables auto tuning with the current set value (SP) • Able to set Y/N for tuning button in [8.PID group] in [Installation manual]
⑧	Hold (HOLD ON) or off (HOLD OFF) of currently progressing set value of temperature
⑨	Terminate the currently progressing segment and force it to the next segment

(4) Program operation end screen

- The program operation of channel 1 and channel 2 is terminated displaying the message "Pattern operation end" as shown below when the setting section operation of all segments stored in pattern is complement.
- Since the channel 1 and channel 2 are operated independently, it is possible to set the same time for "Program pattern operation", but the termination point of time may be different.
- If you press the "Stop" button forcibly during operation, the message will not be appeared on the screen.
- If a message indicating operation termination is displayed at the end of operation, press the corresponding part and then the message will be disappeared (It is identical to operation termination of fixed time setting)



[Fig.4-23] Program operation end screen (Asynchronous operation)




Fig.4-24] Program operation end screen (Synchronous operation)

References

- ▶ It is a screen where the time setting operation of channel 1 and 2 is terminated.
- ▶ The termination timing of channel 1 and 2 can be differed depending on the time setting operation.

4-3. Fixed and program operation

(1) Fixed and program operation stop screen 1

- Operation mode of channel 1 and channel 2 can be selected differently for "Fixed" and "Pattern" in [5. operation motion setting]
- Synchronous operation or Asynchronous operation can be selected in [5. Operation motion setting]
- Refer to [6-1 Pattern setting] for pattern setting method
- It converts to [Fig.4-32] fixed/program operation run screen 1(Synchronous operation) when  is pressed on the right bottom in [Fig.4-26] fixed/program operation stop screen 1 (Synchronous operation)



[Fig.4-25] Program/fix operation stop screen 1(Asynchronous operation)



[Fig.4-26] fixed/program operation stop screen 1(Synchronous operation)



[Fig.4-27] Screen for pattern number setting input key of program to be operated in program/fixed operation stop screen (Asynchronous operation)

References

- ▶ The pattern number input method of channel 1 is activated as shown in [Fig.4-27] when **PTN NO:** 1 is pressed.
- ▶ The setting value input method of channel 2 is activated as shown in [Fig.4-28] when **SP:** 200.0 is pressed



[Fig.4-28] Screen for target value setting input key to be fixed operated in program/fixed operation stop screen (Asynchronous operation)

Parameter	Setting range	Unit	Initial value
Channel 1 pattern number	1~500	ABS	1
Channel 2 setting value (SP)	CH2.EU (0.0 ~ 100.0%)	CH2.EU	CH2.EU(0.0%)



[Fig.4-29] Screen for target value setting input key to be fixed operated in fixed/program operation stop screen (Synchronous operation)



[Fig.4-30] Screen for pattern number setting input key of program to be operated in fixed/program operation stop screen (Synchronous operation)

References

- ▶ The setting value input method of channel 1 is activated as shown in [Fig.4-29] when **SP: 100.0** is pressed.
- ▶ The pattern number input method of channel 2 is activated as shown in [Fig.4-30] when **PTN NO: 1** is pressed

Parameter	Setting range	Unit	Initial value
Channel 1 setting value(SP)	CH1.EU (0.0 ~ 100.0%)	CH1.EU	CH1.EU(0.0%)
Channel 2 pattern number	1~500	ABS	1

(2) Fixed and program operation run screen 1

- It is a screen to display measured value, set value, output amount and state display lamp.
- The operation method of channel 1 and 2 can be selected differently for "Fixed" and "Pattern" in [5, Operation motion setting]
- Synchronous operation or Asynchronous operation can be selected in [5, Operation motion setting]
- Refer to [4-1(2) Fixed operation run screen 1] and [4-2(2) Program operation run screen 1 for fixed/program operation run screen 1]
- Refer to [4-1(3) Fixed operation run screen 2] and [4-2(3) Program operation run screen 2 for fixed/program operation run screen 2]
- Refer to [4-1(4) Fixed operation run screen 3] and [4-2(4) Program operation run screen 3 for fixed/program operation run screen 3]
- Refer to [4-1(5) Fixed time setting operation end screen] and [4-2(5) Program time setting operation end screen fixed/program operation end screen]
- Since the run/stop button of channel 1 and 2 in Asynchronous operation are divided independently, user can operate and stop their desired channel
- Since the run/stop button of channel 1 and 2 in Synchronous operation are consisted in one, user can operate and stop the channel 1 and 2 with one button



[Fig.4-31] Program/fixed operation run screen 1 (Asynchronous operation)



[Fig.4-32] fixed/program operation run screen 1 (Synchronous operation)

4-4. Auto tuning

- Auto tuning is classified into SEG PID method and zone PID method.
- The hold and step keys cannot be used during program operation and auto tuning.

(1) Auto tuning (SEG PID method)

- In the segment PID method, auto tuning is performed based on the present set value (SP) and the tuning value is stored in the "PID number" set in the auto tuning parameter
- During program operation, the segment is held and the segment proceeds when the auto tuning is terminated
- It operates with the current set value (SP) at the end of auto tuning in fixed operation
- The screen below is a description of channel 1 and the screen of channel 2 is identical to channel 1

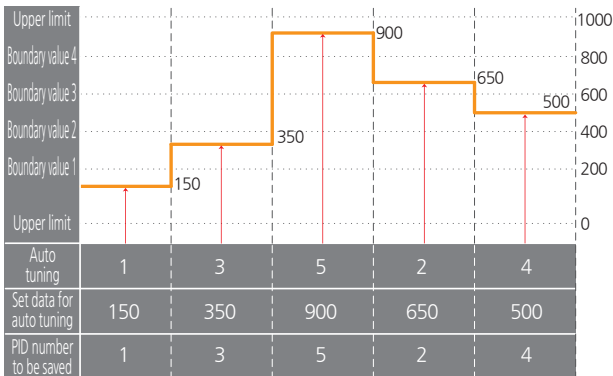


①

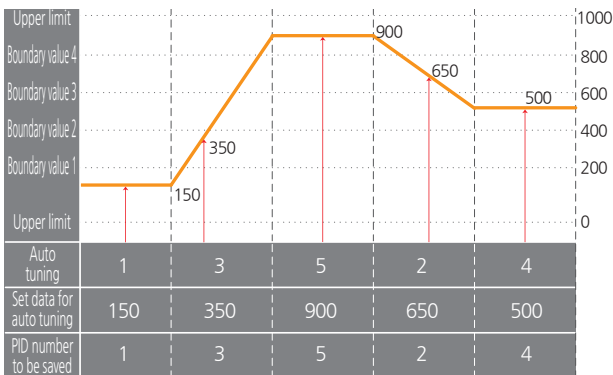
It sets the PID number

- The tuning value is saved to the selected number when the auto tuning is completed

Parameter	Setting range	Unit	Initial value
Auto tuning	OFF, 1 ~ 6	ABS	OFF



Fixed operation auto tuning (SEG)



Program operation auto tuning(SEG)

References

- ▶ Fixed/program operation auto tuning (SEG)
 - Upper limit, Lower limit : it displays the range of input sensor
 - Boundary value 1~4 : indicates the boundary value of the PID number
 - Auto tuning : indicates the PID number selected during the auto tuning
 - Auto tuning set value : indicates current operation value
 - PID number to be saved : indicates the PID number where the tuning value will be saved after auto tuning is terminated

(2) Auto tuning (Zone PID method)

- The zone PID method tunes at the center point of the boundary value of the PID number group set in the auto-tuning parameter, not the current setting value (SP) and the tuning value is stored in the set PID number
- During program operation, the segment is held and the segment proceeds when the auto tuning is terminated
- When the auto tuning is terminated in the fixed operation, the current set value is changed to the set value before auto tuning
- The screen below is a description of channel 1 and the screen of channel 2 is identical to channel 1



①

It sets the PID number

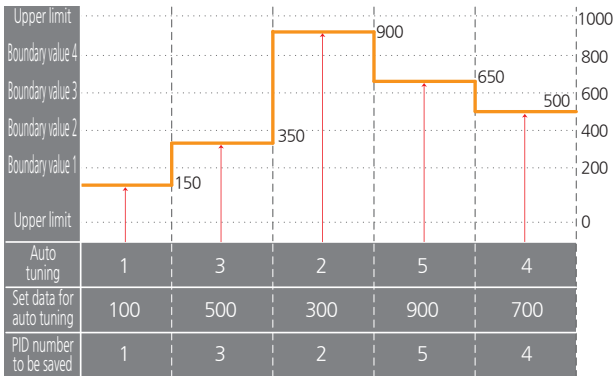
- The tuning value is saved to the selected number when the auto tuning is completed

Parameter	Setting range	Unit	Initial value
Auto tuning	OFF, 1 ~ 6, AUTO	ABS	OFF

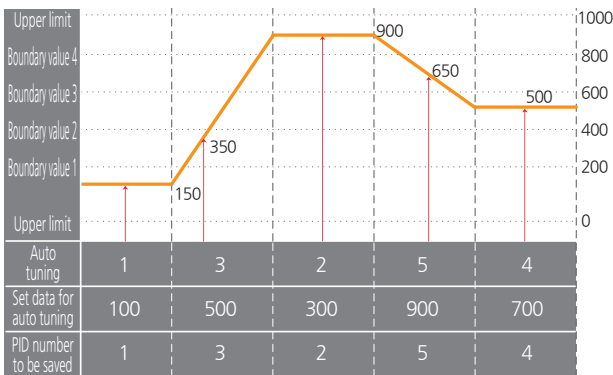


Cautions in operation

- When it is forcibly stopped with **AUTO** during auto tuning, no single PID number is stored.
- No single PID number is stored during power failure



Fixed operation auto tuning (Zone)



Program operation auto tuning (Zone)

References

► Fixed/Program operation auto tuning(zone)

- Upper limit, Lower limit: it displays the range of input sensor
- Boundary value 1~4: indicates the boundary value of the PID number
- Auto tuning: indicates the PID number selected during the auto tuning
- Auto tuning set value: indicates current operation value
- PID number to be saved: indicates the PID number where the tuning value will be saved after auto tuning is terminated

► The tuning point calculation method is as follows.

① Tuning point : 1(It executes PID1 section auto tuning.)

$$\text{PID1 auto tuning set value} = \text{lower limit} + \frac{\text{Boundary value1} - \text{lower limit}}{2}$$

② Tuning point : 2(It executes PID2 section auto tuning.)

$$\text{PID2 auto tuning set value} = \text{boundary value 1} + \frac{\text{Boundary value2} - \text{Boundary value1}}{2}$$

③ Tuning point : 3(It executes PID3 section auto tuning.)

$$\text{PID3 auto tuning set value} = \text{boundary value 2} + \frac{\text{Boundary value3} - \text{Boundary value2}}{2}$$

④ Tuning point : 4(It executes PID4 section auto tuning.)

$$\text{PID4 auto tuning set value} = \text{boundary value 3} + \frac{\text{Boundary value4} - \text{Boundary value3}}{2}$$

⑤ Tuning point : 5(It executes PID5 section auto tuning.)

$$\text{PID5 auto tuning set value} = \text{boundary value 4} + \frac{\text{Upper limit} - \text{Boundary value4}}{2}$$

References

⑥ Tuning point : 6(It executes PID6 section auto tuning.)

$$\text{-- PID6 auto tuning set value} = \text{Lower limit} + \frac{\text{Upper limit} - \text{Lower limit}}{2}$$

⑦ Turning point : Automatic

- Auto tuning is executed sequentially for PID1 ~ 6 sections
- The auto tuned PID value is stored in PID 1~6 sections

$$\text{-- PID1 auto tuning set value} = \text{lower limit} + \frac{\text{Boundary value1} - \text{lower limit}}{2}$$

$$\text{-- PID2 auto tuning set value} = \text{boundary value 1} + \frac{\text{Boundary value2} - \text{Boundary value1}}{2}$$

$$\text{-- PID3 auto tuning set value} = \text{boundary value 2} + \frac{\text{Boundary value3} - \text{Boundary value2}}{2}$$

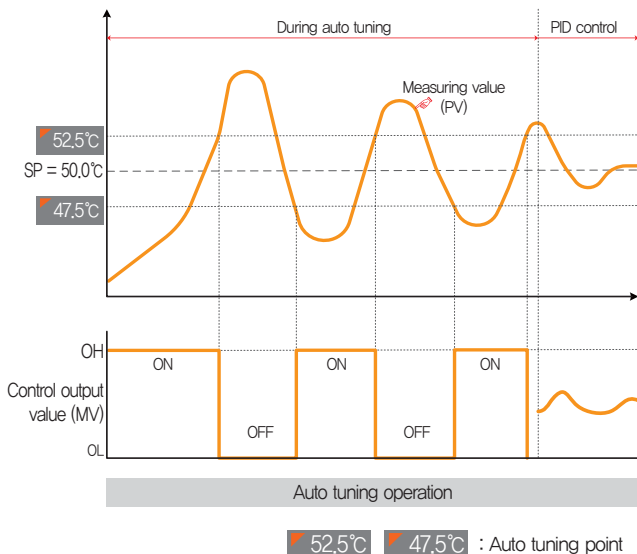
$$\text{-- PID4 auto tuning set value} = \text{boundary value 3} + \frac{\text{Boundary value4} - \text{Boundary value3}}{2}$$

$$\text{-- PID5 auto tuning set value} = \text{boundary value 4} + \frac{\text{Upper limit} - \text{Boundary value 4}}{2}$$

$$\text{-- PID6 auto tuning set value} = \text{lower limit} + \frac{\text{Upper limit} - \text{Lower limit}}{2}$$

4-5.Auto tuning and tuning point

- Auto tuning is a function that the controller automatically set the optimal PID quorum by measuring and calculating the characteristics of the controlled objects
- During auto tuning, the controller generates ON/OFF control output for “2,5 periods”, and at this time it calculates the PID value automatically based on the period and amplitude using the limit cycle to the object to be controlled.
- Auto tuning is available for both fixed and program operation
- When the “auto” is selected in auto tuning parameter, auto tuning is performed sequentially and stored in order to the PID number



References

- ▶ An example of auto tuning depending on the set value.
 - Operation method : Fixed operation/input sensor : temperature (K2)
 - Range : 0.0°C ~ 1000.0°C
 - Temperature auto tuning point : 0.25% → EUS 0.25% = 2.5°C
 - Current set value(SP) : 50.0°C
 - Output lower limit(OL) : 0.0%/output upper limit(OH) : 100.0%



CAUTION

Cautions in operation

- Even if the current setting value (SP) is changed during auto tuning, the tuning point is not changed. Then the control is started with the change setting value (SP) after auto tuning termination as the target setting value (TSP).
- Auto tuning is terminated if “Sensor disconnection” occurs in the input during auto tuning. At this time, PID value is kept with the previous setting value
- Auto tuning is stopped when auto tuning exceeds 27 hours
- PID setting values can be changed during auto tuning, but it is reset to PID value calculated by calculation at the end of auto tuning
- When auto tuning is forcibly terminated, PID values retain the set value before auto tuning

Part 05

Operation motion setting

- 5-1. Operation method setting 50
- 5-2. Fuzzy function 52
- 5-3. Setting value change rate (SLOPE) operation 53



Figure 1-10 shows the 'FUNCTION VIEW' of the LCD screen. The interface includes a top navigation bar with 'MAIN', '101', 'FUNCTION VIEW', and 'NEXT'. The main display area is organized into four functional sections:

- OPERATION MODE:** Features a 'PROG' button and a 'G/FIX' button.
- TIME OPERATION:** Includes 'UNUSE' and 'USE' buttons, and input fields for 'HOUR' (0 H) and 'MIN' (0 M).
- POWER STOP MODE:** Includes a 'STOP' button, a 'COLD' button, and a 'SP SLOPE' field set to '0.0 °C'.
- RESTRICT OF MAIN:** Includes 'UNUSE' and 'USE' buttons, a 'USER PASSWORD' field (displayed as '****'), and 'RELOCK' and 'ASYNC' buttons at the bottom.

[Fig. 5-1] Operation related motion setting screen

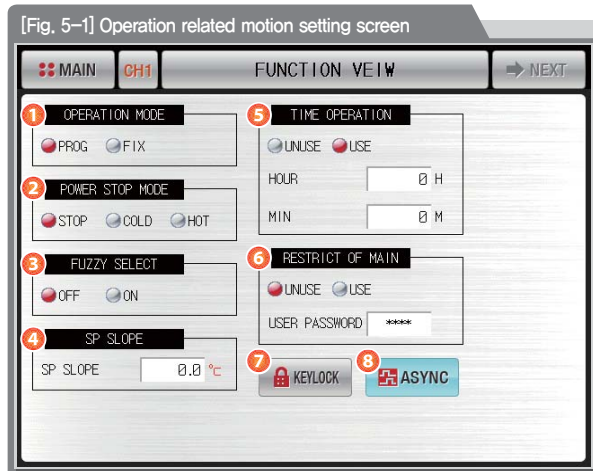


05. Operation motion setting

5-1. Operation method setting

(1) Fixed operation stop screen 1

- It converts to [Fig.5-1] Operation related motion setting screen when the operation motion setting is selected in [Fig.2-1] Main screen
- The screen below is a description of channel 1 and the screen of channel 2 is identical to channel 1



①

Set the operation mode to either pattern or fixed operation (Cannot be changed during operation)

- PROG : Setting in program operation
- FIX : Setting in fixed operation

②

Set recovery action in case of power failure

- STOP : Motion returning to operation stop state after power on from the power failure in operation state
- Restart : Motion starting the operation from the beginning after power on from the power failure in operation state
- Continue: Motion returning to operation state before power failure after power on from the power failure in operation state

③


The overshoot is prevented in case of setting value change

- OFF : Unuse of fuzzy function
- ON : Use of fuzzy function

④

Automatically increase or decrease at a set ratio when setting value is changed

- It is adopted in fixed operation only

⑤	Total operation in the set time and the [4-1. (3) Fixed operation run screen] Operation is terminated when process time is consisting with set time • It is usable for fixed operation only
⑥	When setting the main button constraint, press the main button run screen, then a keypad for entering the password will be displayed • Refer to [Fig. 5-2] Screen for setting main button constraint
⑦	When  is pressed, all parameters cannot be set • Screen movement and key unlocking are possible
⑧	Button to select "Synchronous operation" or "Asynchronous operation" • Synchronous operation : Since the "Run/stop" button is configured as one in "Fixed/program" run screen it is able to operate/stop simultaneously • Asynchronous operation : Since the "Run/stop" button is configured separately in "Fixed/program" run screen it is able to run/stop separately

Return motion in power failure	Program operation	Fixed operation
Stop	Program stop	Stop
Restart	Operate from the first segment	Run
Continue	Operate from the operation segment before power failure	Run

Parameter	Setting range	Unit	Initial value
Operation method	Prog, Fix	ABS	Prog
Power stop mode	Stop, Restart, Continue	ABS	Stop
Fuzzy Select	Off, On	ABS	Off
Channel #n SP Slope	Channel #n.EUS(0.00 ~ 100.00%)/MIN	Channel#n.EUS/MIN	Channel#n.EUS(0.00%)/MIN
Time operation	Unuse, Use	ABS	Unuse
Hour	0 ~ 9999 HOUR	ABS	0
Minute	0 ~ 59 MIN	ABS	1
Restrict of main	Unuse, Use	ABS	Unuse
Key lock	Unuse, Use	ABS	Unuse
Run/Stop operation method	Synchronous operation , Asynchronous operation	ABS	Asynchronous operation

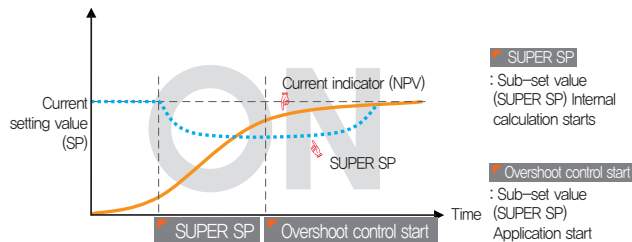
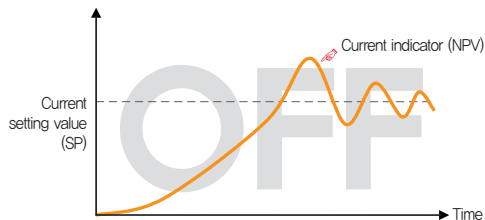
※ #n : 1 ~ 2



[Fig 5-2] Screen when setting main button constraint

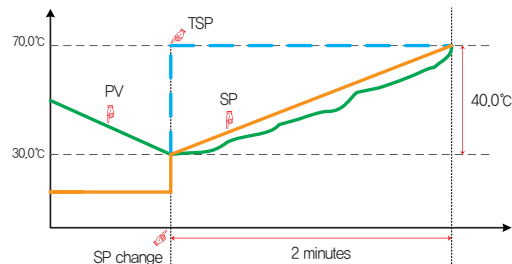
5-2. Fuzzy function

- Generally, overshoot may occur if load fluctuation is severe during operation or the current set value changes frequently
At this time, more effective control can be performed by operating the fuzzy function
- Internal operation sequence of fuzzy function: it suppresses overshoot by calculating control output value (MV) with sub-target value (Super SP) instead of current setting value (SP) from the starting point of overshoot.



5-3. Setting value change rate (SLOPE) operation

- The setting value is changed as a constant rate of change from the present value (PV) to the set value when the setting value (SP) is changed



Change rate (SLOPE) operation

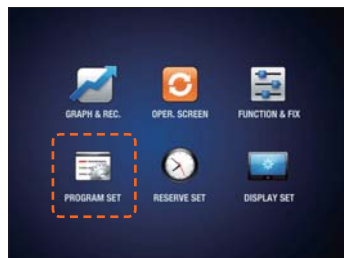
References

- ▶ Operation Method : Fixed Operation
- ▶ Temperature change rate : 20.0 °C/MIN
- ▶ Change [Changed SP(TSP) – PV at the SP changing point] with slope of 20.0°C per minute
: Change $(70.0 - 30.0)^{\circ}\text{C} = 40.0^{\circ}\text{C}$ with slope of 20.0°C per minute
- ▶ Increases the current set value (SP) from 30.0°C to 70.0°C with a constant change rate for 2 minutes.

Part 06

Program setting

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Main screen



[Fig. 6-1] Program setting screen



Move to main screen



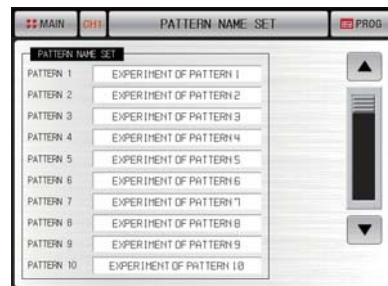
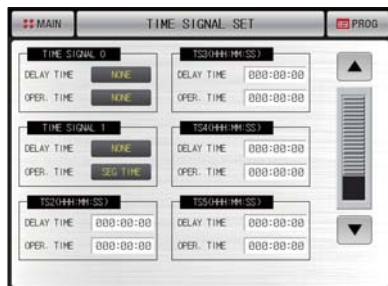
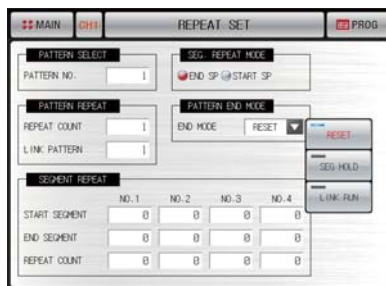
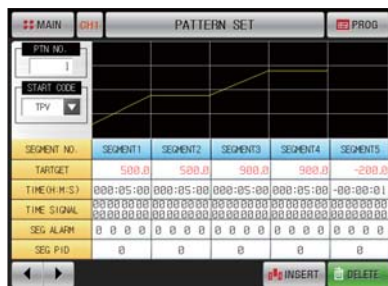
Move to CH1/CH2 screen



Move to next screen



Move to prog screen





06. Program setting

- It converts to [Fig.6-1] Program setting screen when press the program setting button in [Fig.2-1] Main screen
- This screen group is used to set parameter related to program operation



- | | |
|---|--|
| ① | Move to pattern editing screen |
| ② | Move to pattern and segment repeat setting screen |
| ③ | Move to screen for setting copy and delete pattern |
| ④ | Move to screen for time signal setting |
| ⑤ | Move to screen for setting standby mode |
| ⑥ | Move to screen for setting experiment name |

6-1. Pattern editing

- It is a screen to set the segment according to the pattern number
- Refer to [Fig.6-4] **Time signal** for time signal setting
- The screen below is a description of channel 1 and the screen of channel 2 is identical to channel 1

[Fig. 6-2] Pattern editing screen

SEGMENT NO.	SEGMENT1	SEGMENT2	SEGMENT3	SEGMENT4	SEGMENT5
TARTGET	500.0	500.0	900.0	900.0	-200.0
TIME(H:M:S)	00:05:00	00:05:00	00:05:00	00:05:00	-00:00:01
TIME SIGNAL	00000000	00000000	00000000	00000000	00000000
SEG ALARM	0	0	0	0	0
SEG P-ID	0	0	0	0	0

① Input the pattern number to set the segment

Setting the start condition at program operation

- TPV : At the start of program operation, the current set value (SP) starts from the present value (PV) regardless of the slope or start set value (SSP) and progress for the set time (TM1) up to the current set value 1 (SP1) set in segment 1 (SEG1)

② At the start of program operation, the current set point (SP) starts from the present value (PV) and progresses to the current set point 1 (SP1) set in segment 1 (SEG1) and at this the operation calculate the remaining time assuming that the time has elapsed to the program start point time by referring to the contents of the set program pattern

- SSP : At the start of program operation, the current set value (SP) starts from the set start set value (SSP) and continue to progress for the set time (TM1) until the current set value 1 (SP1) set in segment 1

③ Set the setting value of segment to operate

④ Set the time of segment to operate

Set the signal and sub-output of segment to operate

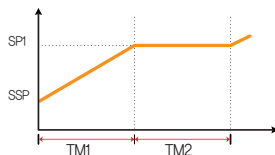
- Able to set up 8-time signals for each segment and can select 20-time signals for each segment.
- Refer to [Fig.6-4] **Time signal**
- One sub-output can be set per segment and output 4 ~20mA DC by inputting 4 ~ 20. Refer to [61 page]

⑥	Set the seg-alarm of segment to operate
⑦	Set the seg PID of segment to operate
⑧	Moves the screen left/right in 1 segment unit
⑨	When one of the buttons SEGMENT 1 (segment 01~99) is pressed for segment insertion, the selected button SEGMENT 1 (segment ~1~99) and INSERT button is activated and the selected segment can be inserted when, INSERT is pressed.
⑩	When one of the buttons SEGMENT 1 (segment 01~99) is pressed for segment deletion, the selected button SEGMENT 1 (segment ~1~99) and DELETE button is activated and the selected segment can be inserted when, DELETE is pressed.



Program operation start

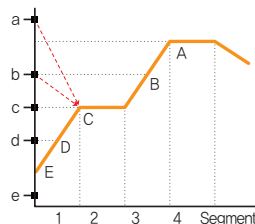
- Start of the program operation is processed according to the setting of start condition (STC : START CODE)
- Setting value priority program operation (STC = SSP)
: at the start of program operation, the current set value (SP) starts from the set start set value (SSP) and continues for the set time (TM1) until the current set value 1 (SP1) set in segment 1 (SEG1)



- Slope priority program operation (STC = SPV)

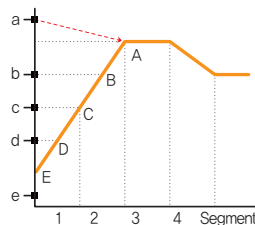
: At the start of program operation, the current set point (SP) from the present value (PV) and proceeds to the current set point 1 (SP1) set in segment 1 (SEG1) At this time, the operation time is regarded as the elapsed time to the program operation start point and the remaining time is calculated by referring to the contents of the set program pattern

- ① When the segment 2 is the first maintenance interval



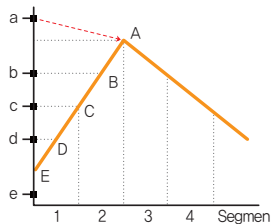
Current indication value	Program operation start point
a	C
b	C
c	C
d	D
e	E(SSP)

- ② When the segment 3 is the first maintenance interval



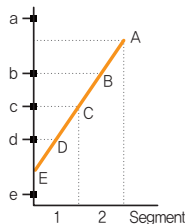
Current indication value	Program operation start point
a	A
b	B
c	C
d	D
e	E(SSP)

③ When there is no maintenance interval



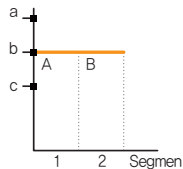
Current indication value	Program operation start point
a	A
b	B
c	C
d	D
e	E(SSP)

④ When there is only rising interval without maintenance interval



Current indication value	Program operation start point
a	No operation start
b	B
c	C
d	D
e	E(SSP)

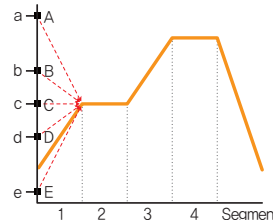
⑤ When maintenance interval start from segment 1



Current indication value	Program operation start point
a	B
b	B
c	A(SSP)

● Time priority program operation (STC = TPV)

: at the start of program operation, the current setting value (SP) starts from the present value (PV) regardless of the slope or start setting value (SSP) and proceeds for the set time (TM1) until the current set value (SP1) set in segment 1 (SEG1)



Current indication value	Program operation start point
a	A
b	B
c	C
d	D
e	E

Sub-output setting screen

SEGMENT NO.	SEGMENT1	SEGMENT2	SEGMENT3	SEGMENT4	SEGMENT5
TARGET	500.0	500.0	500.0	500.0	-200.0
TIME (H:M:S)	000:05:00	000:05:00	000:05:00	000:05:00	00:00:01
TIME SIGNAL	00000000	00000000	00000000	00000000	00000000
SEG. ALARM	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
SEG. PID	0	0	0	0	0

- Select sub-output from [4, Control & transmission output] in [Installation manual]
- Set the sub-output in the 8th zone of the time signal

Time signal input key(Sub-output setting)

SEGMENT NO.	SEGMENT1	SEGMENT2	SEGMENT3	SEGMENT4	SEGMENT5
TARGET	500.0	500.0	500.0	500.0	-200.0
TIME (H:M:S)	000:05:00	000:05:00	000:05:00	000:05:00	00:00:01
TIME SIGNAL	00000000	00000000	00000000	00000000	00000000
SEG. ALARM	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
SEG. PID	0	0	0	0	0

- When press "Time signal" button, input key is displayed and when button on the right top is pressed button to set sub-output is displayed.

Pattern number setting input key

SEGMENT NO.	SEGMENT1	SEGMENT2	SEGMENT3	SEGMENT4	SEGMENT5
TARGET	500.0	500.0	500.0	500.0	-200.0
TIME (H:M:S)	000:05:00	000:05:00	000:05:00	000:05:00	00:00:01
TIME SIGNAL	00000000	00000000	00000000	00000000	00000000
SEG. ALARM	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
SEG. PID	0	0	0	0	0

- When press "Pattern number" button, the input key for setting the pattern number is displayed.

Start condition (TPV)

The screenshot shows the 'PATTERN SET' screen with the 'START CODE' dropdown menu set to 'TPV'. The 'TARTGET' row shows values for segments 1 through 5: 500.0, 900.0, 900.0, 900.0, and -200.0. The 'TIME (H:M:S)' row shows times for each segment: 000:05:00, 000:05:00, 000:05:00, 000:05:00, and 00:00:01. The 'TIME SIGNAL' row shows a sequence of 0s and 1s. The 'SEG ALARM' and 'SEG PID' rows show 0s. The 'INSERT' and 'DELETE' buttons are at the bottom right.

- When the “Start condition” button is pressed, an input key for setting the start condition is displayed.

Start condition (SSP)

The screenshot shows the 'PATTERN SET' screen with the 'START CODE' dropdown menu set to 'SSP'. The 'TARTGET' row shows values for segments 1 through 5: 500.0, 500.0, 900.0, 900.0, and -200.0. The 'TIME (H:M:S)' row shows times for each segment: 000:05:00, 000:05:00, 000:05:00, 000:05:00, and 00:00:01. The 'TIME SIGNAL' row shows a sequence of 0s and 1s. The 'SEG ALARM' and 'SEG PID' rows show 0s. The 'INSERT' and 'DELETE' buttons are at the bottom right.

- It is a screen where the start condition is set to “SSP”.

Start condition (SPV)

The screenshot shows the 'PATTERN SET' screen with the 'START CODE' dropdown menu set to 'SPV'. The 'TARTGET' row shows values for segments 1 through 5: 500.0, 500.0, 900.0, 900.0, and -200.0. The 'TIME (H:M:S)' row shows times for each segment: 000:05:00, 000:05:00, 000:05:00, 000:05:00, and 00:00:01. The 'TIME SIGNAL' row shows a sequence of 0s and 1s. The 'SEG ALARM' and 'SEG PID' rows show 0s. The 'INSERT' and 'DELETE' buttons are at the bottom right.

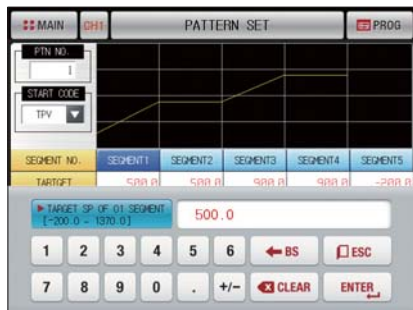
- It is a screen where the start condition is set to “SPV”.

Segment

The screenshot shows the 'PATTERN SET' screen with the 'START CODE' dropdown menu set to 'TPV'. The 'TARTGET' row shows values for segments 1 through 5: 500.0, 500.0, 900.0, 900.0, and -200.0. The 'TIME (H:M:S)' row shows times for each segment: 000:05:00, 000:05:00, 000:05:00, 000:05:00, and 00:00:01. The 'TIME SIGNAL' row shows a sequence of 0s and 1s. The 'SEG ALARM' and 'SEG PID' rows show 0s. The 'INSERT' and 'DELETE' buttons are at the bottom right.

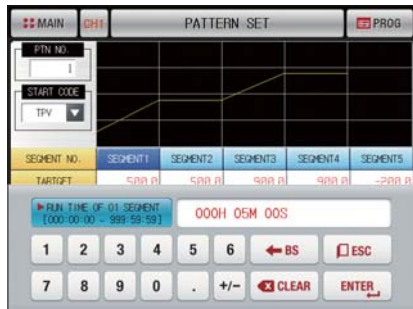
- When **SEGMENT1** button is activated, **INSERT**, **DELETE** buttons are activated.

Target setting value input key



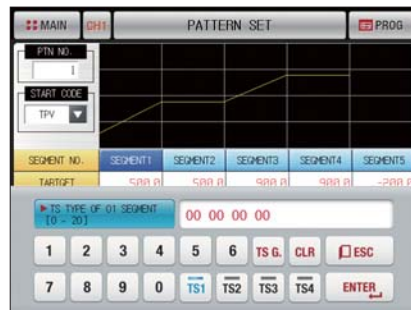
- When "Target SP" button is pressed, the input key for setting the setting value is displayed.

Operation time input key



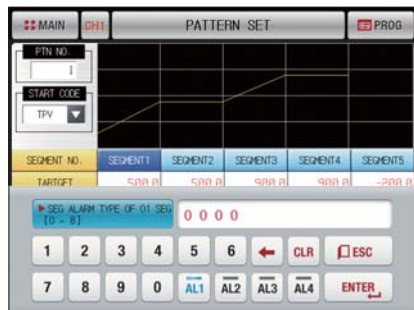
- When button is pressed, the input key for setting the segment time is displayed.

Time signal input key



- When "Time signal" button is pressed, the input key for setting the time signal is displayed.
- When button is pressed, you can set the time signal from TS1 to TS8.

SEG alarm input key



- When "Seg alarm" button is pressed, the input key for setting the seg alarm is displayed.

SEG PID input key



- When "SEG PID" button is pressed, the input key for setting the SEG PID is displayed.

References

- ▶ Input time signal and SEG alarm by pressing button.
- ▶ To exit from the input screen, select the button.
- ▶ It is able to enter the desired time signal group by pressing the TS1~TS8 buttons set in the [6-4, Time signal]
- ▶ Time signal 8 cannot be used when using sub-output from the OUT1~4 control output terminal.

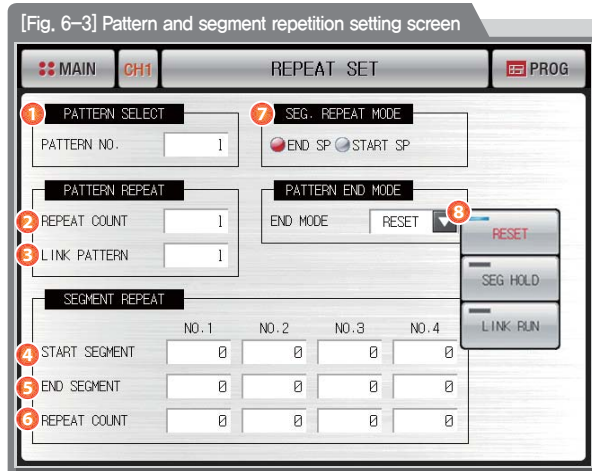
Parameter	Setting range	Unit	Initial value
Channel #n pattern number	1~500	ABS	1
Start condition	TPV, SPV, SSP	ABS	TPV
Start condition (SSP)	#m,EU(0.0~100.0%)	#m,EU	#m,EU(0.0%)
Segment #m target SP	#m,EU(0.0~100.0%)	#m,EU	#m,EU(0.0%)
Segment #m time	-00.00.01(OFF) ~ 999.59.59(Hour,Min,Sec)	ABS	-00.00.01
Segment #m time signal 1 ~ 8	0 ~ 20	ABS	0
Segment # sub-output	4 ~ 20	ABS	0
Segment #m SEG alarm 1 ~ 4	0 ~ 8	ABS	0
Segment #m SEG PID	0 ~ 6	ABS	0

※ #n : 1 ~ 2

※ #m : 1 ~ 99

6-2. Repetition setting

- It is a screen to set the function for the whole or partial repetition of the set pattern.
- It is able to set the operation method at the pattern operation termination.
- The following screen is an explanation for channel 1 and channel 2 screen is identical to the channel 1



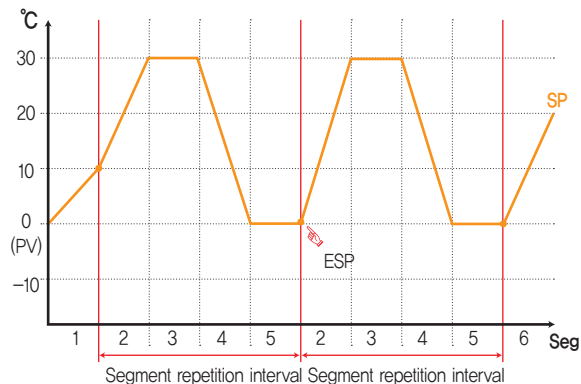
- ① It set the pattern number to execute repeated operation
- ② It set the number of repeated operations of the set pattern
- ③ It sets the number of patterns to be continuously operated at the operation termination of the set pattern
- ④ It sets the segment to start partial repetitive operation of the set pattern
 - It starts from the start set value (SSP) in partial repetitive operation regardless of the start time condition (STC) when the start segment is "1".
- ⑤ It sets the segment to terminate partial repetitive operation of the set pattern
- ⑥ It sets the number of repetitions of partial repetitive operation among set patterns
- ⑦ It determines the start SP value when segment repeat operation
 - END SP : The SP value starts from the last END SP
 - START SP : SP value starts from the beginning SP of the segment
- ⑧ It sets the action to be performed when the operation of the set pattern is completed
 - Operation stop : it generates the pattern termination signal and the operation state is program stop
 - SEG hold : it is operated in last operation set value and maintains hold state
 - Connection operation : it operates the pattern set in connection pattern

Parameter	Setting range	Unit	Initial value
Channel #n pattern no.	1~500	ABS	1
Number of repetitions	0(Infinite repetition)~999	ABS	1
Channel #n connection pattern	1~500	ABS	1
Segment repetitive action	Termination SP, Start SP	ABS	Termination SP
Operation in pattern termination	Operation stop, SEG hold, Continuation operation	ABS	Operation stop
Start segment for repetition setting 1~4	0~99	ABS	0
Termination segment for repetition setting 1~4	0~99	ABS	0
Repetition frequency for repetition setting 1~4	0~99	ABS	0

Example)

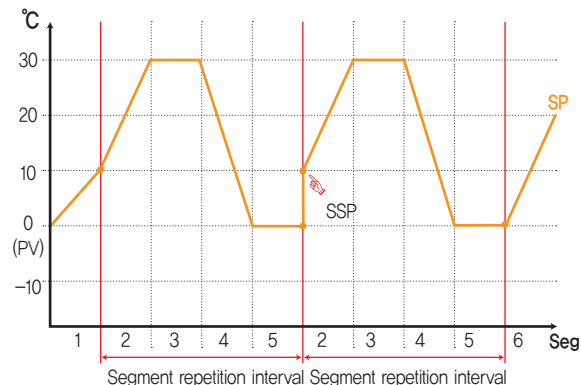
Segment repetition operation : Termination SP

– The SP value will be processed from the last operated END SP



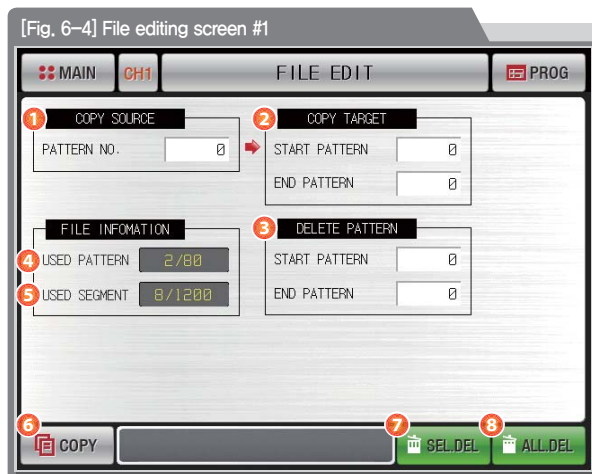
Segment repetition operation : Start SP

– The SP value will be processed from the start SP of the segment



6-3. File editing

- It is a screen to copy or delete the segment values entered in pattern in [6-1. Pattern editing].
- The following screen is an explanation for channel 1 and channel 2 screen is identical to the channel 1.
- The patterns between channels cannot be copied.
- The pattern numbers in operation cannot be deleted.
- Deleted patterns cannot be restored.



- | | |
|---|--|
| ① | It sets the number of original patterns to be copied. |
| ② | It sets the start and end pattern numbers to be copied.
• Only the start pattern is copied when the end pattern is "0". |
| ③ | It sets start and end pattern numbers to delete.
• Only the start pattern is deleted when the end pattern is "0". |
| ④ | It displays the total number of patterns set in [6-1. Pattern editing]
• It cannot be changed as it is read-only. |
| ⑤ | It displays the total number of segments set in [6-1. Pattern editing]
• It cannot be changed as it is read-only. |
| ⑥ | Copy the pattern set in ① to the pattern set in ② |
| ⑦ | The set value of the pattern set in ③ is initialized. |
| ⑧ | It initializes the set value of all patterns. |



[Fig. 6-5] File editing screen #2

References

- ▶ The message "It is a parameter setting error" is displayed at the bottom of the screen when copying or deleting without entering the pattern number.

Parameter	Setting range	Unit	Initial value
Channel #n pattern number	1~500	ABS	0
Copy : channel #n start pattern	0~500	ABS	0
Copy : channel #n end pattern	0~500	ABS	0
Copy	Unuse, Use	ABS	Unuse
Delete selection : channel #n start pattern	0~500	ABS	0
Delete selection : channel #n end pattern	0~500	ABS	0
Delete selection	Unuse, Use	ABS	Unuse
Delete whole	Unuse, Use	ABS	Unuse

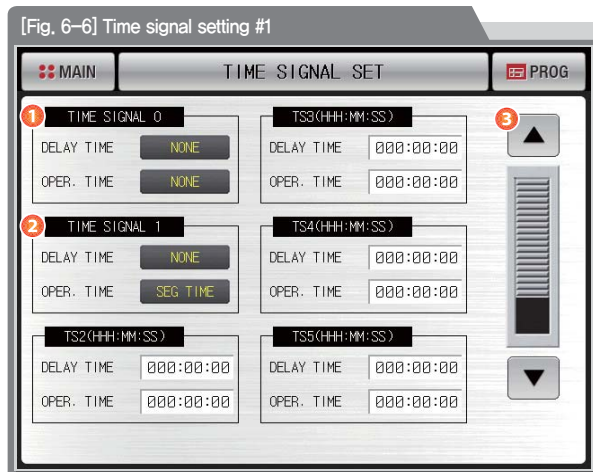
※ #n : 1 ~ 2

Display message	Explanation
"No data stored in the selected pattern"	It is displayed when there are no contents stored in the pattern number but need to copy it
"Copying to the selected pattern is completed"	It is displayed when the selected pattern copy is completed
"Deletion of the selected pattern is completed"	It is displayed when the selected pattern has been deleted.
"All patterns have been deleted"	It is displayed when all patterns have been deleted.
"Pattern to be copied is in use"	It is displayed when patterns are in use.

6-4. Time signal

- The time signal operation is classified into ON/OFF operation and time setting operation. And the time signal set here is used for setting the time signal number (NO.) in segment setting in [6-1, Pattern editing]

(1) Time signal ON/OFF operation



①

The time signal is OFF during corresponding segment operation when "0" is selected.

- It cannot be changed as it is read-only

②

The time signal is ON during corresponding segment operation when "1" is selected.

- It cannot be changed as it is read-only

③

It moves screen up/down

(2) Time signal time setting operation

- Time signal 2~20(TS2~20) operates according to delay time and operation time.

The screenshot shows the 'TIME SIGNAL SET' screen with a 'MAIN' button on the left and a 'PROG' button on the right. The screen is divided into six sections, each for a different time signal (TS6, TS9, TS7, TS10, TS8, TS11). Each section contains two input fields: 'DELAY TIME' and 'OPER. TIME', both set to '000:00:00'. To the right of the sections is a vertical scroll bar with up and down arrow buttons.

[Fig. 6~7] Time signal setting #2

The screenshot shows the 'TIME SIGNAL SET' screen with a 'MAIN' button on the left and a 'PROG' button on the right. The screen is divided into six sections, each for a different time signal (TS12, TS15, TS13, TS16, TS14, TS17). Each section contains two input fields: 'DELAY TIME' and 'OPER. TIME', both set to '000:00:00'. To the right of the sections is a vertical scroll bar with up and down arrow buttons.

[Fig. 6~8] Time signal setting #3

[Fig. 6-9] Time signal setting #4

MAIN TIME SIGNAL SET PROG

TS18(HH:MM:SS)

DELAY TIME 000:00:00

OPER. TIME 000:00:00

TS19(HH:MM:SS)

DELAY TIME 000:00:00

OPER. TIME 000:00:00

1 TS20(HH:MM:SS)

2 DELAY TIME 000:00:00

OPER. TIME 000:00:00

①

The time signal is "ON" after the time set in the delay time from the corresponding segment start point.

- However, the time signal does not work when the delay time is longer than the corresponding segment time.

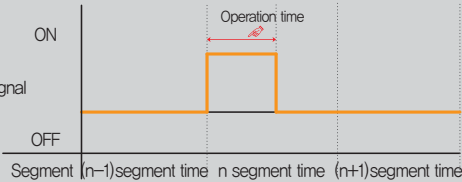
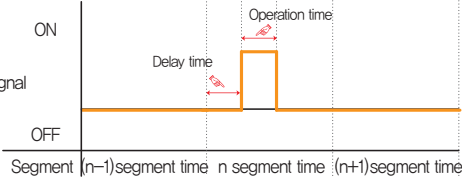
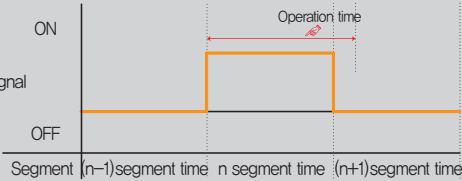
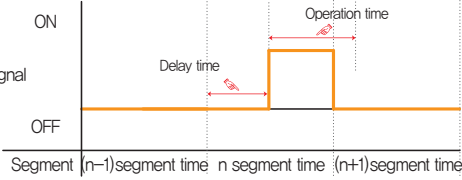
②

The time signal that is "ON" by the delay time in the corresponding segment is "ON" only for the time set in the operation time

- However, when (Delay time + Operation time) is larger than the segment time, the time signal is ON only during the segment operation, and the next segment is not operated.

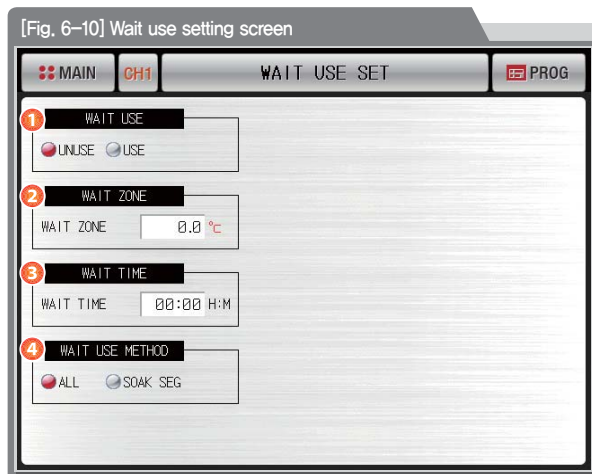
Parameter	Setting range	Unit	Initial value
Delay time	000.00.00(OFF) ~ 999.59.59(Hour, Min, Sec)	ABS	000.00.00
Oper. time	000.00.00(OFF) ~ 999.59.59(Hour, Min, Sec)	ABS	000.00.00

(3) Example of operation when input the time signal

Setting	Time signal operation
<p>1. Delay time = 000.00.00</p> <p>Segment N time \geq Delay time $+$ Operation time</p>	 <p>ON</p> <p>Time signal</p> <p>OFF</p> <p>Segment (n-1)segment time n segment time (n+1)segment time</p> <p>Operation time</p>
<p>2. Delay time \neq 000.00.00</p>	 <p>ON</p> <p>Time signal</p> <p>OFF</p> <p>Segment (n-1)segment time n segment time (n+1)segment time</p> <p>Operation time</p> <p>Delay time</p>
<p>3. Delay time = 000.00.00</p> <p>Segment N time $<$ Delay time $+$ Operation time</p>	 <p>ON</p> <p>Time signal</p> <p>OFF</p> <p>Segment (n-1)segment time n segment time (n+1)segment time</p> <p>Operation time</p>
<p>It does not affect the next segment</p> <p>4. Delay time \neq 000.00.00</p>	 <p>ON</p> <p>Time signal</p> <p>OFF</p> <p>Segment (n-1)segment time n segment time (n+1)segment time</p> <p>Operation time</p> <p>Delay time</p>

6-5.Wait use

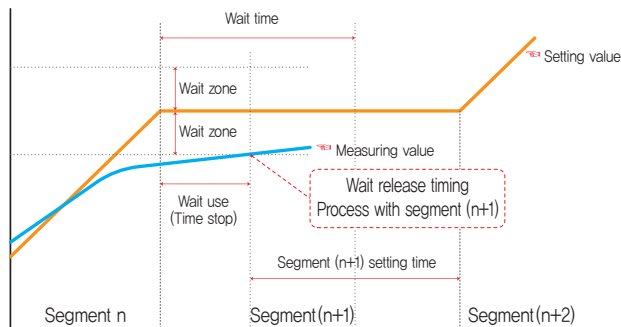
- It is a screen to set the range and time for wait use during program operation.
- The wait use set here is applied to [Fig.6-1. Pattern editing].
- The following screen is an explanation for channel 1 and channel 2 screen is identical to the channel 1
- Definition of wait use
 - Wait use entry condition : When the measured value fails to enter the wait zone within the set segment time
 - Wait use release condition : When the measured value enters the wait zone
 - The wait time has infinite value if the wait time is not set (initial value)



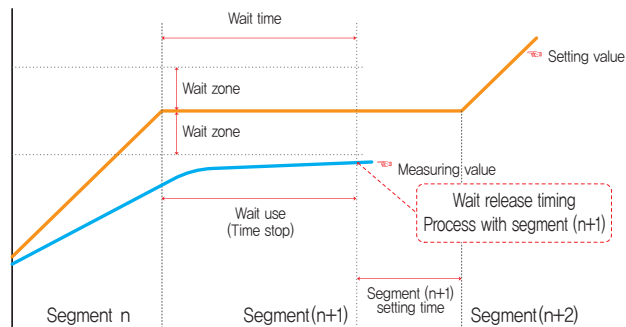
- | | |
|---|--|
| ① | It sets Y/N of the wait use |
| ② | It sets the range of operation to apply the wait use <ul style="list-style-type: none"> • The wait use is not operated if the wait zone to "0.0" |
| ③ | It sets the wait time to be applied when the measured value fails to enter the wait zone <ul style="list-style-type: none"> • Infinite wait until entering wait zone when the wait time is set to "00:00". |
| ④ | It sets whether the wait use method is to be "All" or "Soak SEG." <ul style="list-style-type: none"> • All : the standby operation is applied to the entire segment set in [6-1. Pattern editing] • Soak segment : the wait use is applied only to the maintenance range segment set in [6-1. Pattern editing] |

Parameter	Setting range	Unit	Initial value
Wait use	Unuse, Use	ABS	Unuse
Channel #n wait zone	Channel#n,EUS(0.00~100.00%)	Channel#n,EUS	Channel#n,EUS(0.00%)
Wait time	00.00 ~ 99.59(Hour, Min)	ABS	00.00
Wait use method	All, Soak SEG	ABS	All

※ #n : 1 ~ 2



In case of Wait use release within the wait time



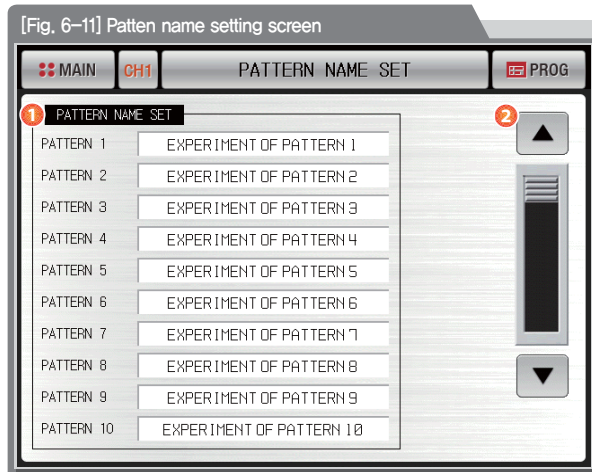
In case of no entry of the measuring value into wait zone within the wait time

References

- ▶ It is a graph for the correlation of wait use and wait time
- ▶ Wait zone : it indicates the temperature range to which the wait use is applied

6-6. Patten name setting

- The experiment names can be set for each pattern. Refer to [4-2, (2) Program operation run screen 1]
- The following screen is an explanation for channel 1 and channel 2 screen is identical to the channel 1



[Fig. 6-12] Patten name input screen

References

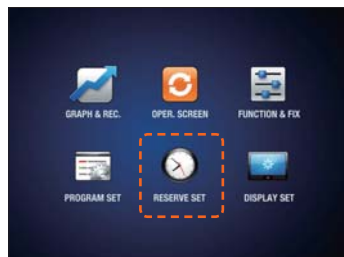
- When button is pressed, an input key for setting the experiment name is displayed.

- ① Input experiment name of each pattern
- ② Switch to next or previous experiment name screen

Parameter	Setting range	Unit	Initial value
Channel 1 experiment name 1~500	0~9, A~Z, Special character (Max 24 characters)	ABS	EXPERIMENT OF PATTERN 1~500
Channel 2 experiment name 1~500	0~9, A~Z, Special character (Max 24 characters)	ABS	EXPERIMENT OF PATTERN 1~500

Part **07**

Reserved operation setting 80



Main screen



[Fig. 7-1] Time setting screen



07. Reserved operation setting

- It converts to [Fig.7-1] Time setting screen when reserved operation setting button is pressed in [Fig.2-1] Main screen
- It is a screen to set the current time and reserved operation time
- The following screen is an explanation for channel 1 and channel 2 screen is identical to the channel 1

[Fig. 7-1] Time setting screen

1 CURRENT TIME		2 RESERVE TIME	
YEAR	2019 Y	YEAR	2013 Y
MONTH	8 M	MONTH	1 M
DAY	6 D	DAY	1 D
AM/PM	PM ▼	AM/PM	AM ▼
HOUR	9 H	HOUR	12 H
MIN	30 M	MIN	0 M

3 L RESERVE

- ① It sets the current year, month, day and time
 - It is unable to change the current time while recording the measured value and operating
- ② It sets the year, month, day and time for reserved operation
 - When button is pressed, operation is possible at the set reservation time
- ③
 - When button is applied, it specifies the reservation time on the run screen as, the [Fig. 7-2] Operation reserved setting screen



[Fig. 7-2] Operation reserved setting screen
(Asynchronous operation)



[Fig. 7-3] Operation reserved setting screen
(Synchronous operation)

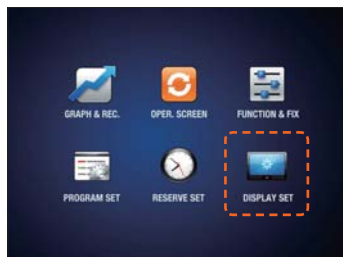
Parameter		Setting range	Unit	Initial value
Current time	Year	2000~2099	ABS	—
	Month	1~12	ABS	—
	Day	1~31	ABS	—
	AM/PM	AM, PM	ABS	—
	Hour	1~12	ABS	—
	Minute	0~59	ABS	—
Reserved operation time	Year	2000~2099	ABS	2013
	Month	1~12	ABS	1
	Day	1~31	ABS	1
	AM/PM	AM, PM	ABS	AM
	Hour	1~12	ABS	12
	Minute	0~59	ABS	0
Reservation		Click to make a reservation		

※ AM12:00 : Night 00:00/PM12:00 : PM 12:00

Part 08

Screen display setting

- 8-1. Screen display setting85
- 8-2. Touch screen carib87
- 8-3. DI error occurrence history view89



Main screen



[Fig. 8-1] Screen display setting screen



[Fig. 8-9] DI error creation history screen



Move to main screen



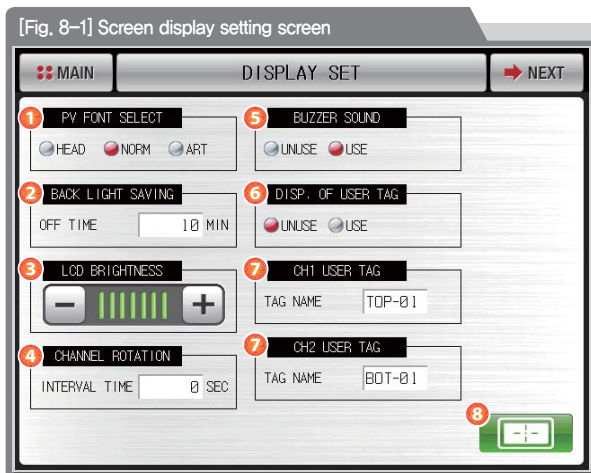
Move to Next screen



08. Screen display setting

8-1. Screen display setting

- It converts to [Fig. 8-1] screen display setting screen when screen display setting button is pressed in [Fig. 2-1] Main screen



- ① It sets the Present value (PV) font of run screen
- ② It sets the backlight saving time
 - The power saving operation time sets the operation timing of backlight OFF when there is no button operation
- ③ The brightness of LCD is controlled by, button
- ④ It sets the run screen conversion of channel 1 and channel 2
 - When the screen conversion time is set and the set time elapses after 30 seconds and after the "Beep" sound is heard without any touch on the run screen 2, channel 1 and channel 2 run screen is switched repeatedly
 - When the screen is converted, all touches become the key lock. To unlock the key, touch anywhere to unlock the key lock
 - It is operated only in run screen 2
- ⑤ It sets Y/N of buzzer sound
 - The buzzer sound generated in DI error is operated even if it is set to Unuse
- ⑥ It sets Y/N of user tag display
 - It sets the tag name of channel 1 and channel 2
 - Maximum 6 digits can be input, and the set tag is displayed on the run screen
 - Refer to [Fig. 4-6] Fixed operation run screen 2
- ⑧ Touch screen setting



[Fig. 8-2] User tag name setting screen of channel 1 and 2

Parameter	Setting range	Unit	Initial value
PV font select	HEAD, NORM, ART	ABS	HEAD
Backlight saving	0 ~ 99 MIN	ABS	10
LED brightness	1 ~ 7	ABS	7 spaces
Channel rotation	0 ~ 99 SEC	ABS	0
Buzzer sound	Unuse, Use	ABS	Use
Disp. of user tag	Unuse, Use	ABS	Unuse
CH1 user tag	0~9, A~Z, special characters (Max 6 characters)	ABS	TOP-01
CH2 user tag	0~9, A~Z, special characters (Max 6 characters)	ABS	BOT-01

8-2.Touch screen carib

- Touch screen can be corrected by pressing the  button on the left/right top, left/right bottom and centre on the touch screen correction screen




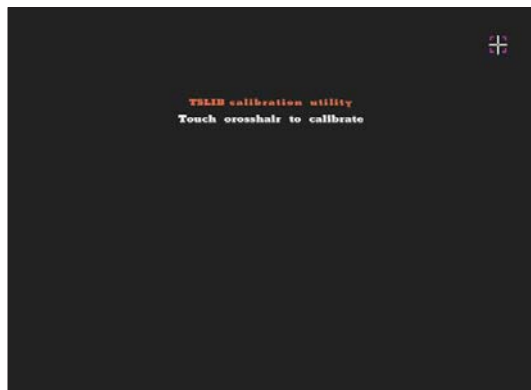
[Fig. 8-3] Touch screen correction screen #1



[Fig. 8-4] Touch screen correction screen #2

References

- ▶ Please select all the  buttons in the left/right top, left/right bottom and centre in order
- ▶ After correction is completed, please turn OFF ⇨ ON.



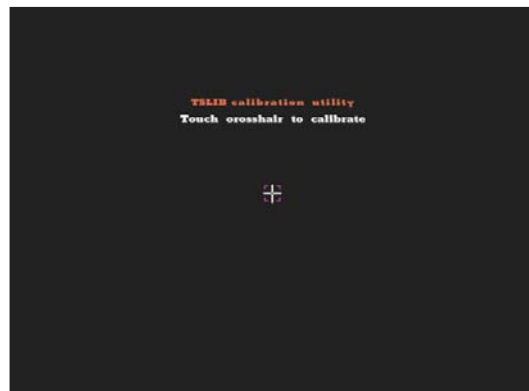
[Fig. 8-5] Touch screen correction screen #3



[Fig. 8-7] Touch screen correction screen #5



[Fig. 8-6] Touch screen correction screen #4

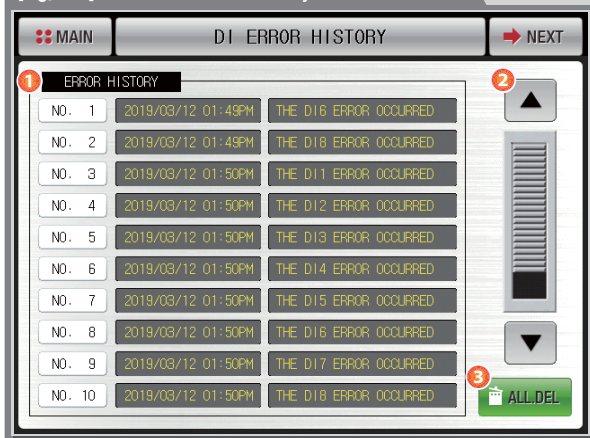


[Fig. 8-8] Touch screen correction screen #6

8-3. DI error occurrence history view

- It is a screen to display the type, date and time of the DI with error occurred.
- The error history is stored up to 30 cases and the history after that is stored after the first stored history is deleted.

[Fig. 8-9] DI error occurrence history screen






- ① It displays the history when DI error occurs
- The name set in [11-2 Error name] in [Installation manual] is displayed
 - It cannot be changed as it is read-only.
- ② It checks the next or previous error history.
- ③ It deletes the entire DI error history

Parameter	Setting range	Unit	Initial value
Delete entire	Unuse, Use	ABS	Unuse






[Fig. 8-10] Screen for DI error display method by letter

References

- ▶ it is a screen when DI error occurs.
- ▶ Setting for letter and photo screen can be set in [11. DI function and operation] in [Installation manual]
- ▶ It converts to the run screen by exiting from the DI error screen when  button is pressed.
- ▶ The same DI error is ignored for 1 minute if the screen is exited by pressing  button after DI creation. (Here, the ignore means DI error screen)
Ex) If you exit "Return" while DI1 is being occurred, ignore it for 1 minute even if DI1 is occurring, and if DI1 occurs even after 1 minute, DI error screen is displayed
- ▶  Button is a button to stop the warning sound when DI error occurs

Ex) Explanation according to lamp state

-  THE D11 ERROR OCCURRED DI error no occurrence ("OFF" state)
-  THE D11 ERROR OCCURRED DI error occurrence ("ON" state)
-  THE D11 ERROR OCCURRED DI error occurrence ("ON" state)

Part 09

Communication error 92



09. Communication error



[Fig. 9-1] Control unit communication error screen



[Fig. 9-2] I/O board communication error screen



[Fig. 9-3] Sub-channel communication error screen

References

- ▶ When there is communication error between the display and control unit, The message like “Control unit was disconnected!” is displayed at the bottom of screen as shown in [Fig.9-1] **Control unit communication error screen**.
- ▶ When there is communication error between control unit and I/O board The message like “I/O board was disconnected!” Is displayed at the bottom of screen as shown in [Fig.9-2] **I/O board communication error screen**.
- ▶ When there is communication error between control unit and sub-channel unit, The message like “Sub-channel was disconnected!” is displayed at the bottom of the screen as shown in [Fig.9-3] **Sub-channel communication error screen**.
- ▶ Communication failure
: Communication cable faulty, communication cable connection state faulty

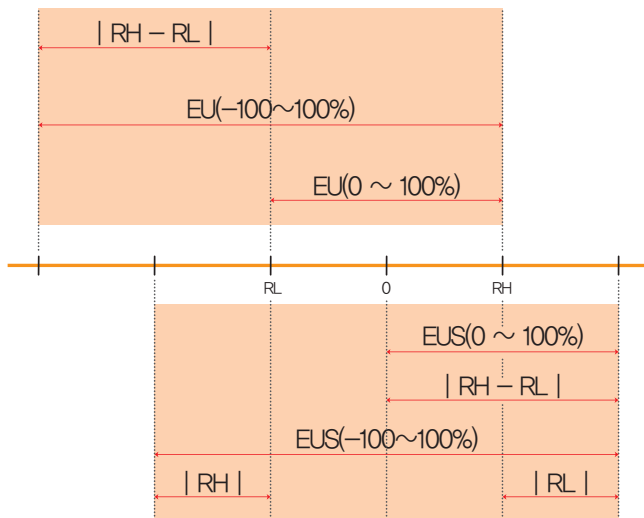
Engineering Units - EU, EUS

⚙️ When the sensor type (IN-T) or the upper limit, lower limit of input range is changed, the parameters expressed in EU(), EUS() are changed in proportion to current data. (However, the upper and lower range setting data is initialized.)

⚙️ Download the instruction manual and communication manual from the homepage.

⚙️ EU() : Value of engineering unit depending on the range of instrument

EUS() : Value of engineering unit depending on the span of instrument



► Range of EU() and EUS()

	Range	Center point
EU(0 ~ 100%)	RL ~ RH	$ RH - RL /2 + RL$
EU(-100 ~ 100%)	$-(RH - RL + RL) \sim RH$	RL
EUS(0 ~ 100%)	$0 \sim RH - RL $	$ RH - RL /2$
EUS(-100 ~ 100%)	$- RH - RL \sim RH - RL $	0

(Example)

► INPUT = T/C(K2)

► RANGE = -200.0°C(RL) ~ 1370.0°C(RH)

	Range	Center point
EU(0 ~ 100%)	- 200.0 ~ 1370.0°C	585.0°C
EU(-100 ~ 100%)	- 1770.0 ~ 1370.0°C	- 200.0°C
EUS(0 ~ 100%)	0 ~ 1570.0°C	785.0°C
EUS(-100 ~ 100%)	- 1570.0 ~ 1570.0°C	0.0°C

RL: Lower limit of input range
RH: Upper limit of input range

Part 10

Web server and firmware updates

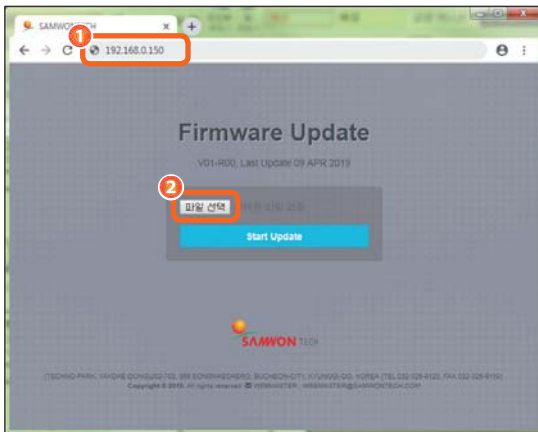
10-1. Display unit update	96
10-2. Sub-channel update	98



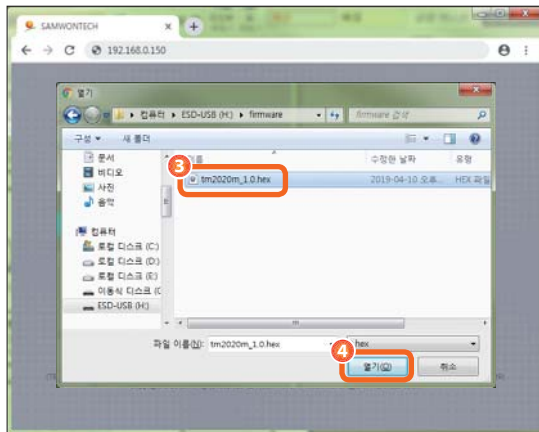
10. Web server and firmware updates

- It is able to update display unit and sub-channel firmware update via built-in web server.
- It can be connected through various devices such as PC, smart phone and tablet etc.

10-1. Display unit update



[Fig. 10-1] Display unit firmware update #1



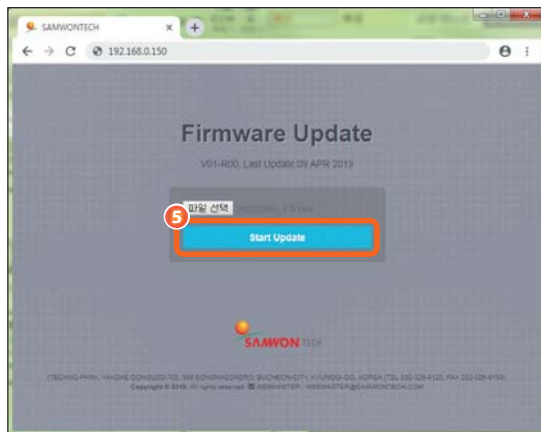
[Fig. 10-2] Display unit firmware update #2

① Input IP address set on the display unit in the address window (Initial value : 102.168.0.150)

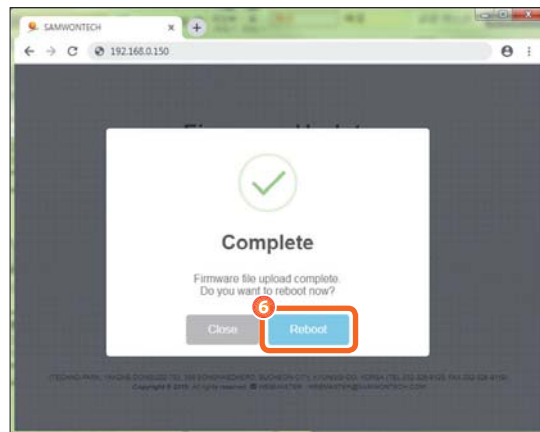
② Click **파일 선택** (Select file) button

③ Select update file

④ Click **열기(O)** (Open) button

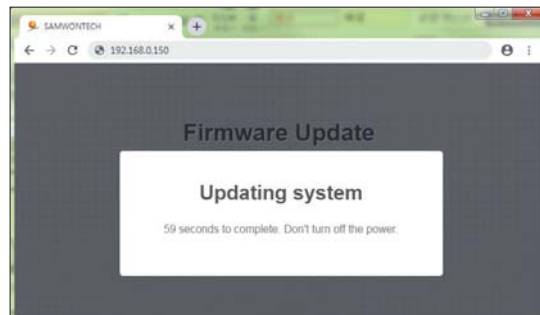


[Fig. 10-3] Display unit firmware update #3



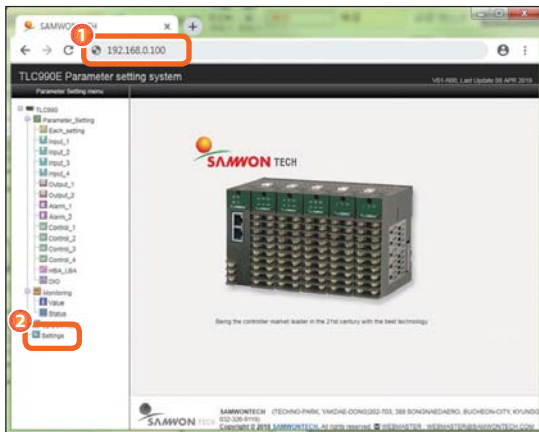
[Fig. 10-4] Display unit firmware update #4

- ⑤ Click **Start Update** button to update after completing file selection
- ⑥ Click **Reboot** button to update after completing file selection



[Fig. 10-5] Display unit firmware update #5

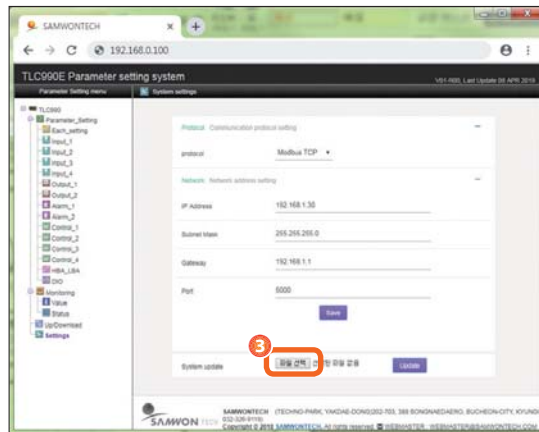
10-2. Sub-channel update



[Fig 10-6] Sub-channel firmware update #1

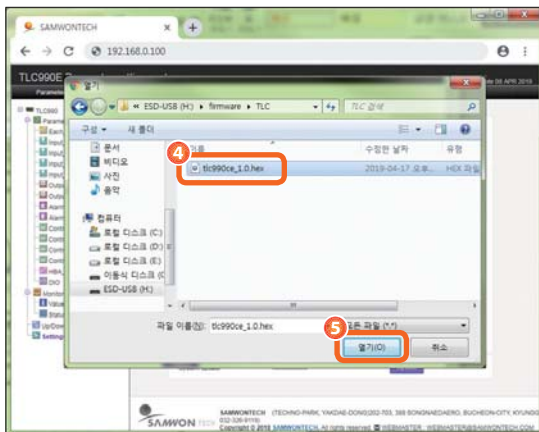
① Input IP address set on the sub-channel in the address window (Initial value : 102.168.0.100)

② Click  Settings button

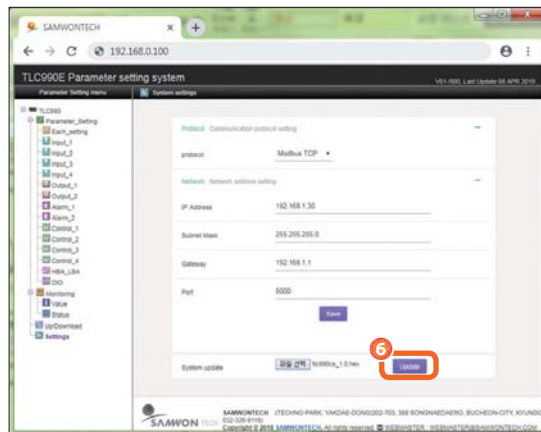


[Fig 10-7] Sub-channel firmware update #2

③ Click  (Select file) button



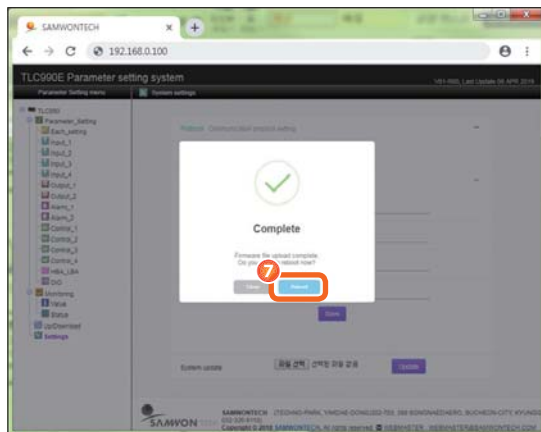
[Fig 10-8] Sub-channel firmware update #3



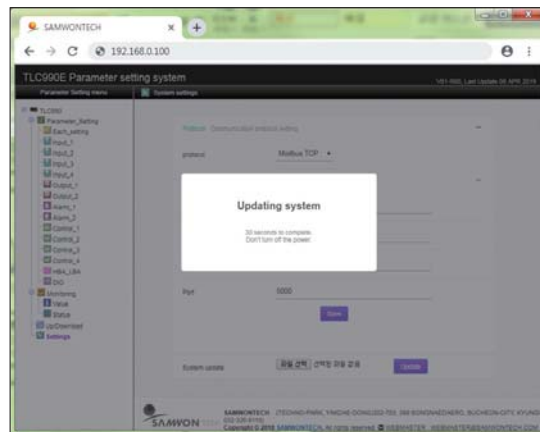
[Fig 10-9] Sub-channel firmware update #4

- ④ Select update file
- ⑤ Click **열기(O)** (Open) button

- ⑥ Click **Update** button to update after completing file selection



[Fig. 10-10] Sub-channel firmware update #5



[Fig. 10-11] Sub-channel firmware update #6

⑦

Click **Reboot** button to reboot after the update is completed

MEMO



Inquiries related TEMP2020M SERIES A/S

Please inform TEMP2020M model name, fault state
and contact information when contacting for A/S.

T : 82-32-326-9120

F : 82-32-326-9119



Customer contact for TEMP2020M SERIES

Quotation request / Product request

Specification request / Data request / Other request

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