EC5900R
Programmer/Controller
Instruction Manual

DRAFT

Ohkura

WXPEC5900R01E
Nov 2007 (1st edition)

For Safety Using

Thank you for purchasing our EC5900R Programmer/Controller. For proper and effective use of full functions of this instrument, please read and understand this instruction manual well before use.

The following symbol marks are used in this instrument and the instruction manual for safety using.

Safety Precautions	
⚠ **Warning**	It is clearly described when dangerous situation for causing death or serious injury of the user is expected in case of mishandling.
⚠ **Caution**	It is clearly described when dangerous situation for causing light injury of the user or object damage is expected in case of mishandling.
	Indicate “Caution in handling.” It is described at points were the instruction manual needs to be reffered for protection of the user and equipment.
	Indicate “Protective grounding terminal.” Be sure to provide grounding before operating the instrument.
	Indicate “Caution for electric shock.” It is described at points where electric shock may occur if instruction is neglected.

To ensure safety in handling the instrument, please be sure to observe the following warnings/cautions as well as the precautions in this manual.

⚠ Warning

General	To prevent an electric shock, be sure to disconnect this instrument from the main power supply when wiring it.
Protective grounding	(1)To prevent an electric shock, be sure to provide protective grounding before providing power supply to this instrument. (2)Do not cut off the protective grounding conductor or disconnect protective grounding.
Power supply	Check that the power supply voltage of this instrument matches that of the supply source. Rated power voltage range : 100-240VAC Rated power freguency : 50/60Hz Power consumption : 40VA max
Environment	Do not operate this instrument in atmosphere containing inflammable, explosive or corrosive gas, or in environments where water or steam may be splashed on the product.
Input/output wiring	To prevent electric shock, be sure to provide wiring after turning off the power.

⚠ Caution

Input/output wiring	Do not use the open terminals for other purposes such as relay.
Inside of instrument	Do not disassemble the inside of the main unit.

[Caution]

Instruction manual

(1)Please deliver this instruction manual to the final user.
(2)Be sure to read this instruction manual before handling the instrument.
(3)If you find any questions, errors or omissions, please inform our sales representative.
(4)When you have read this instruction manual, store it safely near the instrument.
(5)If it is lost, stained or damaged by accident, please inform our dealer where you purchased the instrument or our sales representative.
(6)It is forbidden to reprint or copy all or part of this instruction manual without permission.

Installation

(1)Please be sure to attach to a panel so that the operator who operates it cannot touch the back of this instrument.
(2)Please attach to the point distant from what burns easily. Please do not install what burns especially easily under an instrument base.
(3)When installing this instrument, put on a protective gear such as safety shoes, helmet, etc. for your safety.
(4)Do not put your foot on the installed instrument or get on it, because it is dangerous.

Maintenance

(1)It is prohibited to remove or disassemble the unit, printed circuit board, etc. by anyone except our serviceman or persons with our approval.
(2)When protection against dust and waterproofing performance are not needed, and when not making shakiness between an inner unit and a case into a problem, there is no problem on the performance even if it removes packing between an inner unit and a case.

Disposal

To dispose of this instrument, consign to the special agent as an industrial waste.

Cleaning

(1)Clean the surface of this instrument with a dry cloth.
(2)Do not use organic solvents.
(3)Cleaning the instrument after turning off the power.

Revisions

This instruction manual may be revised without prior notice.

How to Use This Instruction Manual

This instruction manual consists of “For safety using”, “Table of Contents,” and “Chapters 1 to 11” as follows. Read the applicable pages to suit your purpose:

Chapter and title	At purchase and installation	At the time of the first operation	In daily operation	In maintenance and troubleshooting
For safety using (pages 1 and 2)	◎	◎	◎	◎
Chapter 1 When Instrument Arrives	◎			
Chapter 2 Installation	◎			○
Chapter 3 Wiring	◎			○
Chapter 4 Part Names		◎	○	
Chapter 5 Basic Operation and Setting		◎	○	
Chapter 6 Determination of Function		◎	○	
Chapter 7 Operation Guidance and Setting List		◎	○	
Chapter 8 Program Pattern Setting			○	
Chapter 9 Operation			○	
Chapter 10 Procedure for Major Functions			○	
Chapter 11 Troubleshooting				◎

◎ : Be sure to read the chapter ○ : Read if necessary.

【Initial setting and operation】

Operation is mentioned in Chapter 9 from Chapter 4. In the beginning, please check basic operations in Chapter 4 and Chapter 5. Afterwards, according to Section 6.1 (from page 21), perform checking and setting of a basic function. If checking and setting of a basic function finish, perform setting and checking of the function of others in a Setup screen if needed.

The setting item of the main functions of this instrument is explained for every function after Section 6.2 of Chapter 6. Please read an applicable point if needed. Please read chapter 8 about setting of a program pattern and read Chapter 9 about an operating method, respectively.

Chapter 7 shows all the displays of this instrument and all the setting items, and the description of those. Please refer to the chapter of relevance and Chapter 7 not only at the time of initial setting but at the time of everyday operation.

Type of Instruction Manual

		Name	Description
This ➡ manual	1	EC5900R Programmer/Controller Instruction Manual WXPEC5900R01E	Describes the general information on EC5900R including installation, wiring, operation and functions.
	2	RS-232C/RS-422A/RS-485 Interface Instruction Manual WXPEC5900R02E	Describes the setup, communication protocol, etc. for using communication.
	3	Analog Retransmission (AO), Sensor source (24V Power) Instruction Manual WXPEC5900R03E	Describes AO wiring, setup and functions. Describes Sensor power wiring and functions.
	4	Expansion Interface, Servo Drive Output Instruction Manual WXPEC5900R04E	Describes wiring, setup and functions for using Expansion Interface or Servo Drive output.

Caution/reference mark

This instruction manual describes the cautioning and reference information with the following marks:

Caution/reference mark	
[Caution]	This is cautionary information for correct use of the instrument. Be certain to read.
[Reference]	This is information to help you use the functions of this instrument more effectively.
☞	There is an item, table, figure or another instruction manual to be referred at the same time.

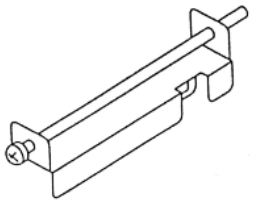
Table of Contents

Chapter 1 When Instrument Arrives

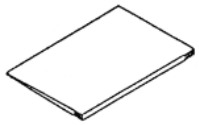
1.1 Checking the Accessories

When this instrument arrives, please check on the accessories and appearance and check that there is no lacking parts or damages. If you find any inappropriate parts, inform our dealer where you purchased the instrument or our sales representative.

This instrument has the following accessories:



Mounting fixture (2)



Instruction manual
(this document)

1.2 Checking the Specifications

① ② ③ ④ ⑤ ⑥ ⑦

EC590□R□□ □ □□□

①1st output

1	Relay
2	SSR drive
5	4 to 20mA
6	0 to 5mA
8	Multi-output

②Number of contact Output point

0	2
1	4

③Built-in options

0	No
5	AO
8	AO, a sensor power source

⑦Special

0	No
Z	Yes

⑥DI/DO option

0	No
1	DI/DO adaptor terminals
2	DI/DO connector

⑤2nd output

0	No
1	Relay
2	SSR drive
5	4 to 20mA
6	0 to 5mA

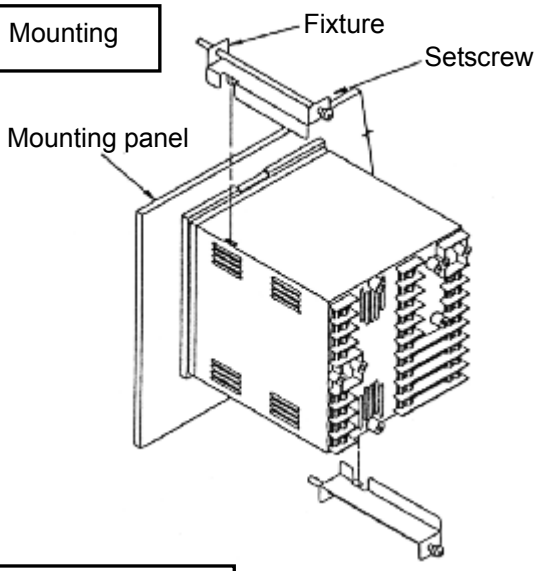
④Expansion options

0	No
1	ARCNET®
2	Servo drive
3	ARCNET® & Servo drive
4	RS-485

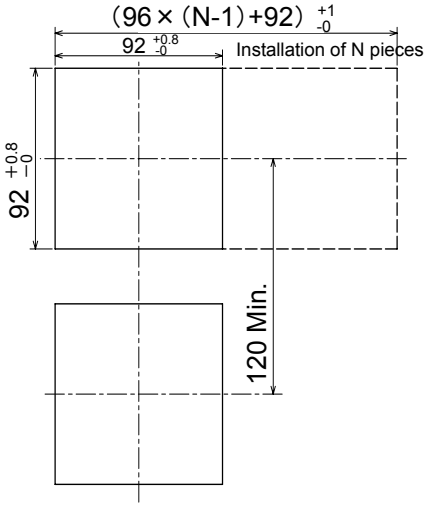
Chapter 2 Installation

Install this product by establishing holes according to the panel cutout drawing and fixing it with the accessory fixtures.

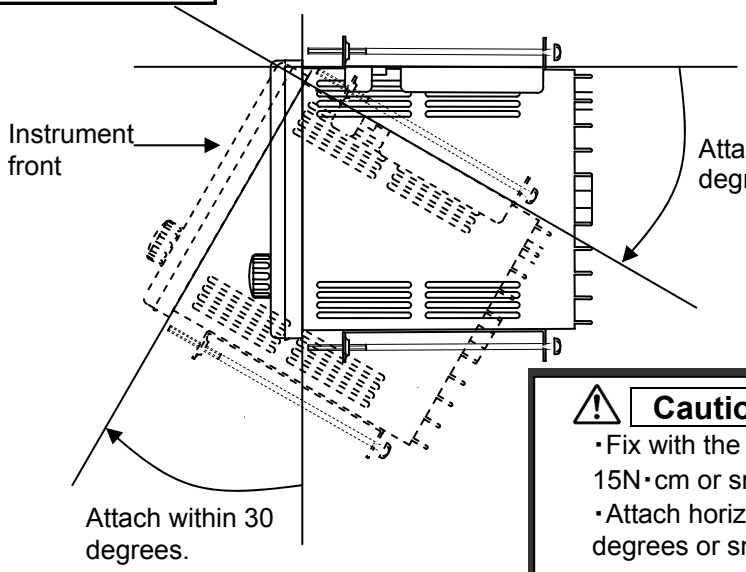
Mounting



Panel cutout (Unit: mm)



Attachment posture



⚠ Caution **Mounting procedure**

・Fix with the fixture tightening torque of 15N・cm or smaller.

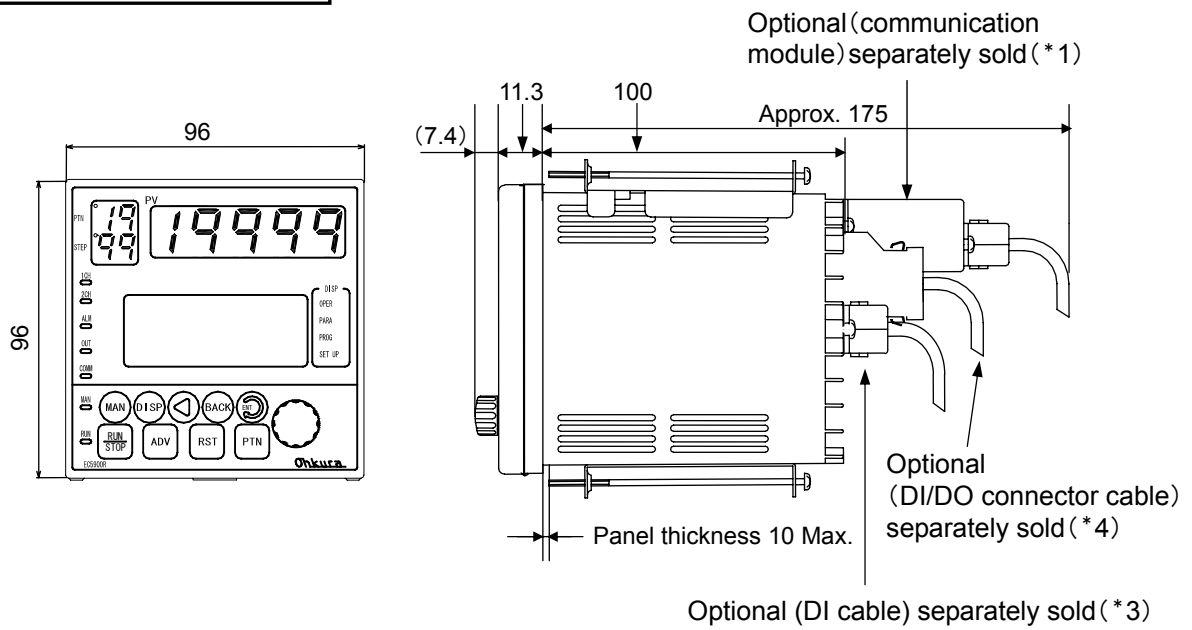
・Attach horizontally and upward angle or 30 degrees or smaller and no downward angle.

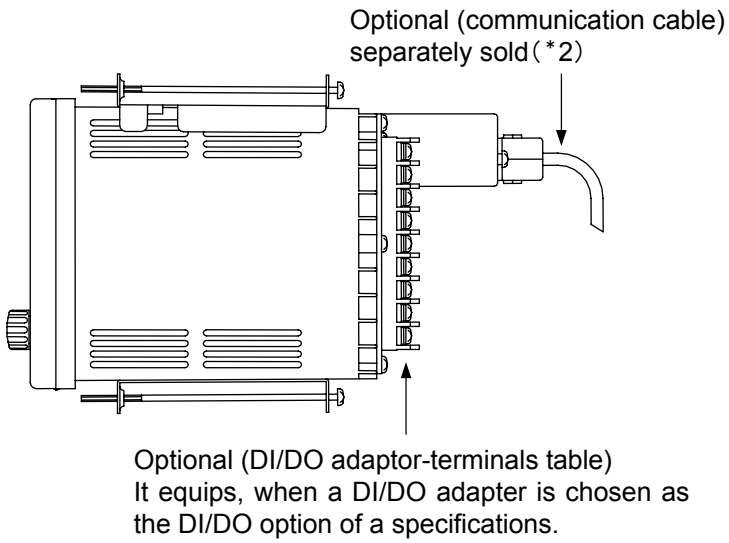
⚠ Caution **Location**

Install at locations with stable peripheral temperature in the range of -10 to 55℃. Avoid the following location:

- ○ Locations where people can touch the terminal easily
- ○ Locations with dusts in the air, with corrosive gas
- ○ Locations with vibration or impact or strong noise
- ○ Locations with direct sunlight or wind and rain (water is splashed)
- ○ Locations with direct wind on the back terminal
- ○ Locations near flammable objects

Outside dimension diagram （Unit：mm）





Separately sold part number

	RS-232C	RS-422A	RS-485
*1 Communication module	ZE7101A0113	ZE7101B0411	
*2 Communication cable	HMSU2255B02	WMSU0075A01	WMSU0075A02

*3 DI cable HMSU2695A01 : 1m

*4 DI/DO connect cable WMSU0243A01 : 1m

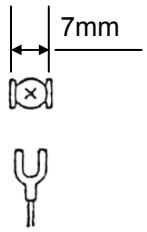
WMSU0243A02 : 5m

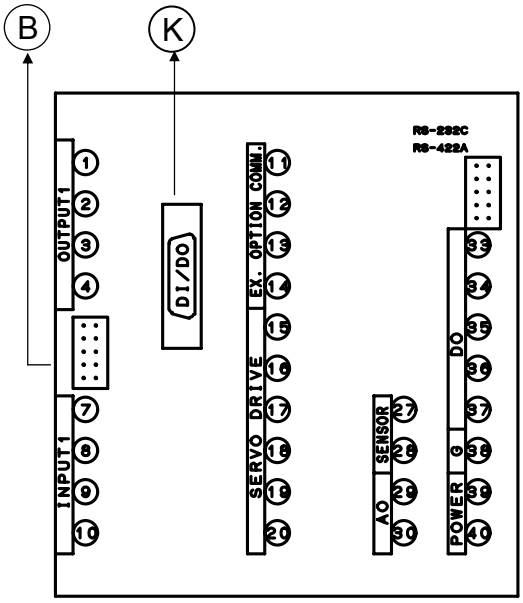
⚠ Warning

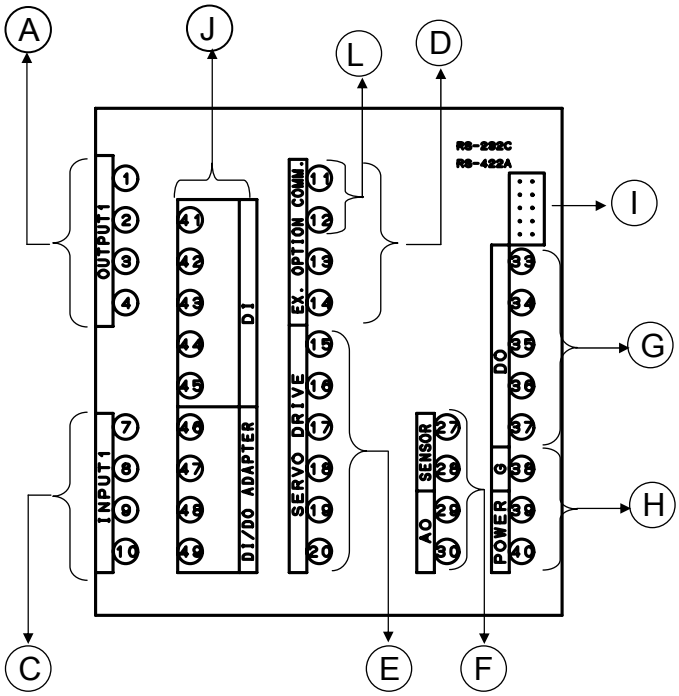
- Never touch the power supply terminal while the power is supplied. When the power supply terminal is touched, it gets an electric shock.
- Never touch relay output terminal and alarm output terminal when they are connected with power supply.

⚠ Caution

- Use a M3.5 press-fitting terminal.
- Use shielded wire and set the signal line (input, AO, communication, etc.) as far away as possible from the power line.
- Use the specified compensating lead wire for thermocouple input.
- Lifetime may be shortened if frequently operated for relay contact output. Use auxiliary relay.
- Attach circuit breaker, switch, etc. on power supply wiring for safety and specify that this is a switch for turning off the power for this instrument.







(H) Power supply

Connection	Grounding: 38 Grounding (Protective grounding)
	Power suply: 39, 40 100 - 240VAC 50 / 60Hz

(I) External communication

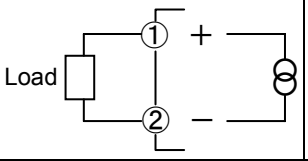
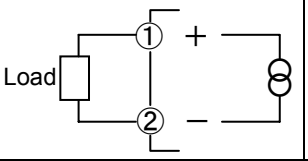
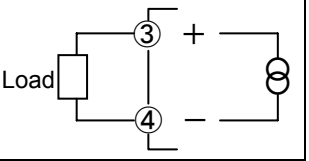
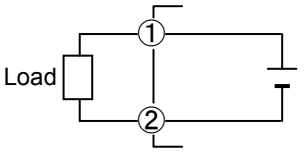
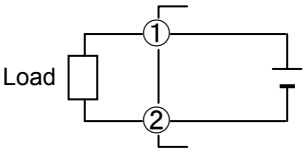
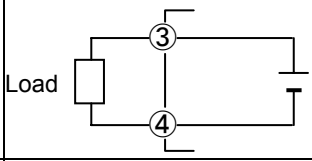
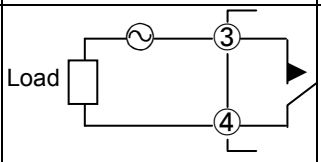
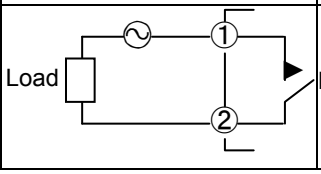
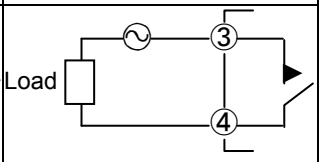
RS-232C communication module instruction manual ☞ HXPZE7101A01E

RS-422 A/RS-485 communication module instruction manual ☞ HXPZE7101B04E

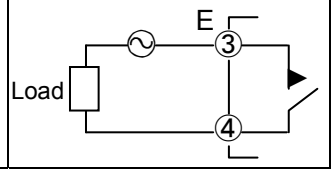
(L) External communication (RS-485)

Interface instruction manual ☞ WXPEC5900R02E

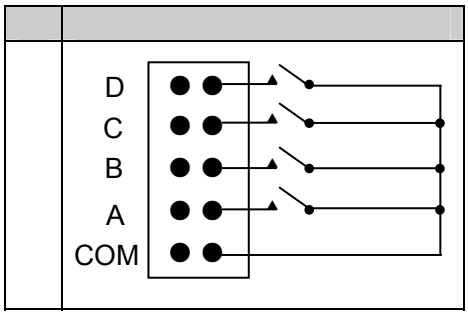
Ⓐ Control output/ Alarm output

	Output	Single output	Dual output	
			1st output	2nd output
Connection	Current			
	SSR drive			
	Relay			

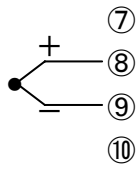
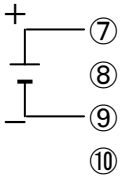
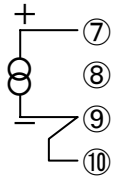
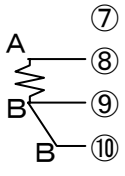
Load condition	Current	4 to 20mA DC：Max. 600Ω、0 to 5mADC：Max. 2kΩ
	SSR drive	0／15VDC Max. 20mA
	Relay	250VAC 3A Max （resistive load）

	Alarm output (ALM)
Connection	

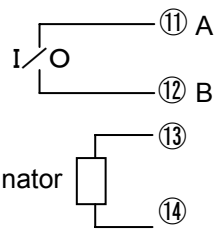
Ⓑ DI connector (normal)



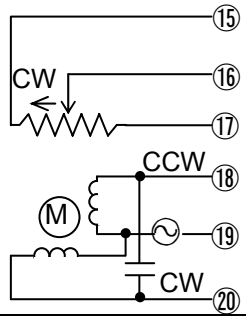
Ⓒ Input

	Thermocouple (TC) voltage (mV)	Voltage（V）	Current（mA）	Resistance temperature detector（RTD）
Connection				

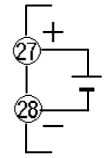
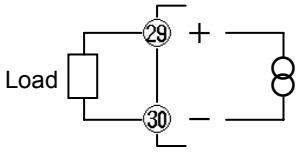
Ⓓ Expansion Interface

	Expansion I/F (ARCNET®: Optional)
Connection	

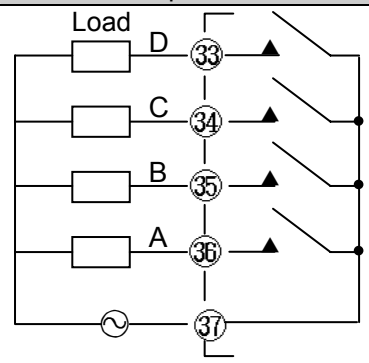
Ⓔ Servo Drive

	Servo drive（optional）
Connection	

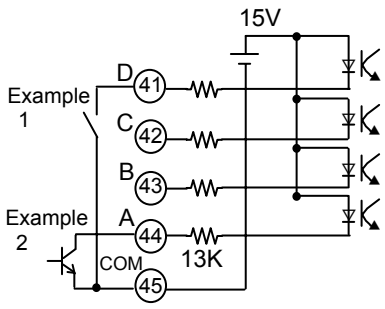
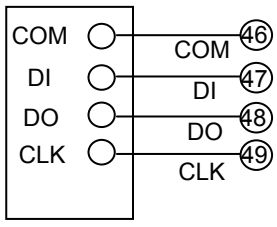
(F) Built-in option

	Sensor power source
Connection	 24VDC 24mA Max
	Analog retransmission
Connection	 4 to 20mA or 0 to 20mA output

(G) DO contact terminal

	Alarm output（ALM）
Connection	 250V AC 0.5A（resistive load）

(J) DI/DO adapter (option)

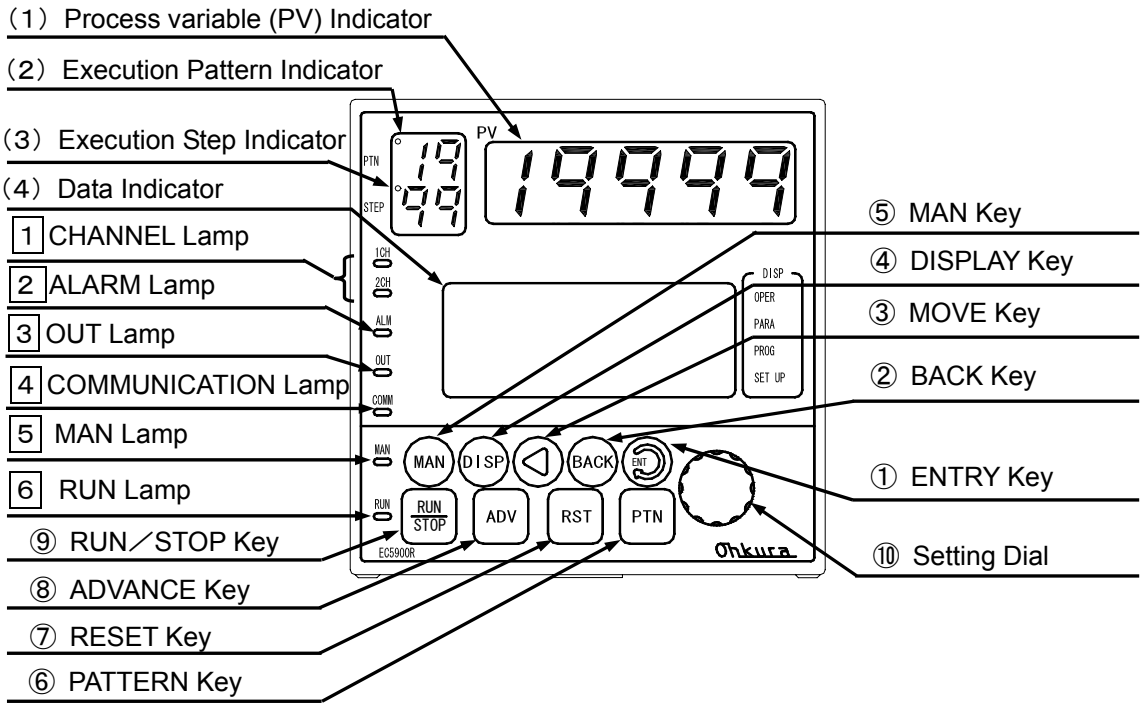
	DI
Connection	
	DI/DO adapter
Connection	 DI/DO adapter CA2005A02

[Caution]
The cable is located in a line in order of No.1 (red) to 2, 3 and 4, ..., cable No.

(K) DI/DO connector (option)

Cable No.	Wire color	Connector No.	Signal name.
1	Red	1	DI-1
2	Gray	14	DI-2
3	Gray	2	DI-3
4	Gray	15	DI-4
5	Gray	3	DI-5
6	Gray	16	DI-6
7	Gray	4	DI-7
8	Gray	17	DI-8
9	Gray	5	COM
10	Green	18	COM
11	Gray	6	DO-1
12	Gray	19	DO-2
13	Gray	7	DO-3
14	Gray	20	DO-4
15	Green	8	DO-5
16	Gray	21	DO-6
17	Gray	9	DO-7
18	Gray	22	DO-8
19	Gray	10	DO-9
20	Green	23	DO-a
21	Gray	11	COM
22	Gray	24	COM
23	Gray	12	COM
24	Gray	25	COM
25	Green	13	COM
26	Gray	26	COM

Chapter 4 Part Names



No.	Key/dial	Function	Chapter/section for reference
①	ENT	Data are registered while numerals or characters are blinking. The cursor moves to the next item while numerals or characters are not blinking. A program is operated combining RUN/STOP, ADV, RST, and the PTN key.	Chapter 5,7,8,9
②	BACK	The cursor moves to the previous item. On Operation screen and Program screen, it moves to a sub screen by the pressing for approx. 3 seconds.	Chapter 5,7,8
③	◀	This key allows you to move to the blinking numerals or characters and to shift changing data digit.	Sec. 5.3
④	DISP	This key switches display screens.	Sec. 5.1, Chapter 7
⑤	MAN	This key switches between manual (MAN) and automatic (AUTO). All reset is carried out by the pressing approx. for 10 seconds.	Sec. 9.2
⑥	PTN	This key switches execution pattern No.	Sec. 9.4
⑦	RST	An execution step is turned back to 00 step (start step). In case of program setting / checking, setting / checking step is returned to 00 step by pressing the ◀ simultaneously.	Sec. 9.4
⑧	ADV	This key advances an execution step to the next step compulsorily. In case of program setting / checking one setting / checking step are advanced by pressing the ◀ simultaneously.	Sec. 9.4
⑨	RUN STOP	This key lets you run or stop a program.	Sec. 9.4

No.	Key/dial	Function	Chapter/section for reference
⑩	DIAL	Data changing is performed. Moreover, menu No. in a menu screen is chosen.	Sec. 5.2.3, 5.3

No.	Display	Function	Chapter/section for reference
(1)	PV indicator	Indicates the PV (process variable) always.	————
(2)	Execution pattern indicator	Indicates the execution pattern No. usually. The indicator blinks to show the switched pattern No. when you switch execution pattern No.	Sec. 9.4
(3)	Execution step indicator	Indicates the execution step No. always.	Sec. 9.4
(4)	Data indicator	Indicates all the data other than described above, setting, changing and current display screens, and various messages.	————
No.	**Lamp**	**Function**	**Chapter/section for reference**
1	CH1 CH2	It is not used in this instrument. CH1 lamp is always lighting up.	————
2	ALM	Blinks when even one alarms from A to E occurred. Also blinks when the contact of failure output is ON.	Sec. 6.2.1
3	OUT	The monitoring of the 1st output. Turns ON/OFF by synchronizing output during ON/OFF control. Brightness changes in response to output values during PID/PD control.	————
4	COMM	Lights on in communications remote.	————
5	MAN	Lights on during manual operation. Blinks in automatic tuning	Sec. 9.1, 9.2, 9.3
6	RUN	Lights on during program RUN. Blinks in program END.	Sec. 9.4

[Reference]
This manual expresses a key or a dial with the code which shows here.

[Caution]
The values which can be displayed with PV indicator are -19999 to 19999. When the numerical value with decimal point becomes less than -20000 or 20000 or more in disregarding decimal point, a display will be shifted automatically and it will become the display that are one digit fewer till then. Since this is a problem of only a display, it influences neither control nor an alarm action.
Example -1999.9 →-2000, 1999.9→2000

Chapter 5 Basic Operation and Setting

[Reference]
Chapter 7 shows all the displays and the displaying order of screen. In Section 7.2, all the menu description including the reference pages to which details have been described and the method of changing screen are written together. When you operate this instrument, we recommend you checking of Section 7.2 first.

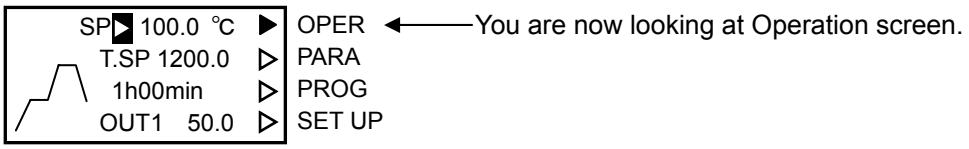
5.1 The type of screen, and switching

5.1.1 Display categories

This controller has four screens.

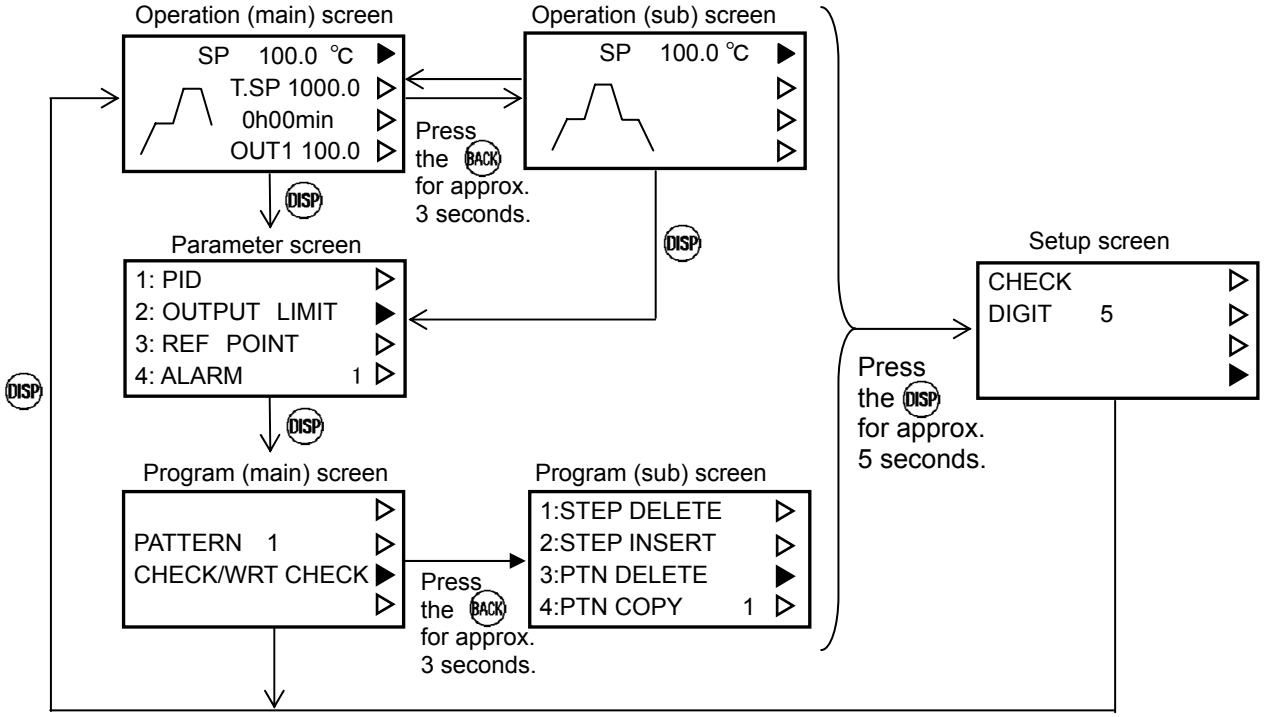
Screen name	Guide display	Description
Operation screen	▶ OPER	This is the screen mainly for displaying and setting items for operation such as constant SP (setpoint), changing of manual output values, execution programs operations (RUN/STOP, ADVANCE, RESET and switching execution pattern No.) and confirmation of operating condition.
Parameter screen	▶ PARA	This is the screen mainly for displaying and setting parameters such as PID values, output limiter and alarm values.
Program screen	▶ PROG	This is the screen for displaying and setting program pattern data.
Setup screen	▶ SET UP	This is the screen mainly for determining the system function of this instrument.

▶ mark on the right end of the data indicator shows the screen category displayed at present.



5.1.2 Switching method

Pressing the DISP switches screens as follow:
The screen shows the first display when switched by pressing the DISP. The screen except the sub screen of Operation and Program is called each “Top screen” among these.



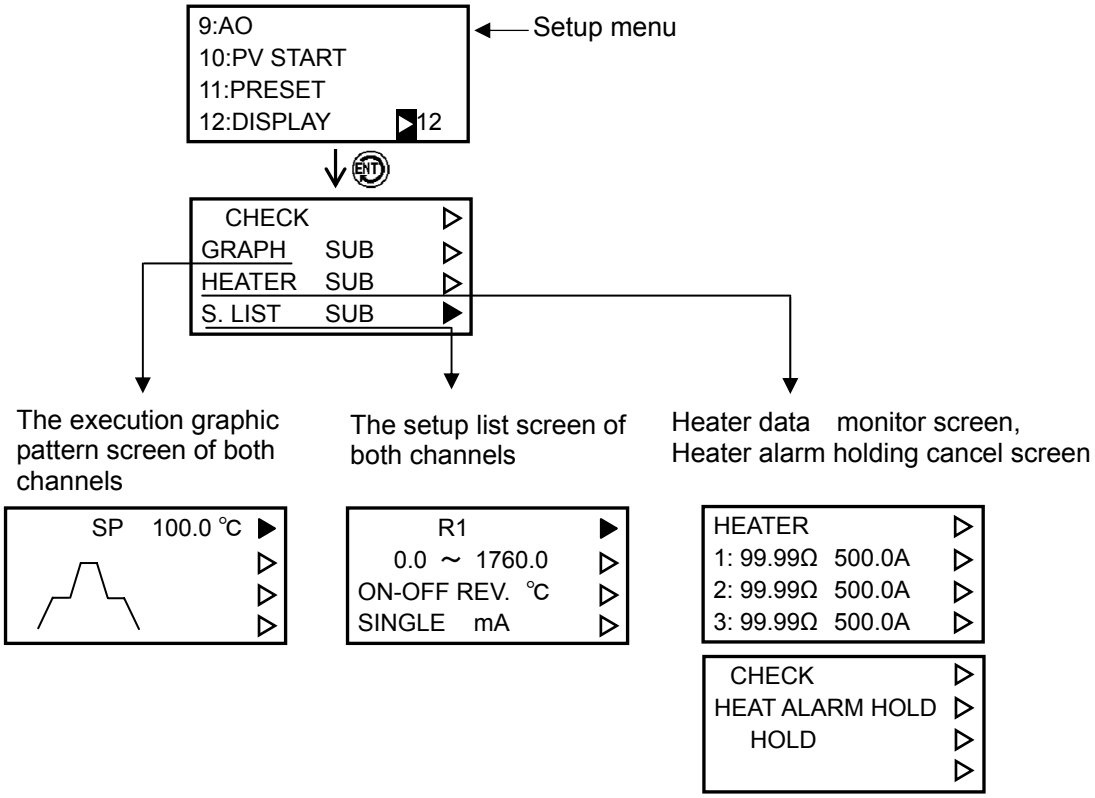
5.1.3 A main screen and a sub screen

Operation screen and Program screen are divided into the main screen and the sub screen.

(1)In the case of Operation screen

If it presses the BACK for approx. 3 seconds when Operation main screen is displayed, it will move to a sub screen. It returns from a sub screen to a main screen by the same operation. Moreover, it returns via Parameter screen and Program screen by pressing the DISP . Please refer to the switching method of page 13. The detail of a main screen and a sub screen should look at page 37 and 38.

In Operation screen, the display of a sub screen is movable to a main screen for every type. Choose menu 12:DISPLAY on Setup screen and change "SUB" which is the data of a required screen out of three screens into "MAIN". The correspondence of the screen name currently displayed here and an actual screen is as follows.

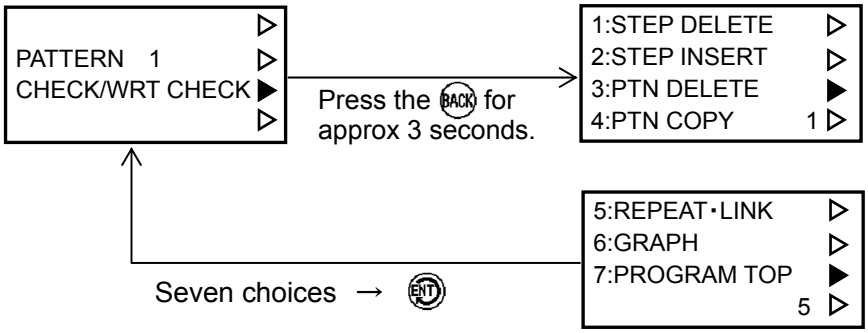


(2)In the case of Program screen

If it presses the BACK for approx. 3 seconds when Program main screen is displayed, it will move to a sub screen.

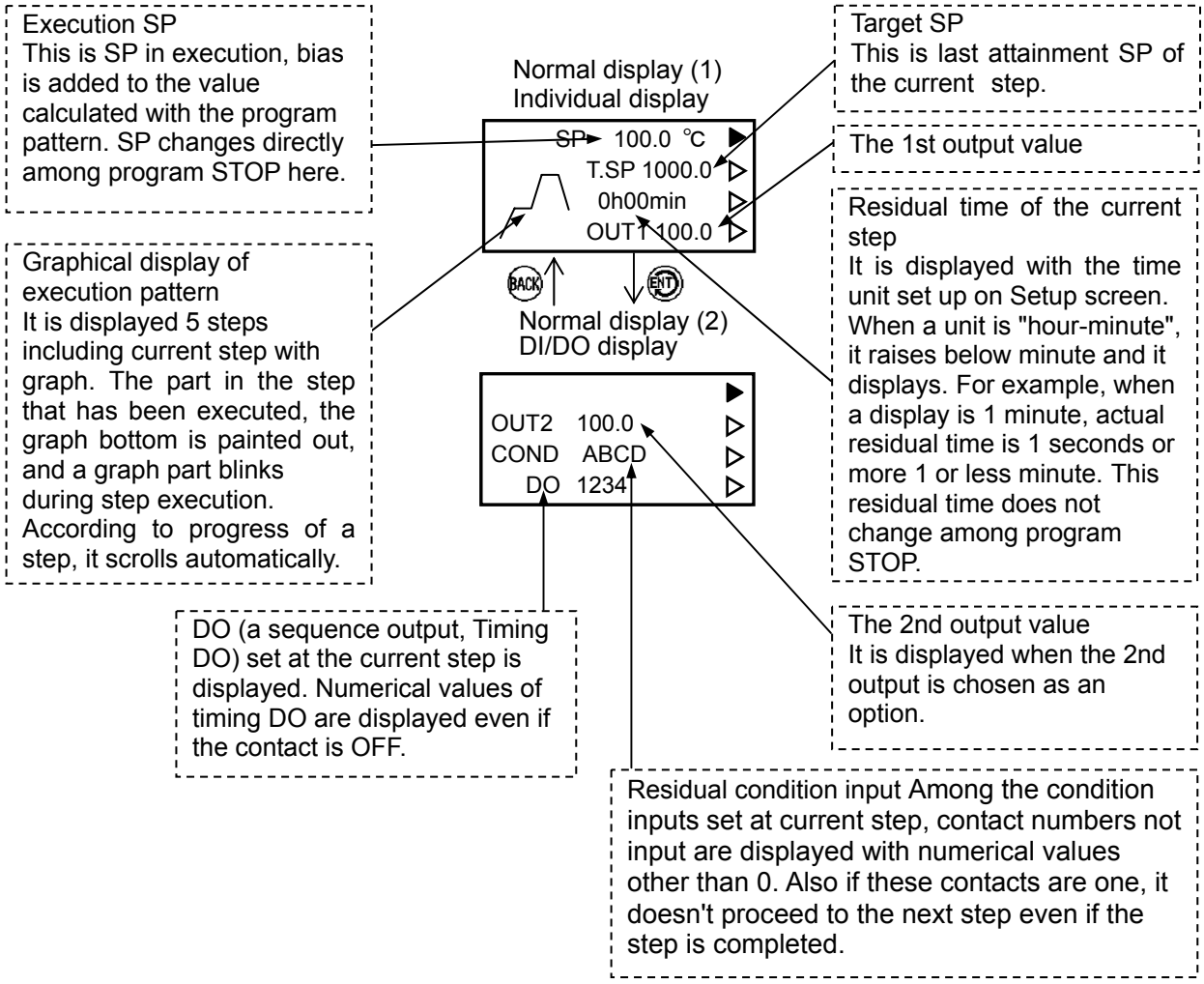
In case of returning to a main screen from a sub screen, choose a menu 7:PROGRAM TOP of a sub screen, and press the ENT . It returns to the top of a main screen.

On Program screen, a sub screen is unmovable to a main screen like Operation screen.



5.1.4 Normal display and auto restoration

The display which checks an operation condition in an Operation screen is called “Normal display”. When turning on the power, normal display (1) is displayed after lighting all. An auto restoration is carried out except normal display.
An auto restoration is a function which returns to normal display (1), when not operating a key or a dial 2 minutes or more.



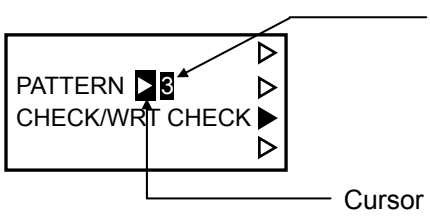
5.2 Operation in a screen

5.2.1 Cursor and its handling

The blinking of ▶ indicates the cursor on this instrument. The value or character on the right side of cursor is a change target. The data changing of the item which cannot be pointed at with the cursor is impossible. Moreover, there is also a screen where the cursor is not displayed. In this case, it means that all the data on data indicator cannot be changed.

▶ indicates the cursor with this manual.

The cursor moves by pressing the ENT and BACK. In the same screen, the cursor moves by pressing the ENT downward and moves by pressing the BACK upward.



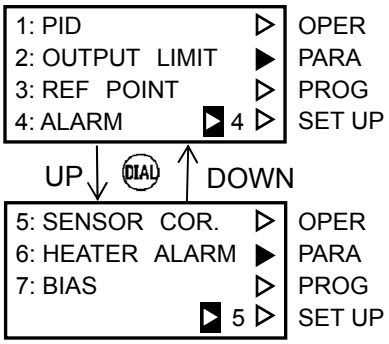
[Caution]
Four ▶and ▷ marks with which it lined at the right end of data indicator of this manual and this instrument are not the cursor for data changing. These are the mark which shows the current screen position.

5.2.2 CHECK and WRT

This instrument is usually CHECK (: check = setting prohibition) in order to prevent rewriting of the data by mis-operation. A changing data is attained by switching to "CHECK"→"WRT" (WRITE: write = setting permission) using DIAL and ENT.

[Caution]
When a screen is switched with DISP , and when normal display (1) is displayed, it returns to CHECK.

5.2.3 Menu choice

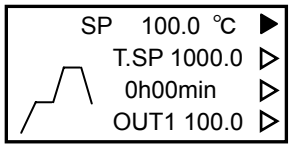


On Parameter screen, Program sub screen, and Setup screen, choose each item from a menu.

The menu name has a number each, and choose a number with the DIAL. If a number is changed by the DIAL , a number will be interlocked with and a menu screen will change. When choose a menu No. of hope with the DIAL and press the ENT , it will switch to an individual item display.

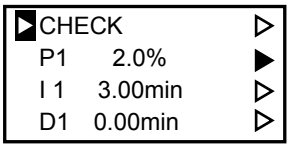
5.3 Data setting method

Use the ◀ and the DIAL to change data into desired values or characters, and register the data by pressing the ENT .

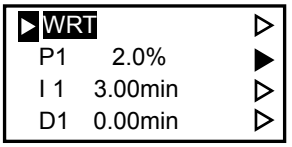


Switch to PARA (Parameter) screen by pressing the DISP .

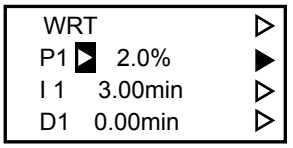
Choose 1:PID by rotating the DIAL and press the ENT twice.



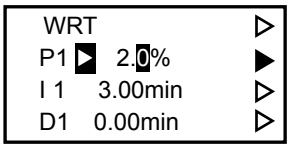
The cursor shows blinking on the left of "CHECK".



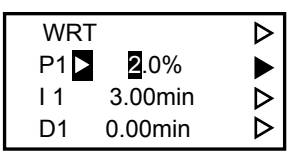
Rotating the DIAL to turn the character "CHECK"→ "WRT (write)", and pressing the ENT .



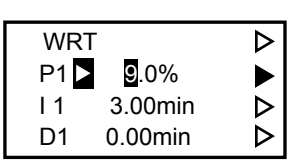
The cursor move to the P1(Proportional band 1).



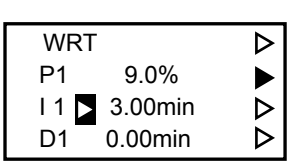
① The lowest digit of numeric value blinks by pressing the ◀ or a click of the DIAL .
You can change this blinking digit of numerals.



② Shift the blinking digit to be changed by pressing the ◀.



③ Change the numerals by rotating the DIAL .
Repeat ② and ③ until all the numerals are input, and then register the data by pressing the ENT .



④ And then results in stopping the blinking of numerals and the cursor position moves to the next item.

[Caution]
If you do not operate the ◀ or the DIAL for about 10 seconds while numerals or characters are blinking, the data will automatically return to the original data.

[Reference]
In the case of a character, the whole character blinks during data changing, and, in a numerical case, only the digit of a change target blinks. Reversed characters (the upper example WRT, 0, etc.) express this position in this manual.

5.4 Operation messages

5.4.1 Key message

This message appears (blinks) when you press the key shown in bellow table.

Each action is performed by pressing the ENT while the message is displayed.

The message will disappear when you conduct a normal key operation or no key operation for 5 seconds or longer.

Massage	Contents	Reference page
RUN	Shows that the RUN/STOP is pressed while a program is stopping. When you press the ENT while the message is displayed, the program will be executed (RUN).	72
STOP	Shows that the RUN/STOP is pressed while a program is running. When you press the ENT while the message is displayed, the program will stop.	73
ADVANCE	Shows that the ADV is pressed. When you press the ENT while the message is displayed, one of execution steps will advance.	74
RESET	Shows that the RST is pressed. When you press the ENT while the message is displayed, execution steps will return to 00 step (Start SP).	73
MAN	Shows that the MAN is pressed during automatic (AUTO) operation. When you press the ENT while the message is displayed, switches to manual (MAN).	67、68
AUTO	Shows that the MAN is pressed during manual (MAN) operation. When you press the ENT while the message is displayed, switches to automatic (AUTO) operation.	67、68

5.4.2 Error Message

When a key is pressed, it displays (blinks). It is shown that the key is mistaken. A message disappears, when pressing a right key or not operating 2 seconds or more.

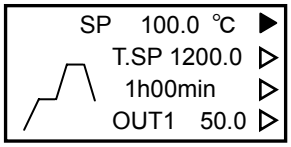
Massage	Contents
NOW RUN	You cannot operate or set because programs are running now.
DI ASSIGN	You cannot execute by the keys because of assignment to DI.
KEY LOCK	The key is locked now. Execute after unlocking.
CAN'T SET	These data cannot be changed now.
NOW MAN	You cannot operate or set because it is manually operated now. Execute after switching to AUTO.
NOW AT.ON	You cannot operate or set because automatic tuning is being executed. Execute after stopping automatic tuning
NOW REMOTE	You cannot operate or set during communication REMOTE
DATA ERROR	Data to be set are invalid.
DATA NOTHING	You cannot operate or set because step data are not set further.
NEED RESET	You cannot execute programs. Reset programs by pressing the RST , ENT.
PROGRAM END	Programs have ended now. Restart after resetting programs by pressing the RST , ENT .

5.5 Graphic display

Operation screen displays some including current step graphically.

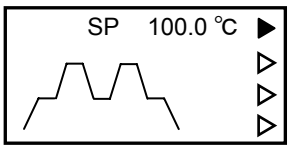
5.5.1 Display format

（1）Partial display



This screen displays 5 steps including current steps.
You can confirm execution steps all the time on this display. Scrolls up and down, left and right automatically everytime steps switch.

（2）Overall display



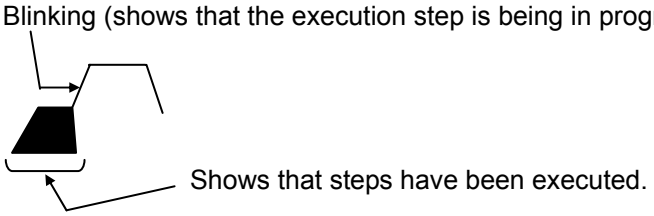
This screen displays 15 steps including current steps.
This display scrolls up and down, left and right automatically as done by the partial display. It is shown on Operation (sub) screen at the time of factory settings.

5.5.2 Graphic elements

／(Right up) ····· shows increasing steps
＼(Right down) ····· shows decreasing steps
— ····· shows keep steps
⌐ ····· shows stepwise up steps
¬ ····· shows stepwise down steps

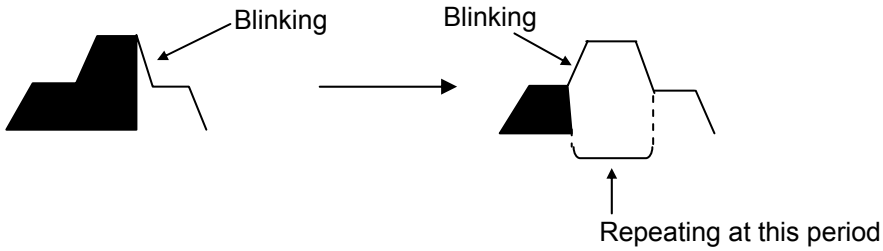
Blinking ····· shows that the execution step is being in programmed run.

Black ····· shows that steps have been executed.



5.5.3 Caution on checking

(1) The horizontal axis is indicated in steps with one figure for one step regardless of step time.
(2) SP variations in steps are indicated on the vertical axis regardless of their quantity. They are indicated in one line or half for one step regardless of a difference with the previous step. It is automatically distinguished according to the contens of step data. The graphic display is indicated in either one line or half. No mixture exists on the same display.
(3) When there is a pattern to be linked, the graphic display is represented to link that pattern.
(4) Even when the repeat is set, the display is conducted in a step number order.
There is no way to distinguish on the graphic display whether it is repeated or not.
When a step returns to the previous one, the black-out (executed steps) between repeated steps disappeares.



5.6 All Reset

All Reset is the operation to return to the factory setting all parameters except for basic settings. To perform All Reset, press the (MAN) for more than 10 seconds.

[Caution] Data initialization by All Reset

All Reset maintains the following items and initializes all other items.

Group	Maintained item
Setup top	Display digit, quantity of programs, input type, output type (in case of multi-output)
Setup 2: SCALING	All the data
Setup 3: CONTROL	All the data
Setup 4: PROGRAM	All the data
Setup 5: DI	All the data
Setup 6: DO	All the data
Setup 8: COMM	All the data

Please change a quantity of programs or an input type to initialize almost all data including the basic function of this instrument.

Chapter 6 Determination of Function

6.1 Determination of a basic function

6.1.1 Basic functions

The basic functions of this controller are as shown in the following table at factory setting. To use with settings other than factory setting, press the (DISP) for about 5 seconds to display Setup screen and then change the data at the specified screen. To change multiple items, change in the order of the table below:

No.	Item	Screen position	Factory setting
1	*Display digit	(top)	5 digits
2	Input type	(top)	K1
3	Output type (When multi-output)	(top)	mA
4	Use of square root (when input type is mV, V, or mA)	AI FUNC	OFF (unused)
5	Scaling	SCALING	-200.0 to1370.0
6	*Control mode	CONTROL	PID
7	*Control direct/reverse action	CONTROL	reverse
8	*Quantity of patterns	PROGRAM	16
9	*Time unit	PROGRAM	hour-minute

[Caution] Data initialization by changing in basic functions

・To change multiple items, be sure to follow the order of the number. The changed data may be returned to the original factory setting if they are not changed in order.

Ex.) If input type is changed after changing the control mode, the control mode returns to the factory setting at the time of changing input type.
In such cases, check the data and change again if the data is factory setting.

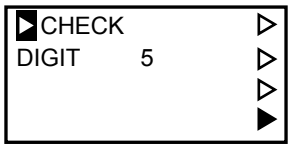
・Please note that changing in 1 to 10 of the above table initializes other items (returning to the factory setting). Changed item and the items initialized by it are shown as follows:

Changed item	Initialized item
1: Display digit	Scaling, PV error limit, PID, output limit, sensor correction, reference point, guarantee soak width, input/output polygonal line approximation, alarm value, alarm hysteresis width, alarm ON delay time, use of pause alarm, and program data
2: Input type	All the data except display digit, 8:COMM and 12:DISPLAY on Setup screen.
4:Use of square root	Initialized item of changing display digit
5: Scaling (when input type is TC or RTD)	Sensor correction, reference point, guarantee soak width, input/output polygonal line approximation, alarm value, alarm hysteresis width, alarm ON delay time, use of pause alarm, and program data
5: Scaling (when input type is V, mV, or mA)	PID, output limit, sensor correction, reference point, guarantee soak width, input/output polygonal line approximation, alarm value, alarm hysteresis width, alarm ON delay time, use of pause alarm, and program data
6: Control mode 7: Control action	PID/output limit mode, use of preset, preset output, use of anti-overshoot, use of profiling control, PID and output limit
8: Quantity of patterns 9: Time unit	All the data on Program screen, execution pattern No., key lock

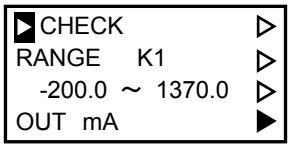
6.1.2 Checking and changing procedure of a basic function

Pressing the DISP for approx. 5 seconds, and Setup top screen (①) is displayed.
Checking and setting of a required basic function are made according to the following procedures.

> **[Reference]**
> Refer to the Section 7.6 (from page 47) for the screen changing method and the detail of description/setting range of the whole Setup screen.

① 

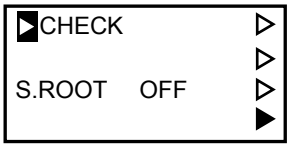
Check and change a display digit (DIGIT) and a quantity of programs (PROGRAM). When changing, changes CHECK into WRT with the ◀ and DIAL, and press the ENT .
If the ENT is pressed as CHECK, it will move to the input type and multi-output display.

② 

Check and change the input type (RANGE) and multi-output (OUT) . A changing procedure is the same as ①. It moves to a Setup menu screen by pressing the ENT .

③ 

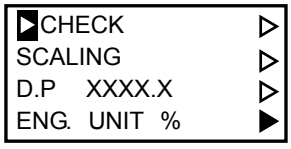
If the ENT is pressed while menu No. has been 1, it will move the use of square root display.
When input type is TC or RTD, the choice of use of square root (S. ROOT) cannot be performed. Please move on to scaling checking and changing from ⑧.

④ 

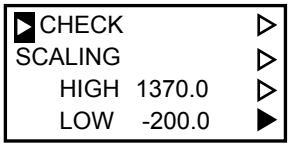
Check and change the use of square root (S. ROOT). A changing procedure is the same as ①. If the ENT is pressed several times as CHECK, it will return to a menu screen.

⑤ 

Change menu No. is into 2 with the DIAL , and press the ENT . It moves to the scaling display

⑥ 

Check and change the decimal point position (D. P). A changing procedure is the same as ①. It moves to a scaling upper and lower limit display by pressing the ENT as CHECK. This screen is not displayed when input type is TC or RTD. It moves to the next scaling upper and lower limit display automatically.

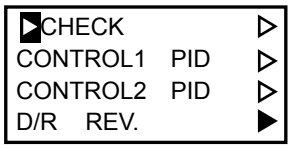
⑦ 

Check and change the scaling upper limit (HIGH) and lower limit (LOW). A changing procedure is the same as ①. If the ENT is pressed several times as CHECK, it will return to a menu screen.

⑧ 

Change menu No. into 3 with the DIAL, and press the ENT. It moves to a control mode choice screen.

⑨

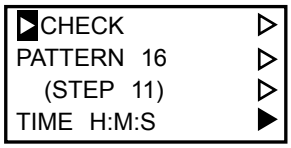


Check and change the control mode (CONTROL), and control direct /reverse action (D/R). A changing procedure is the same as ①. In case of dual output (option) nothing, CONTROL2 is not displayed. Moreover, in case of dual output, changing the control direct/reverse action cannot be performed. If the ENT is pressed several times as CHECK, it will return to a setup menu screen.

⑩

Change menu No. into 4 with the DIAL, and press the ENT . It moves to the quantity of patterns display.

⑪



Check and change the quantity of patterns (PATTERN) and a time unit (TIME). A changing procedure is the same as ①. If the ENT is pressed several times as CHECK, it will return to a setup menu screen.

⑫

Checking and changing of a basic function are completion above.
By changing menu No., check and change other functions, or it returns to an Operation screen by pressing the DISP.

6.1.3 An input type and a display unit

This instrument can choose one from 32 kinds of input range.

The display digit can choose 5 digits (at the time of factory setting), or 4 digits. When 5 digits displaying and input type is TC or RTD except for a part of RTD (Pt2, JPt2), below the decimal point displays in a single digit. When 4 digits displaying, below the decimal point does not display except for a part of RTD (Pt2, JPt2).

The reference of an input type, and a display and the input range has become as it is shown in the following table.

Input	Diaplay	Input range	
		5 digit（At the time of factory setting）	4 digit
TC (thermocouple) input			
B	**B**	0.0 to 1820.0℃	0 to 1820℃
R	**R1**	0.0 to 1760.0℃	0 to 1760℃
R	**R2**	0.0 to 1200.0℃	0 to 1200℃
S	**S**	0.0 to 1760.0℃	0 to 1760℃
K	**K1**	-200.0 to 1370.0℃	-200 to 1370℃
K	**K2**	0.0 to 600.0 ℃	0 to 600 ℃
K	**K3**	-200.0 to 300.0℃	-200 to 300℃
E	**E**	-200.0 to 700.0℃	-200 to 700℃
J	**J1**	-200.0 to 900.0℃	-200 to 900℃
J	**J2**	-200.0 to 400.0℃	-200 to 400℃
T	**T**	-270.0 to 400.0℃	-270 to 400℃
WRe5-26	**C**	0.0 to 2320℃	0 to 2320℃
N	**N**	0.0 to 1300.0℃	0 to 1300℃
PR40-20	**PR42**	0.0 to 1880.0℃	0 to 1880℃
PLⅡ	**PL2**	0.0 to 1390.0℃	0 to 1390℃
U	**U**	-200.0 to 400.0℃	-200 to 400℃
L	**L**	-200.0 to 900.0℃	-200 to 900℃
Au-Fe	**AUFE**	0.0 to 300.0K	0 to 300K
DC voltage, DC current input			
mV	**10mV**	-10.0 to 10.0mV	
mV	**20mV**	0.0 to 20.0mV	
mV	**50mV**	0.0 to 50.0mV	
V	**0-1V**	0.0 to 1.0V	
V	**1-5V**	1.0 to 5.0V	
V	**0-5V**	0.0 to 5.0V	
V	**0-10V**	0.0 to 10.0V	
mA	**20mA**	4.0 to 20.0mA	
RTD (resistance temperature detector) input			
Pt100	**Pt0**	-200.0 to 850.0℃	-200 to 850℃
	Pt1	-200.0 to 300.0℃	-200 to 300℃
	Pt2	-150.00 to 150.00℃	-150.0 to 150.0℃
JPt100	**JPt0**	-200.0 to 650.0℃	-200 to 650℃
	JPt1	-200.0 to 300.0℃	-200 to 300℃
	JPt2	-150.00 to 150.00℃	-150.0 to 150.0℃

6.1.4 A quantity of programs and a quantity of patterns

The quantity of steps which can be used in this instrument are a maximum of 400 steps. Moreover, even a maximum of 19 patterns can choose the quantity of patterns as arbitration. If the quantity of patterns is increased, the quantity of steps per pattern which can be used will decrease.

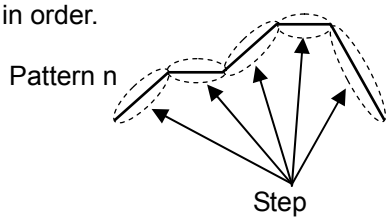
The relationship between the quantity of patterns and the quantity of steps that can be used in one pattern is shown in the following table.

The quantity of patterns	The quantity of steps per one pattern
4	100
5	80
6	66
7	57
8	50
9	44
10	40
11	36
12	33
13	30
14	28
15	26
16	25
17	23
18	22
19	21

[Reference]

About a step : It is a smallest unit in program operation which uses target SP and step time to target SP arrival as the main components.

About a pattern : They are a series of batches which consist of one or more steps. In program operation, the step included in the specified pattern is performed in order.



[Caution]

The quantity of steps per one pattern shown in a list is a step total. The number of steps displayed at 4:PROGRAM on a Setup screen is final step No. which can be set up. Since a step begins from 0, final step No. is set to "step total - 1."

6.1.5 Program data initialization

In program data initialization in case of existing step data, message ∗∗∗ NOW INITIAL ∗∗∗ is displayed during initialization execution. All the keys are invalid while this message is displayed. The message disappears automatically at the completion of initialization.

[Caution]

Program data initialization takes about 20 seconds at the maximum.

6.2 Setting Items of Each Function

This section describes the setting items and the order of setting for each of the major functions.

6.2.1 Use of alarms

Order	Item	A screen and a group	Reference page	Factory setting
①	Determine the alarm function.	Setup・DO	52	DO-A : Deviation high alarm DO-B : Deviation low alarm
②	Set the use of pause alarm, hysteresis width and ON delay time.	Setup・ALARM	53	Pause alarm is not used, hysteresis width = 0.0, ON delay time = 0
③	Set the alarm value.	Parameter ・ALARM	42	DO-A : + Scaling width DO-B : - Scaling width Scaling width ☞

The types and functions of alarm equipped in this instrument are as follows. Furthermore, the alarm occurrence conditions in the table below are those for no pause alarm and 0 hysteresis width and 0 ON delay time (pause alarm, hysteresis width, ON delay time ☞ Page 76):

Type	Function (alarm occurrence condition)
Deviation high alarm	When “deviation (PV – SP) > alarm setting value”
Deviation low alarm	When “deviation (PV – SP) < alarm setting value”
Deviation absolute value alarm	When “deviation (|PV – SP|) > alarm setting value”
PV high alarm	When “PV > alarm setting value”
PV low alarm	When “PV < alarm setting value”
SP high alarm	When “SP > alarm setting value”
SP low alarm	When “SP < alarm setting value”

[Caution]

- Set the functions and the alarm values of ALM (alarm) A to E at DO-A to E.
- When the number of contact output points are two, contacts ALM-C and ALM-D are not output. However, the functions are available and the settings similar to ALM-A and B is possible.
- An alarm occurrence situation can be checked by an ALM lamp and an alarm situation display on Operation screen.
- The ALM-E can be used only when it is a multi-output and not a relay output.

[Caution] Initialization by changing alarm functions

When alarm function is changed, the alarm value, use of pause alarm, hysteresis width and ON delay time for the changed DO No. are initialized.

☞ **[Reference] What is scaling width?**

It indicates “scaling upper limit – scaling lower limit.

6.2.2 Use of two or more PID/output limits

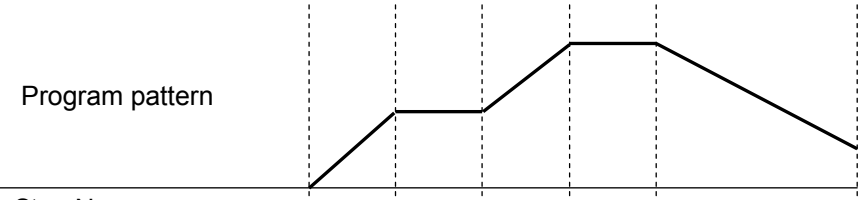
Order	Item	A screen and a group	Reference page	Factory setting
①	Determine the PID/output limit mode. The mode is chosen from a "single", "multi", and "programed".	Setup・CONTROL	49	SINGLE (Single)
②	Set the reference point. (in case of programed mode)	Parameter ・REF POINT	42	1370.0
	PID No. and output limit No. to be used are set as each step. (in case of multi-mode)	Program	45	1
③	Set the output limit.	Parameter ・OUTPUT LIMIT	41	Upper limit：100% Lower limit：0%
④	Set the PID and MR (manual reset: in case of PD control) by manual setting or auto tuning.	Parameter・PID	39	P=2.0% I=3.00 min D=0.00 min MR=50.0%

(1) Single mode

Control at the same PID and output limit values at all times.
Use group 1 of PID and output limit.

(2) Multi-mode

Choose the PID and output limit values used in steps among eight groups.
Set the group No. used in steps for each step on Program screen.
Irrespective of RUN/STOP of a program, it operates with PID and the output limit which are set as the No. according to the execution step.



Step No.	01	02	03	04	05
PID group No.	1	1	2	3	5
Output limit group No.	1	2	5	4	3

(3) Programmed mode

Control by making the execution values of PID and output limit automatically variable as the SP values vary.
In programmed mode, set the PID value and output limit value corresponding to the eigenvalue of input range. This eigenvalue is called reference point (Reference Point=RP), and can be set up three points. PID / output limit values corresponding to RP 1 to 3 are groups 1 to 3. An execution value is automatically calculated from these values and current SP.
The calculation method is shown in the following page.

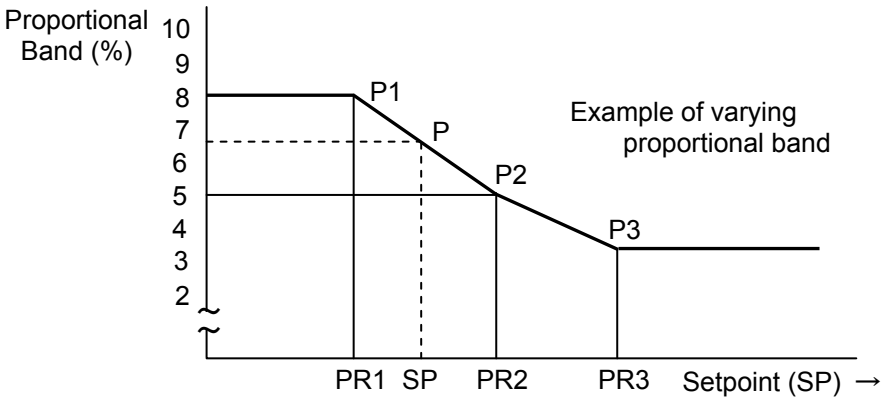
The figure below explains about the proportional band (P:%). Assume that the setting of RP1 (for instance; 300.0℃.) is established for the 1st proportional band and RP2 (for instance: 1000.0℃.) for the 2nd proportional band. On the straight line between these two points, the proportional band corresponding to current SP is calculated.
While SP is between or equal to RP1 and RP2, the proportional band (P:%) is obtained from:

$$P = \frac{P2-P1}{RP2-RP1} \cdot (SP-RP1)+P1$$

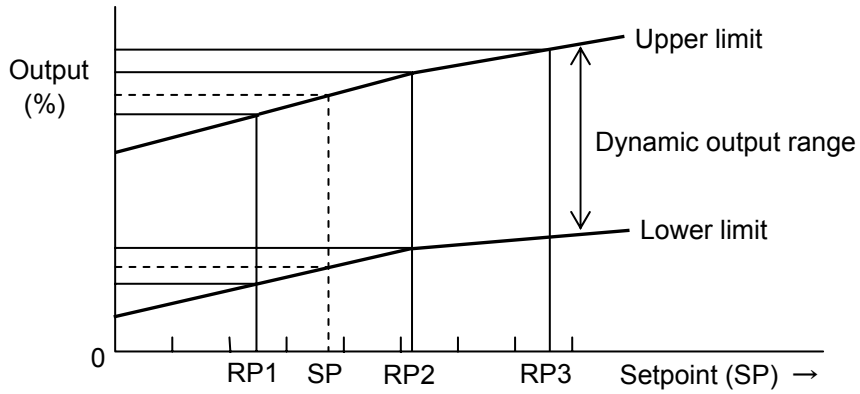
As RP1 is 300.0℃. and RP2 1000.0℃.,

$$P = \frac{P2-P1}{700.0} \cdot (SP-300.0)+P1$$

P corresponding to SP is thus obtained.
Integration time (I: min) and derivative time (D: min) are obtained similarly.
The proportional bands of RP1, RP2 and RP3 are assumed to be P1, P2 and P3 respectively.
The executing proportional band P varies on the graph below.



An output limit is the same as that of PID. However, unlike PID, the computation mode in case SP is RP1 or less or RP3 or more, it varies on the same straight line between RP1-RP2 and as between RP2-RP3, respectively. The polygonal line of an upper limit and a lower limit of operation becomes as it is shown in the following figure.



[Caution]

- P equals P1 if SP is less than RP1, and P equals P3 if SP is greater than RP3.
- When graphs of upper and lower limit intersect, make the upper limit a norm and correct the lower limit so that the upper limit is greater than the lower limit.
- If RP1=RP2 or RP1=RP2=RP3, any PID/output limit values in group1 are used. If RP2=RP3, any PID/output limit values in group2 are used. The PID and output limit values in the group not used are invalid. So, changing these values is not significant to operate.

6.2.3 Execute the program with DI contact.

Order	Item	A screen and a group	Reference page	Factory setting
①	Assign each function to DI (Digital Input).	Setup･DI	51	COND

(1) Execution pattern switch

Switch execution patterns from the external signal.

The following shows the relationship between digital input (DI) and pattern.

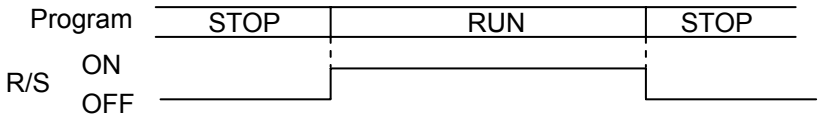
○ mark indicates input ON (contact is closed) and blank indicates input OFF (contact is opened).

	PATTERN No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
DI	PTN1		○		○		○		○		○		○		○		○		○	
	PTN2			○	○			○	○			○	○			○	○			○
	PTN4					○	○	○	○					○	○	○	○			
	PTN8									○	○	○	○	○	○	○	○			
	PTN16																	○	○	○

[Caution]
When you even set up either one of PTN1, 2, 4, 8, or 16, execution patterns can be switched only from the external digital input. In this case, you cannot switch execution patterns on the panel keys.

(2) Program RUN/STOP

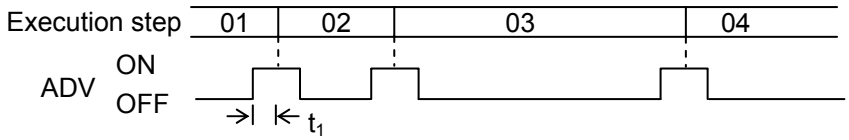
Turn the digital input ON to run program and OFF to stop program.



[Caution]
You cannot run/stop program on the panel keys if R/S is set up DI assignment.

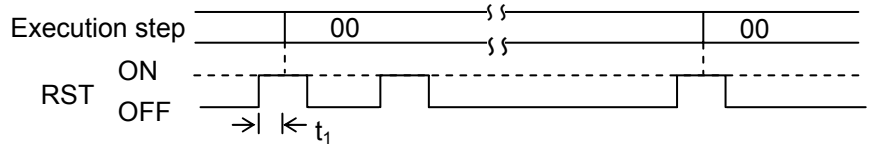
(3) Program ADVANCE (ADV)

Advance one execution step at digital input ON each time by compulsion.



（4）Program RESET (RST)

Return execution steps to 00 step (execution SP to Start SP) at digital input ON each time.



[Caution]
On time (t1) longer than 400 ms is needed to judge the DI ON.
Program ADV and RST with the external DI are valid during program RUN.

[Caution]
In a standard model, a total of 4 points, DI-A, B, C, and D, can be used.
In case of equipping DI/DO adapter of an option, DI-1 to 7 are added to this and 11 points in total can be used, and in case of equipping DI/DO connector of an option, DI-1 to 8 are added to this and 12 points in total can be used, respectively.

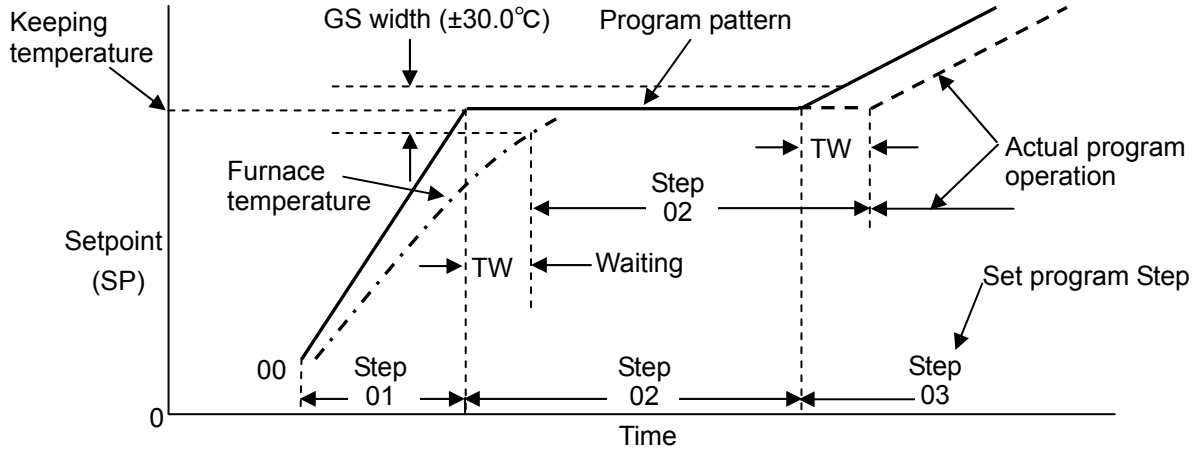
6.2.4 Wait by the movement to the next step

When it makes the following situation of process variable (PV) to setpoint (SP) a condition, a guarantee soak function is used. When it makes the contact input from the outside a condition, a condition input function is used.

(1) When guarantee soak is used

Order	Item	A screen and a group	Reference page	Factory setting
①	Guarantee soak (G･S) is used.	Setup･PROGRAM	50	OFF
②	Set the guarantee soak width (GS BAND).			0.0
③	G･S of a step to keep waiting is validated.	Program	45	OFF

When a furnace temperature does not follow the programmed pattern as shown in Figure below, effective keep time of the work will not secure. In this case, you can use the guarantee soak (GS) function. In GS function ON, step 02 wait until the difference between SP of program and actual temperatures reaches within guarantee soak width (between ±setting, for instance, ±30.0℃). Thus, a total time is prolonged for TW to run step 02. Afterward, the 02 step runs as programmed time.



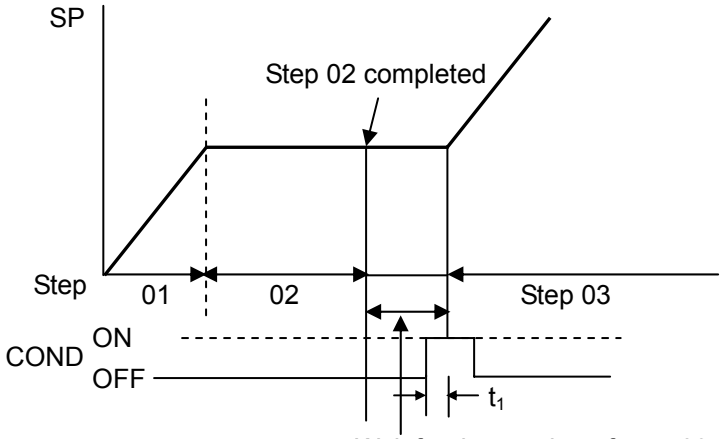
An Example of Guarantee Soak

[Caution]
It does not function in guarantee soak width =0 (it does not wait). Please be sure to set it excluding 0 to function.

(2) When a condition input is used

Order	Item	A screen and a group	Reference page	Factory setting
①	Assign condition input function to DI.	Setup･DI	51	COND
②	The contact number of ① is set as DI of a step to keep waiting. A maximum of 4 points can be set as one step.	Program	44	0 (Nothing)

When you set COND to step data of programs, the condition input-ON is a condition to move to the next step. All the condition input-ON with several COND settings is a completion of conditional input to move to the next step. The condition input is always accepted while executing the step. Once it turns ON while executing the step with COND setting, it will mean that this contact had fulfilled conditions.



Wait for the starting of step 03.
SP holds at the previous value for this period.

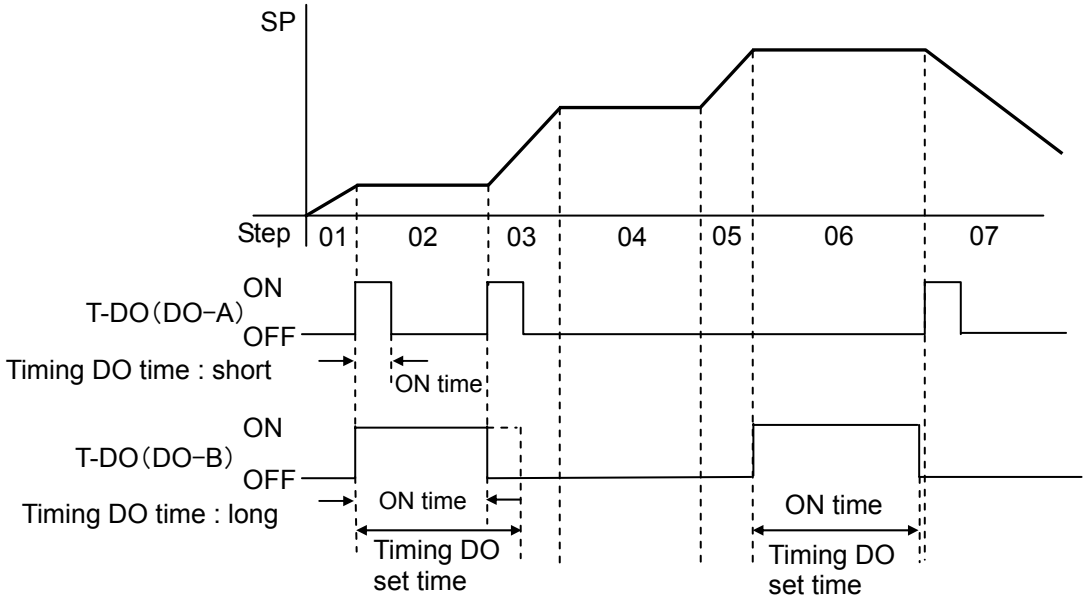
[Caution]
The ON time (t1) longer than 400 ms is needed to judge the digital input-ON.

[Caution]
Please do not change DI of the number into a function except COND after setting a condition as DI of a step. In this case, keep in mind that a step does not move even if DI setting of a step does not disappear but the contact of that DI is set to ON.

6.2.5 Output the contact for each step

Order	Item	A screen and a group	Reference page	Factory setting
①	Assign sequence output or timing DO to DO.	Setup･DO	52	DO
②	In case of timing DO, ON time is set up.			1 second
③	The contact number of ① is set as DO of a step to make it output. A maximum of 4 points can be set as one step.	Program	45	0 (Nothing)

In case of sequence output, contact output is ON while programs are running at the designated step. In case of timing DO, contact output turns ON at the beginning of a designated step and turns OFF automatically after passing the ON delay time.
The action of timing DO is shown as following figure.



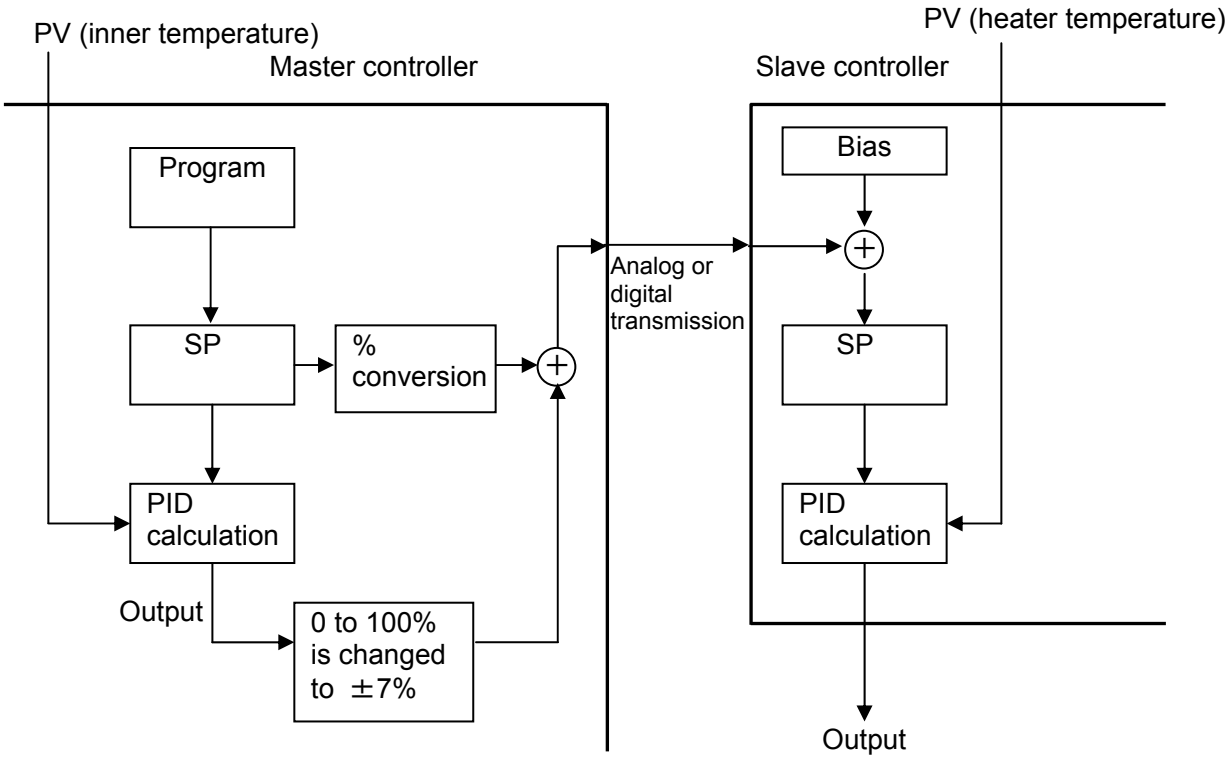
[Caution]
- When steps are switched while the timing DO is ON, that DO turns OFF. (See DO-B in Figure above)
- If the power fails while timing DO is ON, it turns OFF at power restoration.
- Even if it changes the ON time of the timing DO in outputting ON, the current ON time is not updated.

[Caution]
After setting a sequence output or timing DO as DO of a step, even if it changes DO function selection of that number into functions other than that function, setting of the step does not disappear. In this case, keep in mind that that DO does not function as a sequence output or timing DO.

6.2.6 Inner temperature control (profiling control) is performed.

It is a type of cascade control in which the range of remote setting value change for the slave controller is restricted. Master controller adds the value obtained by converting -50 to +50% with 50% PID computing result as 0% into ±7% with the master SP converted into %, and it becomes SP of slave controller (slave SP).

Order	Item	A screen and a group	Reference page	Factory setting
①	Profiling control is used.	Setup ･CONTROL	49	OFF



[Reference] Slave channel controller

Indicating controller EC5500R series (EC5300R, EC5500R, EC5700R, EC5800R) can use it as other controllers of a slave controller. In these, EC5300R and EC5700R support only analog signal transmission. The handling mode as a slave controller should read the option instruction manual of each instrument.

[Caution] The output value display of a master controller

The output value on a display is the control result of an operation. In profiling control, a actual output value turns into a value which was computed by profiling operation unlike the display output value.

[Caution] Auto tuning

AT of master controller is effective if connected with slave controller. Even if it controls with the result, hunting occurs and good control may not be obtained. In this case, please change P (proportional band) value 1 by 5 to 10 times the P value of a slave controller. It acts in the direction which suppresses hunting, so that P value is enlarged. Please do not perform AT when it is not connected with slave controller. It does not complete, even if it performs AT.

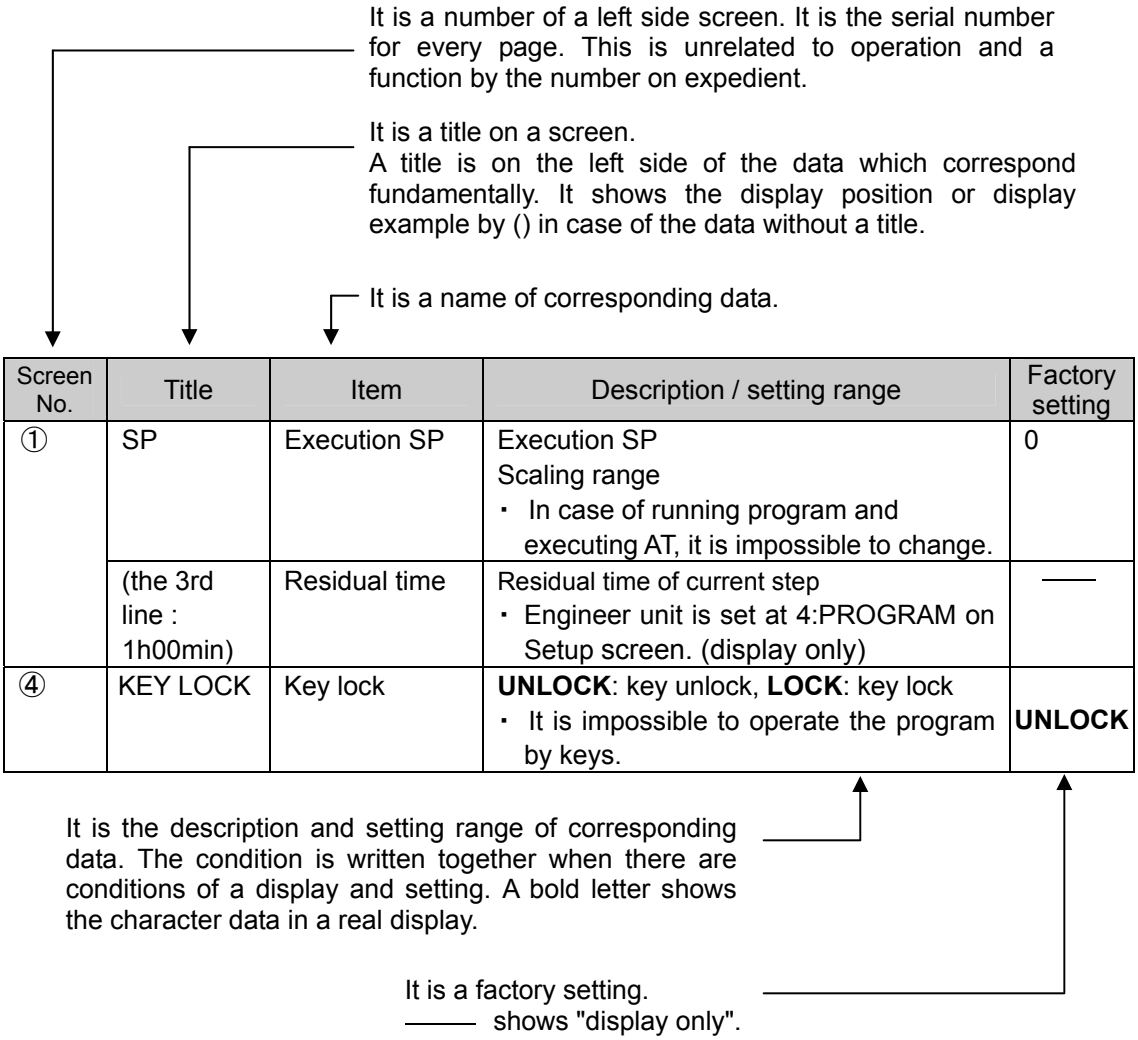
Chapter 7 Operation Guidance and Setting List

7.1 The reference of a guide

This section shows the point of the notation and table in Chapter 7.
Please use reference at the time of seeing operation guidance and a setting list.

↓ : A motion of the ENT is expressed. A key symbol is omitted.

↑ : A motion of the BACK is expressed. A key symbol is omitted.

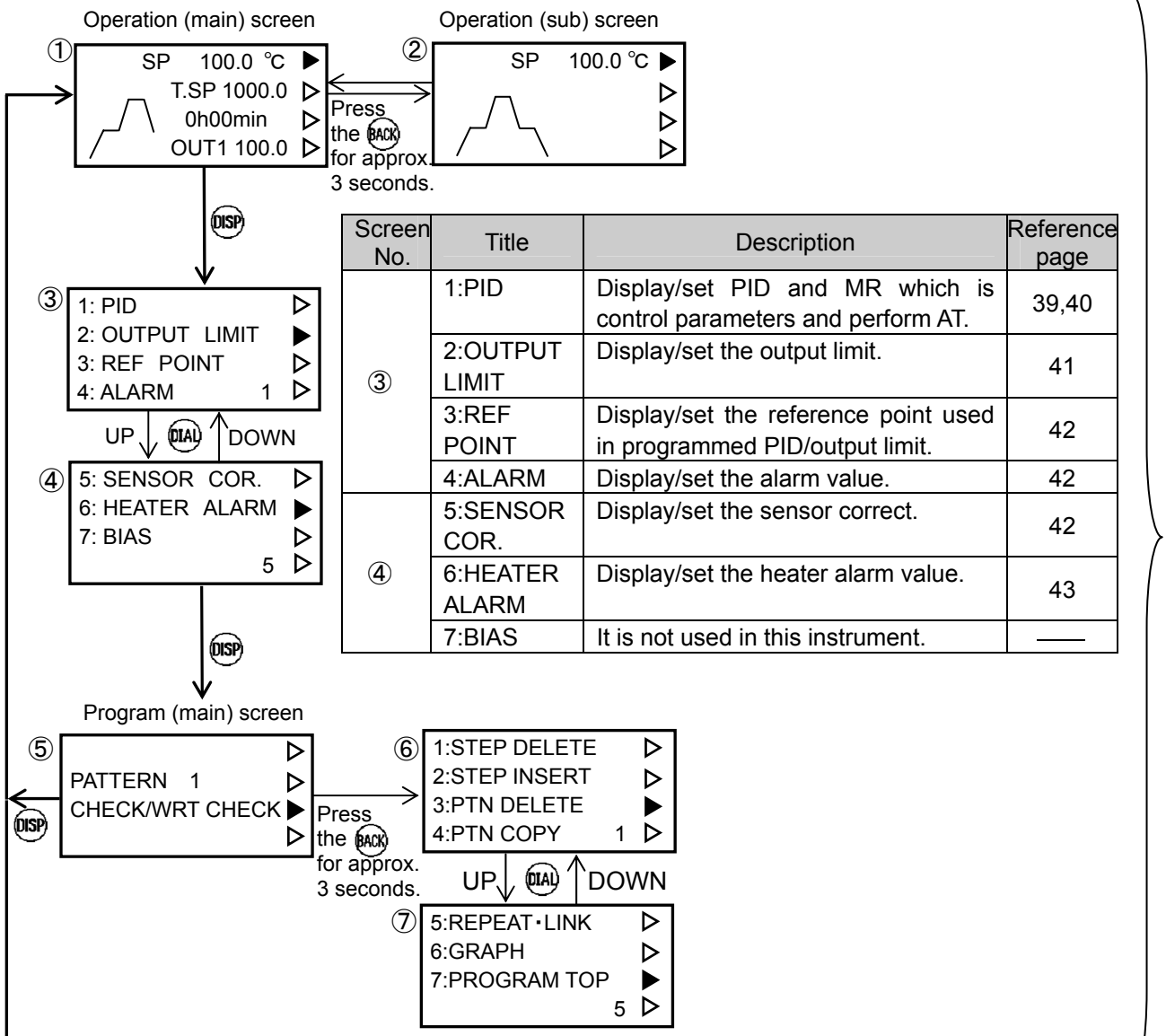


Screen No.	Title	Item	Description / setting range	Factory setting
①	SP	Execution SP	Execution SP Scaling range ・ In case of running program and executing AT, it is impossible to change.	0
	(the 3rd line : 1h00min)	Residual time	Residual time of current step ・ Engineer unit is set at 4:PROGRAM on Setup screen. (display only)	——
④	KEY LOCK	Key lock	**UNLOCK**: key unlock, **LOCK**: key lock ・ It is impossible to operate the program by keys.	**UNLOCK**

In the case of a menu screen, a [title] is included in the [description]. Moreover, the page which explains a menu transition diagram and the description on [reference page] instead of [factory setting] is shown.

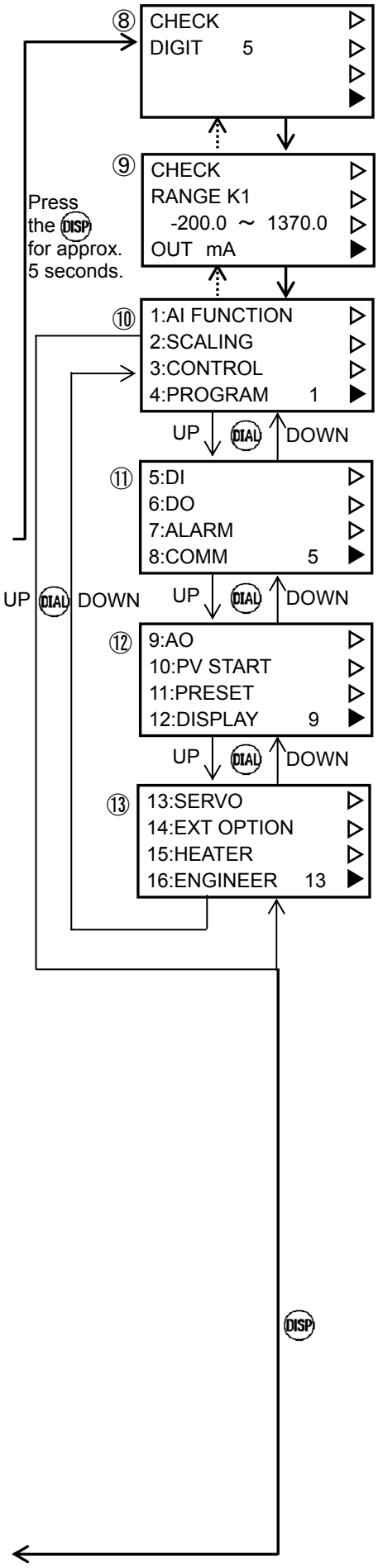
[Display condition] : The screen number and display condition when not displaying according to a specifications or settings are shown. This is the conditions of a screen unit. The display condition for every data in a screen is written together to [Description / setting range] in a list.

7.2 The outline of screen changing



Screen No.	Title	Description	Reference page
③	1:PID	Display/set PID and MR which is control parameters and perform AT.	39,40
	2:OUTPUT LIMIT	Display/set the output limit.	41
	3:REF POINT	Display/set the reference point used in programmed PID/output limit.	42
	4:ALARM	Display/set the alarm value.	42
④	5:SENSOR COR.	Display/set the sensor correct.	42
	6:HEATER ALARM	Display/set the heater alarm value.	43
	7:BIAS	It is not used in this instrument.	――

Screen No.	Title	Description	Reference page
⑥	1:STEP DELETE	Delete the specified step (one step) of the specified pattern. As for the step after that step, a step number is done -1 of each. Valid only at WRT (write mode). In case of CHECK (check mode), do not move to step deletion screen.	45
	2:STEP INSERT	Insert the vacant step to the specified step (one step) of the specified pattern. As for the step after that step, a step number is done +1 of each. Valid only at WRT (write mode). In case of CHECK (check mode), do not move to step insertion screen.	45
	3:PTN DELETE	Delete the specified pattern.	46
	4:PTN COPY	Copy the specified pattern to others.	46
⑦	5:REPEAT･LINK	Display/set repeat and link.	46
	6:GRAPH	Display the setting data of specified pattern by graph.	47
	7:PROGRAM TOP	Return to Program top screen (screen of ⑤).	――

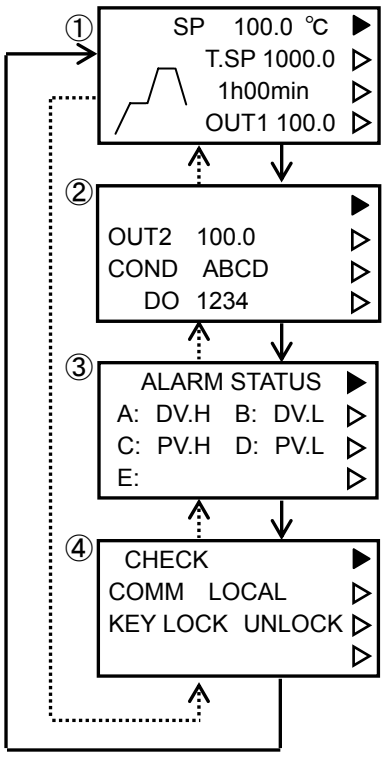


Screen No.	Title	Item	Description / setting range	Factory setting
⑧	DIGIT	Display digit	4, 5	5
⑨ ⑩	RANGE	Input type	Input type (refer to page 24)	**K1**
	OUT	Multi-output	**mA**: current output, **SSR**: SSR drive, **RELAY**: relay output ・ Displayed only when multi-output	**mA**

Screen No.	Title	Description	Reference page
⑪	1:AI FUNCTION	Display/set the various functions used in input.	47
	2:SCALING	Display/set the data that relates to scaling.	48
	3:CONTROL	Display/set the data that relates to control.	49
	4:PROGRAM	Display/set the data that relates to program.	50
⑫	5:DI	Assign the functions to DI (Digital Input) contact.	51
	6:DO	Assign the functions to DO (Digital Output) contact.	52
	7:ALARM	Display/set the pause alarm, hysteresis width and ON delay time.	53
	8:COMM	Display/set the data that relates to communication with host computer.	53
⑬	9:AO	Display/set the data that relates to analog retransmission (optional).	53
	10:PV START	Display/set the use of PV start.	54
	11:PRESET	Display/set the use of preset and preset value.	54
	12:DISPLAY	Change the contents on Operation screen.	54
⑭	13:SERVO	Display/set the dead band and operate the automatic calibration.	55
	14:EXT OPTION	Display/set the data that relates to an expansion interface.	55
	15:HEATER	Display/set the data that relates to the heater monitoring unit.	56
	16:ENGINEER	It is a display for the factory adjustment. Please do not operate it.	56

7.3 Operation screen

《 Main screen 》



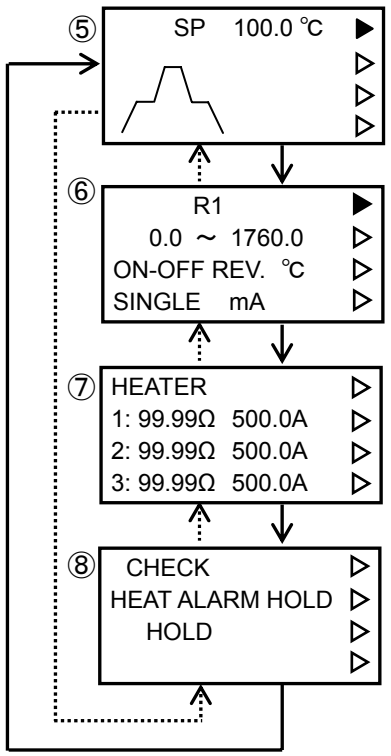
Screen No.	Title	Item	Description / setting range	Factory setting
①	SP	Execution SP	Execution SP Scaling range ・ In case of running program and executing AT, it is impossible to change.	0
	T.SP	Target SP	Target SP of current step (display only)	——
	(the 3rd line : 1h00min)	Residual time	Residual time of current step ・ Engineer unit is set at 4:PROGRAM on Setup screen. (display only)	——
	OUT1	1st output value	Output lower limit to upper limit ・In AUTO, it is impossible to change. ・In case of ON-OFF control, it is possible to set only the value of 0% and 100%.	0.0
	(left side)	Graphic display of execution pattern	(display only)	——
②	OUT2	2nd output	2nd output lower limit to 2nd output upper limit ・Displayed only when there is dual output. ・In AUTO, it is impossible to change. ・In case of ON-OFF control, it is possible to set only the value of 0% and 100%.	0.0
	COND	Residual condition input	(display only)	——
	DO	Outputting sequence output and timing DO	(display only)	——

Continue to next page.

Continuation from previous page

Screen No.	Title	Item	Description / setting range	Factory setting
③	ALARM STATUS	Alarm situation The warning situation of the occurrence is displayed	The alarm occurrence situation is displayed (display only) ・ **A**:, **B**:, **C**:, **D**:, and **E**: are an alarm No. and these indicate DO No. that an alarm (ALARM) was chosen at DO function selection of 6:DO on Setup screen. ・ As for the display only for alarm No., the alarm is chosen, but it indicates that the alarm does not occur. When an alarm occurs, an alarm type the alarm type which was chosen at 6:DO on Setup screen) is displayed.	——
④	COMM	Communication Remote/Local	**LOCAL**: communication local, **REMOTE**: remote ・ It is impossible to switch from REMOTE to LOCAL.	**LOCAL**
	KEY LOCK	Key lock	**UNLOCK**: key unlock, **LOCK**: key lock ・ It is impossible to operate the program by keys.	**UNLOCK**

《 Sub screen 》



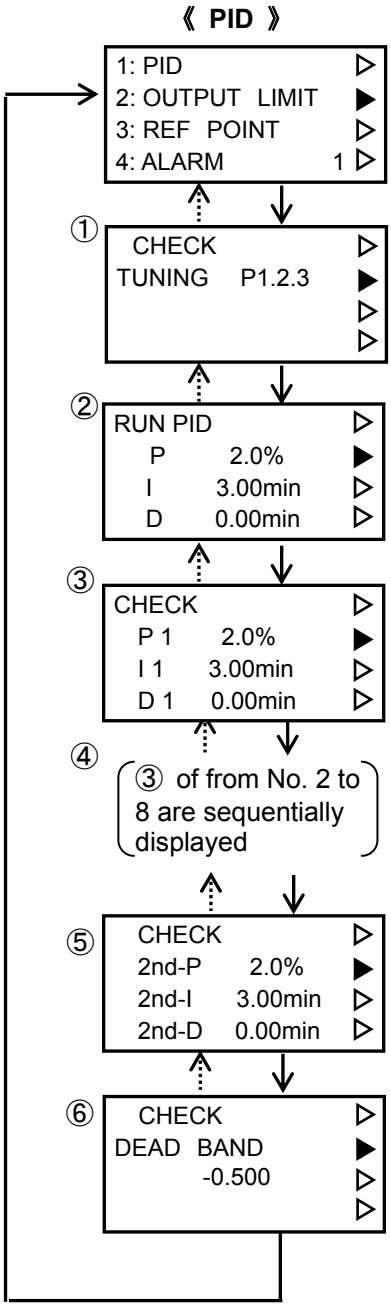
【Display condition】

⑦: Display only when there is optional expansion interface and as much as one heater address is set excluding 0.

⑧: Displayed only when heater monitoring alarm is holding.

Screen No.	Title	Item	Description / setting range	Factory setting
⑤	SP	Execution SP	(display only)	——
	(the 2nd, 3rd, 4th lines)	Graphic display of execution pattern	Display 15 steps including current step in graphic. (display only)	——
⑥	(the 1st line : R1)	Setup list (all is display only)	Input type (refer to page 24)	——
	(the 2nd line : 0.0 to 1760.0)		Scaling range	——
	(the 3rd line)		(from the left) 1st output control mode **PID**: PID control, **PD**: PD control, **ON-OFF**: ON-OFF control, Control direct/reverse **REV.**: reverse action **DIR.**: direct action Engineer unit	——
	(the 4th line)		(from the left) PID/output limit mode **SINGLE**: single, **MULTI.**: multi., **PROG**: programmed Multi-output type **mA**: current **SSR**: SSR drive **RELAY**: relay	——
⑦	(left side of the 2nd, 3rd and 4th lines)	Heater resistance value	1, 2, and 3 are the heater No.	——
	(right side of the 2nd, 3rd and 4th lines)	Heater current value	1, 2, and 3 are the heater No.	——
⑧	HEAT ALARM HOLD	Alarm hold	**HOLD**: Holding, **OFF**: Hold cancelled	——

7.4 Parameter screen



Screen No.	Title	Item	Description / setting range	Factory setting
①	TUNING	Auto tuning (AT)	**STOP**: Tuning stop, **AT.ON:** : immediate execution at current SP, **2AT.ON** : immediate execution of 2nd output , **1** : immediate execution at RP(reference point) 1, **2** : immediate execution at RP2, **3** : immediate execution at RP2, **1.2.3** : point 1,2 and 3 continued execution, (Six types of AT to here are possible only in the program stop.) **P1.2.3** : During program execution, when SP reaches RP, execute AT at that point ・**AT.ON** is valid only when PID/output limit mode is single or multi.. **1**, **2**, **3**, **1.2.3**, and **P1.2.3** are valid only when PID/output limit mode is programmed. **2AT.ON** is valid only when dual output. Detail of functions ☞ page 69	**STOP**
	[Caution] In case of AT of programmed PID/output limit mode, set SP for AT as a reference point at 3:REF POINT on Parameter screen beforehand.			
②	RUN PID	Execution PID	Current PID, MR (display only)	——
③ ④	Pn	Multi-P (n : 1 to 8) *1	Multi-proportional band 0.1 to 999.9%	2.0
	In	Multi-I (n : 1 to 8) *1	Multi-integration time 0.01 to 99.99 min ・Displayed only when 1st output is PID control.	3.00
	Dn	Multi-D (n : 1 to 8) *1	Multi-derivative time 0.00 to 20.00 min	0.00
	MRn	Multi-MR (n : 1 to 8) *1	Multi-manual reset 0.0 to 100.0 % ・Displayed only when 1st output is PD control.	50.0

Continue to next page.

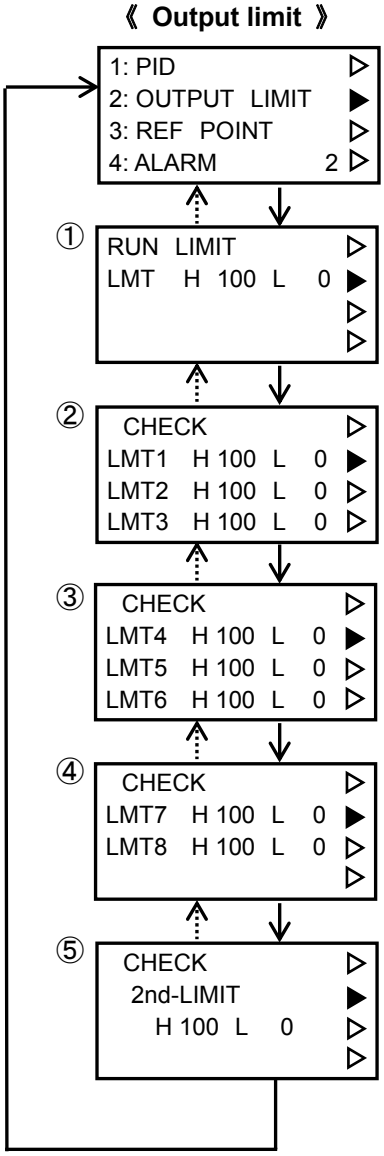
Continuation from previous page

Screen No.	Title	Item	Description / setting range	Factory setting
⑤	2nd-P	2nd output P	2nd output proportional band 0.1 to 999.9%	2.0
	2nd-I	2nd output I	2nd output integration time 0.01 to 99.99 min ・ Displayed only when 2nd output is PID control.	3.00
	2nd-D	2nd output D	2nd output derivative time 0.01 to 20.00 min	0.00
	2nd-MR	2nd output MR	2nd output manual reset 0.0 to 100.0 % ・ Displayed only when 2nd output is PD control.	50.0
⑥	DEAD BAND	Dead band coefficient	-0.500～+0.500 ・ Dead band (%) = dead band coefficient × 100 Detail of dual output functions☞page79	0.000

*1 : The data of n=1 is displayed only when PID/output limit mode is single.
The data of n=1 to 3 is displayed when PID/output limit mode is programmed.
The data of n=1 to 8 is displayed when PID/output limit mode is multiple.

【Display condition】

① : Displayed only when the control mode is PID control or PD control.
② : Displayed only when the PID/output limit mode is Multi or Programmed.
③④: Displayed only when the control mode is PID control or PD control.
⑤ : Displayed only when there is 2nd output and 2nd output control mode is PID control or PD control.
⑥ : Displayed only when there is 2nd output.



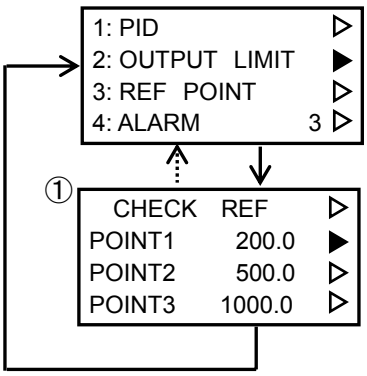
Screen No.	Title	Item	Description / setting range	Factory setting
①	RUN LIMIT	Execution output limit	Current output upper and lower limit (display only)	——
② ③ ④	LMTn H	Multi-output upper Limit (n：1 to 8) *1	Output lower limit to 100 (%)	100
	LMTn L	Multi-output lower limit (n：1 to 8) *1	0 to output upper limit (%)	0
⑤	2nd-LIMIT H	2nd output upper limit	2nd output lower limit to 100 (%)	100
	2nd-LIMIT L	2nd output lower limit	0～2nd output upper limit (%)	0

*1 : The data of n=1 is displayed only when PID/output limit mode is single.
The data of n=1 to 3 is displayed when PID/output limit mode is programmed.
The data of n=1 to 8 is displayed when PID/output limit mode is multiple.

【Display condition】
① : Displayed only when PID/output limit mode is programmed mode or multi-mode.
②, ③, ④ : Displayed only when 1st output is PID or PD control.
⑤ : Displayed only when 2nd output is PID or PD control.

[Caution] P correction for changing of output limit value
When you change the output limit value (dynamic output range), EC5950R correct the proportional band (P) automatically not to change the sensitivity against the preceding deviation. The following describes how to correct it in each mode:
(1) Single mode
Change the output limit of group 1. → Correct P of group 1.
(2) Multi-mode
Change the output limit of the execution group.
→Correct P of the executing group.
Change the group No. of the executing output limit.
→Correct P of executing group No. only when the output limit varies.
Change the group No. of the executing PID.
→Correct when the current output limit group (executing output limit group) varies with the preceding one in values.
(3) Programmed mode
Change the output limit of the executing pair No..
→Correct P of the executing pair No..

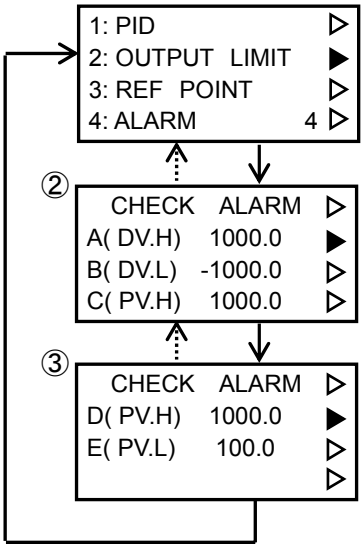
《 Reference point 》



Screen No.	Title	Item	Description / setting range	Factory setting
①	REF POINTn	Reference point (RP)n (n=1, 2, 3)	Reference point of programmed PID/output limit Scaling range (however, RP1≦RP2≦RP3) Detail of functions ☞ page 27, 28	Scaling upper limit

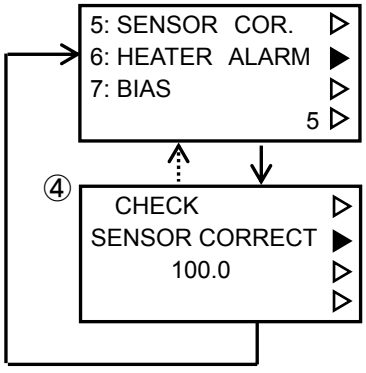
【Display condition】
① : Displayed only when PID/output limit mode is programmed mode.

《 Alarm value 》



Screen No.	Title	Item	Description / setting range	Factory setting
② ③	(the left side of each line : A,B,C,D,E)	Alarm (DO) No.	A, B, C, D, E Displayed only when DO function selection is alarm (ALARM). (display only)	——
	(in () of the center of each line : 1DV.H etc.)	Alarm type	alarm type set at 6: DO on Setup screen. (display only)	——
	(the value of right side of each line)	Alarm value	PV alarm: scaling range SP alarm: scaling range Deviation high alarm: 0 to + scaling width Deviation low alarm: - scaling width to 0 Deviation absolute value alarm: 0 to + scaling width Detail of functions ☞ page 26	A: 1570.0 B: -1570.0

《 Sensor correct 》

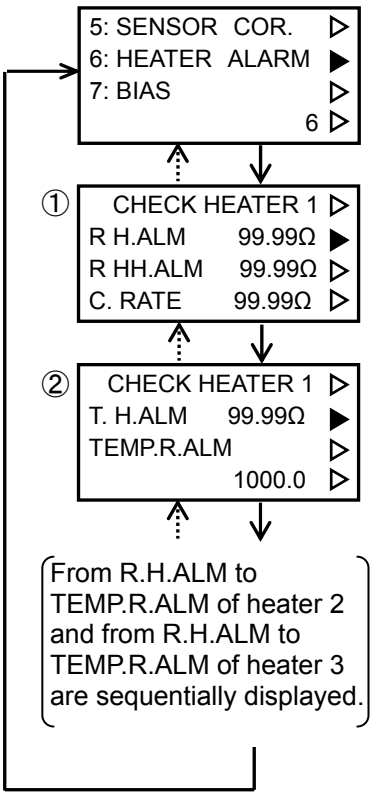


Screen No.	Title	Item	Description / setting range	Factory setting
④	SENSOR CORRECT	Sensor correct	-100.0 to 100.0 ℃	0

Detail of functions ☞ page 77

【Display condition】
④ : Displayed only when input type is TC or RTD

《 **Heater alarm value** 》

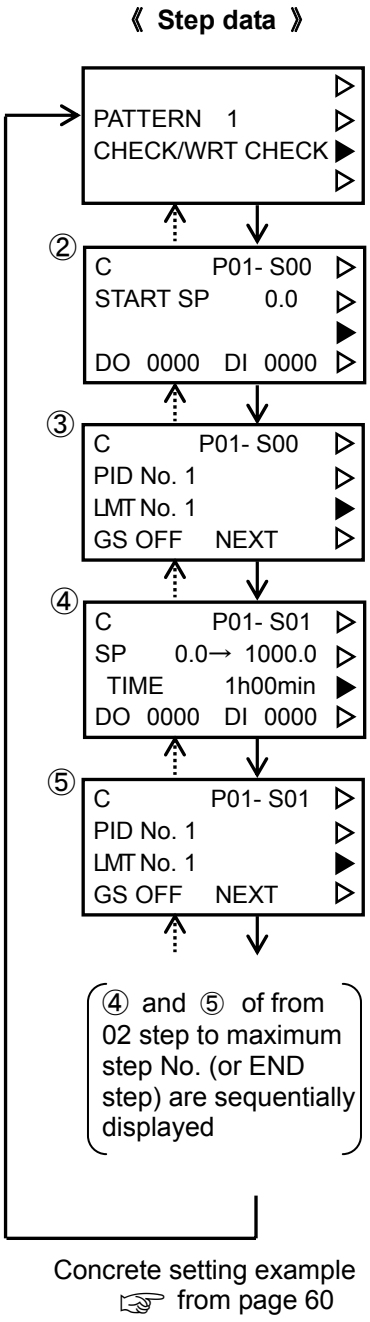


Screen No.	Title	Item	Description / setting range	Factory setting
①	HEATER	Heater number	1,2,3 Heater number that corresponds to the following data (display only)	——
	R.H.ALM	Heater resistance high alarm value	0.01 to 99.99Ω	99.99
	R.HH.ALM	Heater resistance high-high alarm value	0.01 to 99.99Ω	99.99
	C.RATE	Heater resistance change rate alarm value	0.01 to 99.99Ω	99.99
②	T.H.ALM	Specified heater high alarm value	(display only)	——
	TEMP.R.ALM	Heater high alarm specified temperature	Scaling range	100.0

Detail of functions ☞ Heater Monitoring Unit Instruction Manual HXPZE7201A01E
Expansion Interface, Servo Drive Output Instruction Manual WXPEC5900R04E

【Display condition】
①, ② : Displayed only when there is optional expansion interface and as much as one heater address is set excluding 0.

7.5 Program screen



Concrete setting example ☞ from page 60

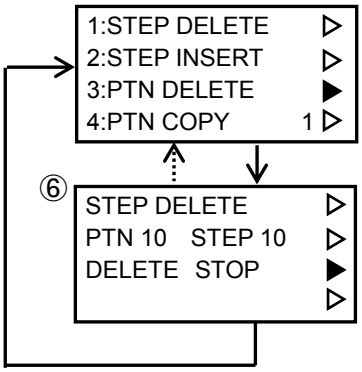
Screen No.	Title	Item	Description / setting range	Factory setting
①	PATTERN	Display/ setting pattern No.	1 to quantity of patterns	Execution pattern No.
	CHECK/WRT	Check mode /write mode switching	**CHECK**: check mode, **WRT**: write mode	**CHECK**
② ③ ④ ⑤	(the 1st left end : "C")	Check mode /write mode display	**C**: check mode, **W**: write mode The mode selected by screen ① is displayed as it is. (display only)	——
	P	Display/ setting pattern No.	The pattern No. selected by screen ① is displayed as it is. (display only)	——
	S	Display/ setting step No.	(display only)	0 or execution step No.
②	START SP	Start SP	Scaling range Displayed only when 00 step.	0
③	SP m → n	Target SP	Scaling range **m**: Target SP of previous step (display only) **n**: Target SP of current step ・ Displayed only when not 00 step	0
	TIME	Step time	0 to 399h59min (unit is hour-minute) 0 to 5h59min59sec (unit is hour-minute-second) ・ Displayed only when not 00 step.	0
② ④	DO	Choice of sequence output and timing-DO of this step	0, A to E, 1 to 9, and a (It is possible to set only DO No. that sequence output or timing-DO was chosen at 6:DO on Setup screen.) 0 is a meaning without the setting.	0
② ④	DI	Choice of condition input of this step	0, A to D, and 1 to 8 (It is possible to set only DI No. that condition input was chosen at 6:DI on Setup screen.) 0 is a meaning without the setting.	0

Continue to next page.

Continuation from previous page

Screen No.	Title	Item	Description / setting range	Factory setting
③ ⑤	PID No.	PID No.	In case of multi-PID/output limit mode, it is group No. which is used in step executing. 1～8	1
	LMT No.	Output limit No.	・ Displayed only when multi-PID/output limit	1
	GS	Use of guarantee soak in step	**OFF** : unused, **ON**: used ・ Displayed only when guarantee soak on Setup screen is used.	**OFF**
	(the 4th line right side)	Continue/END step	**NEXT**: continue, **END**：END step	**NEXT**

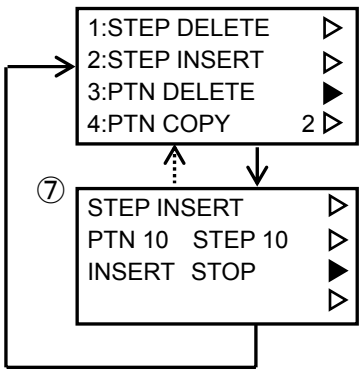
《 Step deletion 》



Screen No.	Title	Item	Description / setting range	Factory setting
⑥	PTN	Pattern No. for deletion	1 to quantity of patterns	Display pattern No.
	STEP	Deletion step No.	1 to quantity of steps	Display step No.
	DELETE	Execute step deletion	**STOP**: non-execution, **START**: execution Detail of functions ☞ page 64	**STOP**

【Display condition】
⑥ : Displayed when WRITE mode.

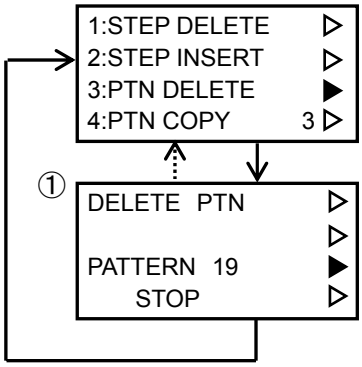
《 Step insertion 》



Screen No.	Title	Item	Description / setting range	Factory setting
⑦	PTN	Pattern No. for insertion	1 to quantity of patterns	Display pattern No.
	STEP	Insertion step No.	1 to quantity of steps	Display step No.
	INSERT	Execute step insertion	**STOP**: non-execution, **START**: execution Detail of functions ☞ page 64	**STOP**

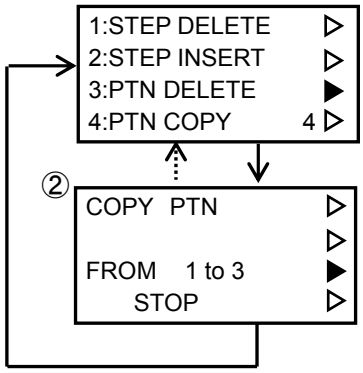
【Display condition】
① : Displayed when WRITE mode.

《 **Pattern deletion** 》



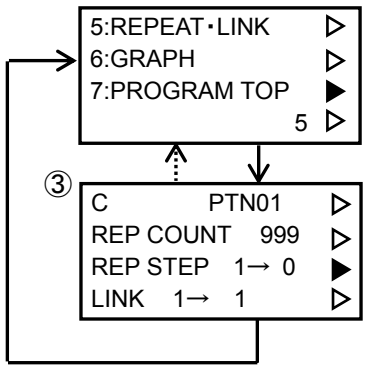
Screen No.	Title	Item	Description / setting range	Factory setting
①	DELETE	Deletion object	**ALL**: all pattern deletion, **STEP**: specified pattern deletion **END**: subsequent END step of specified pattern,	**ALL**
	PATTERN	Deletion pattern No.	1 to quantity of patterns ・Displayed only when deletion object is **STEP**, **END.**	Display pattern No.
	(the 4th line : STOP)	Execute pattern deletion	**STOP**: non-execution, **START**: execution Detail of functions☞ page 65	**STOP**

《 **Pattern copy** 》



Screen No.	Title	Item	Description / setting range	Factory setting
②	COPY	Copy object	**PTN**: Specified pattern copy	**PTN**
	FROM m to n	Pattern No. (m: copy-from n: copy-to)	Specified pattern copy: pattern No. (1 to quantity of patterns)	Display pattern No.
	(the 4th line : STOP)	Execute pattern copy	**STOP**: non-execution, **START**: execution Detail of functions ☞ page 65	**STOP**

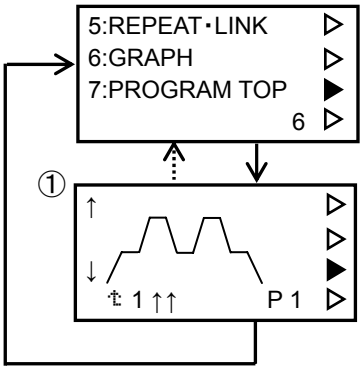
《 **Pattern data** 》



Screen No.	Title	Item	Description / setting range	Factory setting
③	REP COUNT	Repeating times	0 to 999 Repeat setting is nothing in = 0.	0
	REP STEP m → n	Repeat step No. m: start step n: end step	0 to maximum step No. Repeat between from step-m to step-n. ・Repeating action dose not function in setting = 0 or start step = end step.	0
	LINK m → n	m: link-from pattern No.	Display/setting pattern No. (display only)	——
		n: link-to pattern No.	1 to maximum pattern No. ・Displayed only when pattern link is used. ・Repeating action dose not function in setting m≧n.	Setting pattern No.

Detail of functions☞ page 63

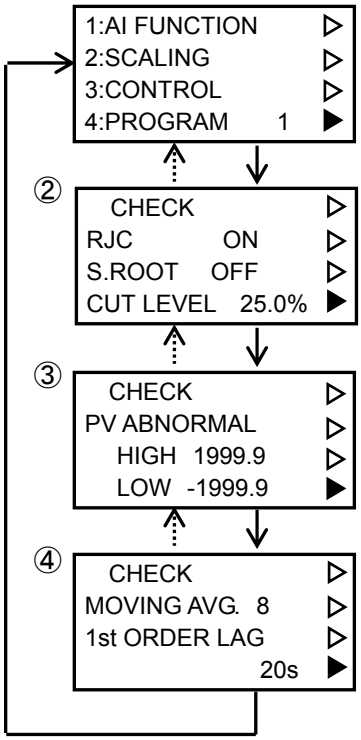
《 Graphic pattern 》



Screen No.	Title	Item	Description / setting range	Factory setting
①	P	Graph display pattern No.	1 to maximum pattern No.	Setting pattern No.
	(the 4th line : arrow)	Upper and under scroll	↑: Shifted above one line. ↑↑: Shifted above two lines. ↓ : Shifted under one line. ↓↓: Shifted under two lines.	(blank)
	mark	Right and l eft scroll (graph left end step No.)	1 to maximum step No. ･Step No. specifies and the graph is scrolled right and left.	1
	(the 1st line left end)	" ↑ " display	Displayed when graph not seen up exists.	——
	(the 3rd line left end)	" ↓ " display	Displayed when graph not seen downward exists.	——

7.6 Setup screen

《 AI function 》

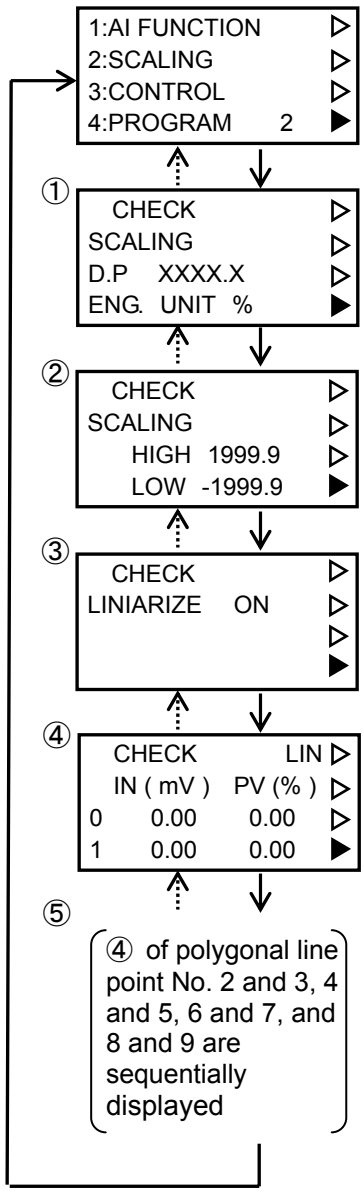


Screen No.	Title	Item	Description / setting range	Factory setting
②	RJC	Reference junction compensation	**OFF**: unused, **ON**: used ・ Displayed only when input type is TC.	**ON**
	S.ROOT	Use of square root	**OFF**: unused, **ON**: used ・ Displayed only when input type is V, mV, or mA. Detail of functions ☞ page 77	**OFF**
	CUT LEVEL	Input cut level	0.0 to 25.0% ・ Displayed only when square root is used.	10.0
③	PV ABNORMAL HIGH	PV error upper limit	Range to permit PV to be displayed as numerical value (When PV exceeds the upper limit, H is displayed, and when PV is lower than the lower limit, L is displayed in the PV indicator.) -19999 to 32000 (when there is a decimal point in five digit display), -19999 to 19999 (when there is no decimal point in five digit display), -9999 to 9999 (in four digit display), decimal point position follows the scaling	1401.4 1401.4
	PV ABNORMAL LOW	PV error lower limit		-231.4 -231.4
④	MOVING AVG.	Moving average	1 to 8 ・ Displayed only when 1st order lag is 0.	8
	1st ORDER LAG	1st order lag	0 to 20 sec	0

【Display condition】

② : Displayed only when input type is not RTD.

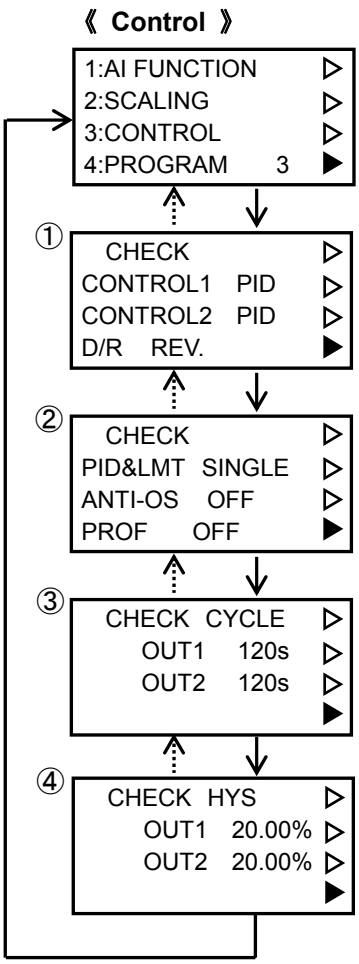
《 Scaling 》



【Display condition】
②,④: Displayed only when input type is DC.
⑤,⑥: Displayed only when input polygonal line approximation is used.

Screen No.	Title	Item	Description / setting range	Factory setting
①	SCALING DP	Scaling decimal point	Number of digits below scaling decimal point **XXXXX**: nothing, **XXXX.X**:1 digit, **XXX.XX**:2 digits, **XX.XXX**:3 digits, **X.XXXX**:4 digits (**X.XXXX** is only when 5 digits)	**XXX.XX**
	ENG. UNIT	Engineer unit	**℃**, **%**, **V**, **A**, **m**, **K**, **Pa**, **kg**, **kW**, (blank) · Displayed only when input type is V, mV, or mA.	**%**
②	SCALING HIGH	Scaling upper limit	TC,RTD input : input range、 DC input : -19999 to 32000 (when there is a decimal point in five digit display), -19999 to 19999 (when there is no decimal point in five digit display), -9999 to 9999 (in four digit display), decimal point position follows the scaling	1370.0
	SCALING LOW	Scaling lower limit		-200.0
③	LINIARIZE	Use of input polygonal line approximation	**OFF** : unused, **ON** : used · Displayed only when input type is V, mV, or mA.	**OFF**
④ ⑤	(the value of the 3rd, 4th lines left end)	Polygonal line point No.	0 to 9 (display only)	——
	IN (engineer unit)	Input of polygonal line approximation	The setting range is different according to the input range in () -10.00 to 10.00 (±10.0mV) 0.00 to 20.00 (0.0 to 20.0mV) 0.00 to 50.00 (0.0 to 50.0mV) 0.00 to 1.00 (0.0 to 1.0V) 1.00 to 5.00 (1.0 to 5.0V) 0.00 to 5.00 (0.0 to 5.0V) 0.00 to 10.00 (0.0 to 10.0V) 4.00 to 20.00: (4.0 to 20.0mA)	0
	PV (engineer unit)	Output of polygonal line approximation	Scaling range	0

Detail of functions☞ page 77

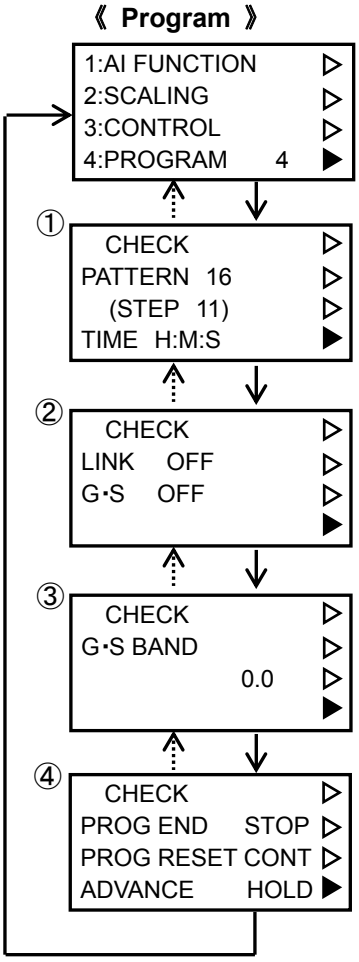


Screen No.	Title	Item	Description / setting range	Factory setting
①	CONTROL1	Control mode for 1st output	**PID**: PID control, **PD**: PD control, **ON-OFF**: ON-OFF control	**PID**
	CONTROL2	Control mode for 2nd output	**PID**: PID control, **PD**: PD control, **ON-OFF**: ON-OFF control ・ Displayed only when dual output. ・ Setting simultaneous with CONTROL1 (CONTROL2 is impossible of setting alone)	**PID**
	D/R	Control action	**REV.**: reverse action, **DIR.**: direct action	**REV.**
②	PID&LMT	PID/output limit mode	**SINGLE**: single mode **MULTI.**: multi mode **PROGRAM**: programmed mode	**SINGLE**
	ANTI-OS	Use of anti-overshoot	**OFF** : unused, **ON**: used ・ Displayed only when single or multi-PID/output limit. Detail of functions☞ page 78	**OFF**
	PROF	Use of profiling control	**OFF**: unused, **ON**: used(profiling master) Detail of functions ☞ page 33	**OFF**
③	CYCLE	Output cycle time	1 to 120 sec Cycle time = output ON time + output OFF time ・ Only the output of PID control or PD control and SSR drive output or relay output is displayed. OUT1: 1st output OUT2: 2nd output	60
④	HYS	Output hysteresis width	0.00 to 20.00 % ・ Only the output of ON-OFF control is displayed. Note: The display contents are the same as output cycle time. Detail of functions☞ page 78	0.10

【Display condition】

③ : Displayed only when it is PID control or PD control and SSR drive output or relay output.

④ : Displayed only when it is ON-OFF control.

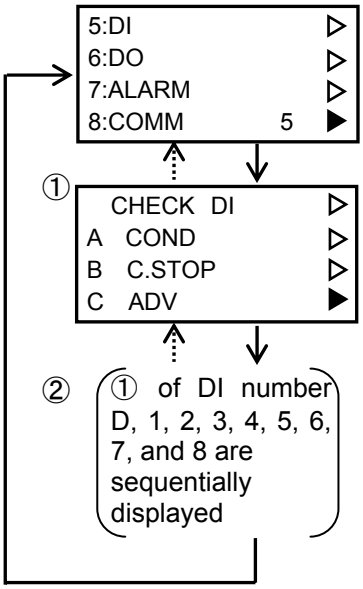


Screen No.	Title	Item	Description / setting range	Factory setting
①	PATTERN	Quantity of patterns	2 to 19 (in case of 2 programs) 4 to 19 (in case of 1 program)	16
	(STEP)	Maximum steps	Maximum step No. usable per one pattern (display only: interlocking to quantity of patterns) Detail of functions ☞ page 25	——
	TIME	Time unit	**H:M** : hour-minute, **H:M:S** : hour-minute-second	**H:M**
②	LINK	Use of pattern link	**OFF** : unused, **ON** : used Detail of functions ☞ page 63	**OFF**
	G·S	Use of guarantee soak	**OFF** : unused, **ON** : used Detail of functions ☞ page 30	**OFF**
③	G·S BAND	Guarantee soak width	0 to + scaling width The guarantee soak which is set in =0 dose not function	0
④	PROG END	Output at program END	Choose the control action at program END (RUN lamp blinks) **CONT**: continue the control, **STOP**: control STOP (output the output lower limit value) ・ When setting is **STOP**, control starts from output lower limit by program RESET	**CONT**
	PROG RESET	Output of program standby	Choose the control action when the program is in 00 step (from program RESET to RUN) **CONT**: continue the control, **STOP**: control STOP (output the output lower limit value) ・ When setting is **STOP**, control starts from output lower limit by program RUN	**CONT**
	ADVANCE	Program ADVANCE function	**HOLD** : SP hold, **STEP** : It is shifted to target SP set in an advance-from step.	**HOLD**

【Display condition】

③ : Displayed only when guarantee soak is used

《 **DI function** 》



Screen No.	Title	Item	Description / setting range	Factory setting
① ②	(the 2nd , 3rd, 4th lines left end : A,B･･･)	DI No.	DI No. is indicated in A, B, C, D, and 1 to 8. In case of standard model, it is only A, B, C, and D. When optional DI/DO adaptor is equipped with, 1 to 7 are added to standard model. When optional DI/DO connecter is equipped with, 1 to 8 are added to standard model. DI function selection shown in the line of DI No. are functions of that DI. (display only)	——
	(the 2nd, 3rd, 4th lines right side : COND, C.STOP ･･･)	DI function selection	**COND**: condition input, **R/S**: program RUN/STOP, **ADV**: program ADVANCE, **RST**: program RESET **MAN**: AUTO/MAN switching (MAN when contact ON), **C.STOP**: control STOP (control STOP when contact ON), **PTN1**: execution pattern switching (PTN-)1, **PTN2**: PTN-2, **PTN4**: PTN-4, **PTN8**: PTN-8, **PTN16**: PTN-16, **CAS** : (It is not used in this instrument.)	All No. **COND**

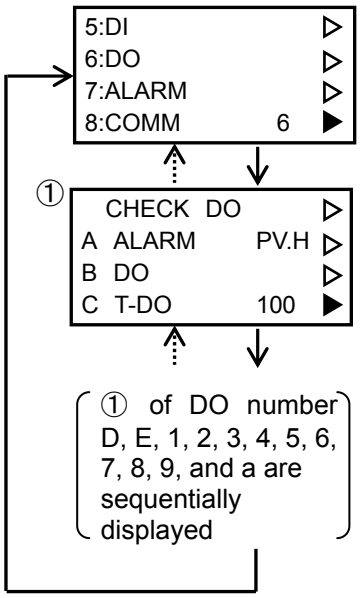
Action of **R/S**, **ADV**, **RST**, and **PTN-**n ☞ page 29
Action of **COND** ☞ page 31
Action of **C.STOP** ☞ page 78

【Display condition】

①, ② : In case of standard model, only the line of A, B, C, and D of DI number are displayed. When optional DI/DO adaptor is equipped with, the line of 1 to 7 are displayed as well as the line of standard model. When optional DI/DO connecter is equipped with, the line of 1 to 8 are displayed as well as the line of standard model.

[Caution]
Because there is a case to malfunction, the same function do not set the same DI function to a different DO number.

《 **DO function** 》



【Display condition】

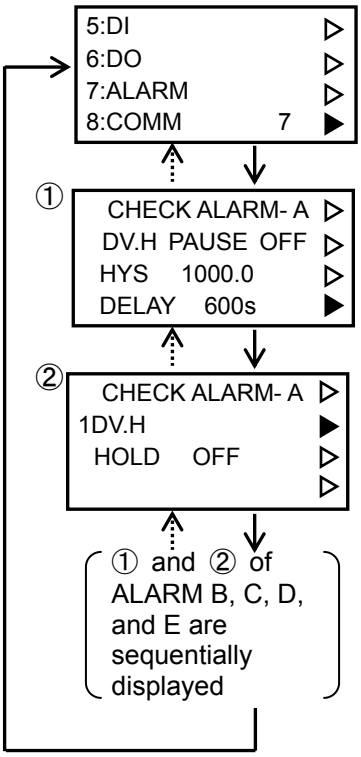
①: ・At standard, only the line of A, B, C, and D of DI number are displayed.
・The line of E in addition to standard is displayed when it is multi-output and is not relay output.
・The line of 1 to 8 in addition to standard is displayed when DI/DO adaptor is equipped with an option.
・The line of 1 to 9 and a in addition to standard is displayed when DI/DO connecter is equipped with an option.

Action of **ALARM**
☞ page 26 and76

Action of **DO** and **T-DO**
☞ page 32

Screen No.	Title	Item	Description / setting range	Factory setting
①	(the 2nd, 3rd, 4th lines left end : A,B・・・)	DO No.	DI No. is expressed in A, B, C, D, E, 1 to 9, and a. In case of standard model, it is only A, B, C , D, and E. When it is multi-output and is not relay output, it can use DO-E. When optional DI/DO adaptor is equipped with, 1 to 8 are added to standard model. When optional DI/DO connecter is equipped with, 1 to 9 and a are added to standard model. DO function selection and alarm type or On time of timing-DO shown in the line of DO No. are functions of that DO. (display only)	——
	(the 2nd, 3rd, 4th lines left side : ALARM, DO,・・・)	DO function selection	**DO**: Sequence output, **T-DO**: Timing-DO, **MAN**: MAN output (contact ON when MAN), **RUN**: Program RUN output (contact ON when program running) **END**: Program END output (contact ON when program END), **C.S**: Control STOP output (contact ON when control STOP), **ALARM**: Alarm output (contact ON when alarm is occurred), **FAIL**: Failure output (contact ON when CPU error and error in self diagnostics) ・ **ALARM** and **FAIL** are possible to choose only at DO-A, B, C, D, and E.	A and B: **ALARM**, Other: **DO**
	(the 2nd, 3rd, 4th lines right side : PV.H, 100 ・・・)	Alarm type	**DV.H**: Deviation high alarm, **DV.L**: Deviation low alarm, **PV.H**: PV high alarm, **PV.L**: PV low alarm, **ABS**: Deviation absolute value alarm, **SP.H**: SP high alarm, **SP.L**: SP low alarm, **HEAT**: Heater alarm ・ Valid when DO function selection is **ALARM**.	A: **DV.H** B: **DV.L**
		ON time of timing -DO	1 to 9999 sec ・ Valid when DO function selection is **T-DO** (timing-DO).	1

《 **Alarm parameter** 》



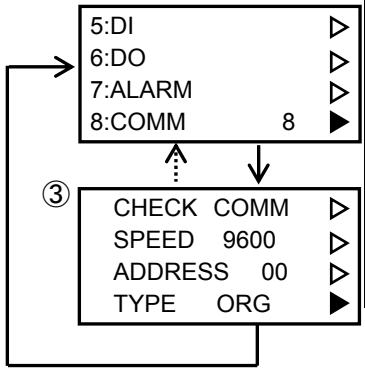
Screen No.	Title	Item	Description / setting range	Factory setting
①	(the 2nd line left end)	Alarm type	Display alarm type set at 6:DO on Setup screen (display only)	——
	PAUSE	Use of pause alarm	**OFF**: unused, **ON**: used	**OFF**
	HYS	Alarm hesteresis	0 to scaling width	0.0
	DELAY	Alarm ON delay time	0 to 600 sec	0
②	HOLD	Use of alarm hold	**OFF**: Not used、 **ON**: Used	**OFF**

Detail of functions ☞ page 76

【Display condition】

① : Displayed only when DO function selection is alarm (**ALARM**) and alarm type is **DV.H, DV.L, PV.H, PV.L, and ABS**.

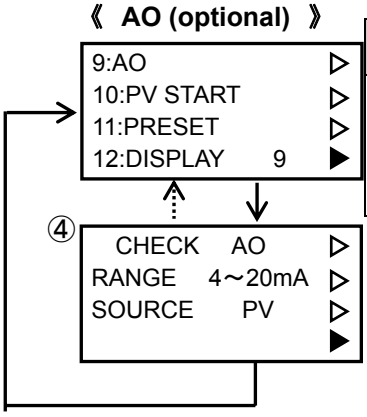
《 **Communication** 》



Screen No.	Title	Item	Description / setting range	Factory setting
③	SPEED	Transmission speed	**300**, **600**, **1200**, **2400**, **4800**, **9600** bps	**9600**
	ADDRESS	Communication Address	0 to 31	0
	TYPE	Communication type	**ORG**: original protocol **MOD.A**: Modbus protocol (ASCII mode), **MOD.R**: Modbus protocol (RTU mode)	**ORG**

Detail of functions ☞ Interface Instruction Manual WXPEC5900R02E

《 **AO (optional)** 》



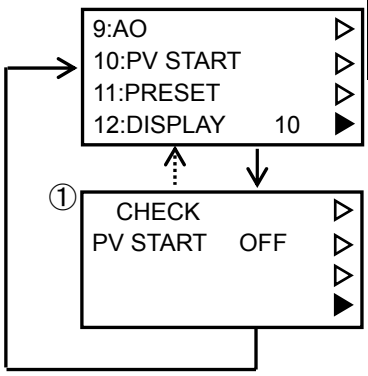
Screen No.	Title	Item	Description / setting range	Factory setting
④	RANGE	AO range	**0-20mA**: 0 to 20mA output, **4-20mA**: 4 to 20mA output	**4-20mA**
	SOURCE	AO source	**PV**: process variable, **SP**: setpoint, **OUT**: output	**PV**

Detail of functions ☞ AO Instruction Manual WXPEC5900R03E

【Display condition】

④ : Displayed only when there is optional AO

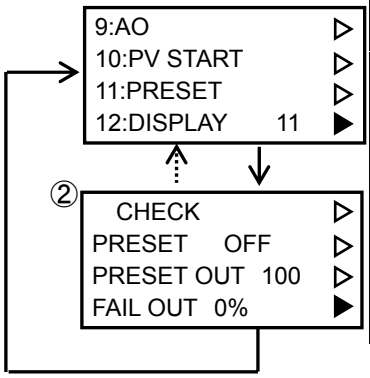
《 PV start 》



Screen No.	Title	Item	Description / setting range	Factory setting
①	PV START	PV start	**OFF**: unused, **ON**: used	**OFF**

Detail of functions ☞ page 72 and 75

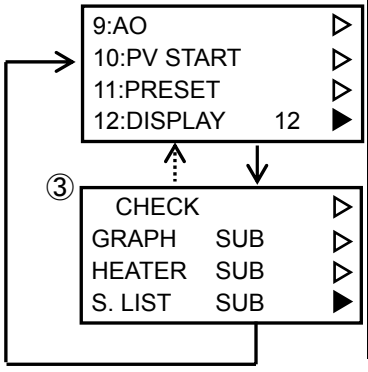
《 Preset output 》



Screen No.	Title	Item	Description / setting range	Factory setting
②	PRESET	Use of preset output	**OFF**: unused, **ON**: used	**OFF**
	PRESET OUT	Preset value	Output lower limit to output upper limit (%)	0
	FAIL OUT	Output value at failure	Specify the output when PV display is H or L or there is self diagnostics error. **0%**: output lower limit, **PRESET**: preset value	**0%**

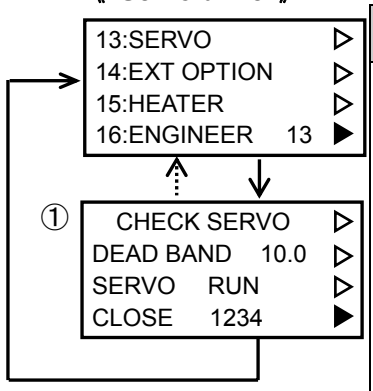
Detail of preset output ☞ page 75

《 Display switching 》



Screen No.	Title	Item	Description/setting range	Factory setting
③	GRAPH	The execution graphic pattern screen on Operation screen	**SUB**: sub display, **MAIN**: main display Detail of functions ☞ page 14	**SUB**
	HEATER	Heater data monitor screen and heater alarm holding cancel screen on Operation screen		
	S. LIST	The setup list screen on Operation screen		

《 **Servo drive** 》



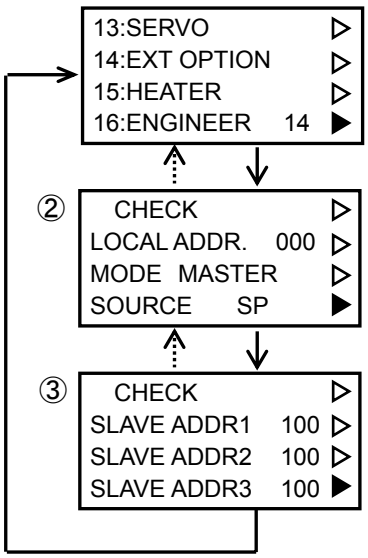
Screen No.	Title	Item	Description/setting range	Factory setting
①	DEAD BAND	Dead band	0.5 to 10.0%	1.0
	SERVO	Servo status	**RUN**: during operation, **ADJUST**: Automatic calibration start	**RUN**
	(the 4th line left side : CLOSE)	Automatic calibration situation	**CLOSE**: Zero calibration, **OPEN**: Open calibration, **END**: Normal completion, **ERROR**: Error occurrence ・Displayed only when automatic calibration is executing. (display only)	——
	(the 4th line right side)	A/D count value for automatic calibration	・Displayed only when automatic calibration is executing. (display only)	——

Detail of functions ☞ Expansion Interface, Servo Drive Output Instruction Manual WXPEC5900R04E

【Display condition】

① : Displayed only when there is optional servo drive.

《 **Expansion interface** 》



Screen No.	Title	Item	Description/setting range	Factory setting
②	LOCAL ADDR.	Expansion interface local address	Communication address (local address) on ARCNET® is set. 0 is considered that there is no setting and the expansion interface will not function. 0 to 255	0
	MODE	Expansion interface function selection	**OFF**:Not used, **MASTER**:Master controller	**OFF**
	SOURCE	Output source	The source for transmitting to the slave controller **PV**: Process variable, **SP**: Setpoint, **OUT**: Output value ・Displayed only when an expansion interface function selection is **MASTER**.	**SP**
③	SLAVE ADDR n	Slave address n	n=1,2,3 Local address of slave controller 0 to 255	0

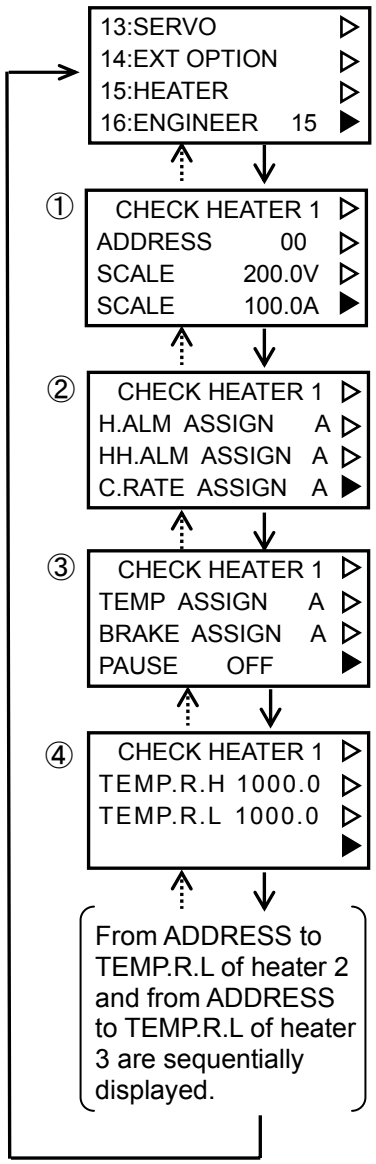
Detail of functions ☞ Expansion Interface, Servo Drive Output Instruction Manual WXPEC5900R04E

【Display condition】

② : Displayed only when there is optional expansion interface.

② : Displayed only when an expansion interface local address is set excluding 255 and an expansion interface function selection is **MASTER**.

《 **Heater parameter** 》



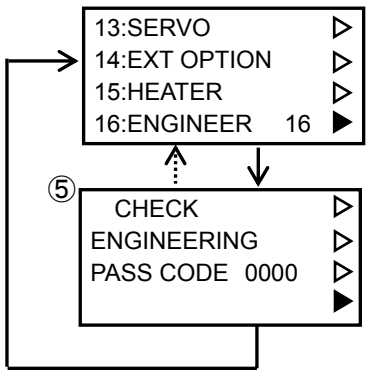
Screen No.	Title	Item	Description/setting range	Factory setting
① ② ③ ④	HEATER	Heater number	1,2,3 Heater number that corresponds to the following data (display only)	——
①	ADDRESS	Heater address	The address of each heater monitoring unit is set 0 to 63	0
	SCALE V	Voltage scale	Input voltage for ZE7201 is scaled. 1.0 to 999.9V	According to setting in ZE7201
	SCALE A	Current scale	Input current for ZE7201 is scaled. 1.0 to 999.9A	5.0A
②	H.ALM ASSIGN	Heater resistance high alarm function selection	0,A,B,C,D(= 0: None, = A,B,C,D correspond to the DO number.) It is not used with setting = 0.	**0**
	HH.ALM ASSIGN	Heater resistance high-high alarm function selection		**0**
	C.RATE ASSIGN	Heater resistance change rate alarm function selection		**0**
③	TEMP ASSIGN	Heater temperature high alarm function selection		**0**
	BRAKE ASSIGN	Heater break alarm function selection		**0**
	PAUSE	Use of heater pause alarm	**OFF** : Not used 、 **ON** : Used	**OFF**
④	TEMP.R.H	Heater alarm judgment lower temperature	Scaling range	1500.0
	TEMP.R.L	Heater alarm judgment upper temperature		100.0

Detail of functions ☞ Heater Monitoring Unit Instruction Manual HXPZE7201A01E
Expansion Interface, Servo Drive Output Instruction Manual WXPEC5900R04E

【Display condition】

①, ②, ③, ④ : Displayed only when there is optional expansion interface and as much as one heater address is set excluding 0.

《 **Engineer** 》



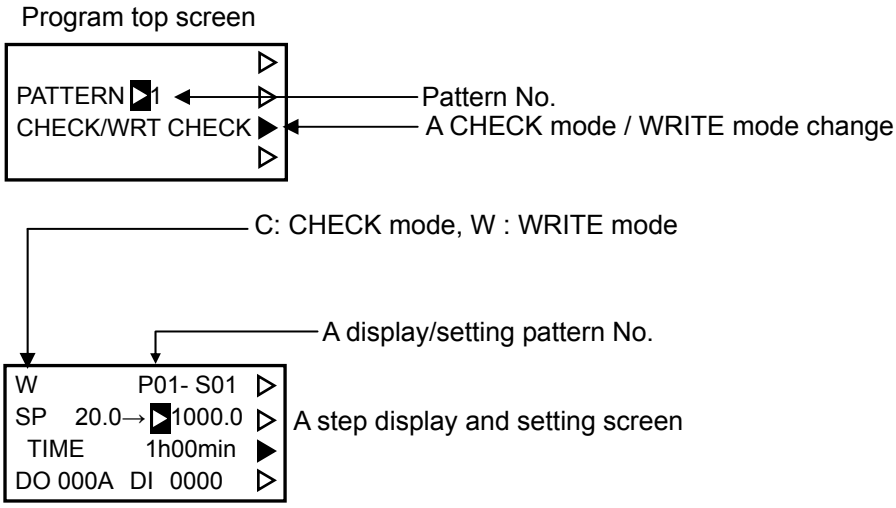
Screen No.	Title	Item	Description/setting range	Factory setting
⑤	PASS CODE	Pass number	Secret number	0

Chapter 8 Program Pattern Setting

8.1 The basic operation on Program screen

8.1.1 Pattern No. changing

Pattern No. which is displayed and set up on Program screen are beforehand chosen on Program top screen. It cannot change on other screens.
In a step display and setting screen, a CHECK/WRITE mode and pattern No. are displayed on the 1st line.



[Caution]
Keep in mind that pattern No. and step No. displayed and set up on Program screen may differ from pattern No. and step No. which are displayed on 7 segment indicator.

8.1.2 CHECK mode and WRITE mode

The changing CHECK/WRITE mode is possible only on Program top screen as well as the pattern No. of the Section 8.1.1.
In the case of CHECK mode, it is possible to check the program pattern, but setting of the data except pattern deletion and pattern copy is impossible. The CHECK/WRITE mode is held until it will escape from Program screen, if either is specified on Program top screen.

8.1.3 The type of step

It roughly divides into a step and there are two types.

a: Start step (00 step)

b: Normal step (except 00 step)

SP executed at the time of program RESET (an execute step is returned to 0) is set to a start step. Here, there is no setting of time.

The normal step becomes an action as shown in the following table with the combination of SP and time.

Display example	Description	Meaning	SP action
SP 500.0→ 500.0 TIME 2h30min	Target SP is equal to a SP of previous step.	Keep step	Hold SP during setting time. Time =0 is performed for 0.1 second.
SP 500.0→ 700.0 TIME 15h20min	Target SP is larger than SP of previous step, and time is not zero.	Ramping Up step	SP increases to target SP at the slope speed calculated with setting time and the difference of target SP.
SP 500.0→ 20.0 TIME 2h30min	Target SP is smaller than SP of previous step, and time is not zero.	Ramping Down step	SP decreases to target SP at the slope speed calculated with setting time and the difference of target SP.
SP 500.0→ 550.0 TIME 0h00min	Target SP is larger than SP of previous step, and time is 0.	Stepwise Up step	SP changes to target SP immediately in time 0 (actually 0.1 second).
SP 500.0→ 450.0 TIME 0h00min	Target SP is smaller than SP of previous step, and time is 0.	Stepwise Down step	SP changes to target SP immediately in time 0 (actually 0.1 second).

8.1.4 Movement of display/setting step

Display/setting step can be advanced or returned by moving cursor using the ENT or BACK.

After the cursor advance of the item for one step finishes with the ENT in WRITE mode, it moves to setting SP of the next step, and returns to previous step similarly with the BACK. In CHECK mode, if the ENT or BACK is pressed twice, respectively, it will move to the next step or a previous step.

Moreover, a step is also movable with the ADV and ◀, or RST and ◀.

・If the ADV and ◀ are pressed simultaneously, it will move to the next step.

・If the RST and ◀ are pressed simultaneously, it will return to zero step (start step).

Although the display/setting step No. will change, a cursor location does not change.

[Reference]

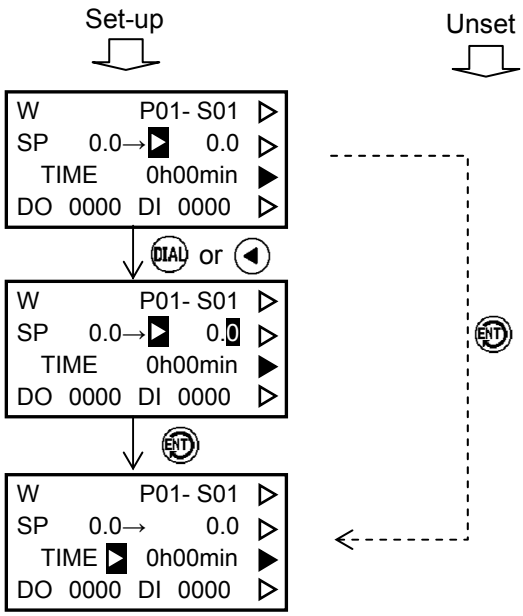
Even if it presses the ADV and ◀, or RST and ◀ simultaneously, step No. may not change. Please operate it again similarly. Although a value may be in a blinking (situation which can be changed) at this time, unless a dial is turned, a value does not change.

8.1.5 Unset step

The unset step is the step that the ENT is never pressed in the situation that it is possible to change at target SP or step time.

It is considered that this step was set up when the ENT was pressed in the situation that changing is possible even if target SP and step time are 0. It is not recognized as having been set up only by pressing the ENT like the wavy line of the following figure. As for unset step, the program is not executed. The program stops at the end of previous step.

However, as for 0 step, it is considered that it is set-up step even if neither target SP nor step time is set up, and the program can be executed.



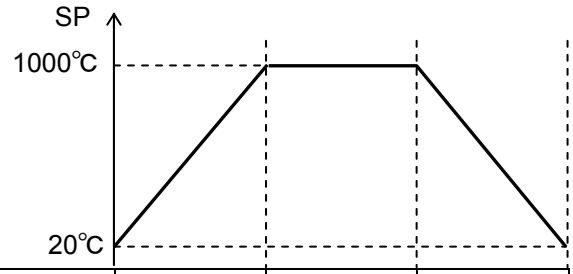
[Caution]

Even if it sets up only the data other than target SP or step time (DO, DI, etc.), that step is not set-up step. In order to make it recognize as a set-up step, please be sure to set up target SP or step time.

8.2 The example of program pattern setting

It is the example and the operation/display procedure of program pattern.

【The example of a program pattern】



Setting condition (all are chosen on Setup screen)
Time unit : H:M
PID / output limit mode : multi
GS : used

[Reference]
The initial value when displaying a Program top screen by (DISP) is as follows.
PATTERN (pattern) = execution pattern,
CHECK/WRT=CHECK (check mode).

Step	01	02	03
Time	1h	2h30min	45min
DO	D		
DI		A,B	
PID No.	1	2	1
LMT No.	1	1	3
GS	ON		
END			END

【Action】

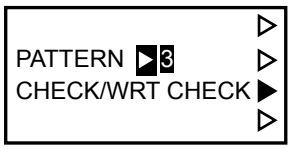
END: The program is completed when this step is completed.
PID of No.1 and the output limit of No.3 are used.
Multi-PID / output limit ☞ page 27

DI: Unless both A and B of DI contact are set to ON during executing step, don't move to the next step. ☞Page 31
PID of No.2 and the output limit of No.1 are used.

DO: The DO contact D turns on during step execution. ☞ page 32
GS: When process variable is out of guarantee soak width to SP at the time of step completion, don't move to the next step. ☞ page 30
PID and the output limit of No.1 are used.

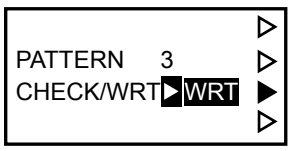
【Operation and display procedure example】

①



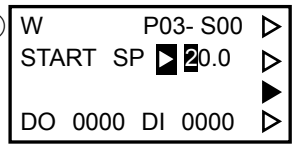
Press the (DISP) and a program top screen is displayed.
Change the setting pattern No..
Change the value into 3 with the ◀ and (DIAL) , and press the (ENT) .

②



WRT (write-in mode) is used.
Change the character into **WRT** with the ◀ and (DIAL), and press the (ENT) . In case of checking, press the (ENT) with CHECK.

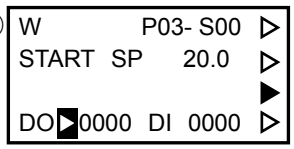
③



Set the data of 00 step.
SP is start SP of the pattern. There is no setting out of step time.
Change the value into 20 with the ◀ and (DIAL), and press the (ENT).

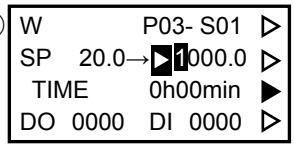
[Reference]
The step No. displayed first is as follows.
It is the execution step when display/setting pattern is execution pattern. It is 00 step when display/setting pattern is not execution pattern.

④



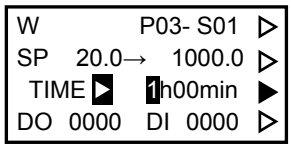
In this example, there is not the setting besides the setting of start SP. Press the ENT 6 times continuously and cursor is advanced to SP setting of 01 step.

⑤



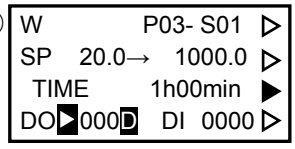
Set the target SP of 01 step.
Change a value into 1000 with the ◀ and DIAL, and press the ENT.

⑥



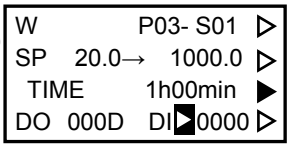
Set the step time of 01 step.
Change a value into 1 hour and 00 minute with the ◀ and DIAL, and press the ENT.

⑦



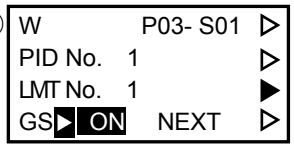
Set the DO (sequence contact output) of 01 step.
Change into D with the ◀ and DIAL, and press the ENT. DO and DI can set a maximum of 4 digits (4 points), respectively. A setting position is not related. Where of 4 digits is the same.

⑧



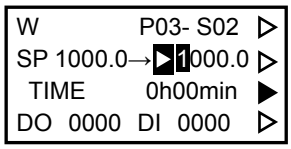
There is no setting of DI. Moreover, since each of PID No. and LMT No. is 1, there is no need for setting. Press the ENT 3 times and it moves to setting of GS.

⑨



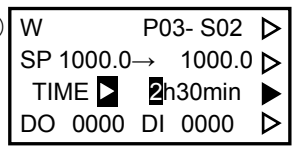
Set the GS of 01 step.
Change a character into **ON** with the ◀ and DIAL, and press the ENT. Press the ENT once again and it advances to setting of 02 step.

⑩



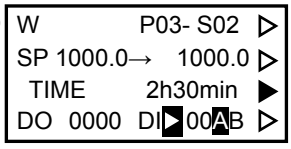
Set the target SP of 02 step.
Change a value into 1000 with the ◀ and DIAL, and press the ENT. If the same value as a previous step (01 step) is used, the step will turn into a keep step.

⑪



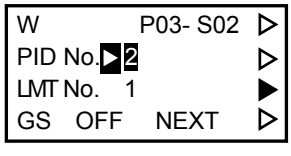
Set the step time of 02 step.
Change a value into 2 hour and 30 minute with the ◀ and DIAL, and press the ENT. Since there is no setting of DO, it press the ENT once again and it moves to DI setting.

⑫



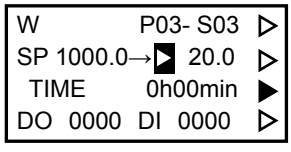
Set the DI (condition contact input) of 02 step.
Change into A and B with the ◀ and DIAL, and press the ENT.

⑬



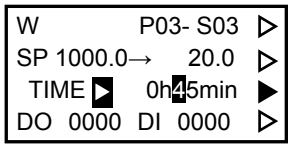
Set the PID No. of 02 step.
Change a value into 2 with the ◀ and DIAL, and press the ENT.
The ENT is pushed 3 times continuously and it advances to the setting of next step.

⑭



Set the target SP of 03 step.
Change a value into 20 with the ◀ and DIAL, and press the ENT.

⑮



Set the step time of 03 step.
Change a value into 45minute with the ◀ and DIAL, and press the ENT . Press the ENT 3 times continuously and it moves to setting out of LMT No.

⑯

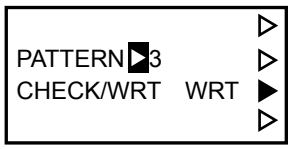
Set the LMT No. of 03 step.
Change a value into 3 with the ◀ and DIAL , and press the ENT .

⑰

Set the END step as 03 step.
Change a character into **END** with the ◀ and DIAL, and press the ENT . If the ENT is pushed at **END**, it will not move to the next step (here 04 step), but will return to a Program top screen.

> **[Reference]**
> When perform the display/setting of the program of other pattern successively without setting an END, press the DISP 3 times. By this operation, it returns to Program top screen (page 61 ①). However, pattern No. and CHECK/WRITE mode are returned to initial value. Please set pattern No. to display and set once more.

⑱



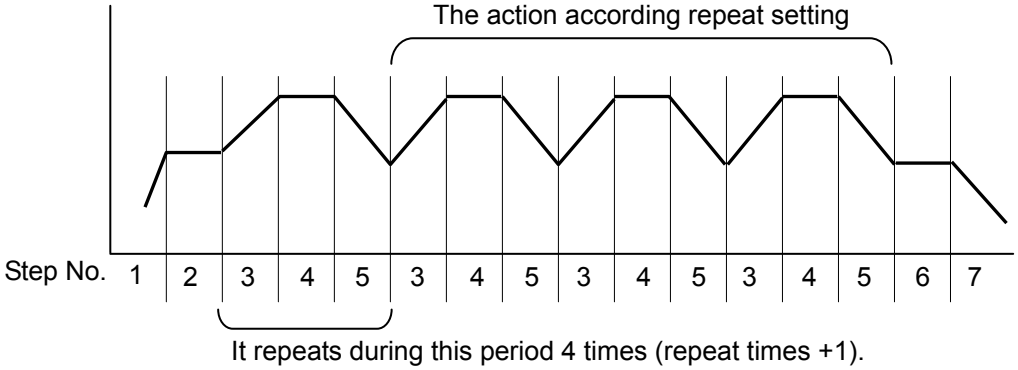
If it returns to Program top screen with the ENT after setting an END step, setting pattern No. and WRITE mode will be held.

8.3 Repeat and pattern link function

When using repeat and pattern link function, choose 5:REPEAT-LINK from the menu screen of Program sub screen, and it goes to a repeat and pattern link display/setting screen.
The repeat data and a pattern link data are called “pattern data”.

8.3.1 Repeat

It can repeat between specified steps 999 times or less. If repeat times is 3, repeat start step No. is 3 and repeat end step No. is 5, a program is executed as follows.



[Caution]
During program RUN, when the repeat times of execution pattern is changed, operates by new repeat times from this time regardless of a repeat action of until now.

8.3.2 Link

Two or more patterns are performed continuously.
When the final step of a pattern is completed and the link-to pattern is set, it continues a program automatically from 01 step of the link-to pattern.

[Caution]
- When the execution pattern switching is being performed with DI, the pattern link does not operate.
- When the "END" step is set in the middle of the pattern, the link to a succeeding pattern does not operate.
- Execution pattern No. can be switched with the PTN when the pattern link is used. For example, when link setting is carried out to pattern No. 1→2→3, a program will perform pattern No. 2→3 if start the program after choosing pattern No.2.

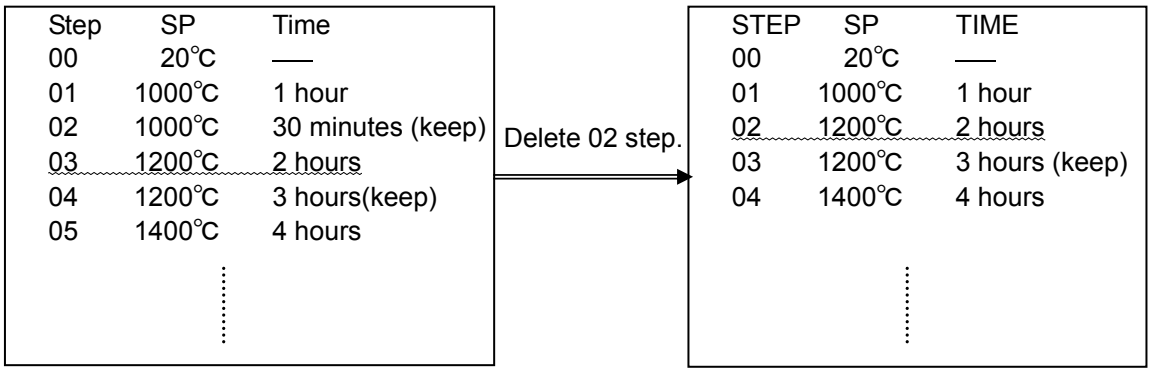
8.4 Program editor

Edit of a program has four functions of step deletion, step insertion, pattern deletion, and pattern copy. Choose a number from the menu of Program sub screen, and it goes to the screen of hope.

8.4.1 Step deletion

Delete the specified step (one step) of the specified pattern. As for the step after that step, a step number is done -1 of each. Although an example shows only SP and time, other data (DO, DI, etc.) are also deleted and shifted.

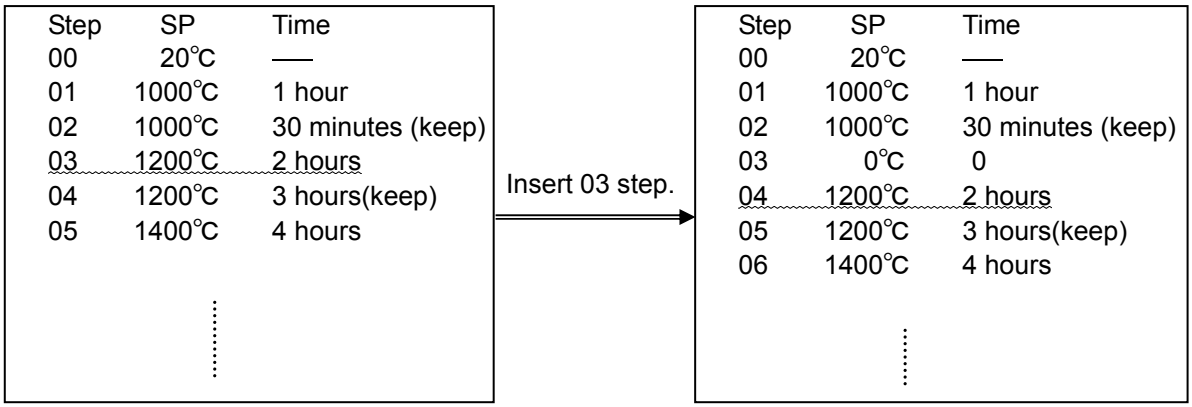
Message ＊＊ STEP DELETE ＊＊ is displayed on the lower position of data indicator during step deletion. When a message disappears, it is completion of step deletion



8.4.2 Step insertion

Insert the vacant step to the specified step (one step) of the specified pattern. As for the step after that step, a step number is done +1 of each. Although an example shows only SP and time, other data (DO, DI, etc.) are also shifted.

Message ＊＊ STEP INSERT ＊＊ is displayed on the lower position of data indicator during step insertion. When a message disappears, it is completion of step insertion.



[Caution]

- The inserted step is an unset step. If a program is operated from 00 step as it is, a program will be ended in front of an intercalation step. When you continue a program to the inserted step or subsequent ones, please be sure to set the SP or time (or both).
- Keep in mind that a final step will disappear if step insertion is performed when all to the maximum step have setting before insertion.

8.4.3 Pattern deletion

The pattern (step data and pattern data) of the specified range is deleted. The type of range specification is three kinds of deletion about "all pattern deletion", "specified pattern deletion", or “subsequent END step of specified pattern”.

Message ＊＊ NOW DELETE ＊＊ is displayed on the lower position of data indicator during pattern deletion. When a message disappears and the data changes to STOP, it is completion of pattern deletion.

[Caution]

- In “subsequent END step of specified pattern”, when an END step does not exist, deletion is not performed.
- Restoration of the deleted pattern cannot be performed. Please be sure to check the specified range before performing deletion.

8.4.4 Pattern copy

The specified pattern (step data and pattern data) is copied to another pattern.

Message ＊＊ NOW COPY ＊＊ is displayed on the lower position of data indicator during pattern copy. When a message disappears and the data changes to STOP, it is completion of pattern copy.

[Caution]

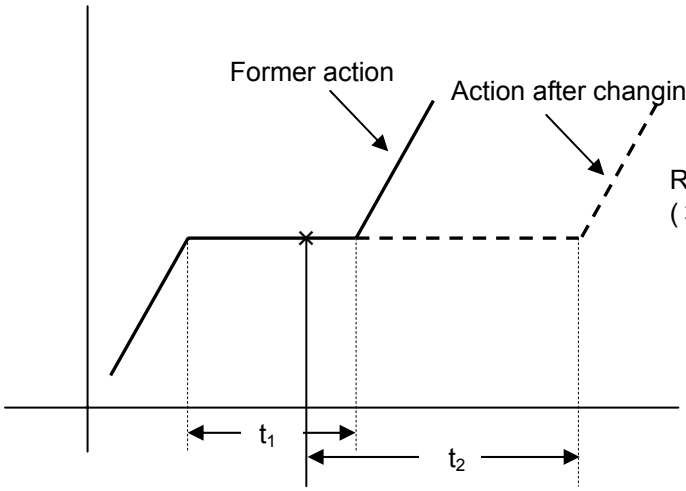
- The overwriting of step data by pattern copy cannot be performed. When step data exist in pattern of a copy destination, a copy is not performed but message ＊＊ STEP EXIST ＊＊ is displayed.

8.5 Changing of step data during execution

You can change execution step data during program running.

(1)Changing of step time during keep step

Data are kept for a new set time from a point of changing regardless of elapsed time.



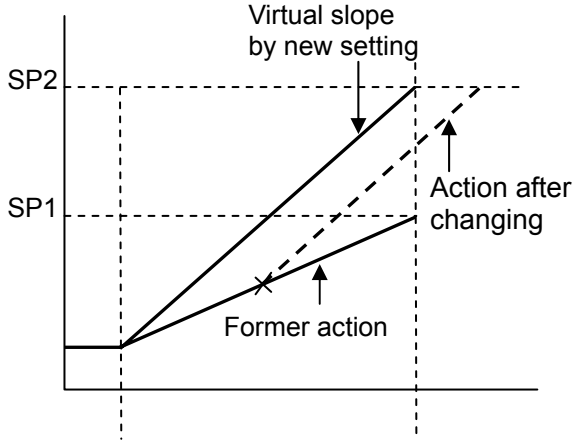
Run by changing keep time t1 to t2.
(× mark : a point of changing)

(2)Changing of the data during ramping step

Figure shows run after changing target SP or step time.

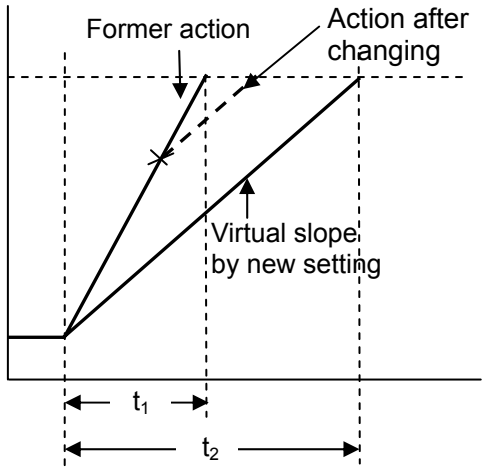
Changing them varies ramping rate (new settings in Figure). Run progresses with the new ramping rate from a point of changing (marked as ×). The slope of new action after changing is the same as virtual slope by new setting.

a. Changing of target SP



SP1 : Former SP
SP2 : New SP
× : Point of changing

b. Changing of step time



t_1 : Former step time
t_2 : New step time
× : Point of changing

Chapter 9 Operation

9.1 Control Method

Control methods are classified into automatic operation (AUTO) and manual operation (MAN).

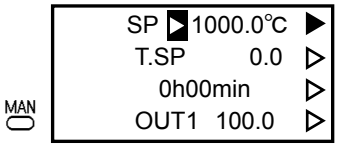
Control method	Output	MAN lamp
AUTO	Output is calculated by controlled computing of PID, etc. Output cannot be set manually.	OFF
MAN	Operation is executed with the set output.	ON

9.2 Automatic Control (AUTO) and Manual Control (MAN)

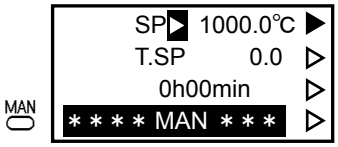
9.2.1 AUTO/MAN switching

A switching of AUTO/MAN uses the (MAN) . By pressing the (MAN) → (ENT) , in case of AUTO, it is switched to MAN, and in case of MAN, it is switched to AUTO.

(1) AUTO to MAN

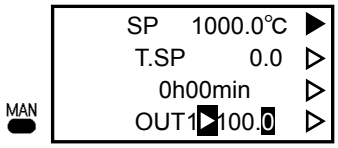


Display Operation screen.



Press the (MAN) to blink the message on the data indicator.

←Blinking

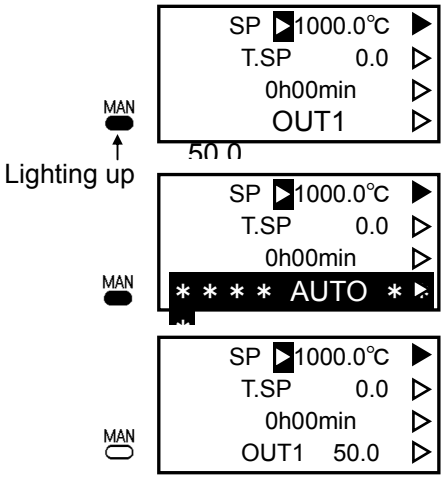


Press the (ENT) to turn off the message, light up the MAN lamp and switch to MAN. The cursor moves to OUT1 (1st output).

[Caution]

- A message blinks for approximately 5 sec. Unless you press the (ENT) during that time, switching from AUTO to MAN is not done.
- When you switch to MAN during program RUN, the program will stop at that moment (RUN turns OFF). You cannot execute programs during manual control.

(2) MAN to AUTO



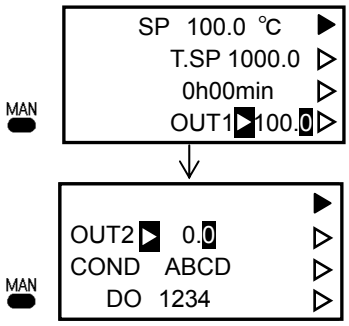
Display Operation screen.

Press the (MAN) while the MAN lamp is lighting up (during manual control) to blink the message on the data indicator.

Press the (ENT) to turn off the message, turn off the MAN lamp and switch to AUTO

9.2.2 Manual output

Press the (ENT) or (BACK) to choose output (OUT1 or OUT2) and change numerals by rotating the (DIAL) .



Change the 1st output.

Change the 2ns output.

[Caution]

・At the moment of choosing output by the cursor, numerals of figures to be altered blink. (DIAL)

・Values changed with (ENT) are output directly. This is a direct output method unnecessary for the (◀) operation.

・When you change the output value largely, the (DIAL) can move a digit of cursor.

・In the case of ON-OFF control, it will display either 0.0 or 100.0 by rotating the .

9.3 Auto tuning (AT)

An output is changed with 0 ⟷ 100% (in case of current output, changed with output lower limit ⟷ output upper limit), the characteristics of a process are measured from change of measured value, and a PID value is calculated automatically. In AT execution, an MAN lamp blinks. The action of AT and the storage destination of a result is different with PID/output limit mode.

PID/output limit mode	Action of AT and storage destination of result.
Single	AT is immediately performed by the current SP and a result goes into a group 1.
Multiple	AT is immediately performed by the current SP and a result goes into the group of execution. Since group No. is set for every step, when changing the group who wants to store, PID No. of a step is changed during execution or an execute step is changed into the step to which PID No. of hope is set by programs ADVANCE or RESET.
Programmed	RP (reference point) which performs AT is specified. In case of P1.2.3 (program AT) is set, if SP reaches into Program RUN at RP, AT will be performed with the RP value. In setting of those other than this, AT is immediately performed with specified RP value. A result goes into the group of RP who performed AT.

[Caution]

- Execution of AT will rise / drop a process value (example: temperature of a furnace). Please be sure to check that there is no trouble in an instrument or a product before starting AT.
- Depending on the characteristics of a furnace, good control may not be obtained by AT, either. In such a case, please adjust PID manually.

[Caution] Caution of program AT

- Even if it sets program AT, AT is not performed immediately. AT is performed when SP changes according to a program and RP is reached (MAN lamp blinks).
- It becomes AT STOP only when AT is completed by all RP of three points. If program RUN is carried out in the situation that unperformed RP remain (before setting AT to STOP with hand control or turning off the power), AT will be performed when SP reaches the RP. In the case of AT needlessness, please change AT into STOP manually surely.

[Caution]

- It will become AT STOP if there is turning off the power. Keep in mind that program AT becomes also STOP. In addition, the result of AT ended before turning off the power is saved. Moreover, if MAN (manual control) is used, it will become STOP similarly.
- AT is possible in only AUTO. If it switches into AT to MAN, it will become STOP.
- The following data cannot be changed among AT. An error message is displayed.
  - ○ Constant value SP
  - ○ Step data
  - ○ PID/manual reset
  - ○ Output limit
  - ○ Reference point
  - ○ PID / output limit mode

9.4 Program operation

[Caution] key lock
If the key lock is set to “LOCK” on Operation screen, the program operations (program RUN/STOP, program ADVANCE, program RESET, switching execution pattern) with a surface key are not permitted. Please operate it after canceling the key lock (set to “UNLOCK”).
Even if it is that the key is locked, an operation with external DI contact or external communication is possible.

[Caution] Operation with an external DI contact
When it is set so that program RUN/STOP and switching execution pattern are performed with an external DI contact, each operation with surface key and external communication cannot be performed. However, either an external DI contact or a surface key (or external communication) is possible for Program ADVANCE and program RESET.

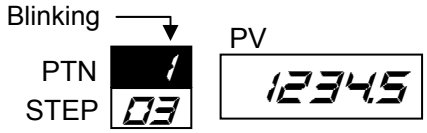
9.4.1 Program operational situation

There are three situations in program operation. Each display and action is as follows.

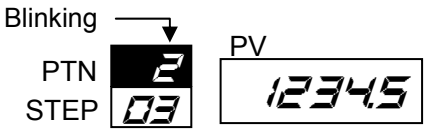
Program situation	Display (RUN lamp)	Action
RUN	Lighting up	A program is performing. Execution SP changes according to program setting, and step residual time decreases. However, residual time is not subtracted although waiting situation such as guarantee soak and a condition are in program RUN.
STOP	Lighting out	A program is stopping. Step residual time does not decrease and SP holds the current value. If it is AUTO (automatic control), control will be continued with holding SP. In program STOP, SP (constant SP) can change directly.
END	Blinking	The program was completed. The program will be completed when execution of the END step was completed or there is no next step. It is in the waiting situation of program RESET or switching execution pattern. Unless these operations are performed, a program cannot be executed again. Moreover, if “output at program END” is set to “STOP”, the current output lower limit value will be outputted compulsorily. It is the same as the action of Program STOP except this.

[Caution]
Although setting maximum time is 399 hours 59 minutes (when a time unit is H:M), when start SP of a ramping step changes by PV start, changing constant SP, etc., step execution time may exceed setting maximum time. The step time at this time is restricted to the maximum step execution time (about 466 hours). Therefore, it will increase or decrease more quickly than an original ramping speed. (Example: When start SP changes to 900℃ at the step to increase the temperature 1000℃→1100℃ in 300 hours, although calculative step execution time is 600 hours, about 466 hours turns into step execution time)
Although the setting maximum time has a the same time also when a time unit is H:M:S (hour-minute-second), residual time for 6 hours 55 minutes 35 seconds or more cannot be displayed. When residual time is more than this time, residual time display "6H55m35s" blinks, and it is shown that actual residual time is 6 hours 55 minutes 35 seconds or more. The residual time on a display does not decrease at this time. If real residual time becomes shorter than this time, the residual time on a display will change.

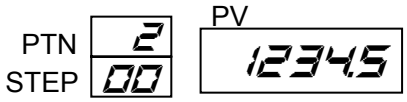
9.4.2 Pattern switching



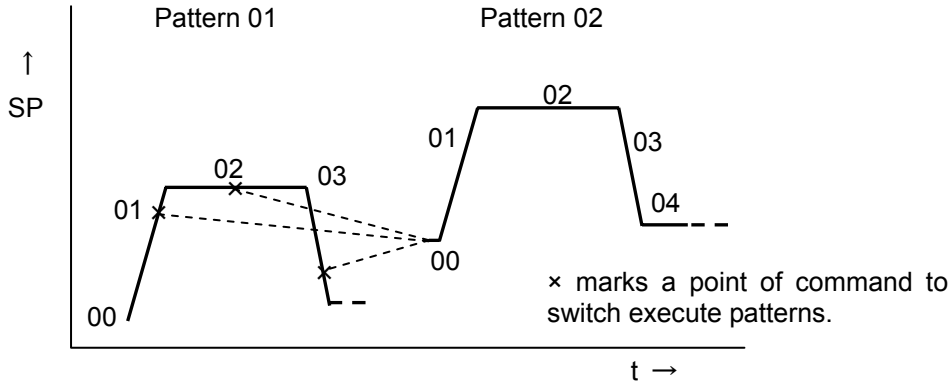
Pressing the PTN and blink the numerals (current execution pattern No.) on the pattern No. indicator.



Choose pattern No. by rotating the DIAL.



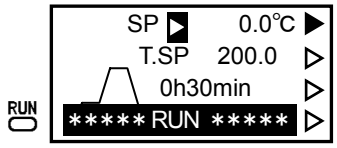
Pressing the ENT here to switch execution patterns. Switching execution patterns resets programs automatically and becomes a new pattern start SP



9.4.3 PROGRAM RUN

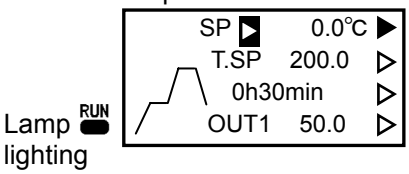
〈Operation〉

Operation screen



Pressing the RUN/STOP during program stop allows to display the message. Press the ENT on this situation.

Operation screen



Programs begin to be executed and the RUN Lamp lights up.

〈Run〉

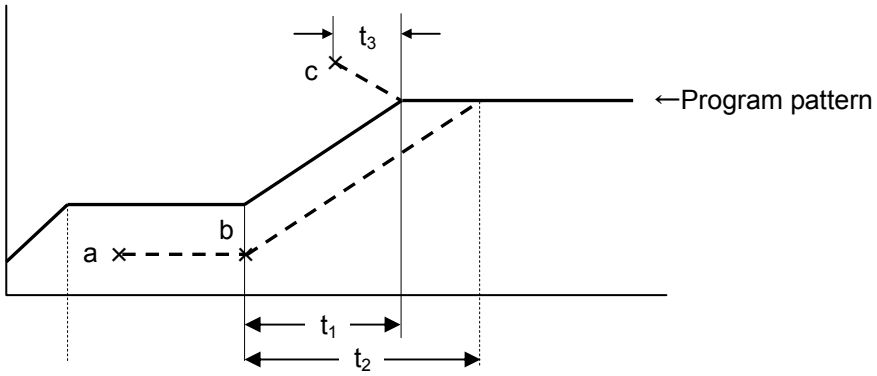
Run starts from the SP just before when you begin to execute programs.

After each function of program ADV, stepping back to the repeat start step, changing of execution SP during program stop, program link and PV start is run and executed, at the start of program execution, it may be out of the straight line (solid line in figure) of set program pattern.

In this case, the program action is different by the situation of set program pattern (broken line in figure).

(1) Keep operation as “a” in figure:
It keeps its level at the current SP for a period indicated in a residual time and then, shifts running to a ramping step as explained in (2).

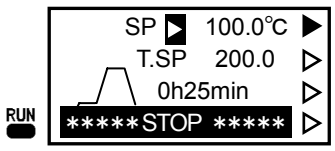
(2) Ramping operation as “b” and “c” in figure:
It is oriented from the current SP to the target SP at the same ramping rate as step data in program pattern.
Thus, the execution time is different (t2 for “b”, t3 for “c”) from the programmed time (t1).



[Caution]
When program is running, you cannot change a constant SP, switching execution pattern by DI contact and key operations, and program ADVANCE and RESET by key operations.

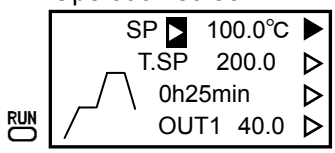
9.4.4 PROGRAM STOP

Operation screen



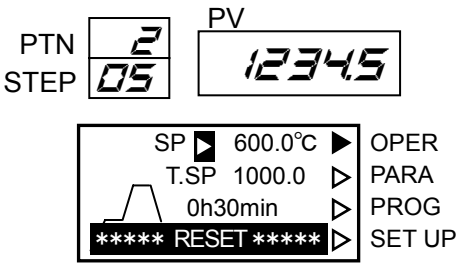
Pressing the RUN/STOP during program run allows you to display the message. Press the ENT on this situation.

Operation screen

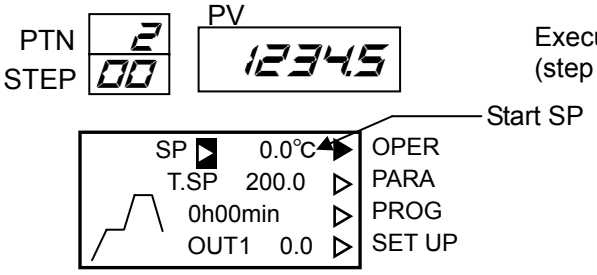


The program stops and the RUN Lamp lights out.
At this moment, the SP value is held at the value just before STOP and residual time stops decreasing.

9.4.5 PROGRAM RESET

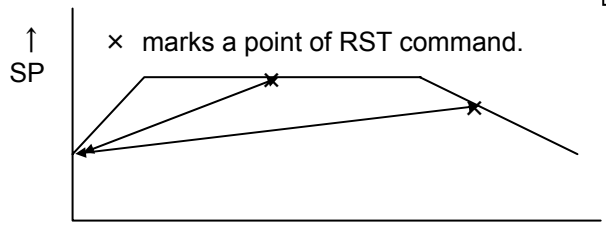


Pressing the RST during program stop allows you to display the message. Press the ENT on this situation.



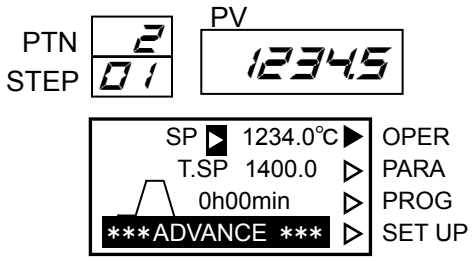
Execution step returns to 00 and becomes start SP (step 00 SP).

[Caution]
When do program RESET for link-to patterns, steps will return to step 00 (start SP) of link-from pattern.

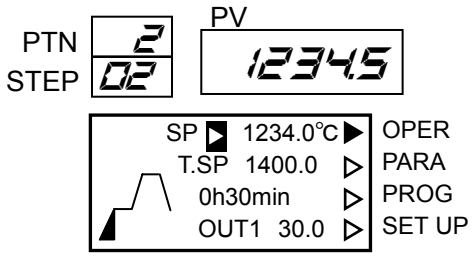


9.4.6 PROGRAM ADVANCE

Advance one execution step.



Pressing the ADV during program stop allows you to display the message. Press the ENT on this situation.



The execution step advances once.

SP at this time is different by program ADVANCE function (title: ADVANCE) at 4:PROGRAM on Setup screen.

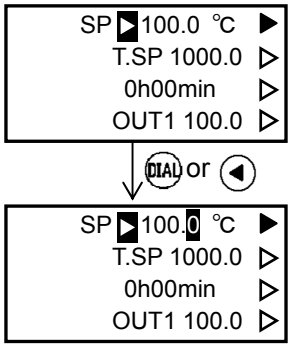
Setting of program ADVANCE function	SP
HOLD	SP in front of an advance is held.
STEP	It is set to target SP of an advance former step. (Example: Execution SP shifts to target SP set at 01 step when an advance is carried out from 01 step to 02 step.)

[Caution]

- When program ADVANCE is carried out at the final step with pattern link, the execution step will move to step 01 of that link-to pattern.
- When program ADVANCE is carried out at the last step halfway during repeat operation, it will move to the next step without returning to the repeat start step. (It slips out of repeat operation.)

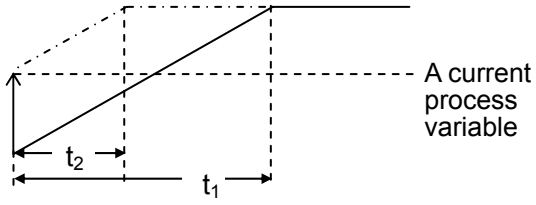
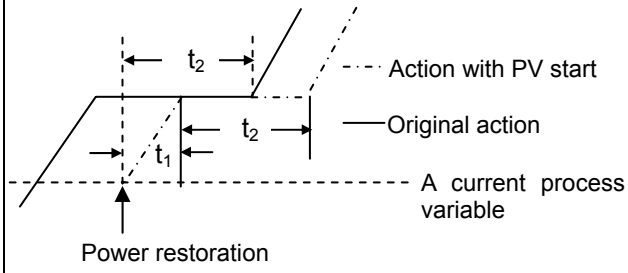
9.5 Constant value operation

In program STOP, it can change execution SP at normal display(1) directly.
Cursor is always displayed on SP during the display in the program STOP at normal display (1).
When press the ENT after changing into the situation that changing is possible with the ◀ or DIAL after changing SP, control is started by new SP immediately.



9.6 Power Failure and Power Restoration during Operation

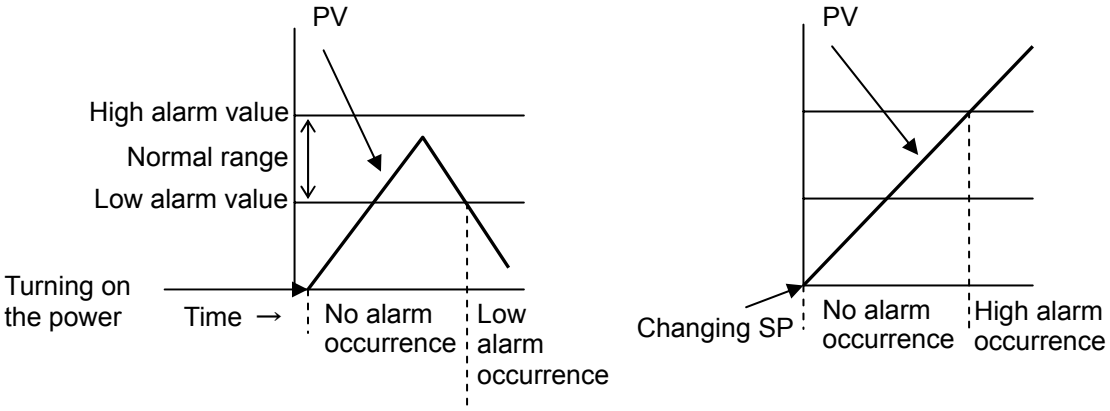
When the power failure occurs during program running, an action at power restoration is different by setting of PV start, setting of preset output, and the situation of execution step. The relationship of these setting and the action are shown in the following table.

<table>
<tr><th colspan="2">Setting</th><th rowspan="2">Step situation</th><th rowspan="2">Action</th></tr>
<tr><th>Use of preset output (11:PRESET on Setup screen)</th><th>Use of PV start (10:PV START on Setup screen)</th></tr>
<tr><td>Used</td><td>————</td><td>——</td><td>It changes to program STOP and MAN (manual control). A preset value is outputted at this time.</td></tr>
<tr><td rowspan="3">Unused</td><td>Unused</td><td>——</td><td>Control is started from execution SP in front of power failure. Residual time and ramping speed are the same before power failure.</td></tr>
<tr><td rowspan="2">Used</td><td>Ramping</td><td>Control is started after execution SP becomes equal to process variable at power restoration. Ramping speed is the same before power failure. Therefore, residual time may be different from it before power failure.
 
</td></tr>
<tr><td>Keep</td><td>If there is no ramping step before the step that power failure occurred, it is the same as the action when PV start is not used. If there is ramping step, after SP becomes equal to process variable, increases or decreases to former hold SP with the ramping speed of the ramping step before the current step. After reaching keep SP, SP is held only in same time as the residual time before power failure.
 
</td></tr>
</table>

10.1 Alarms

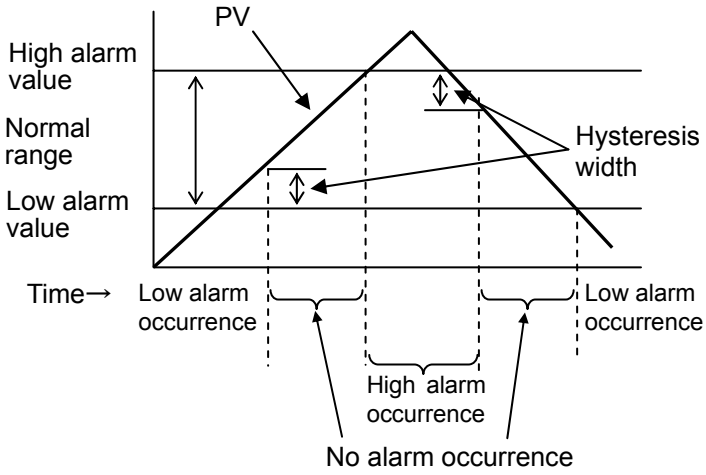
10.1.1 Pause Alarm

This function is validated after turning on the power or after changing the setpoint (SP) or alarm value. An alarm doesn't occur even if it is in an alarm range (both or either of PV and SP at values where an alarm is occurred if usual) if it doesn't pass in a normal range (both PV and SP at values where an alarm is not occurred). The figure below shows an example of PV alarm.



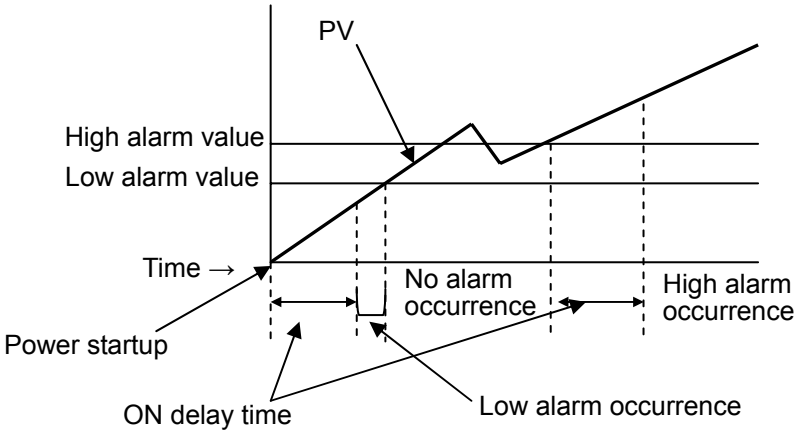
10.1.2 Hysteresis Width

This is the function to continue alarm occurrence in the range of setting hysteresis width when it shifts from alarm range to normal range. It does not function for shift from normal range to alarm range.



10.1.3 ON Delay Time

This is the function to delay alarm occurrence for the setting period when it turned on the power (in alarm range) or when it shifts from normal range to alarm range.



10.2 Input function

10.2.1 Scaling

(1)When inputs are TC and RTD

The bound value of a scaling is committed as a limiter of setting out.

For example, if a scaling is carried out to 0to1200 degrees C in [input] -200to1370, setting out over less than 0 degree C and 1200 degrees C cannot be performed.

(2)When inputs are mV, V, and mA

The display of process variable and SP to an input can be arbitrarily set up in -9999 to 9999 (when the display position is 4), -19999to19999 (when the display position has below no point 5), or -19999to32000 (in the case of with [in the display position] below the point at 5).

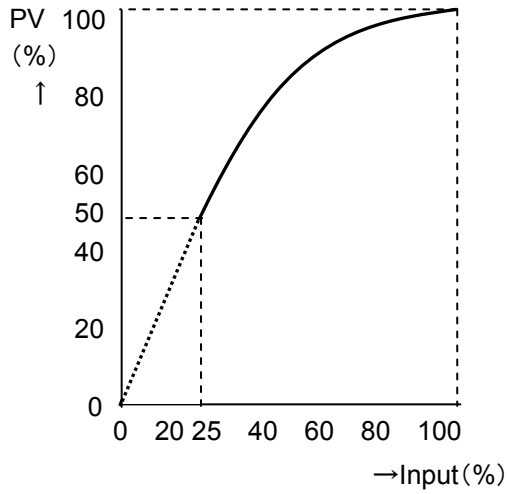
10.2.2 Square Root

Enabled for mV (except 0.0 to ±10.0mV), V, mA input. The following formula is used to calculate the process variable (PV) from input:

$PV = \sqrt{\text{input}} \times 10$

Furthermore, PV= 0 is set compulsorily if input is smaller than the input cutoff level.

Ex.) PV stays 0 until 50% when input cutoff level is set to 25%.



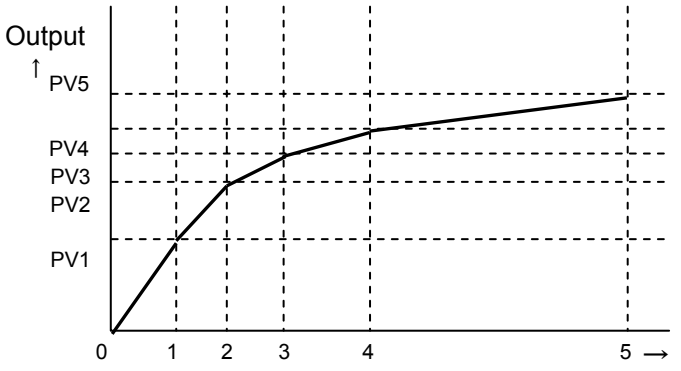
10.2.3 Sensor Correction

Correction value up to ±100.0℃ can be added uniformly to PV in all measurement range. However, it is limited to TC or RTD input. The PV to be displayed and the PV to be used in control are those that added the sensor correction value to the input signal after linearization.

10.2.4 Polygonal line approximation

Input is divided into 10 break points different from normal scaling at the input of mV, V and mA. Input between those points is converted by each straight line (y=ax+b).

Input (mV, V or mA) and output (units indicated in ENG, UNIT) are set to each polygonal line point (No.0 through 9 for 10 points)



If setting input at the polygonal line point is zero except No.0, that polygonal line point is invalid. Polygonal line points for use are No.0 (always for use) and after No.1 until invalid polygonal line point.

Even if setting input is zero, it is invalid after that.

Example : No.0 : Input= 0.00
No.1 : Input=10.00
No.2 : Input=20.00
No.3 : Input=30.00 } Valid
No.4 : Input= 0.00
No.5 : Input=40.00

[Caution]

Set input as gradual increase in Nos. There is a case to malfunction except this setting. Moreover, it is likely to become a display that PV doesn't intend while setting it. Input lower than No.0 is used the straight line between Nos.0 and 1.

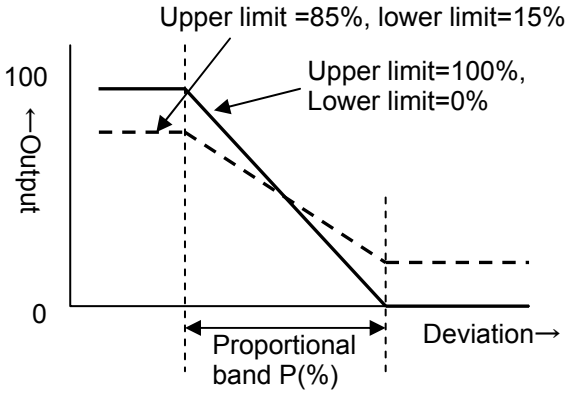
Input higher than No.5 is used the straight line just before (between Nos.4 and 5) (over No.5 for example in Figure).

10.3 Control function

10.3.1 Output Limit

Output limit operates as shown in the figure on the lower. An independent value can be set for each of 1st output and 2nd output. When output limit is changed, proportional band (P value) is compensated automatically.

$$\text{P after compensation} = \frac{\text{New output limit width}}{\text{Old output limit}} \times \text{P before changing}$$

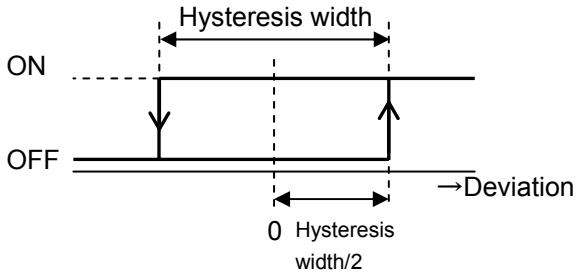


10.3.2 Control STOP

PV display blinks and the preset value is outputted compulsorily when it is changed to Control STOP by surface key, external communication or DI contact. PV display blinking stops and control is started from the preset value when it is changed back to control RUN.

10.3.3 ON-OFF Control Hysteresis Width

Specify the point for output ON/OFF. The value is set as the ratio to scale width.



10.3.4 Anti-overshoot

In case of program operation, it is the function to suppress overshoot (in case of an increasing slope)/undershooting (in case of a decreasing slope) of a control system. If anti-overshoot is set as "used (ON)" on Setup screen, anti-overshoot will work near the target SP of the increasing step and decreasing step of a program.

However, only when all the following conditions are satisfied, anti-overshoot functions.

- PID control
- PID / output limit mode is a single mode or a multi-mode.
- Increasing or decreasing step that the next step is a keep step
- Program AT (P1.2.3 setting) of auto tuning is not set.
- It is not MAN (manual control) or Control STOP.
- The step time of increasing or decreasing step is longer than "I (integration time)/2.4x20."
- It is not an end step of a repeat.

[Caution]

In the following case, anti-overshoot is stopped immediately, and it returns to usual control. Moreover, when the integration time of a ramping step and a keep step differs between PID / output limit in a multi-mode, when it moves to a keep step, it recognizes it as integration time having been changed, and stops anti-overshoot similarly.

- When integration time is changed
- When the setting of a step data is changed during execution

After initiation of near target SP of a ramping step, and the next keep step, a little in between, if anti-overshoot is stopped, some output changes may occur.

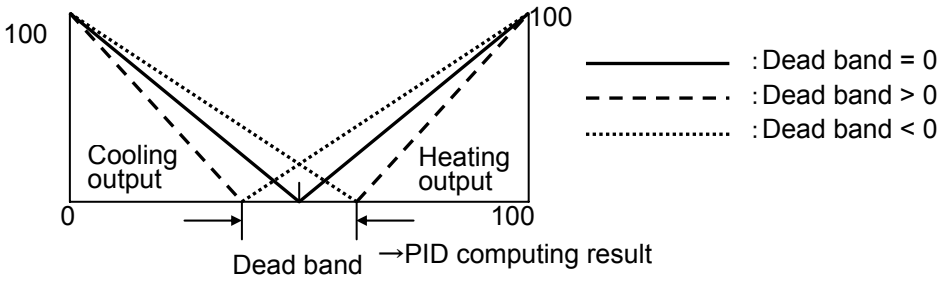
10.3.5 Heat/Cool Control

Heat/cool control outputs the heating output value and cooling output value calculated based on the PID computing results using either PID value for heating side (1st output) or PID value for the cooling side (2nd output). If either is ON-OFF control, PID value for the other side is always used. However, if both heating and cooling are ON-OFF control, deviation (SP - PV value) is used instead of PID computing result. The PID value to be used is selected automatically from PID computing results.

Heating PID is used when PID computing result≧50%.

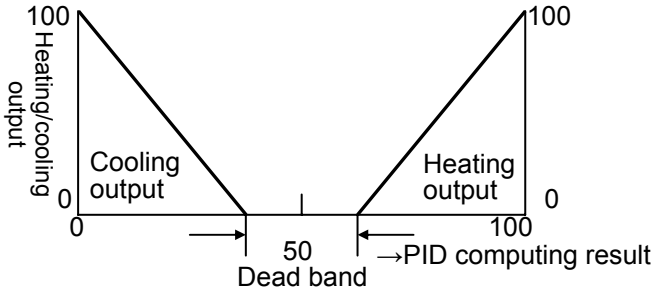
Cooling PID is used when PID computing result＜50%

Dead band functions centering on 50% of PID computing result or 0% deviation (when both outputs have ON-OFF control) (Figure below). Output limit can be set independently for each of heating control and cooling control.

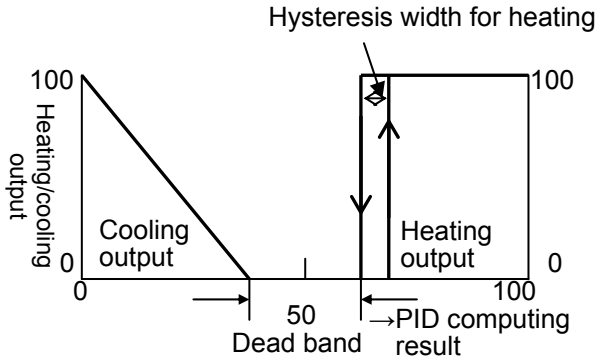


The action in each control mode is as follows (dead band > 0):

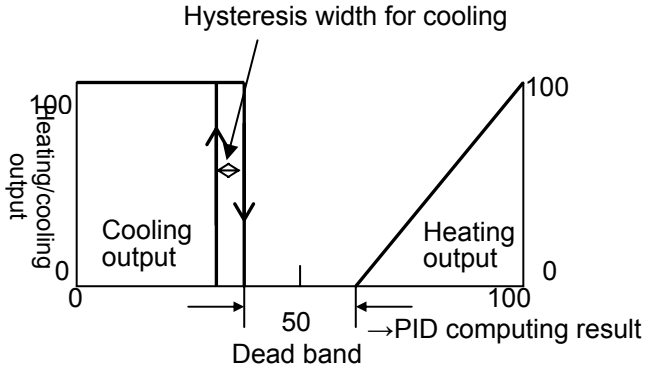
1)PID or PD control for both outputs



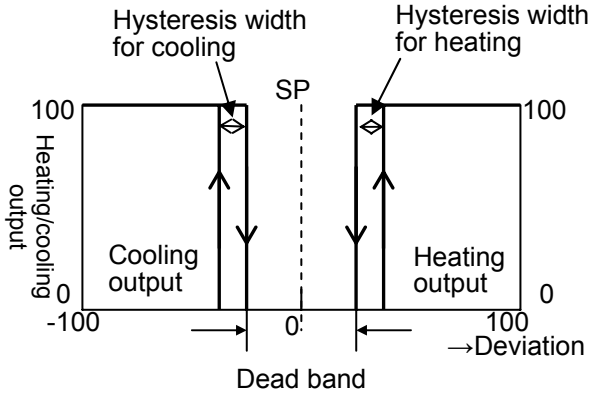
2)ON-OFF for 1st output, PID control for 2nd output



3)PID for 1st output, ON-OFF control for 2nd output



4)ON-OFF control for both outputs



[Caution]
When heating/cooling control is used, control reverse/direct action cannot be switched. Heating side is fixed to reverse action and cooling side to direct action.

	Trouble	Cause	Remedy
Display and setting	Nothing is displayed.	Power supply is not input correctly.	Check the power supply voltage and power supply wiring. If power supply voltage and wiring are correct, contact our dealer where you purchased the instrument or our sales representative.
	If press the DIAL or ◀ at the time of setting, a message is displayed and it cannot set.	It is in the situation that it cannot set.	Deal according to the description of the message. (Error message ... page 18)
	Normal SP cannot be set.	Remote SP is being executed.	Switch SP remote/local to local
		Ramping is being executed.	Set the SP No. back to 0.
		Automatic tuning is being executed.	Wait for completion of automatic tuning or stop it.
	PID cannot be set.	Automatic tuning is being executed.	
	PV displays H or L.	Input exceeds the PV error upper and lower limit value.	Check the input wiring and sensor. If wiring and sensor is correct, check the PV error upper and lower limit value settings.
	AD ERROR is displayed. *1	There is failure in input circuit.	If the same phenomenon is seen even when input terminal is short-circuited, contact our dealer where you purchased the instrument or our sales representative.
	TA ERROR is displayed. *1	Atmosphere for use is outside that range of -20 to 80℃.	Check the atmosphere for use and contact our dealer where you purchased the instrument or our sales representative if it is within the range.
	FERAM ERROR is displayed. *1	There is failure in non-volatile memory.	If the same phenomenon is seen after All reset and change of input type, contact our dealer where you purchased the instrument or our sales representative.
	CAL ERROR or NEED CAL is displayed. *1	There is an error in calibration data.	Contact our dealer where you purchased the instrument or our sales representative.
	IN TIME OUT or EXT TIME OUT is displayed. *1	There is an error in optional card.	Contact our dealer where you purchased the instrument or our sales representative.
	PV display is shifted.	Wrong setting of input type, sensor correction, etc.	Check the items in SU1 on the Setup screen.
		Error, misconnection, etc. at detector or compensating lead wire.	Check the detector, compensating lead wire, connection, etc.
	Abnormal value or character is displayed on PV.	There may be error in CPU.	Execute power re-startup, All reset, or change of input type. If the same phenomenon is still seen, contact our dealer where you purchased the instrument or our sales representative.
	CPU ERROR is displayed.*1		

	Trouble	Cause	Remedy
Control	Output is not transmitted.	Restriction by output limit, MAN operation, automatic tuning being executed, control STOP, etc.	Remove each cause.
		Error display by self diagnostics PV has H or L display.	Remove each cause.
	PV does not match SP.	Insufficient heater POWER, restriction by output limit, inappropriate manual reset value for PD control, etc.	Remove each cause.
	Control is not favorable.	Inappropriate control parameter (PID, etc.)	Execute tuning.
Alarm	Alarm does not function.	DO function selection is wrong or is on pause.	Check the DO function selection and pause alarm.

[Caution]
*1 is nonconformity revealed by the self diagnostics function of this instrument. In such cases, the preset value or output lower limit value is output. It is also output when PV has H or L display. Furthermore, the DO contact set in **FAIL** turns ON in case of nonconformity found by self diagnostics function.

Pattern No. ________ Program name ________________________________

Comment ________________________________

Step No.	SP	Time	DO				DI				Multi-No.		Guarantee soak	END
											PID	Limit		

For questions about this instrument, please inform us of the model number and manufacture number inscribed on the nameplate inside the instrument (or on case surface).

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