EC5500R
Digital Indicating Controller
Instruction Manual

DRAFT

Ohkura

WXPEC5500R01E
JLY 2005 (1st edition)

For Safety Using

Thank you for purchasing our EC5500R Digital Indicating 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.
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	Do not use 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 personnel. (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.
Maintenanc	It is prohibited to remove or disassemble the unit, printed circuit board, etc. by anyone except our service personnel and persons with our approval.
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.
Toll free number	(For questions about industrial measuring instruments) For questions about product handling and maintenance: 0120-17-0096

How to Use This Instruction Manual

This instruction manual consists of “For safety using”, “Table of Contents,” and “Chapters 1 to 10” as follows. Read the applicable pages to suit your purpose:

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

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

Type of Instruction Manual

	Name	Description
This manual ➧ 1	EC5500R Digital Indicating Controller Instruction Manual WXPEC5500R01E	Describes the general information on EC5500R including installation, wiring, operation and functions.
2	RS-232C/RS-422A/RS-485 Interface Instruction Manual WXPEC5500R02E	Describes the setup, communication protocol, etc. for using communication.
3	AO, Isolated Remote SP Instruction Manual WXPEC5500R03E	Describes AO, isolated remote SP wiring, setup and functions.
4	Expansion Interface, Servo Drive Output Instruction Manual WXPEC5500R04E	Describes servo drive and expansion interface wiring, setup and functions.

This instruction manual describes the information to be referred with caution when using the product 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.

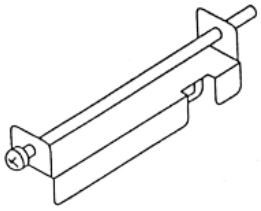
Table of Contents

Chapter 1 When Product Arrives

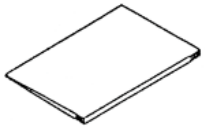
1.1 Checking the Accessories

When this product 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.

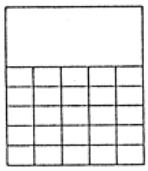
This instrument has the following accessories:



Mounting fixture (2)



Instruction manual (this document)



Unit seal (separately sold)

1.2 Checking the Type

EC550□R□□ □ □□

①1st output

1	Relay
2	SSR drive
3	————
4	————
5	4 to 20mA
6	0 to 5mA
7	————
8	Multi output

②Number of output output points

0	2
1	4 (optional)

③Built-in options

0	No
2	Isolated remote SP
5	AO
6	AO, Isolated remote SP

④Expansion options

0	No
1	ARCNET®
2	Servo drive
3	ARCNET® Servo drive

⑤2nd output

0	No
1	Relay
2	SSR drive
3	————
4	————
5	4 to 20mA
6	0 to 5mA

⑥Special

0	No
Z	Yes

[Caution]
When the number of contact output points (standard), contacts DO3 and DO4 are not output. However, the functions are available and similar setup to DO1 and 2 is possible. The condition can be checked by alarm/event display lamp.

ARCNET® is a registered trademark of the U.S. DATAPOINT.

1.3 Display

[Reference] Display character correspondence table

The display characters used in this instrument and the alphabets indicated by them are shown in table below:

Display character												
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L
Display character												
Alphabet	M	N	O	P	Q	R	S	T	U	V	W	

[Reference] Protective sheet

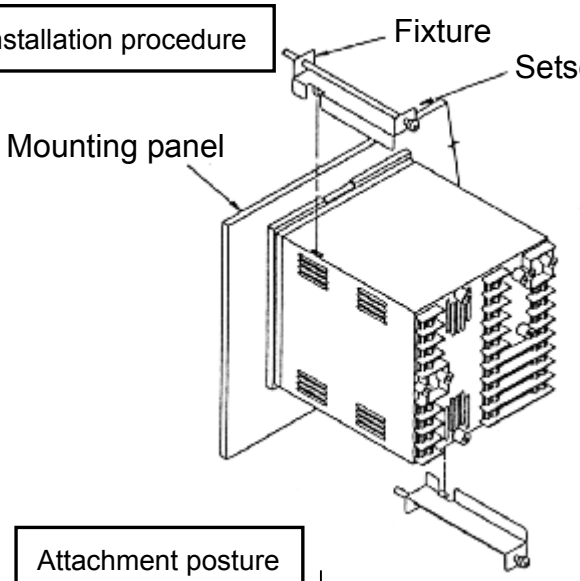
Protective sheet is attached on the front face of this instrument for surface protection. It will use the instrument, remove this sheet.

Chapter 2 Installation

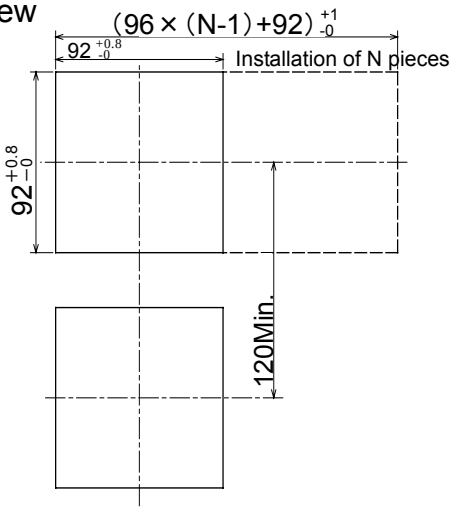
Install this product by establishing holes according to the panel cut drawing and fixing it with the accessory fixtures.

(Unit: mm)

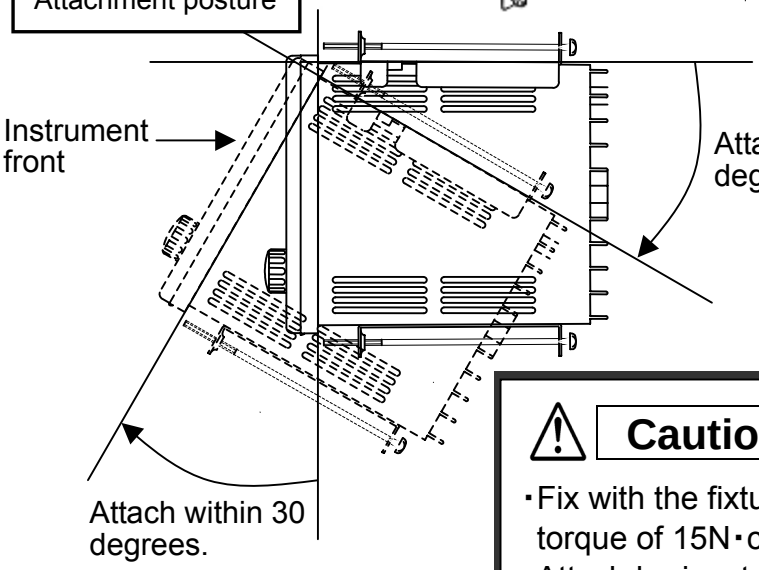
Installation procedure



Panel cut



Attachment posture



Caution **Attachment procedure**

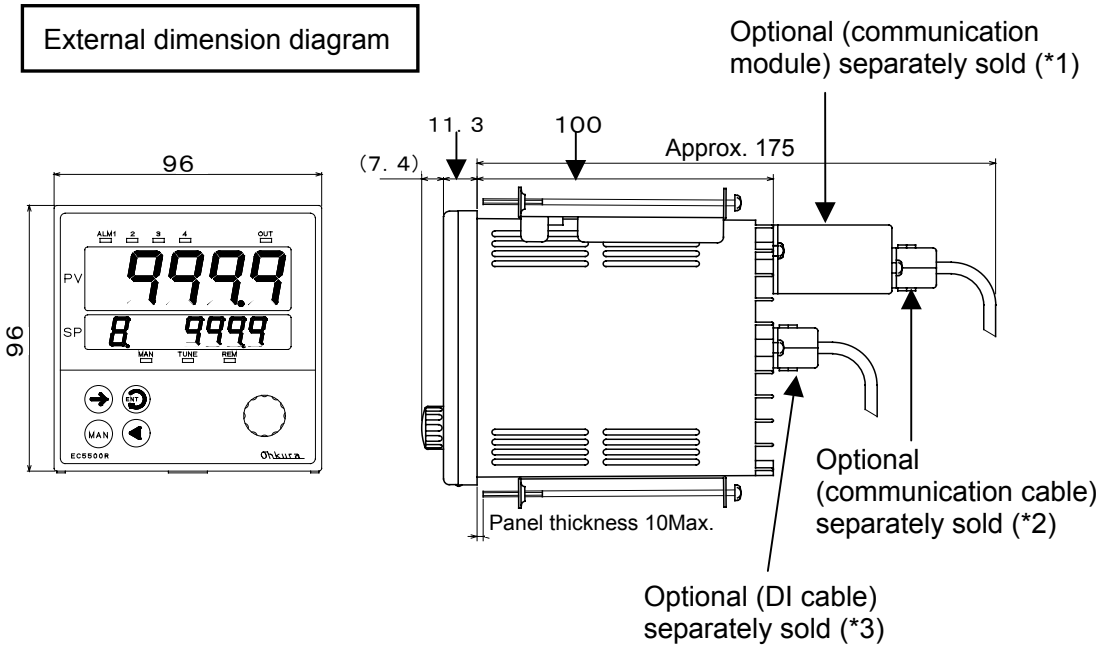
- Fix with the fixture tightening torque of 15N·cm or smaller.
- Attach horizontally and upward angle or 30 degrees or smaller and no downward angle.

Caution **Attachment position**

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

- ○ 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

External dimension diagram

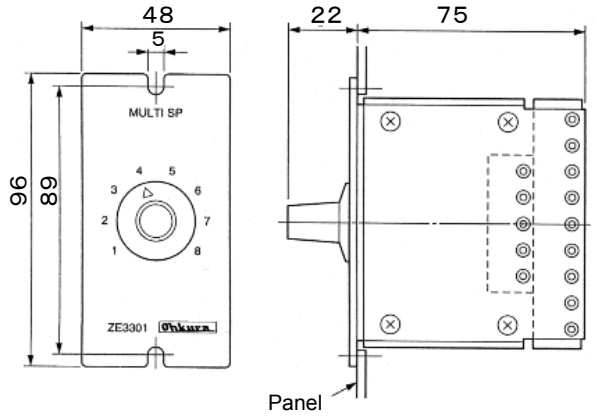


Separately sold products Type

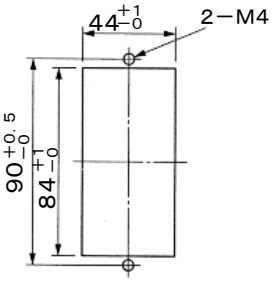
	RS-232C	RS-422A	RS-485
*1 Communication module	ZE7101A0110	ZE7101B0408	
*2 Communication cable	HMSU2255B02	WMSU0075A01	WMSU0075A02

*3 DI cable HMSU2695A01:1m
HMSU2695A02:5m

External dimension diagram for Multi-setpoint selector



Multi-setpoint selector panel cut

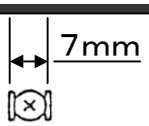


Chapter 3 Wiring

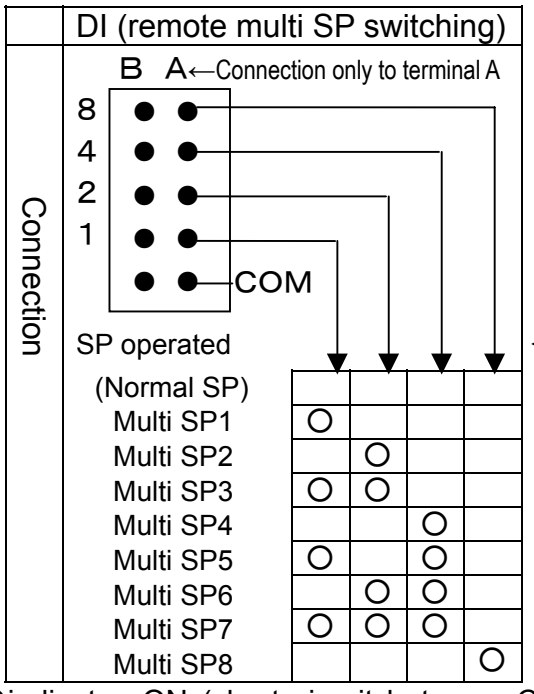
⚠ Warning

- 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.

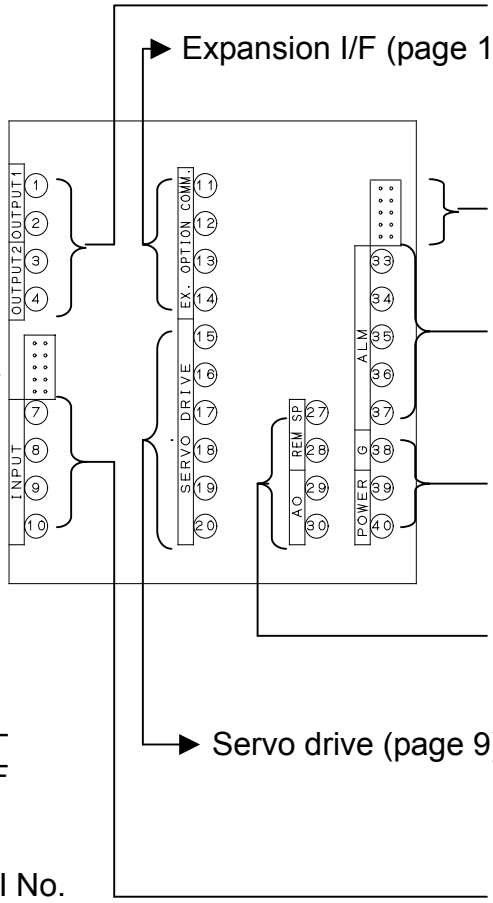
⚠ Caution



- Use a round 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 clearly label that it is the power supply switch for this instrument.



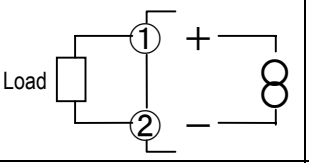
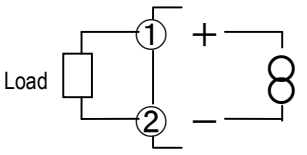
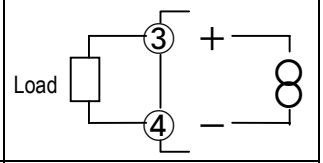
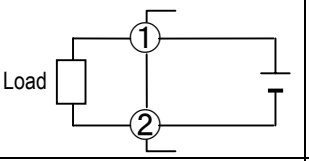
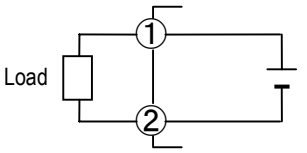
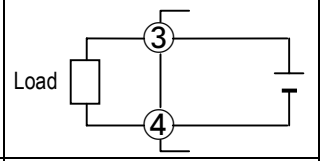
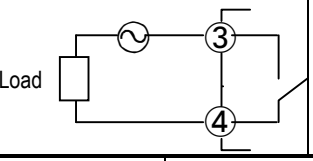
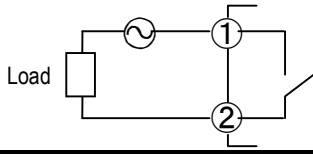
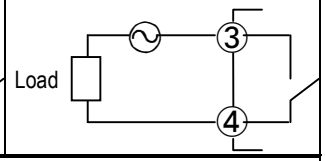
○indicates ON (short circuit between COM-applicable terminal) and blank indicates OFF (open). Do not use terminal B.



Correspondence between terminal No. and DI No.

DI No.	1	2	3	4
Terminal No.	1	2	4	8

Connection with exclusive multi-setpoint selector ☞ (page 11)

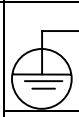
	Output	Single output	Dual output	
			1st output	2nd output
Connection	Current			
	SSR drive			
	Relay			

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

☞ RS-232C Communication Module Instruction Manual HXZE7101A01E
RS-422A/RS-485 communication module instruction manual HXPZE7101B04E

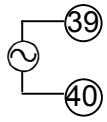
Grounding

Connection



Type D grounding (Protective grounding)

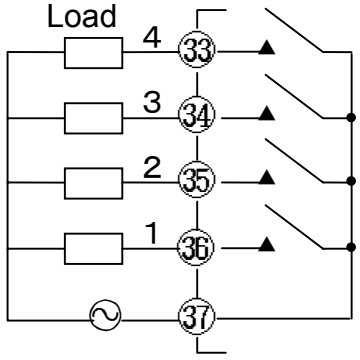
Power supply



100 to 240VA
50 / 60Hz

Alarm output（ALM）

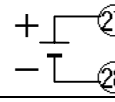
Connection



250VAC 0.5A (resistive load)

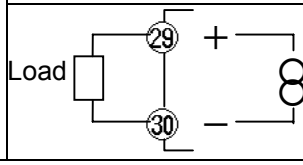
Remote SP (Optional)

Connection



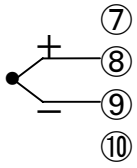
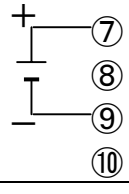
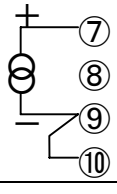
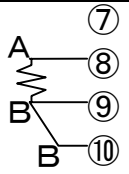
1 to 5V or 0 to 5V input

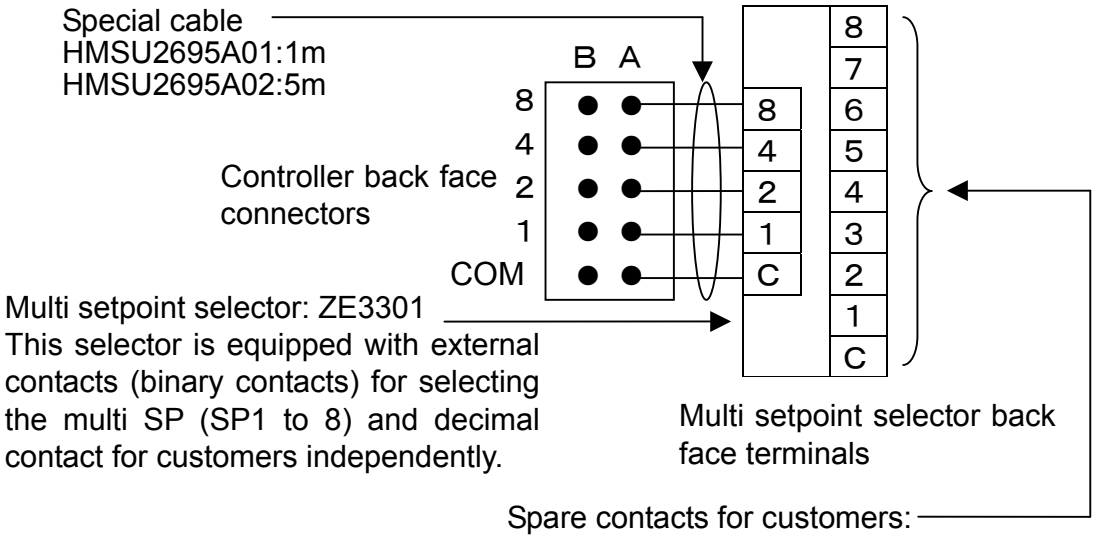
Analog retransmission (optional)



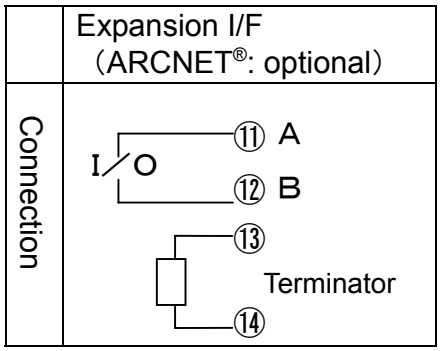
4 to 20mA or 0 to 20mA output

AO, Isolated Remote SP
☞ AO, Isolated Remote SP Instruction Manual WXPECEC5500R03E

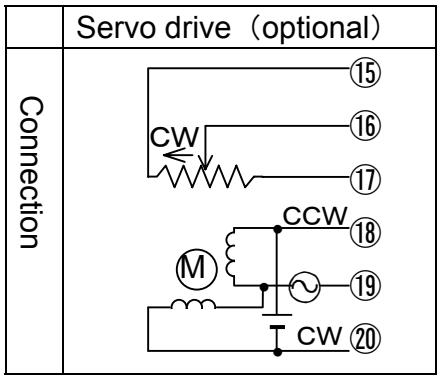
Input	Thermocouple (TC) voltage（mV）	Voltage（V）	Current (mA)	Resistance tempera-ture detector（RTD）
Connection				



Expansion I/F



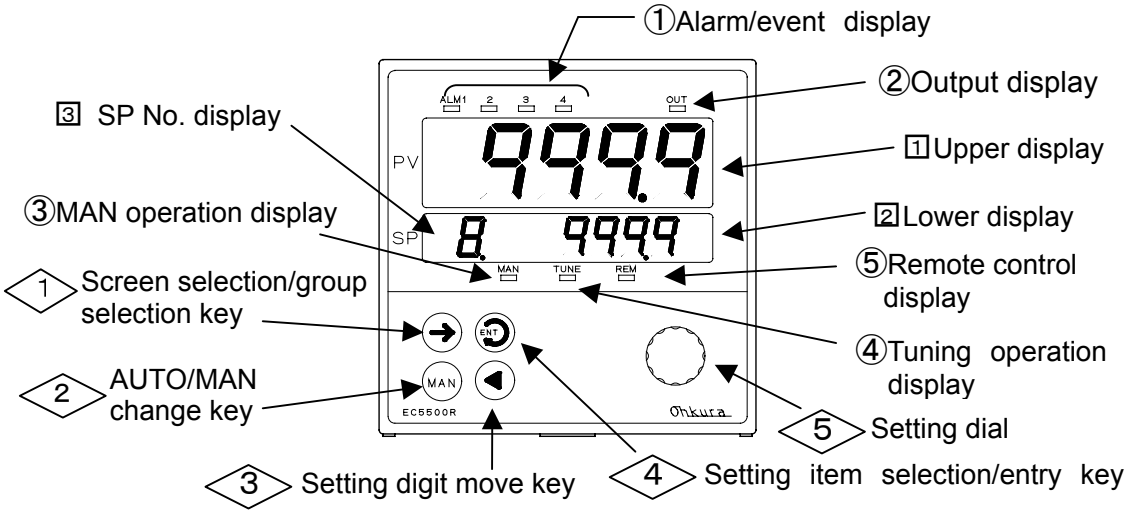
Servo drive



Expansion I/F, servo drive

☞ Expansion Interface, Servo Drive Output Instruction Manual WXPEC5500R04E

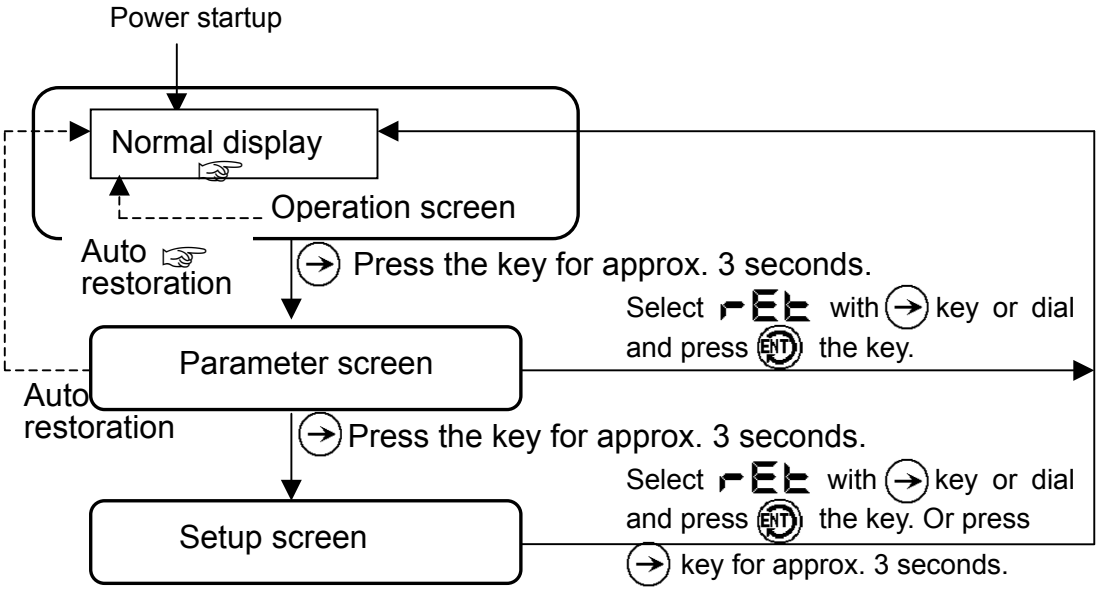
Chapter 4 Part Names



No.	Key/ dial	Function	Chapter/section for reference
1	→	Switch the screen (Operation, Parameter or Setup) and the group on screen.	Sec. 5.1, 5.2, Chapter 6
2	MAN	Switch output indication and automatic (AUTO)／manual (MAN) operation.	Sec. 8.1, 8.2
3	◀	Give data change permission and move the digit for data change.	Sec. 5.3
4	ENT	Switch the display item within a group and register the data.	Sec. 5.2, 5.3, Chapter 6
5	○	Switch the groups on Parameter screen and Setup screen and change the data.	Sec. 5.2, 5.3, Chapter 6
No.	Display	Function	Reference
1	Upper	Display the PV(process variable) or characters that indicate the item name.	Chapter 6, 7
2	Lower	Display SP(setpoint) or various data (numeric values or characters).	Chapter 7
3	SP No.	Used only on Operation screen. Display multi SP No. (at SP display), output No. (at output display) or the characters that indicate item.	Chapter 6, 7
No.	Lamp	Function	Reference
①	ALM 1- 4	Blink during alarm occurrence or when the function assigned to each of DO 1 ～ 4 is executed.	Sec. 5.6.3, 9.1
②	OUT	Light up at the brightness depending on the output value. The light goes off at output = 0%.	———
③	MAN	Light up at MAN (manual control). Blink while the → key is pressed at screen switching or during AUTO/MAN switching standby when the MAN key is pressed.	Sec. 8.1, 8.2
④	TUNE	Blink during automatic tuning and light up during Self tuning.	Sec. 8.4, 8.5
⑤	REM	Light up at communication remote or SP remote.	Sec. 8.6

Chapter 5 Basic Operation and Setting

5.1 Screen Type



Screen name	Description
Operation screen	This is the screen for indicating/setting of PV, SP, output value, Tuning and PID necessary for operation.
Parameter screen	This is the screen for setting/confirming the parameters including the PID and alarm for operation.
Setup screen	This is the screen mainly for determining the system functions such as input type and control method.

[Reference]
Relationship between the operation of each screen and displayed information is shown in Chapter 6 “Operation Guidance.” In addition, detailed information, setting range and initial value for each item is shown in Chapter 7 “List of Items.”

☞ **[Reference] What is normal display?**
PV (upper display) and SP (lower display) are displayed at AUTO operation, and PV and output value (lower display) are displayed at MAN operation. Normal display is displayed at turning on the power, auto restoration, returning from Parameter or Setup screen to Operation screen.

☞ **[Reference] What is Auto restoration?**
It is the function to return to normal display when no key or dial operation is made for more than 1 minute.

[Reference] If you are lost on which screen it is,
Press the key several times. The screen can be distinguished by the information on the upper display.
PA n（n is a numeric value）… Parameter screen
SU n（n is a numeric value）… Setup screen

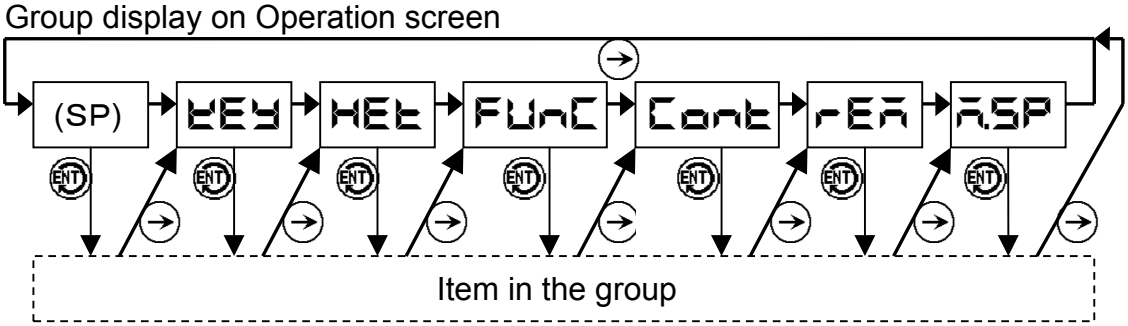
5.2 Selection of Group/Item on Screen

[Reference]What is a group?
There are several “groups” classifying the items by kind on each screen. Each group is given with a name that indicates the kind. Group name is displayed on the upper display (except for SP or output display) on Operation screen and on lower display in group display on Parameter screen and Setup screen.

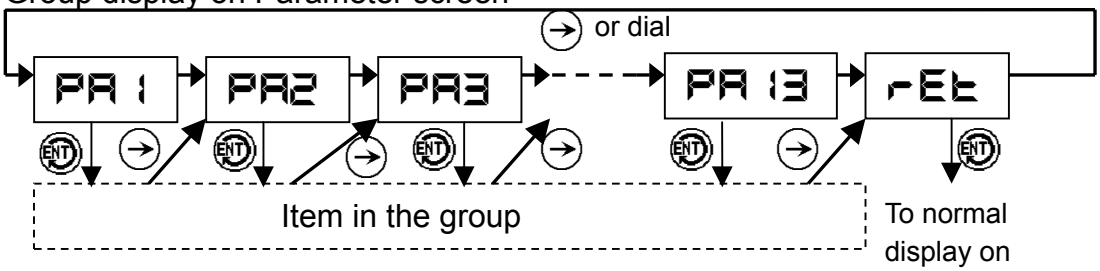
Select the item (use → key) after group selection (use ENT key or dial).

[Reference]
When group display of Parameter screen (upper display is PA n（n is a group number of 1 to 13）or rEt) or Setup screen (upper display is SU n:（n is a group number of 1 to 13）or rEt) is displayed, the group can be changed by the dial as well. When the dial is turned clockwise, the group changes in the same direction as the → key, and in the opposite direction as the → key when it is turned counterclockwise. Pressing the → key when the item in a group is displayed will switch the display to the next group number.

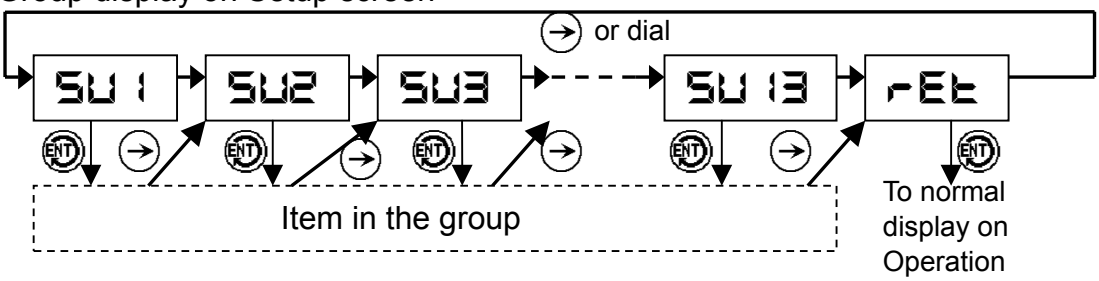
Group display on Operation screen



Group display on Parameter screen



Group display on Setup screen



[Caution]
It is only for group display on Parameter screen or Setup screen where the group can be selected with the dial. Please note that turning the dial in other cases will enable setting.

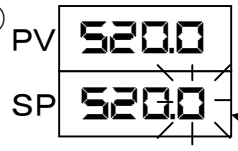
5.3 Data Setting Procedure

Data is classified as “numeric data” and “character data.” Numeric value blinks when change is enabled for numeric data, and the decimal point blinks for character data. It is set up by the following procedure:

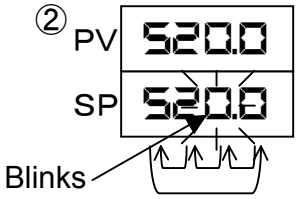
[Caution]
If there is no key or dial operation for more than 10 seconds while change is enabled, the value being changed is invalidated (original value is recovered) and change is disabled.

5.3.1 Numeric Data

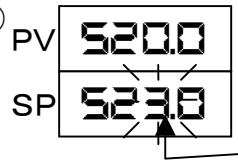
Change in SP is shown as an example.

① 

The lowest numeric value blinks when the ◀ key is pressed or dial is turned by 1 click, indicating that change is enabled.

② 

The digit to be changed is selected by pressing the ◀ key. Every time the ◀ key is pressed, blinking value moves in order indicated by the arrow in figure on the left. The blinking digit is subject for change. However, value of other digit may be changed as well if there is carrying/borrowing.

③ 

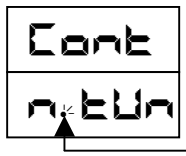
The value of the subject digit to be changed is changed by turning the dial. The desired value is set using the ◀ key or dial.

④ 

The value is registered by pressing the ENT key. The value blinking stops and the display returns to usual display.

5.3.2 Character Data

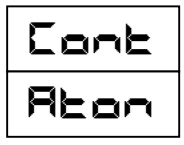
Turning ON automatic turning is used as an example.

① 

The decimal point on the 4th digit blinks when the ◀ key is pressed or the dial is turned for 1 click, indicating that change is enabled.

② 

Desired data (character) is selected by turning the dial.

③ 

The data (character) is registered by pressing the ENT key. Blinking of the decimal point stops.

[Reference] When – – – – is displayed
If – – – – is displayed when the ◀ key or dial is operated to enable change, it means that the item cannot be set. – – – – display disappears in approximately 2 seconds and returns to the original display.

5.4 System Setup

The basic functions of this controller are as shown in the following table at factory setting. To use with settings other than that of factory setting, press the (→) key for about 6 seconds to display the Setup screen and then change on the specified displays. To change multiple items, change in the order of the table below:

No.	Item	Screen position	Factory setting
1	Input type ☞ Input list (page 17)	**SU1**	K1
2	Use of square root (for mV, V, mA input)	**SU1**	Not used
3	Scaling	**SU1**	-200 to 1370℃
4	Output type (not required for dual output specification)	**SU2**	mA
5	Control mode	**SU2**	PID
6	Control reverse/direct action	**SU2**	Reverse action

[Caution]
To change multiple items, be sure to follow the order of the No. 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.
In such cases, check the data and change again if the data is factory setting.

[Caution] Data initialization by change in basic functions
Please note that change in 1 to 6 of the previous page 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: Input type	All data except SU6 on Setup screen
2: Use of square root	All data on Operation screen, all data on Parameter screen except PA2 and PA12, sensor correction, scaling, PV error upper and lower limit
3: Scaling (when input is TC or RTD)	SP, SP No., bias, emergency SP, and PA1 on Parameter screen, and sensor correction
3: Scaling (when input is mV, V, mA)	SP, SP No., bias, emergency SP, up/down rate, all data in CONT group on Operation screen (except control RUN/STOP), all data on Parameter screen except PA2 and PA12, sensor correction, PV error upper and lower limit
4: Output type 5: Control mode 6: Reverse/direct action	All data in CONT group on Operation screen (except control RUN/STOP), all data in PA3 to 11 and PA13 on Parameter screen, PID mode, SP No./PID No. selection, preset output, use of present output, use of gapped control, use of profiling

Input list

Input	Code	Input range
TC (thermocouple) input		
B	b	0 to 1820℃
R	r 1	0 to 1760℃
R	r2	0 to 1200℃
S	S	0 to 1760℃
K	K 1	-200 to 1370℃
K	K2	0 to 600 ℃
K	K3	-199.9 to 300.0℃
E	E	-199.9 to 700.0℃
J	J 1	-199.9 to 900.0℃
J	J2	-199.9 to 400.0℃
T	t	-199.9 to 400.0℃
WRe5-26	C	0 to 2320℃
N	n	0 to 1300℃
PR40-20	Pr	0 to 1880℃
PLⅡ	PL	0 to 1390℃
U	U	-199.9 to 400.0℃
L	L	-199.9 to 900.0℃
Au-Fe	AUFE	0.0 to 300.0K

Input	Code	Input range
DC voltage, DC current input		
mV	10	-10.0 to 10.0mV
mV	20	0.0 to 20.0mV
mV	50	0.0 to 50.0mV
V	1-5	1.0 to 5.0V
V	0-5	0.0 to 5.0V
V	0- 10	0.0 to 10.0V
mA	4A	4.0 to 20.0mA
RTD (resistance temperature detector) input		
Pt 100	Pt0	-199.9 to 850.0℃
	Pt 1	-199.9 to 300.0℃
	Pt2	-150.0 to 150.0℃
JPt 100	JPt0	-199.9 to 650.0℃
	JPt 1	-199.9 to 300.0℃
	JPt2	-150.0 to 150.0℃

5.5 All Reset

All Reset is the operation to return to the factory setting all parameters except for basic settings. To perform All Reset, press (→) key and (ENT) key simultaneously for more than 3 seconds.

[Caution] Data initialization by All Reset

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

Group	Maintained item
SU1	Input type, reference junction compensation, square root, input cutoff level (when square root is used), scaling
SU2	Output type (at multi output), control mode, control reverse/direct action, cycle time, output hysteresis width
SU3	DO function selection
SU4	DI function selection, SP No./PID No. selection
SU6	Communication address, Baud rate, communication type

5.6 Setting Items of Each Function

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

5.6.1 Set the Controlled SP Each Time

Order	Item	Screen/group	Factory setting
①	Set the normal SP.	SP	0
②	Set the normal PID and MR (Manual Reset: at PD control). It can be calculated automatically by automatic tuning or Self tuning (only for PID control).	on Operation screen	P: 2.0% I: 3.00 min. D: 0.00 min. MR: 50%

[Caution] Normal SP and Normal PID
They are used as the SP and PID when multi SP is disabled. Normal SP is set on normal display in AUTO. If multi SP is enabled, 8 kinds of multi SP and multi PIDs that form couples with each multi SP can be used beside this normal SP.

5.6.2 Switching SP registered beforehand

Order	Item	Screen/group	Factory setting
①	Set the use of multi SP to “Used”.	□□□ on Operation screen	Not used
②	Set the multi SP.	SP	0
③	Set the multi PID and MR (for PD control). It can be calculated automatically by automatic tuning or Self tuning (for PID control only).	Manual setting: **PA3** to **PA10** (corresponds to from PID1 to 8) or □□□□ on Operation screen (only PID and MR in execution)	P: 2.0% I: 3.00 min. D: 0.00 min. MR: 50%
④	Set the up/down rate. *1	□□□on Operation screen	OFF(0)
⑤	Switch the multi SP. *1		SP0 (normal SP)

※1：Action for ④、⑤ ☞ Section 8.3.2 (page 40)

5.6.3 Use of Alarms

Order	Item	Screen/ group	Factory setting
①	Alarm function is determined.	**SU3**	DO1: Deviation high alarm DO2: Deviation low alarm DO3: Deviation absolute value alarm DO4: Fail (it is not an alarm.)
②	Set the alarm value .	**PA1**	DO1: + scaling width DO2: - scaling width DO3: + scaling width DO4: None Scaling width ☞
③	Set the pause alarm, hysteresis width and ON delay time.		No pause alarm, hysteresis width = 0, ON delay time = 0

[Caution]

- Set the functions of ALM (alarm) 1 to 4 and the alarm values at DO1 to DO4 of SU3, PA1.
- When the number of contact output points is 2 (standard), ALM3 and ALM4 are not outputted. However, functions are available and setting similar to ALM1 and 2 is possible. The status can be checked with alarm/event display lamp.

[Caution] Initialization by changing alarm functions

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

[Reference] Alarm type and functions

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☞ Section 9.1):

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

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

It indicates “scaling upper limit – scaling lower limit.

5.6.4 Gapped Control (Nonlinear Control)

Order	Item	Screen/ group	Factory setting
①	Switch the gapped control setting to “Enabled”.	**SU2**	Disabled
②	Set the gap width and gap gain.	**PA13**	Gap gain = 0.01, gap width = 0

5.6.5 Remote SP

Order	Item	Screen/ group	Factory setting
①	Set remote SP range and use of emergency SP of isolated remote SP, or local address of expansion interface.	Isolated remote SP: **SP7**	1 to 5V input, No emergency SP
		Expansion I/F: **SU10**	Local address = 0
②	If built-in option isolated remote SP and expansion option expansion interface are both equipped, whether expansion I/F remote SP is used is selected.	**SU10**	Expansion I/F remote SP not used (isolated remote SP used)
③	Select the PID mode (normal PID/programmed PID). *2	**SU2**	Normal PID
④	Select the SP No./PID No. selection (SP No. switching/PID No. switching). *2	**SU5**	SP No. switching
⑤	Switch the SP remote/local switching to SP remote. *2	□□□ on Operation screen	SP local

※2：Relationship between setting and action for ③, ④, and ⑤

☞ Section 8.6 (page 43)

5.6.6 Profiling Control

This is the operation when it is used as master controller on profiling control. In case of using as a slave controller, set the items shown in “Section 5.6.5 Remote SP.”

Order	Item	Screen/ group	Factory setting
①	Switch the profiling control to “Enabled”.	**SU2**	Disabled
②	Select the transmission method to slave controller. In case of using AO, set AO range and output source. In case of using expansion I/F, set local address, master, output source and slave addresses. It is not required when transmitting by current from control output terminal.	AO: **SU8**	4 to 20mA, PV output
		Expansion I/F: **SU10**	Local address= 0, slave

For setting details of AO, isolated remote SP

☞ AO, Isolated Remote SP Instruction Manual WXPEC5500R03E

For setting details of expansion interface

☞ Expansion Interface, Servo Drive Instruction Manual WXPEC5500R04E

5.7 Key Lock

The key lock is the function to prevent setting by mistake. Set the key lock type in SU5 on Setup screen, and “Lock”/”Unlock” is specified in LEY on Operation screen. The key lock type and key lock subjects are shown as follows. Furthermore, the key lock type is set to at the factory setting:

Key lock type	Subject
oFF	Key lock does not function.
ALL	Key lock type setting, key lock/unlock switching, AUTO/MAN switching and output setting for MAN are possible even under key lock. All other functions are subject for key lock.
n.SP	Key lock type setting, key lock/unlock switching, AUTO/MAN switching, output setting for MAN, normal SP setting, multi SP setting and multi SP No. switching are possible even under key lock. All other functions are subject for key lock.
SU	Those setting on Setup screen except for key lock type settings are subjected. All other settings are possible even under key lock.

[Caution]
It becomes automatically “Lock” if the key or dial is not operated for more than 1 minute even when it is switched to “Unlock” on Operation screen when the key lock type is set to other than oFF.

Chapter 6 Operation Guidance

This chapter shows the transition chart of the display and the key operation.

[Reference] How to look at guidance

→ : (ENT) key movement ➡ : (→) key movement

Bold frame: Displayed for factory setting

Broken line frame: Displayed for optional equipment

Italic: Cannot be set up.

* mark: There are conditions for display.

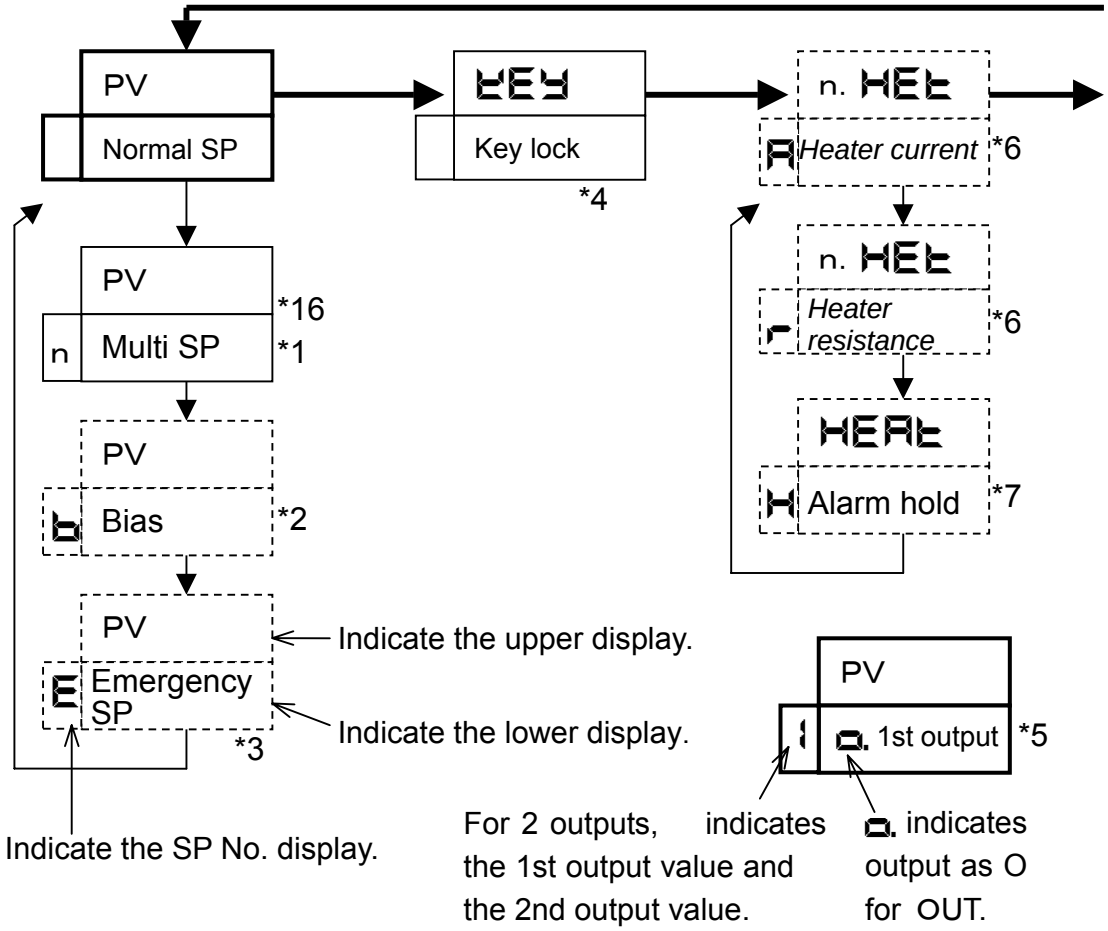
[Caution] Normal display and SP display

Displayed information for normal display, normal SP display and multi SP display vary as shown in the table below depending on the control status during AUTO operation. Furthermore, normal display is the 1st output display during MAN operation:

Control status	Lower display at normal display (at power startup)	Normal SP display	Multi SP display
Normal SP control	Normal SP	Blank on SP No. display	Multi SP No. display blinks (however, it is not displayed for factory setting since “multi SP is disabled.”)
Ramping control	Normal SP	Ramping SP is displayed and the decimal point for SP No. display blinks.	Decimal point on SP No. display blinks.
Multi SP control	Multi SP	No display	Multi SP No. display is lit during execution and SP No. display blinks in other case.

← Factory setting

6.1 Operation Screen



*1: n is SP No. and is displayed by (ENT) key in order of No.1, 2…8.

*2: Displayed for use of isolated remote SP or expansion I/F

*3: Displayed only when the range of isolated remote SP is 1 to 5V and emergency SP is enabled.

*4: Displayed when key lock type is not .

*5: To display the output value, press the (MAN) key. It moves to this display at each display. For single output, it is switched as SP display→ output display→ SP display every time the (MAN) key is pressed. For dual output, it is switched as SP display→ 1st output display→ 2nd output display→ SP display in a similar fashion. (MAN) key is also used for AUTO/MAN switching.

SP/output display switching ☞ Section 8.2.1

AUTO/MAN switching ☞ Section 8.2.2

*6: n indicates the heater No. that is set up with heater address among No.1 to 3. (Displayed with (ENT) key in order of No.1, 2 and 3: No.1 heater current → No.1 heater resistance → No.2 heater current →….)

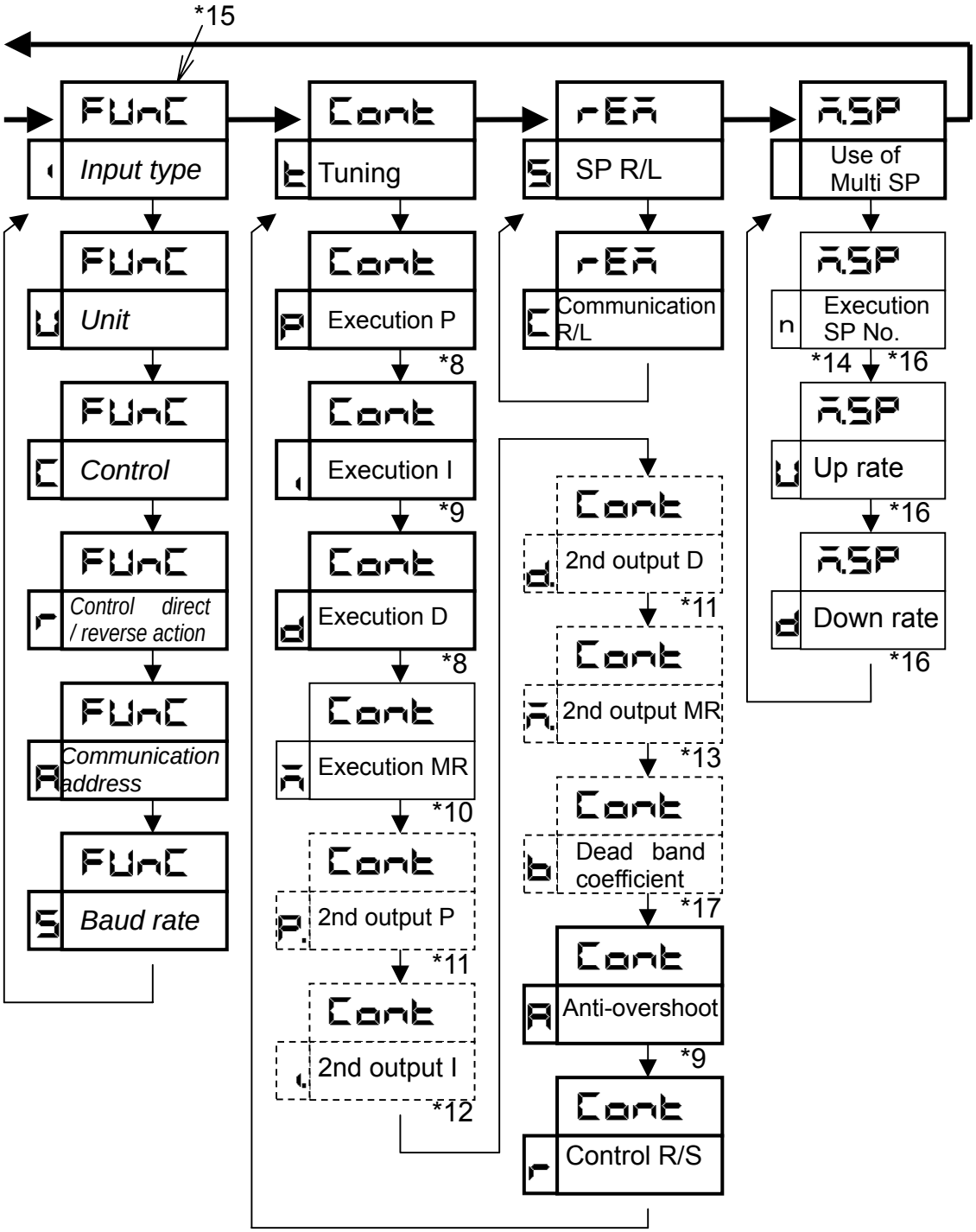
*7: Displayed only when alarm hold is enabled and the heater monitoring unit is connected.

*8: Displayed when 1st output is PID or PD.

*9: Displayed when 1st output is PID control.

*10: Displayed when 1st output is PD control.

*11: Displayed when 2nd output is PID or PD control.



*12: Displayed when 2nd output is PID control

*13: Displayed when 2nd output is PD control

*14: n indicates SP No.

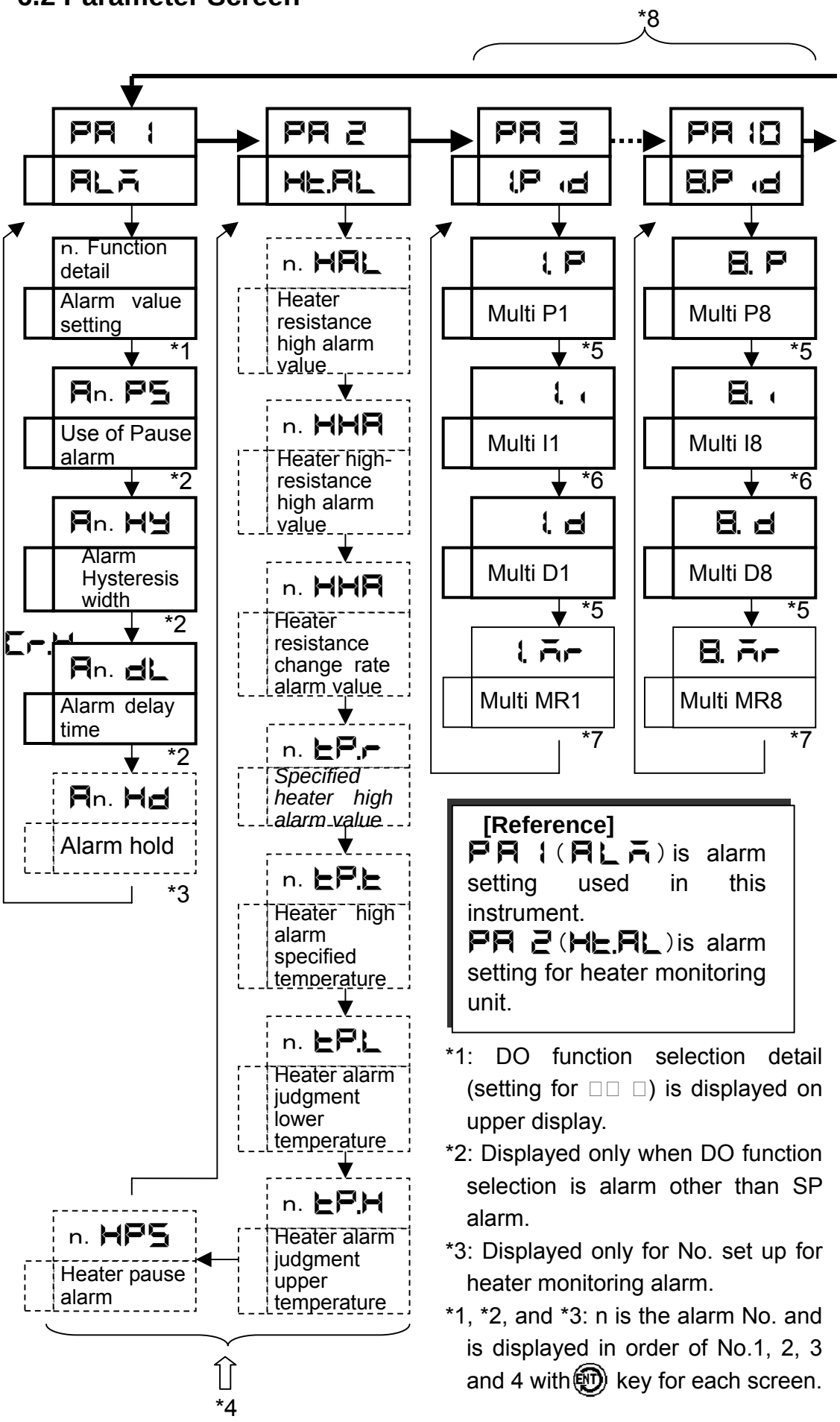
*15: Setting not allowed for group FunC.

*16: Displayed only when multi SP is used.

*17: Displayed only for dual output.

[Reference] Settings and functions
For setting details and functions, refer to Chapter 7 (Details/setting range) and Chapters 8 and 9 (Functions).

6.2 Parameter Screen



[Reference]

PA 1 (ALA) is alarm setting used in this instrument.

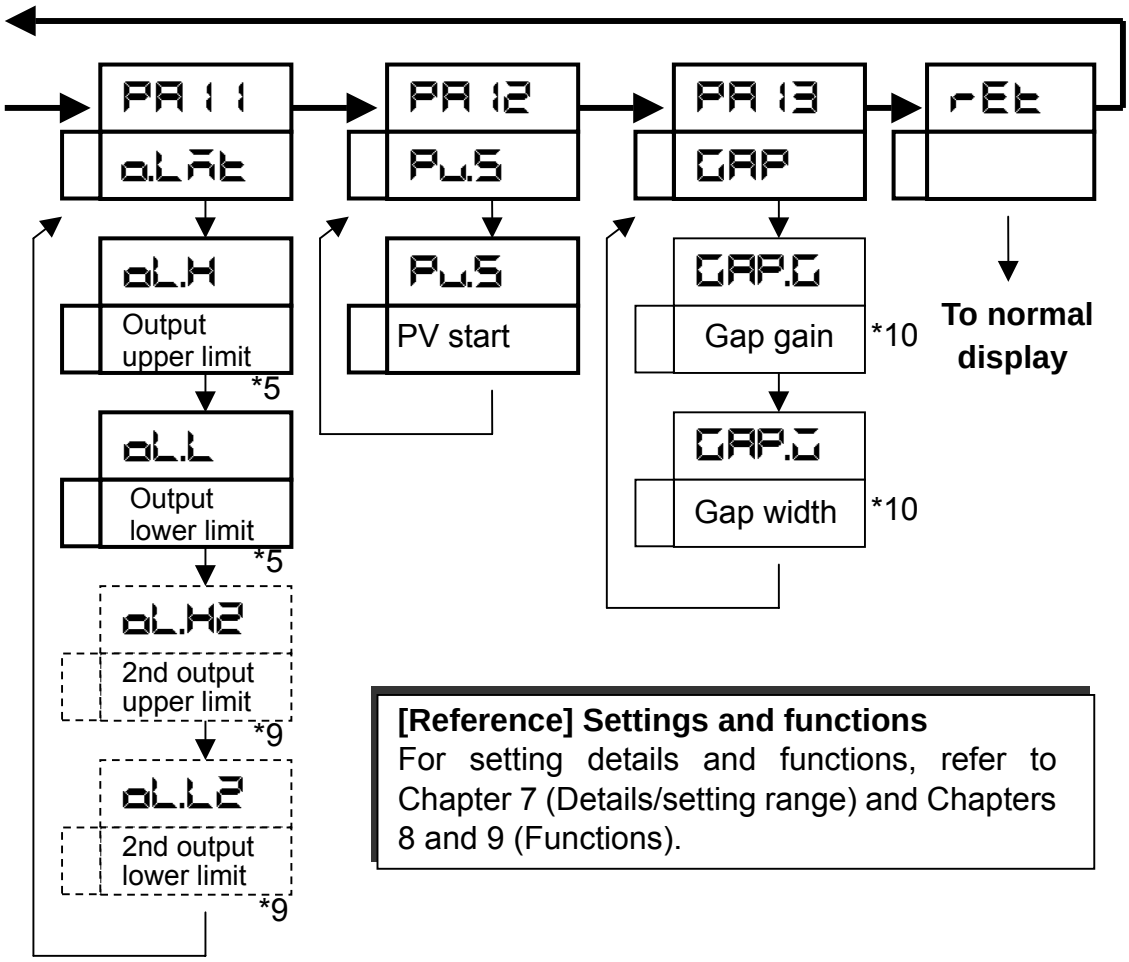
PA 2 (Ht.AL) is alarm setting for heater monitoring unit.

*1: DO function selection detail (setting for □□ □) is displayed on upper display.

*2: Displayed only when DO function selection is alarm other than SP alarm.

*3: Displayed only for No. set up for heater monitoring alarm.

*1, *2, and *3: n is the alarm No. and is displayed in order of No.1, 2, 3 and 4 with (ENT) key for each screen.



[Reference] Settings and functions
For setting details and functions, refer to Chapter 7 (Details/setting range) and Chapters 8 and 9 (Functions).

*4: n indicates the heater No. from No.1 to 3 at which the heater address is set up (displayed with ENT key in order of No.1, 2, and 3: No.1 heater resistance high alarm value → No.1 heater resistance high-high alarm value →···→ use of No.1 heater pause alarm → No.2 heater resistance high alarm value → No.2 heater resistance high-high alarm value →···→ use of No.2 heater pause alarm → No.3 heater resistance high alarm value → No.3 heater resistance high-high alarm value →···→ use of No.3 heater pause alarm).

*5: Displayed when 1st output is PID or PD control.

*6: Displayed when 1st output is PID control.

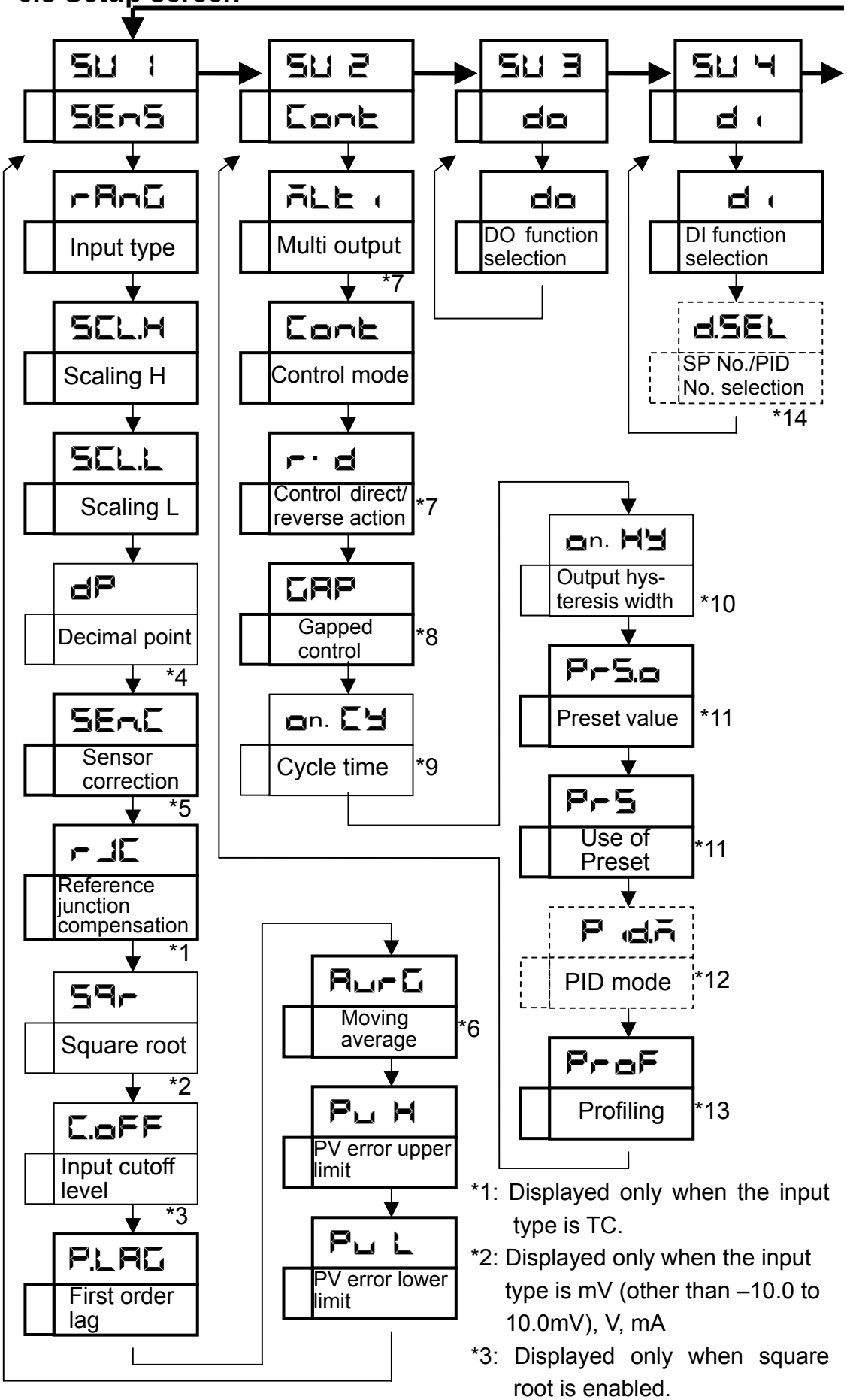
*7: Displayed when 1st output is PD control.

*8: Display PID No.1 – 8 as PA 3 - PA 10.
Multi Pn, In, Dn, MR, (n = 1 to 8) indicate PID and manual reset corresponding to multi SP No.n (n = 1 to 8).

*9: Displayed only when 2nd output is PID or PD control.

*10: Displayed only when gapped control is enabled.

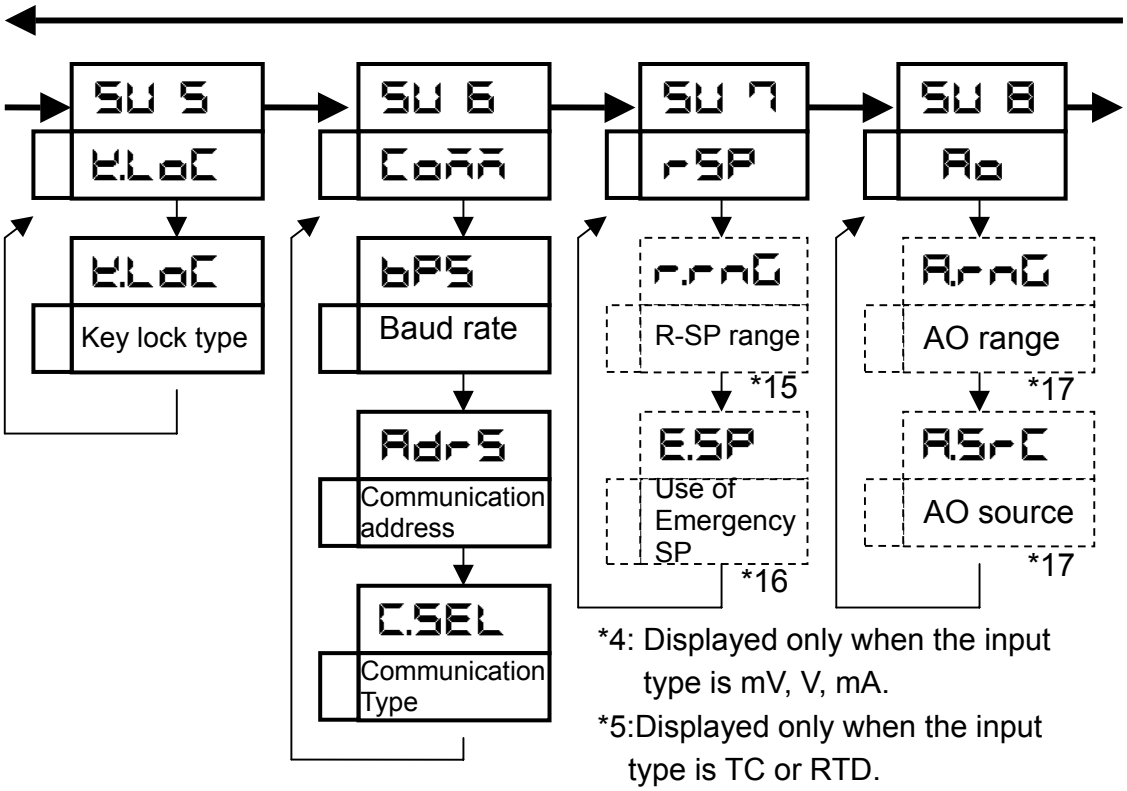
6.3 Setup screen



*1: Displayed only when the input type is TC.

*2: Displayed only when the input type is mV (other than –10.0 to 10.0mV), V, mA

*3: Displayed only when square root is enabled.



*4: Displayed only when the input type is mV, V, mA.

*5:Displayed only when the input type is TC or RTD.

*6: Displayed only when first order lag is 0.

*7: Displayed only when there is no 2nd output.

*8: Displayed only when 1st output is PID control.

*9: n is output No. and displays the cycle time of 1st output when it's not ON-OFF control and has SSR drive or relay output. It displays the cycle time of 2nd output when it's not ON-OFF control and has SSR drive or relay output.

*10: n is output No. and displays the output hysteresis width of 1st output when it's ON-OFF control. It displays the output hysteresis width of 2nd output when it's ON-OFF control.

*11: Displayed only when 1st output or 2nd output is not ON-OFF control.

*12: Displayed only when 1st output is not ON-OFF control and has remote SP or expansion I/F.

*13: Displayed only when 1st output is not ON-OFF control.

*14: Displayed only when there is isolated remote SP or expansion I/F.

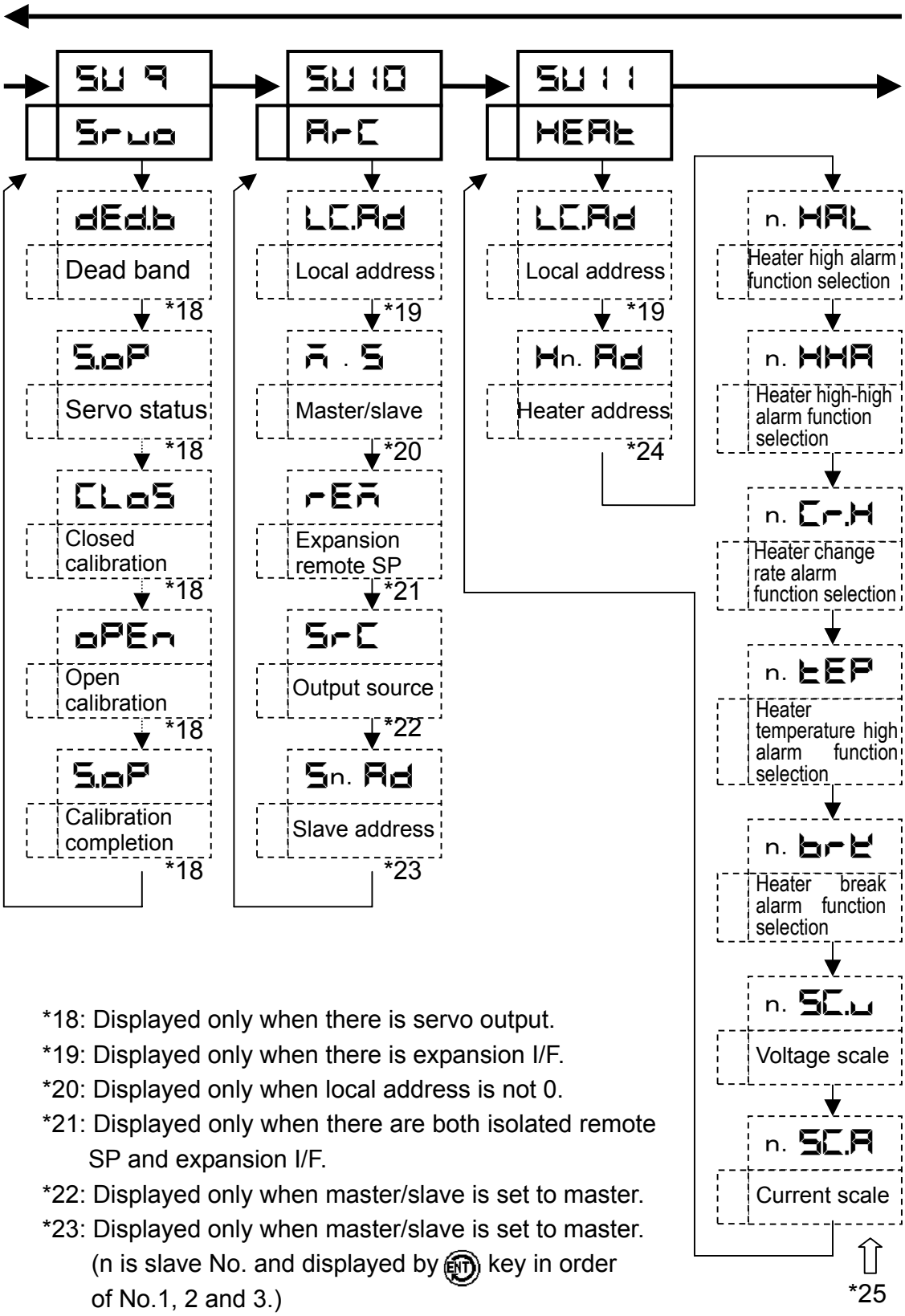
*15: Displayed only when there is isolated remote SP.

*16: Displayed only when there is isolated remote SP and isolated remote SP range is 1 to 5V.

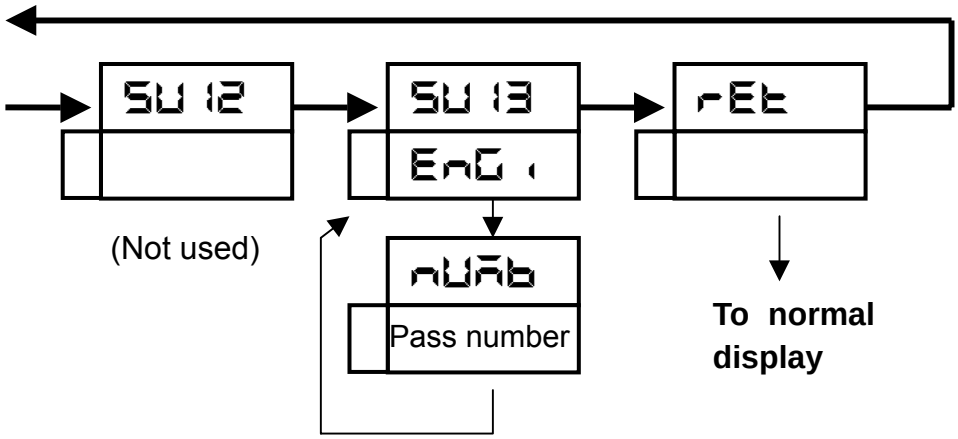
*17: Displayed only when there is AO.

[Reference] Settings and functions

For setting details and functions, refer to Chapter 7 (Details/setting range) and Chapters 8 and 9 (Functions). Furthermore, refer to AO, Isolated Remote SP Instruction Manual "WXPEC5500R03E" for SU 7 and SU 8.



*18: Displayed only when there is servo output.
*19: Displayed only when there is expansion I/F.
*20: Displayed only when local address is not 0.
*21: Displayed only when there are both isolated remote SP and expansion I/F.
*22: Displayed only when master/slave is set to master.
*23: Displayed only when master/slave is set to master. (n is slave No. and displayed by ENT key in order of No.1, 2 and 3.)



[Caution]
Pass number is the item for plant adjustment. Do not operate it.

[Reference] Settings and functions
For setting details and functions, refer to Chapter 7 (Details/setting range) and Chapters 8 and 9 (Functions). Furthermore, refer to Expansion Interface, Servo Drive Output Instruction Manual "WSPEC5500R04E" for SU 9、SU 10 and SU 11.

*24: Displayed only when local address is not 0.
*25: Displayed only for heater Nos. when heater address is not 0.
*24,*25: n is heater No. and the No. from No.1 to 3 at which heater address is set up is displayed (Display in order of No.1, 2 and 2 with ENT key: No.1 heater address → No.1 heater high alarm function selection →···→ No.1 current scale → No.2 heater address → No.2 heater high alarm function selection →···→ No.2 current scale → No.3 heater address → No.3 heater high alarm function selection →···→ No.3 current scale).

Chapter 7 List of Items

7.1 Operation Screen

Item	Upper display () indicates SP No.	Description/setting range		Factory setting
Normal SP	PV	Scaling range		0
Multi SP	PV(n)	Scaling range n: Multi SP No.（n=1 to 8）		0
Bias	(b)	20% of ± scaling width		0
Emergency SP	(E)	Scaling range		0
1st output	PV(1)	Output lower limit to output upper limit		0
2nd output	PV(2)	2nd output lower limit to 2nd output upper limit		0
Heater current	n. HEt(A)	Heater current value	n: Heater No.（n=1 to 3） display only	
Heater resistance	n. HEt(r)	Heater resistance value		
Alarm hold	HEAt(H)	□□□□: No hold, □□□□: Holding, □□□□: Hold cancelled		Hd.oF
Key lock	KEY	□□□□: Key unlock □□□: Key lock		UnLC
Tuning	Cont(t)	□□□□: Normal □□□□or □□□: Automatic tuning □□□□: Self tuning □□□: 2nd output automatic tuning		n.tUn
Execution P	Cont(P)	Execution proportional band 0.1 to 999.9%		2.0
Execution I	Cont(i)	Execution integration time 0.01 to 99.99 min.		3.00
Execution D	Cont(d)	Execution differential time 0.00 to 20.00 min.		0.00
Execution MR	Cont(rA)	Execution manual reset 0 to 100%		50
2nd output P	Cont(P.)	2nd output proportional band 0.1 to 999.9%		2.0
2nd output I	Cont(i.)	2nd output integration time 0.01 to 99.99 min.		3.00
2nd output D	Cont(d.)	2nd output differential time 0.00 to 20.00 min.		0.00
2nd output MR	Cont(rA.)	2nd output manual reset 0 to 100%		50
Dead band coefficient	Cont(b)	-0.500 to +0.500 Dead band (%) = dead band coefficient x 100		0.000

Item	Upper display () indicates SP No.	Description/setting range	Factory setting
Anti-overshoot	Cont(A)	Use of anti-overshoot □□□□: Not used, □□□: Used	n.Ao5
Control R/S	Cont(r)	□□□: Control RUN □□□□: Control STOP	run
SP R/L	rEA(S)	□□□: SP local, □□□: SP remote	LCL
Communi-cation R/L	rEA(C)	□□□: Communication local, □□□: Communication remote	LCL
Use of multi SP	A.SP	Use of Multi SP □□□: Not used, □□: Used	oFF
Execution SP No.	A.SP(n)	0 to 8 n:Multi SP No.(n= 1 to 8)	0
Up rate	A.SP(U)	□□□(0.00) to 650.00 unit/min.	oFF
Down rate	A.SP(d)	□□□(0.00) to 650.00 unit/min.	oFF

7.2 Parameter Screen

Item	Upper display	Description/setting range	Factory setting
PA1 alarms	n: Alarm No. (n = 1 to 4)		
Alarm value setting	n. ○○○	PV alarm: scaling range SP alarm: scaling range Deviation high alarm: 0 to + scaling width Deviation low alarm: - scaling range to 0 Deviation absolute value alarm: 0 to + scaling width ○○○: DO function selection data	1: 1570 2: -1570 3: 1570 4: None
Use of pause alarm	An. PS	Use of pause alarm function □□□: Not used, □□:Used	oFF
Alarm hysteresis width	An. HY	Alarm hysteresis width: 0 to scaling width	0
Alarm delay time	An. dL	Alarm ON delay time: 0 to 600 sec.	0
Alarm hold	An. Hd	Use of alarm hold □□□: Not used, □□: Used	oFF
PA2 heater alarms	n: Heater No. (n = 1 to 3)		
Heater resistance high alarm value	n. HAL	Heater resistance high alarm value 0.01 to 99.99Ω	99.99
Heater resistance high-high alarm Value	n. HHA	Heater resistance high-high alarm value 0.01 to 99.99Ω	99.99
Heater resistance change rate alarm value	n. Cr.H	Heater resistance change rate alarm value 0.01 to 99.99Ω	99.99
Specified heater high alarm value	n. tP.r	Specified heater high alarm value (display only)	

Item	Upper display	Description/setting range	Factory setting
Heater high alarm specified temperature	n. tP.t	Heater high alarm specified temperature Scaling range	100
Heater alarm judgment lower temperature	n. tP.L	Heater alarm judgment lower temperature scaling range	100
Heater alarm judgment upper temperature	n. tP.H	Heater alarm judgment upper temperature scaling range	1500
heater pause alarm	n. HPS	Use of heater pause alarm □□□: Not used, □□: Used	oFF
PA3 – 10 Multi PID n: PID No. (n = 1 to 8)			
Multi P	n. P	Multi proportional band 0.1 to 999.9 %	2.0
Multi I	n. I	Multi integration time 0.01 to 99.99 min.	3.00
Multi D	n. d	Multi differentiation time 0.00 to 20.00 min.	0.00
Multi MR	n. Mr	Multi manual reset 0 to 100%	50
PA11 Output limit			
Output upper limit	oL.H	1st output upper limit lower limit to 100	100
Output lower limit	oL.L	1st output lower limit 0 to upper limit	0
2nd output upper limit	oL.H2	2nd output upper limit 2nd output lower limit to 100	100
2nd output lower limit	oL.L2	2nd output lower limit 0 to 2nd output upper limit	0
PA12 PV start			
PV start	Pv.S	□□□: Disabled, □□: Enabled	oFF
PA13 Gapped control			
Gap gain	GAP.G	0.01 to 0.50	0.01
Gap width	GAP.W	0 to 50%	0

7.3 Setup Screen

Item	Upper display	Description/setting range	Factory setting
SU1 Sensor			
Input type	rAnG	Refer to Input list (page 17)	K 1
Scaling H	SCL.H	Scaling upper limit value TC or RTD input: Range, DC input: − 1999 to ＋9999 (decimal point position follows the setting.)	1370
Scaling L	SCL.L	Scaling lower limit value TC or RTD input: Range, DC input: − 1999 to +9999 (decimal point position follows the setting.)	-200
Decimal point	dP	Scaling value below decimal point 0 to 3	0

Item	Upper display	Description/setting range	Factory setting
Sensor correction	SEn.C	-100.0℃ to 100.0℃	0
Reference junction compensation	r JC	Reference junction compensation □□□: Disabled, □□: Enabled	on
Square root	SQr	□□□: Disabled, □□: Enabled	oFF
Input cutoff level	C.oFF	Input cutoff level at square root. 0.0 to 25.0%	10.0
First order lag	P.LAG	0 to 20 sec.	0
Moving average	AvrG	Moving average times 1 to 8	8
PV error upper limit	Pv H	-1999 to +9999 (decimal point position follows the setting.)	1402
PV error lower limit	Pv L		-231
SU2 Control/output		n: Output No. (n=1,2)	
Multi output	ALt 1	□□: Current, □□□: SSR drive, □□□: Relay	AA
Control mode	Cont	□□□: PID control (both outputs for dual output) □□: PD control (both outputs for dual output) □□□□: ON-OFF (both outputs for dual output) □□□□: PID for 1st output + ON-OFF control for 2nd output □□□□: ON-OFF for 1st output + PID control for 2nd output	P id
Control direct/reverse action	r· d	Control action □□□: Reverse action, □□□: Direct action	rEv
Gapped control	GAP	□□□: Disabled, □□: Enabled	oFF
Cycle time	on.Cy	Output cycle time 1 to 120 sec. Cycle type = Output ON time + output OFF time	60
Output hysteresis width	on.Hy	0.00 to 20.00%	0.10
Preset value	Pr5.o	Preset output value lower limit to upper limit	0
Use of preset	Pr5	Use of preset output □□□: Not used, □□: Used	oFF
PID mode	P id.M	Selection of PID to be used during remote SP execution □□□: Normal PID, □□□□: Programmed PID	nor
Profiling	ProF	Profiling control □□□: Disabled , □□□: Enabled (master controller)	SLv

Item	Upper display	Description/setting range	Factory setting
SU3 DO functions		n: DO No. (n = 1 to 4)	
DO function selection	do	Alarm: n. □□□: Deviation high alarm, n.□□□: Deviation low alarm, n. □□□: Deviation absolute value high alarm, n. □□□: PV high alarm, n. □□□: PV low alarm, n. □□□: SP high alarm, n. □□□: SP low alarm, n. □□□: Heater monitoring alarm Status output: n. □□□: Failure output (contact ON at CPU error and error in self diagnosis) n. □□□: Keep arrival output (contact ON from ramping completion to SP change or start of next ramping) n. □□□: MAN output (contact ON at MAN) n. □□□: STOP (contact ON at control STOP)	1.duH 2.duL 3.Ad1 4.FAL
SU4 DI functions		n: DI No. (n = 1 to 4)	
DI function selection	d1	n. □□□: SP No. switching or PID No. switching (follows the setting for SP No./PID No. selection.) n. □□□: AUTO/MAN switching (MAN with contact ON) n. □□□: SP remote/local switching (SP remote with contact ON) n. □□□: STOP (control STOP with contact ON)	All 4 points SP.R
SP No./PID No. selection	d.SEL	DI functions while remote SP is in execution □□□□: SP No., □□□□: PID No.	SPno
SU5 Key lock			
Key lock type	K.LoC	□□□: None (no key lock function) □□□: All data subjected □□□: All except SP subjected □□: The data on Setup screen subjected	oFF
SU6 Communication			
Baud rate	bPS	□□□:300bps, □□□:600bps, □□□□:1200bps, □□□□:2400bps, □□□□:4800bps,□□□□:9600bps,	9600
Communi-cation address	Adr5	0 to 31	0
Communi-cation type	C.SEL	□□□: Original protocol □□□□: Modebus protocol (ASCII mode) □□□□: Modebus protocol (RTU mode)	orG

Item	Upper display	Description/setting range	Factory setting
SU7 Isolated remote SP Function details☞ AO, Isolated Remote SP Instruction Manual WXPEC5500R03E			
R-SP range	r.rnG	Remote SP range □□□:1 to 5V, □□□:0 to 5V	1-5
Use of emergency SP	E.SP	□□□: Not used, □□: Used	oFF
SU8 AO Function details ☞AO, Isolated Remote SP Instruction Manual WXPEC5500R03E			
AO range	A.rnG	□□□□:0 to 20mA, □□□□:4 to 20mA	4-20
AO source	A.Sr C	□□: Process variable, □□: Setpoint, □□□: Output value	Pv
SU9 Servo drive Function details,☞ Expansion Interface, Servo Drive Output Instruction Manual WXPEC5500R04E			
Dead band	dEd.b	Servo dead band 0.5 to 10.0%	1.0
Servo status	S.oP	□□□□: during operation, □□□□: Automatic calibration start	S.run
Closed calibration	CLoS	A/D count value at automatic calibration Close (zero)	
Open calibration	oPEn	A/D count value for automatic calibration Open (span)	
Calibration completion	S.oP	□□□□: Automatic calibration normal completion, □□□: Error occurrence, □□□□: Operation start	
SU10 Expansion I/F n: Slave No. (n = 1 to 3) Function details, ☞ Expansion Interface, Servo Drive Output Instruction Manual WXPEC5500R04E			
Local address	LC.Ad	Expansion I/F local address 0 to 255	0
Master/slave*	M· S	□□□: Slave, □□□: Master	SLv
Expansion remote SP	rEM	Remote SP by expansion I/F enabled /disabled □□□: disabled (isolated remote SP enabled), □□: enabled	oFF
Output source	Sr C	□□: Process variable, □□: Setpoint, □□□: Output value	SP
Slave address	Sn. Ad	Expansion I/F EC address 0 to 255.	0

Item	Upper display	Description/setting range	Factory setting
SU11 Heater monitoring n: Heater No. (n = 1 to 3) Function details, ☞ Expansion Interface, Servo Drive Output Instruction Manual WXPEC5500R04E			
Local address	LC.Ad	Expansion I/F local address 0 to 255	0
Heater address	Hn. Ad	Expansion I/F heater address 0 to 63	0
Heater high alarm function selection	n. HAL	Heater resistance high alarm function selection 0 to 4 (= 0: None, = 1 to 4 correspond to DO numbers.)	0
Heater high-high alarm function selection	n. HHA	Heater resistance high-high alarm function selection 0 to 4 (= 0: None, = 1 to 4 correspond to DO numbers.)	0
Heater change rate alarm function selection	n. Cr.H	Heater resistance change rate alarm function selection 0 to 4 (= 0: None, = 1 to 4 correspond to DO numbers.)	0
Heater temperature high alarm function selection	n. tEP	Heater temperature high alarm function selection 0 to 4 (= 0: None, = 1 to 4 correspond to DO numbers.)	0
Heater break alarm function selection	n. brt	Heater break alarm function selection 0 to 4 (= 0: None, = 1 to 4 correspond to DO numbers.)	0
Voltage scale	n. SC.u	Heater voltage scaling 1.0 to 999.9V	According to setting in ZE7201
Current scale	n. SC.A	Heater current scaling 1.0 to 999.9A	5.0
SU12 (not used)			
SU13 For factory adjustment			
Path number	nUMb	Secret number	0

8.1 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

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

8.2.1 SP/Output Display Switching

(MAN) key is used for switching of display between SP and output. Display of SP and output is switched every time the (MAN) key is pressed. Operation and displayed data for single output type and dual output type are shown as follows:

Furthermore, PV is always displayed on the upper display.

(1) Single output type

Every time (MAN) key is pressed, display of ① and ② alternate with each other.

	At AUTO			At Man		
	Lower display	SP No. display	MAN lamp	Lower display	SP No. display	MAN lamp
①	□Out put value	□	Blinks	□Out put value	□	ON
②	SP	Blank (at normal SP execution) or multi SP No. (at multi SP execution)	OFF	SP	Blank (at normal SP execution) or multi SP No. (at multi SP execution)	Blinks

(2) Dual output type

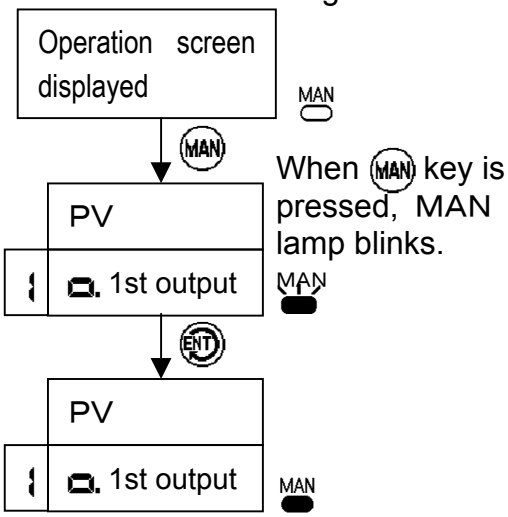
Every time (MAN) key is pressed, display is switched in order of ①→②→③→④→….

	At AUTO			At MAN		
	Lower display	SP No. display	MAN lamp	Lower display	SP No. display	MAN lamp
①	□1st output value	□	Blinks	□1st output value	□	ON
②	□2nd output value	□	Blinks	□2nd output value	□	ON
③	SP	Blank (at normal SP execution) or multi SP No. (at multi SP execution)	OFF	SP	Blank (at normal SP execution) or multi SP No. (at multi SP execution)	Blinks

8.2.2 AUTO/MAN Switching

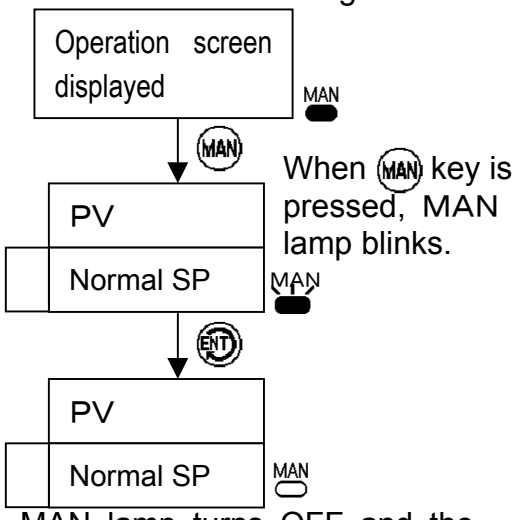
When (ENT) key is pressed with MAN lamp blinking (refer to Sec. 8.2.1 on previous page), the control switches to MAN if the current control is AUTO and to AUTO if the current control is MAN.

AUTO→MAN switching



MAN lamp turns ON and the control switches to MAN and output display.

MAN→AUTO switching



MAN lamp turns OFF and the control switches to AUTO and normal display.

・When AUTO→MAN: MAN is enabled while maintaining the output value immediately before switching.

・When MAN→AUTO: Switch to bump-less from the output value immediately before switching and control is started from this value.

[Caution]
For dual output, it is only 1st output that switches to bump-less at MAN to AUTO switching. 2nd output is not changed to bump-less. However, 2nd output switches to bump-less if 1st output is ON-OFF control and 2nd output is not ON-OFF control.

[Caution]
When AUTO/MAN switching is set up by DI function selection, AUTO/MAN switching from surface key or communication is disabled.

8.2.3 Setting Output Value at MAN

Output value can be changed directly by dial during MAN operation. The value is immediately reflected on the output when the dial is turned. There is no need to use the (ENT) key for registering the value.

When ON-OFF control is used, it changes to 100 when the dial is turned in UP direction and to 0 when it is turned to DOWN direction.

[Caution] Caution during MAN operation
Please note that the value is immediately outputted when the dial is turned while the output value is displayed.

8.3 SP

8.3.1 Normal SP and Multi SP

In this instrument, values can be registered for normal SP and 8 kinds of SPs (multi SP) assigned to No.1 to 8. There is a couple PID for each SP and it automatically switches to the PID to be used in interlock with the SP to be executed (except when remote SP is executed. ☞ Section 8.6 of this chapter).

8.3.2 Multi SP Setting, Switching and Ramping

When “use of multi SP” is set to “Used,” setting of multi SP, up/down rate values and switching of multi SP are enabled. “Use of multi SP” is set to “Not used” at factory setting. Setting and switching with surface keys are executed on Operation screen. Switching of multi SP can be executed from surface key, external communication or DI contact. Multi SP is switched using a surface key by changing the SP No. displayed on SP No. display in display on Operation screen with the dial. Every time the dial is turned, the SP that corresponds to the SP No. is displayed on lower display (conditions for multi SP switching ☞ Section 8.6 of this chapter).

The action when multi SP is switched varies as shown in the table below by the setting for up/down rate. During SP ramping, the decimal point on SP No. display blinks for each display of normal SP, multi SP, bias, emergency SP, multi SP switching, up/down rate and output.

Multi SP switching	Rate setting	Action
Switching to multi SP larger than current SP	Up rate is not equal to OFF	SP ramping is executed to the new multi SP according to up rate value.
	Up rate is equal to OFF	SP immediately shifts to new multi SP.
Switching to multi SP smaller than current SP	Down rate is not equal to OFF	SP ramping is executed to the new multi SP according to Down rate value.
	Down rate is equal to OFF	SP immediately shifts to new multi SP.
Switching from multi SP to normal SP		Current SP is maintained regardless of rate setting (current SP is moved to normal SP without change). However, it immediately shifts to remote SP when the optional remote SP is enabled.

[Caution]
The maximum value for ramping time is approx. 1165 hours (approx. 69905 min.). If ramping time exceeds this, display Err2 for about 2 seconds at the start of ramping and execute ramping at the maximum ramping time.

8.3.3 PV Start

PV start functions at multi SP switching or at turning on the power during ramping or multi SP execution. However, it is limited to cases in which the down rate setting is not 0 (OFF) if PV > target SP and the up rate setting is not 0 (OFF) if PV < target SP at beginning of PV start. At beginning of PV start, SP becomes equal to PV and then ramping is executed for the target multi SP with the setting up/down rate. If PV display is H or L (outside the range of PV error upper and lower limit values), ramping is executed from SP = 0.

8.3.4 Anti-Overshoot

It functions when SP is changed in steps or ramped, and suppresses overshoot near the target SP. It functions only when the control mode is single output type and PID control.

8.4 Automatic Tuning

Output is changed as 0⟷ 100% (lower output limit ⟷upper output limit for current output) to measure the process property from the change in process variable.

Tuning is started by selecting □□□□, □□□ (subjecting 1st output in dual output) or □□□ (subjecting 2nd output in dual output) is selected in Control on Operation screen, and TUNE lamp blinks. Tuning is stopped when □□□□ is selected during automatic tuning, and PID does not change. In addition, it changes automatically to □□□□ when tuning is completed, and TUNE lamp goes OFF.

[Caution] Precautions in automatic tuning

The process value (i.e.: furnace temperature) increases/decreases when tuning is executed. Be sure to check that there is no hitch for the system or product before executing.

8.5 Self Tuning

Unlike automatic tuning which is executed only when the operator intends, Self tuning is the function to execute automatic tuning when the stability of control exceeds the limit or setting changes in steps, etc. by monitoring the existence of deviation, hunting, etc. continuously from the controller. Since the output is not changed in steps as in automatic tuning, there is no disturbance by tuning.

The conditions to update the PID to optimal value during Self tuning (when display is □□□□ and TUNE lamp is ON) are as follows:

a: When SP is changed by 0.5% FS (full scale) or larger in steps with stable PV,

b: When PV or output fluctuation is detected for 3 cycles for more (it may take more time depending on the furnace features and the PID value at fluctuation),

c: When PV is stable and SP is larger than PV by 2% FS or larger at turning on this instrument.

[Reference]
PV stability is judged by the following conditions:
At turning on the power: Stability within ±0.08% FS continues for 2 seconds or longer.
At normal control: Stability within ±0.08% FS continues for 1/2 of the current integration time.

[Caution] Precautions for use
Self tuning execution is maintained when turning off the power during Self tuning. An inappropriate PID may be calculated if the furnace is turned on the power after changing SP with furnace power OFF during Self tuning. Change SP with the furnace power ON. Turns off the instrument once and then turns on again if the difference between SP and PV stays large even after specified period (it varies by the furnace features).

[Caution]
Though PID can be changed manually from surface key or external communication during Self tuning, the set PID may be overwritten by the tuning result depending on the control status.

[Caution]
Self tuning can be executed for single output type with PID control, reverse action, no square root and except the master controller of profiling control. In addition, TUNE lamp goes OFF during MAN and control STOP even when Self tuning is ON, and Self tuning is not operated during this period.

8.6 Selection of Operation Method

Operation method is selected by the setting on SP remote/local, SP No./PID No. selection and PID mode. The SP No. switching method and the SP and PID to be used are decided by these settings. The relationship between these settings and action is shown in the table below:

×: Setting does not affect.

Setting				Operation method/action				
□□□ on Operation screen	□□□ (□□) on Setup screen	Type	□□□ (□□□□) on Setup screen	SP No. switching method	At normal SP execution		At multi SP execution	
Remote switching	DI function	Remote SP *1	PID mode		SP	PID used	SP	PID used
SP remote	SP No. switching	Yes	Normal	External DI contact	Remote SP *2	Normal PID	Multi SP	PID corresponding to SP No.
			Programmed PID			PID corresponding to SP is automatically selected from PID No. 1 to 8.		
		No	(No setting)		Normal SP	Normal PID		
	PID No. switching	Yes	×	Disabled	Remote SP *2	PID for the No. selected in DI	Multi SP execution disabled	
		No	(No setting)		Normal SP			
SP local	×	×	×	Surface key or external communication	Normal SP	Normal PID	Multi SP	PID corresponding to SP No.

※1: Remote SP is set to "Yes" when either or both of built-in option, isolated remote SP or expansion option, expansion I/F are equipped, and "No" when neither is equipped.

※2: It is impossible to change normal SP by key or communication while remote SP is being executed.

[Caution]
When SP remote/local switching is set up by DI function selection, SP remote/local switching from surface key and communication is disabled.

8.7 Power Failure and Power Restoration during Operation

If power failure occurs during operation, the action at power restoration will be as follows:

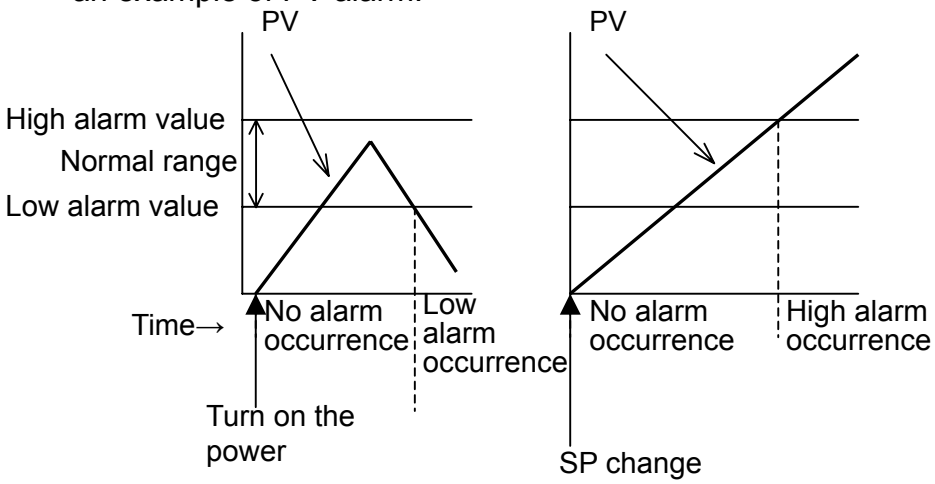
<table>
<tr><td>Power failure period
Item</td><td colspan="4">Approximately 50msec or longer</td><td>Approximately 50ms or shorter</td></tr>
<tr><td>Display</td><td colspan="4">Normal display will be shown.</td><td rowspan="11">Everything is maintained and control continues.</td></tr>
<tr><td rowspan="4">SP</td><td>SP in execution at power restoration</td><td colspan="3">SP action</td></tr>
<tr><td>Normal SP</td><td colspan="3">The value before the Power failure is maintained.</td></tr>
<tr><td>Multi SP</td><td colspan="3">Maintained if PV start is not enabled. Ramping is started again from the PV at power restoration when PV start is enabled.</td></tr>
<tr><td>During ramping</td><td colspan="3">Ramping is started again from the start SP when PV start is not enabled, and from the PV at power restoration when PV start is enabled.</td></tr>
<tr><td rowspan="4">Output</td><td>Control method at power restoration</td><td>Use of preset</td><td colspan="2">Output at power restoration</td></tr>
<tr><td rowspan="2">At AUTO</td><td>Not used</td><td colspan="2">AUTO status is maintained and output becomes the output lower limit.</td></tr>
<tr><td>Used</td><td colspan="2">It is switched to MAN and the output becomes the preset value.</td></tr>
<tr><td>At MAN</td><td></td><td colspan="2">The value before the Power failure is maintained.</td></tr>
<tr><td>Control</td><td colspan="4">The output value when AUTO status is maintained is calculated newly with current PV and SP, and starts controlling.</td></tr>
<tr><td>Alarm status</td><td colspan="4">Alarm judgment is newly started from power restoration.</td></tr>
<tr><td>Others</td><td colspan="4">All other items are maintained.</td></tr>
</table>

Chapter 9 Procedure for Major Functions

9.1 Alarms

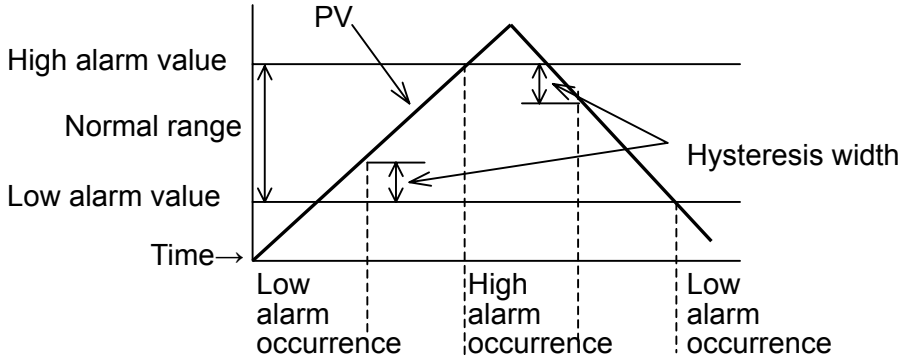
9.1.1 Pause Alarm

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.



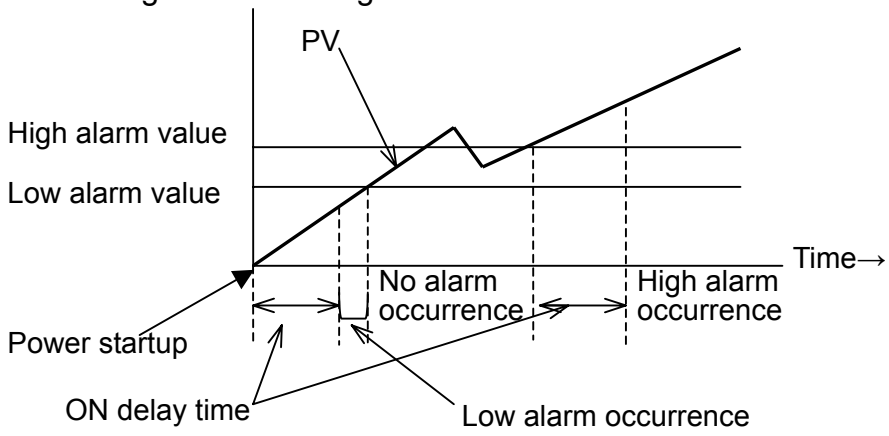
9.1.2 Hysteresis Width

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.



9.1.3 ON Delay Time

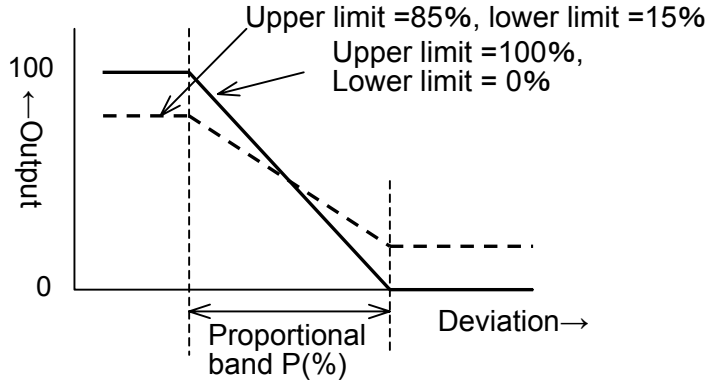
This is the function to delay alarm generation for the setting period when it turned on the power (in alarm range) or when it shifts from normal range to alarm range.



9.2 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.

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



9.3 Input Functions

9.3.1 Scaling

(1) When input is TC, RTD,

The upper and lower limit values for scaling function as setting limits. For example, when scaling is executed for 0 to 1200℃ with input range of －200 to 1370, setting less than 0℃ or higher than 1200℃ cannot be given.

(2) When input is mV, V, mA,

PV and SP display for input can be set optionally in the range of -1999 to 9999.

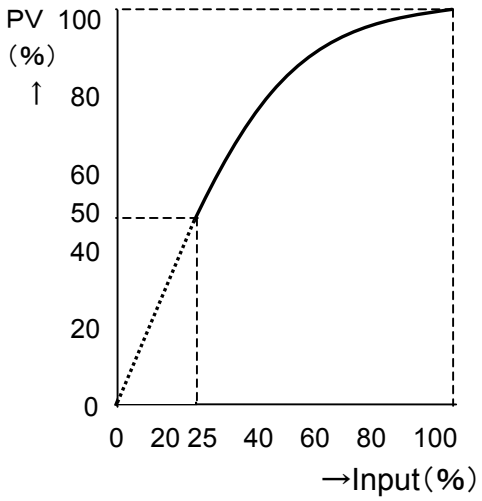
9.3.2 Square Root

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＝ √input x 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%.



9.3.3 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.

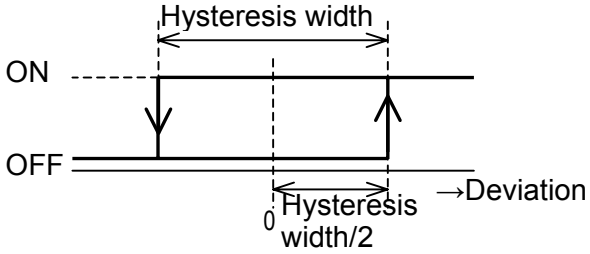
9.4 Control RUN/STOP

PV display blinks and the preset value is outputted compulsorily when it is changed to Control STOP from 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.

[Caution]
When control STOP is set up by DI function selection, control RUN/STOP switching from surface key or communication is disabled.

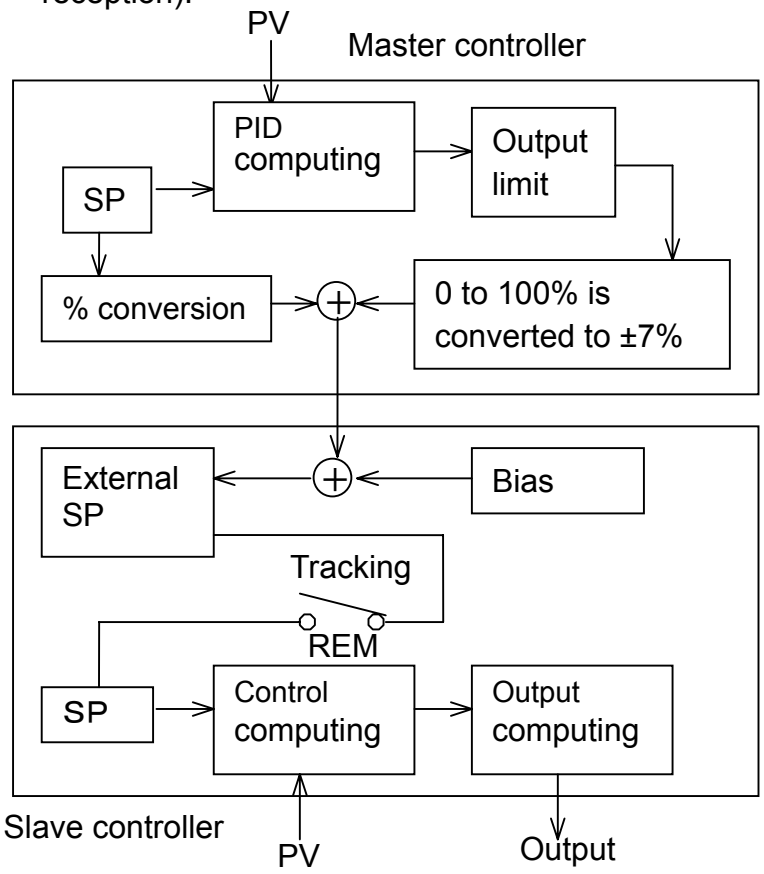
9.5 ON-OFF Control Hysteresis Width

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



9.6 Profiling Control

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 setting value converted into %, and transmits it to the slave controller. The slave controller receives “SP + output” from the master controller using isolated remote SP (analog value reception) or remote SP function of expansion I/F (digital value reception).



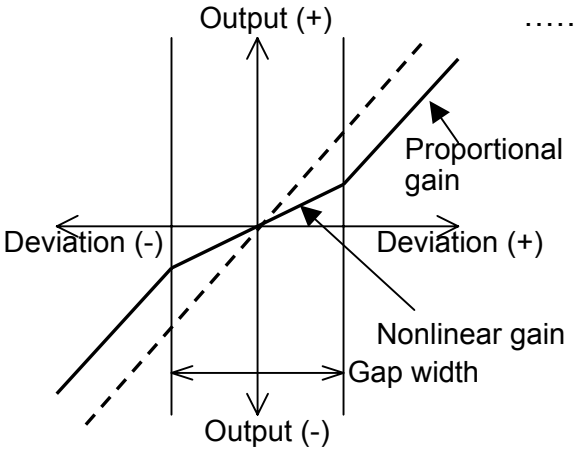
[Caution] Output value display for master controller
The output result on display is the control result. When profiling control is used, output value differs from the display output value and it is the value calculated by profiling computing.

For isolated remote SP,
☞ AO, Isolated Remote SP Instruction Manual WXPEC5500R03E
For expansion I/F,
☞ Expansion Interface, Servo Drive Output Instruction Manual WXPEC5500R04E

9.7 Gapped Control (Nonlinear Control)

Nonlinear PID control is the control method in which deviation changes the proportional gain inside/outside the gap width centering on setting value (SP).

- When | Deviation | ≦ gap, : Proportional gain x gap gain
  ……output change is small.
- When | Deviation | ＞ gap, : Proportional gain x 1
  ……output change is large.



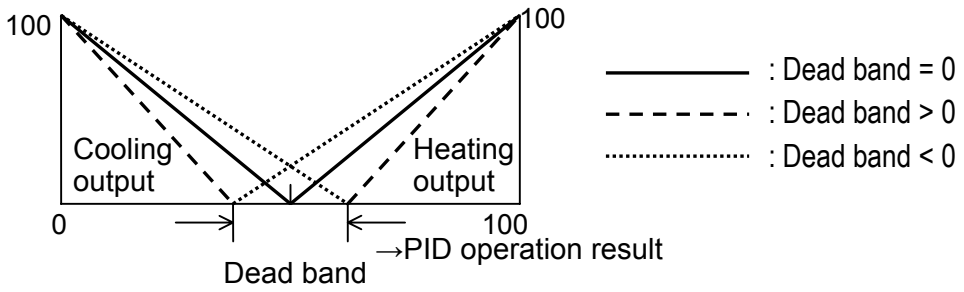
[Caution] P (proportional band) display
P (proportional band) display value is not changed even when proportional gain changes inside/outside gap width.

9.8 Heating/Cooling Control

Heating/cooling 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 from 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.

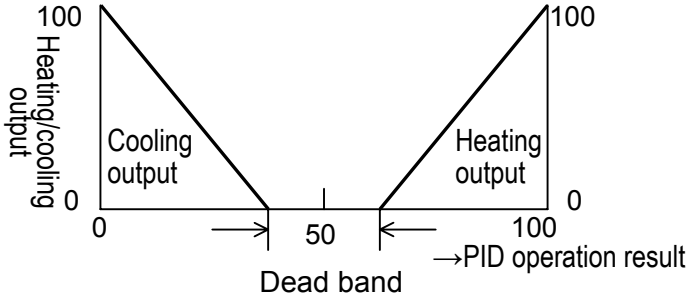
Heating PID is used when PID computing result≧50%.
Cooling PID is used when PID computing result＜50%

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.

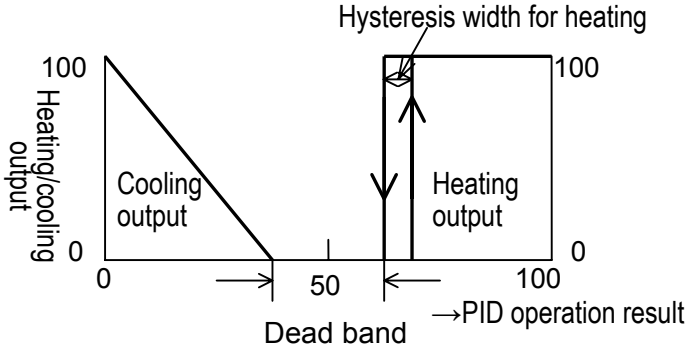


The action in each control mode is as follows (dead band > 0):

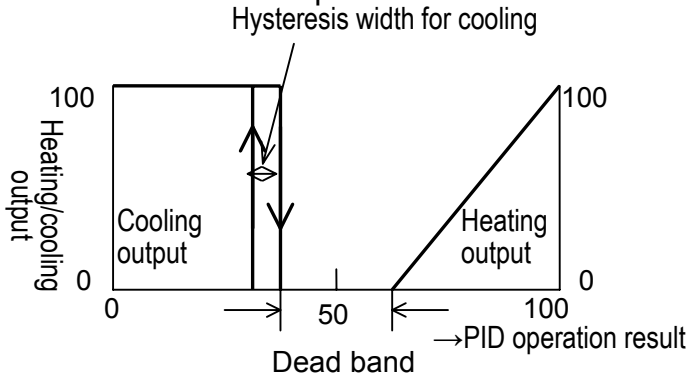
1)PID or PD control for both outputs



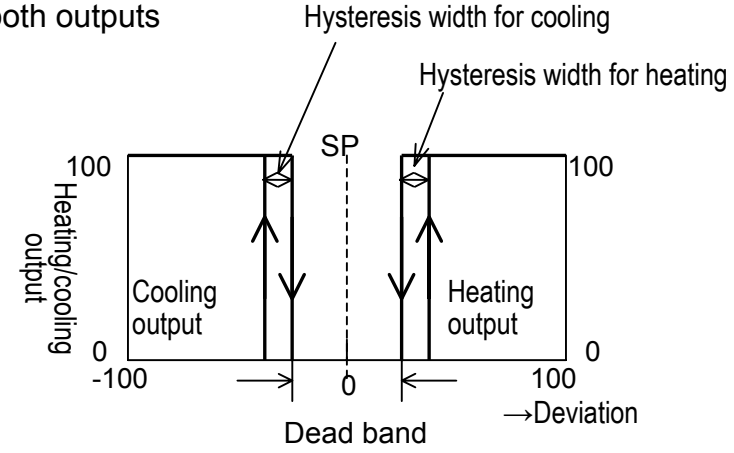
2)ON-OFF for 1st output, PID control for 2nd output



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, reverse/direct action of control cannot be switched. Heating side is fixed to reverse action, and cooling side to direct action.

Chapter 10 Troubleshooting

	Trouble	Cause	Remedy
Display/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.
	is displayed and setting is not enabled when turning the dial or pressing the key to set.	Key lock is enabled.	Execute key unlock.
		Communication remote is enabled.	Switch communication remote/local to local.
	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 abort it.
	PID cannot be set.		
	Multi SP switching cannot be executed from the surface key.	SP remote is enabled.	Switch SP remote/local to local
	PV displays or .	Input exceeds the PV error upper and lower limit value.	Check the input wiring. If wiring is correct, check the PV error upper and lower limit value settings.
	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.
	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.
	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.

	Trouble	Cause	Remedy
Display/setting	or is displayed. *1	There is an error in calibration data.	Contact our dealer where you purchased the instrument or our sales representative.
	or 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.
	CP.Er is displayed.。*1		
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 diagnosis, or PV has □ or □ 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 diagnosis function of this instrument. In such cases, the preset value (when preset output is enabled) or output lower limit value (when preset output is disabled) 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 diagnosis function.

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).

・・・ Ohkura 大倉電気株式会社

Ohkura Electric Co., Ltd. **Website** http://www.ohkura.co.jp /

Headquarters/plant 1-4-4 Nissai Hanamizuki, Sakado-shi, Saitama 〒350-0269
TEL: 049-282-7755(key) FAX:049-282-7001（key）

Osaka Branch Daihoku building, 3-9-13 Nishinakajima Yodogawa-ku, Osaka-city 〒532-0011
TEL: 06-6303-3681 FAX:06-6304-0466

Tokyo Office Kudo building 4F, 4-4-18 Takadanobaba, Shinjuku 〒169-0075
TEL: 03-3368-6031 FAX:03-3368-6127

Nagoya Office Kosho building, 1-27-31 Aoi, Nakaku, Nagoya-city 〒460-0006
TEL: 052-935-5837 FAX:052-935-3498

Kushu Office Hakatamurayama building, 2-7 Nakagofuku-cho, Hakata-ku, Fukuoka-city 〒812-0035
TEL: 092-263-8303 FAX:092-282-8468

Tohoku Suboffice 1-10-26-103 Nakata, Taihaku-ku, Sendai-city 〒981-1104
TEL: 022-306-5480 FAX:022-306-5490