Detailed Instruction Manual

VT
Program Temperature Controller
Ver. 3.3

ISUZU Seisakusho Co., Ltd.

Thank you for purchasing our product.
Thoroughly read this manual before using the product.
Keep this manual with care.

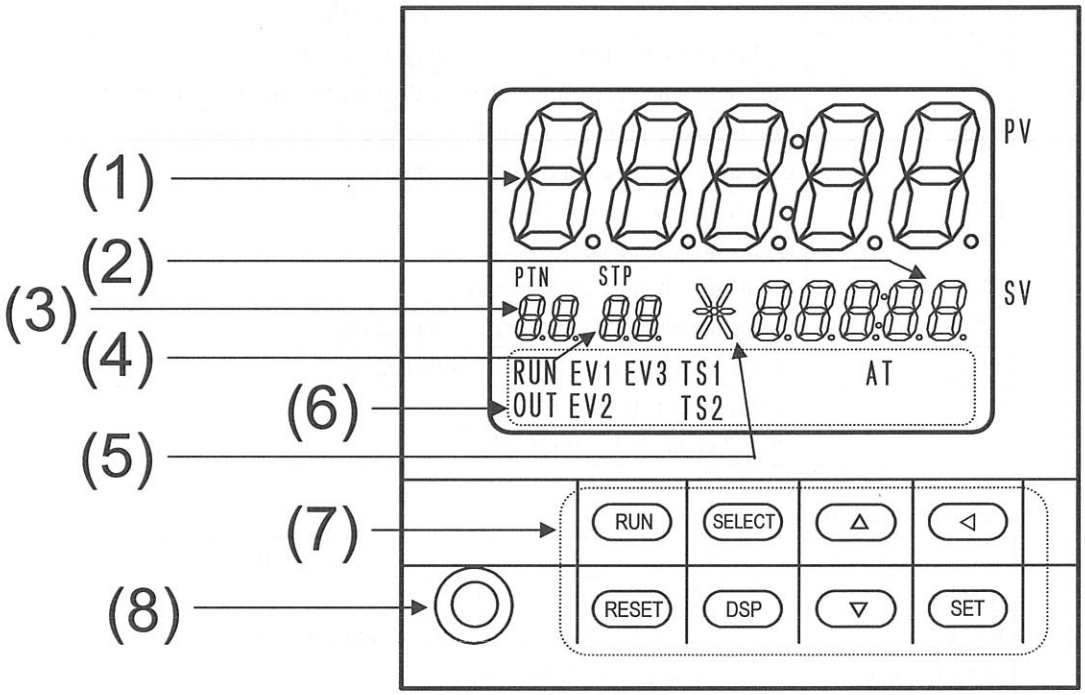
Contents

1. Overview

1.1 Features

This product is a LCD (liquid crystal display) programmable controller that allows continuous (fixed temperature) running; automatic turn-on, turn-off and turn-on/off running; programmed running (six patterns and16 steps); link of programmed patterns one another; etc. In addition, using the dedicated loader software enables, for example, preset values to be changed and data to be recorded from a PC (personal computer).

1.2 Names and functions of respective sections



Segment display section

(1) Measured temperature (PV) display

This section displays a current measured temperature, parameter item, remaining time (when remaining time is displayed) and error No.

(2) Preset temperature (SV) display

This section displays a current preset temperature, preset value of the parameter, turn-on/off time (when remaining time is displayed) and manipulated variable (when manipulated variable is monitored). The display blinks while running halts.

(3) Pattern No. display

"Pr" is displayed when running other than programmed running is selected.

When programmed running is selected, Pattern No. currently in selection is displayed.

Execution count is displayed (when remaining time is displayed).

(4) Step No. display

This section displays the No. corresponding to the running when running other than programmed running is selected.

When programmed running is selected:

During stop: The number of steps of the current pattern is displayed.

During running: The step No. currently in process is displayed.

Link execution count is displayed (when remaining time is displayed).

(5) Running state display

This section displays a state of programmed running.

"–": Blinks during continuous or timer running, or leveled running of programmed running.

"／": Blinks if temperature rises from the previous step during programmed running.

"＼": Blinks if temperature falls from the previous step during programmed running.

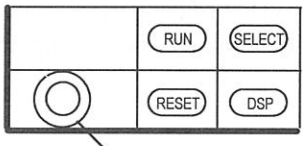
(6) Lamp display section

Lamp character	Description
PTN	Lights up when the pattern is displayed with programmed running in selection.
STP	Lights up when the step is displayed with programmed running in selection.
RUN	Lights up during programmed running, and blinks during halt.
OUT	Lights up when heater output is turned on.
EV1	Lights up when Event 1 occurs.
EV2	Lights up when Event 2 occurs.
EV3	Lights up when Event 3 occurs.
TS1	Lights up when Time Signal 1 is turned on.
TS2	Lights up when Time Signal 2 is turned on.
AT	Lights up during auto-tuning.
	Other lamps are in non-display.

(7) Operation button section

Key name	Description
RUN key	Used for starting running.
RESET key	Used for stopping running or returning screens.
SELECT key	Used for switching display, etc.
DSP key	Used for switching display.
Up key "△"	Used for increasing numerical values.
Down key "▽"	Used for decreasing numerical values.
Digit shifting key "◁"	Shifts the setting digit leftward during setting.
SET key	Used for confirmation of set items, transition, halt, etc.

(8) Loader connector



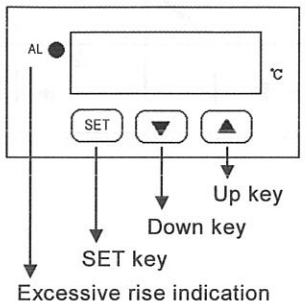
The loader cable can be inserted when the cover mounted in this portion is removed.

* The following tasks can optionally be performed on a PC by preparing a cable and using the dedicated loader software*: Changing preset values for setting, recording data such as measured values and displaying change of measured value over time in graphs.

* Can be downloaded from our website: http://www.isuzuseisakusho.co.jp/.

1.3 Operating the Overheat Protector

The control is stopped in case the inside-the-bath temperature rises to the temperature set on the excessive rise prevention unit.



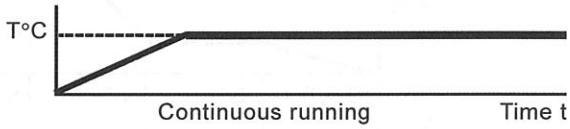
How to operate the unit:

- Use the Up/Down key for setting the temperature.
- SET key: Unused.
  (Used for maintenance by our service technician.)

2. Running Mode Types

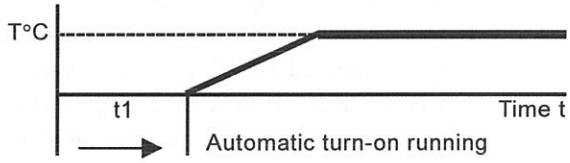
2.1 Continuous running (fixed temperature running)

The heating control starts immediately after running starts, and the temperature is retained at the preset temperature (T°C) until the RESET key is pressed.



2.2 Automatic turn-on running: See Section 3.3.2.

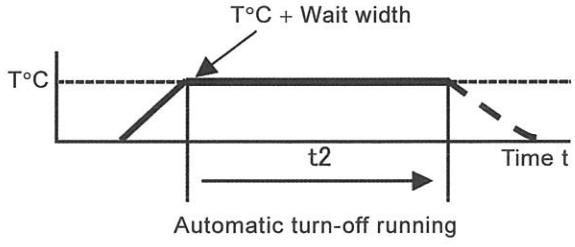
Wait status is retained until the preset time (t1) elapses, and, upon the time t1 elapsing, heating running starts. After start of heating running, the temperature is retained at the preset temperature (T°C) until the RESET key is pressed, similarly to continuous running as described in Section 2.1.



2.3 Automatic turn-off running

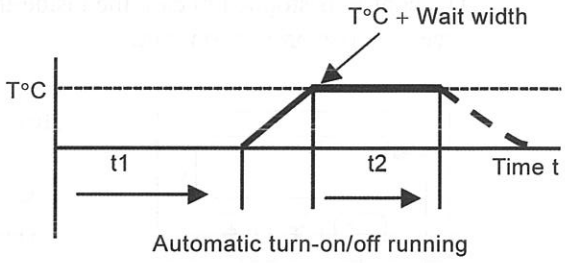
The heating control starts immediately after running starts, and, upon the preset temperature (T°C) reaching the wait zone, the timer starts counting time, retaining the temperature at T°C. Upon the preset time (t2) elapsing, running automatically stops.

* For the wait zone, see Section 3.4.5 "Wait function."



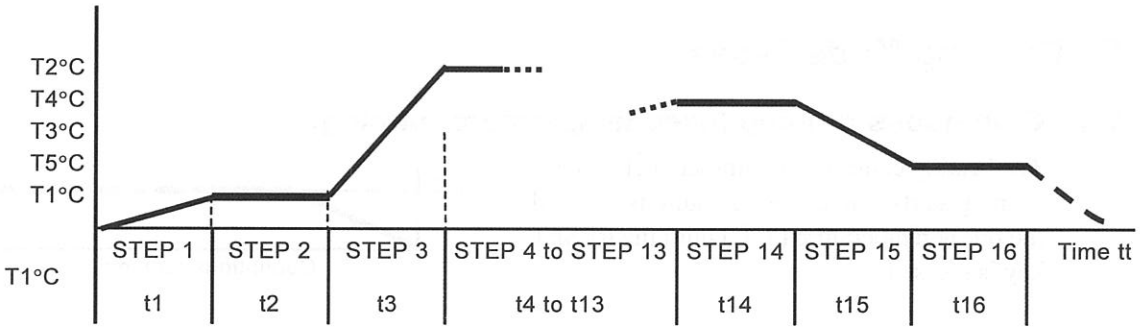
2.4 Automatic turn-on/off running

Upon starting running with the automatic turn-on preset time (t1) and turn-off preset time (t2) being set, the wait status is retained until the time t1 elapses and then, upon the time t1 elapsing, heating running starts. Upon the wait zone of the preset temperature T°C being reached, counting the time t2 starts, the temperature T°C is retained constant, and then, upon the time t2 elapsing, running automatically stops.



Automatic turn-on/off running

2.5 Programmed running (patterns settable as Patterns 1 to 6)

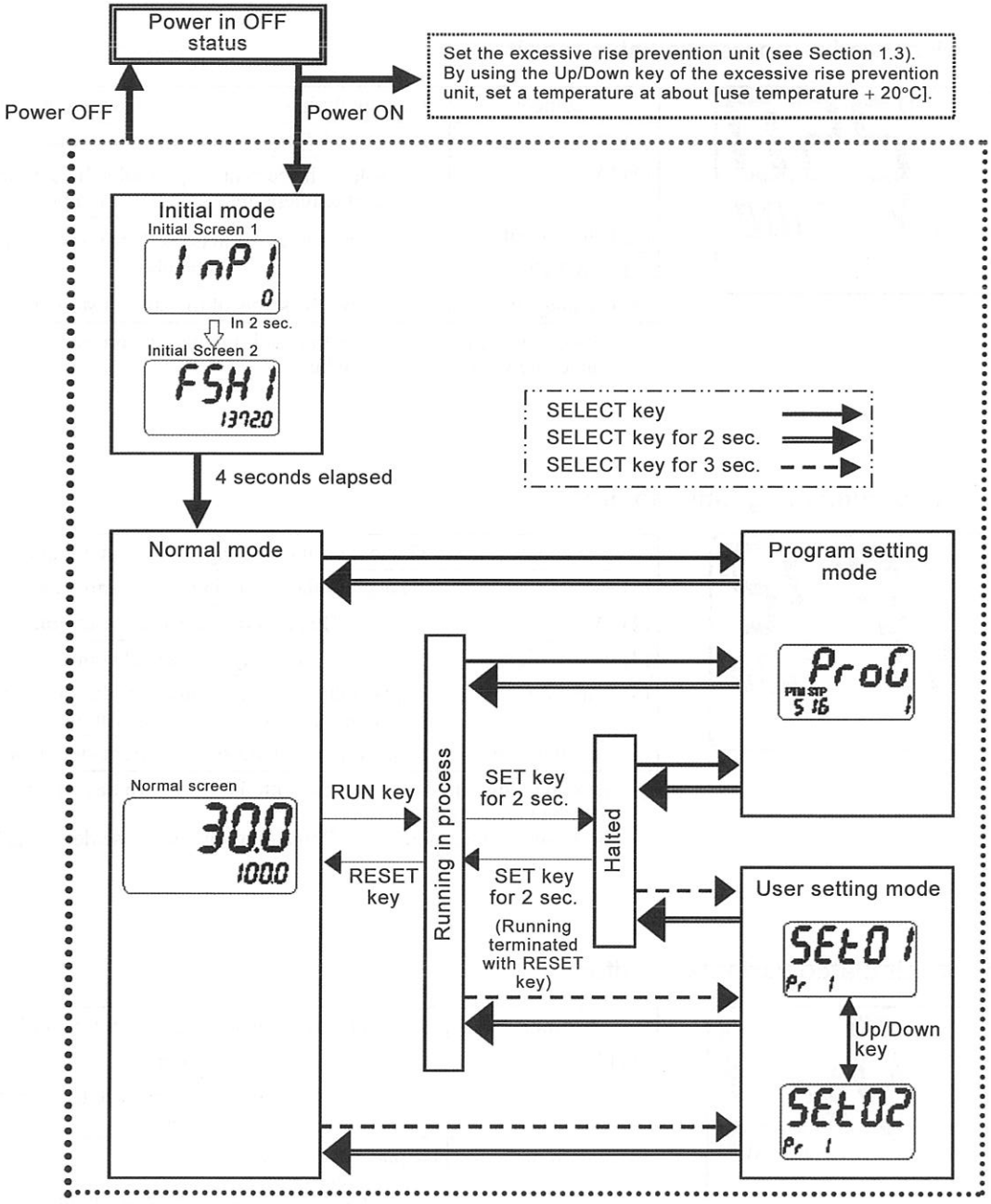


A program of 16 steps can be prepared along temperature and time that are set as respective Patterns 1 to 6. Upon completing executing all the program steps, running automatically stops; however, if time for a step is set at more than the maximum time (99 hours and 59 minutes) of the setting time range (displayed as " ¯"), continuous running starts from said step and continues until the RESET key is pressed. If time for a step is set at less than the minimum time of the setting time range (displayed as " –"), said step and thereafter are invalid, displaying no setting parameters. Step execution terminates at the step before said step shown as " –." In addition, various programming is possible by using wait and/or repeat function (maximum 99 counts) or linking (maximum 99 counts) Patterns 1 to 6.

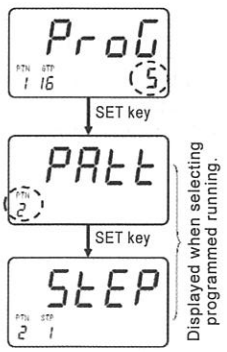
Take advantage of utilizing those features by referring to Section 3.4 "Various functions."

3. Operating Methods

3.1 Sequence of basic setting



* Selecting a running mode

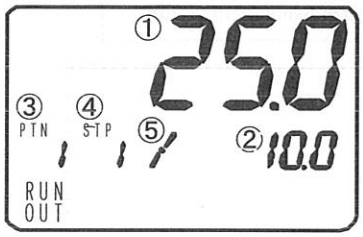


* By pressing the SELECT key in normal mode, open the screen as shown left.
* By using the Up/Down key, select a mode of running and press the SET key.
* If selecting the programmed running "5", select a Pattern No. and press the SET key.
* Hold the SELECT key down for two seconds and open normal mode.
* Selected running mode, pattern No. and step No. are displayed in the PTN/STP section.
* Press the RUN key to start running.

3.2 Monitor display switching

Press the DSP key during running or halt in order to display the measured temperature value, timer remaining time and manipulated variable monitors.

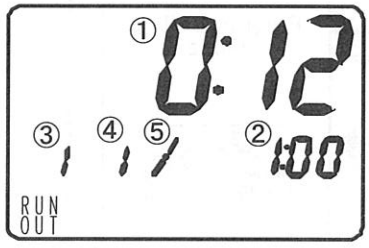
3.2.1 Measured temperature value monitor



Segment	Content during running	Content during halt
(1) PV	Displays measured temperatures.	
(2) SV	Displays the current preset temperature	Blinks the current preset temperature
(3) Pattern digit	Lights up or goes off in accordance with the program contents.	
(4) Step digit		
(5) Running status	Displays the status of the current step in process.	

* During running other than programmed running, the preset temperature is changeable with the Up/Down key.

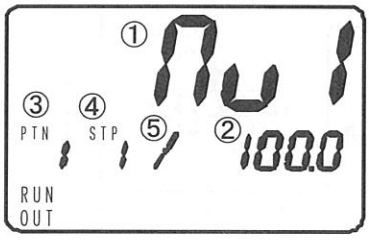
3.2.2 Timer remaining time monitor



Segment	Content during running	Content during halt
(1) PV	Displays the remaining time (semicolon blinks).	
(2) SV	Displays the selected preset time.	
(3) Pattern digit	Displays the repeat count.	
(4) Step digit	Displays the link execution count during programmed running. Goes off in other running modes.	
(5) Running status	Displays the status of the current step in process.	

* The remaining time is changeable with the Up/Down key (during running other than continuous running).
For details, see Section 3.4.2 "Remaining time increase/decrease."

3.2.3 Manipulated variable monitor

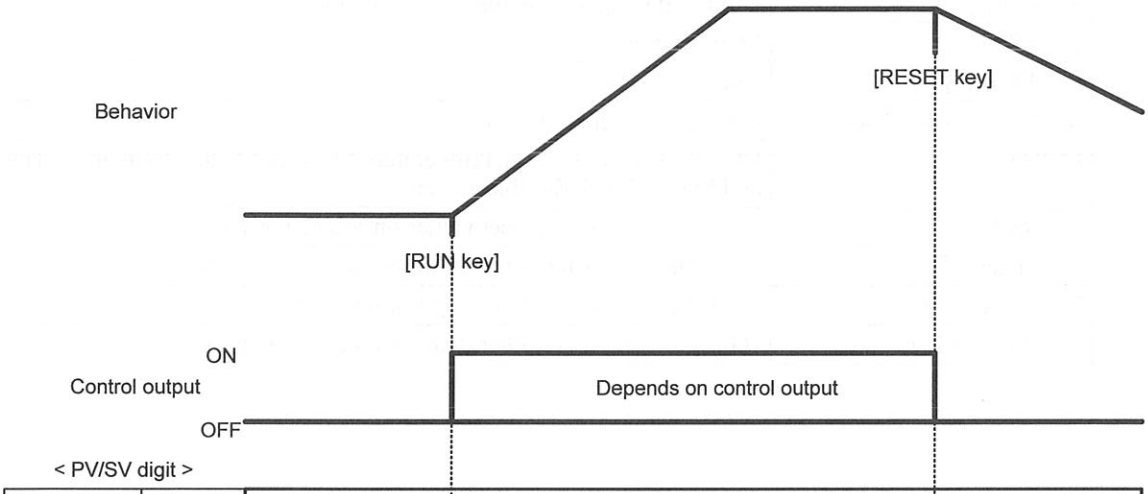


Segment	Content during running	Content during halt
(1) PV	Displays the character "MV1."	
(2) SV	Displays the manipulated variable being currently output.	
(3) Pattern digit	Displays the running character currently selected or pattern No.	Lights up or goes off in accordance with the program contents.
(4) Step digit	Displays the running character or the step No. currently in process.	
(5) Running status	Displays the status of the current step in process.	

* Manipulated variable (MV) is defined as a control amount of heater output in order to match it with a target temperature.
MV is automatically calculated, controlling the heater output in the range of 0.0% to 100.0%.

3.3 Running mode explanation

3.3.1 Continuous running (fixed temperature running)



< PV/SV digit >

PV/SV screen	PV digit		Measured temperature	
	SV digit		Preset temperature	
Remaining Time screen	PV digit	< Non-displayed >	0:00	< Non-displayed >
	SV digit	< Non-displayed >	0:00	< Non-displayed >
Manipulated Variable screen	PV digit	< Non-displayed >	M/1	< Non-displayed >
	SV digit	< Non-displayed >	Manipulated variable	< Non-displayed >

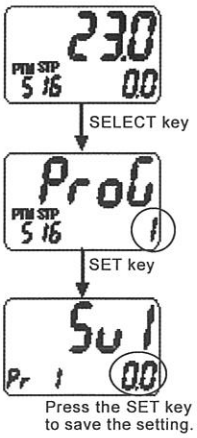
< Other segment digits >

Pattern digit		PR	
Step digit		1	
Running status	Goes off	Displays status	Goes off

< Lamp >

RUN lamp	Goes off	Lights up	Goes off
OUT lamp	Goes off	Lights up during control output in process	Goes off

< Setting method >

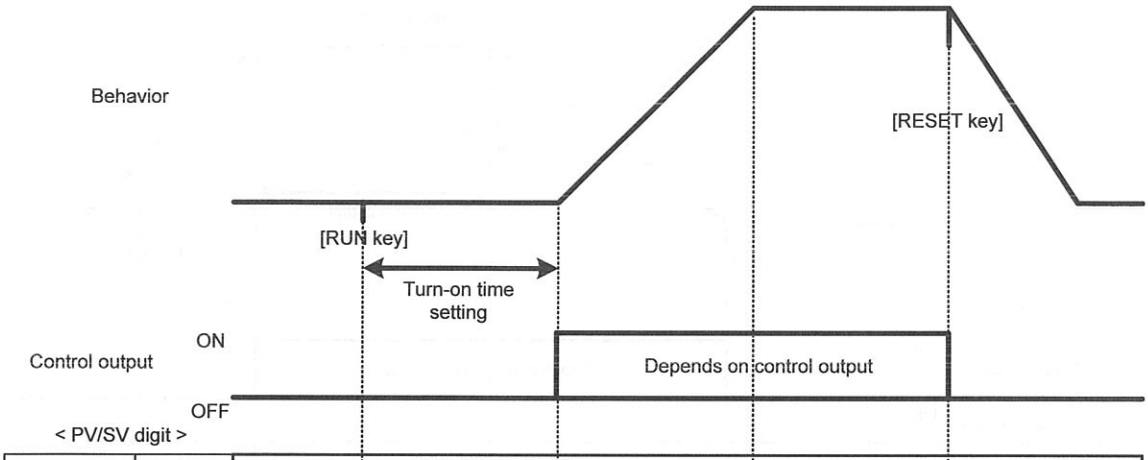


* Press the SELECT key on the Normal Mode screen.
* Set "1" with the Up/Down key.
* Press the SET key and open the next screen.
* Set the temperature with the Up/Down key.
* The setting range is from 0.0°C to [maximum temperature settable on the unit (SLH)]°C.
* Press the SET key to save the setting.
* Hold the SELECT key down for two seconds in order to return to the Normal Mode screen.
* Press the RUN key to start continuous running.
* Press the RESET key to terminate running at that point.

List of key operations during running

Key name	Description
RUN key	During running stop status, starts running.
RESET key	Stops running.
SELECT key	None
SELECT key for 3 seconds	Changes to user setting mode.
DSP key	Changes screen display: Temperature Measured Value, Remaining Time and Manipulated Variable screens.
Up key "△"	Used for increasing preset values on respective screens.
Down key "▽"	Used for decreasing preset values on respective screens.
Digit shifting key "◁"	Shifts the digit leftward during setting operation.
SET key for 2 seconds	Halts counting time (other than continuous running).

3.3.2 Automatic turn-on running



< PV/SV digit >

PV/SV screen	PV digit			Measured temperature	
	SV digit			Preset temperature	
Remaining Time screen	PV digit	< Non-displayed >	Remaining time	0:00	< Non-displayed >
	SV digit	< Non-displayed >	Turn-on set time	0:00	< Non-displayed >
Manipulated Variable screen	PV digit	< Non-displayed >		M/1	< Non-displayed >
	SV digit	< Non-displayed >		Manipulated variable	< Non-displayed >

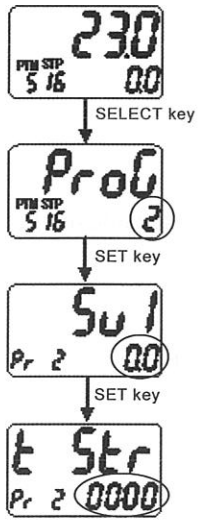
< Other segment digits >

Pattern digit			PR	
Step digit			2	
Running status	Goes off		Displays status	Goes off

< Lamp >

RUN lamp	Goes off		Lights up	Goes off
OUT lamp	Goes off		Lights up during control output in process	Goes off

< Setting method >



* Press the SELECT key on the Normal Mode screen.

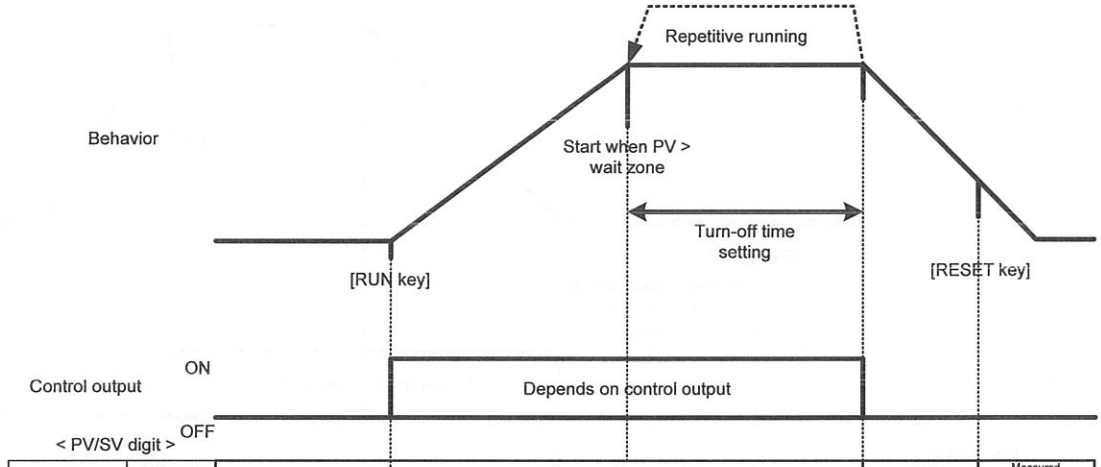
* Set "2" with the Up/Down key.
* Press the SET key and open the next screen.

* Set the temperature with the Up/Down key.
* The setting range is from 0.0°C to [maximum temperature settable on the unit (SLH)]°C.
* Press the SET key and open the next screen.

* Use the Up/Down key for setting automatic turn-on time.
* The setting range is 00 hours 00 minutes to 99 hours 59 minutes.
* Press the SET key and open the Temperature Setting screen.
* Hold the SELECT key down for two seconds in order to return to the Normal Mode screen.
* Press the RUN key to start automatic turn-on running.
* Press the RESET key to terminate running.

* For key operation during running, see Page 8.

3.3.3 Automatic turn-off running



< PV/SV digit >

PV/SV screen	PV digit		Measured temperature		END	Measured temperature
	SV digit	Preset temperature (lighting up)	Preset temperature (blinking)	Preset temperature (lighting up)		
Remaining Time screen	PV digit	< Non-displayed >	0:00	Remaining time	0:00	< Non-displayed >
	SV digit	< Non-displayed >	0:00	Turn-off set time	0:00	< Non-displayed >
Manipulated Variable screen	PV digit	< Non-displayed >	MV1			< Non-displayed >
	SV digit	< Non-displayed >	Manipulated variable			< Non-displayed >

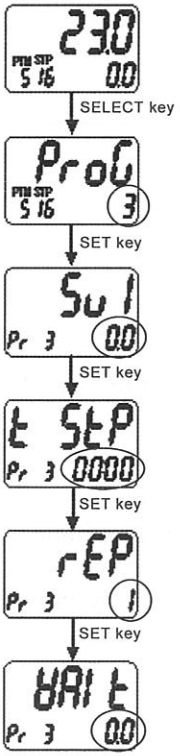
< Other segment digits >

Pattern digit		PR	
Step digit		3	
Running status	Goes off	Displays status	Goes off

< Lamp >

RUN lamp	Goes off	Lights up	Goes off
OUT lamp	Goes off	Lights up during control output in process	Goes off

< Setting method >



* Press the SELECT key on the Normal Mode screen.

* Set "3" with the Up/Down key.
* Press the SET key and open the next screen.

* Set the temperature with the Up/Down key.
* The setting range is from 0.0°C to [maximum temperature settable on the unit (SLH)]°C.
* Press the SET key and open the next screen.

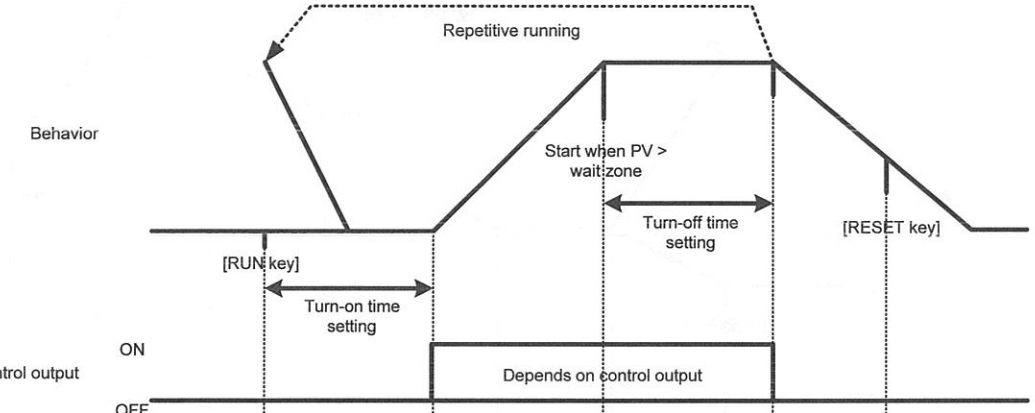
* Use the Up/Down key for setting automatic turn-off time.
* The setting range is 00 hours 00 minutes to 99 hours 59 minutes.
* Press the SET key and open the next screen.

* Set the repeat count with the Up/Down key.
* The setting range is 1 to 99 counts; "1" indicates no repeat.
* Press the SET key and open the next screen.

* Set the wait zone with the Up/Down key (see Section 3.4.5 "Wait function").
* Press the SET key and open the Temperature Setting screen.
* Hold the SELECT key down for two seconds in order to return to the Normal Mode screen.
* Press the RUN key to start automatic turn-off running.
* Upon completing running for a period equivalent to [preset time × repeat count], running automatically terminates.
* Press the RESET key to terminate running at that point.

* For key operation during running, see Page 8.

3.3.4 Automatic turn-on/off running



< PV/SV digit >

PV/SV screen	PV digit			Measured temperature		END	Measured temperature
	SV digit	Preset temperature	00	Preset temperature (blinking)	Preset temperature		
Remaining Time screen	PV digit	< Non-displayed >	Remaining time	0:00	Remaining time	0:00	< Non-displayed >
	SV digit	< Non-displayed >	Turn-on set time	0:00	Turn-off set time	0:00	< Non-displayed >
Manipulated Variable screen	PV digit	< Non-displayed >		MV1			< Non-displayed >
	SV digit	< Non-displayed >		Manipulated variable			< Non-displayed >

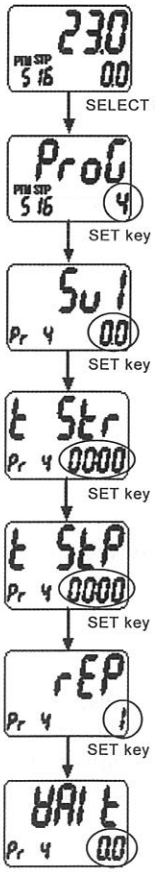
< Other segment digits >

Pattern digit			PR			
Step digit			4			
Running status	Goes off		Displays status		Goes off	

< Lamp >

RUN lamp	Goes off		Lights up		Goes off	
OUT lamp	Goes off		Lights up during control output in process		Goes off	

< Setting method >



* Press the SELECT key on the Normal Mode screen.

* Set "4" with the Up/Down key.
* Press the SET key and open the next screen.

* Set the temperature with the Up/Down key.
* The setting range is from 0.0°C to [maximum temperature settable on the unit (SLH)]°C.
* Press the SET key and open the next screen.

* Use the Up/Down key for setting automatic turn-on time.
* The setting range is 00 hours 00 minutes to 99 hours 59 minutes.
* Press the SET key and open the next screen.

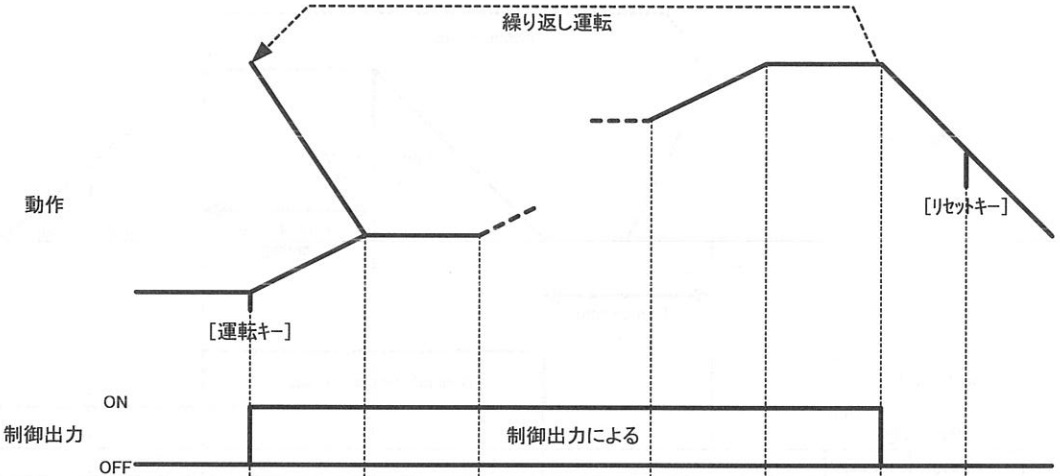
* Use the Up/Down key for setting automatic turn-off time.
* The setting range is 00 hours 00 minutes to 99 hours 59 minutes.
* Press the SET key and open the next screen.

* Set the repeat count with the Up/Down key.
* The setting range is 1 to 99 counts; "1" indicates no repeat.
* Press the SET key and open the next screen.

* Set the wait zone with the Up/Down key (see Section 3.4.5 "Wait function").
* Press the SET key and open the Temperature Setting screen.
* Hold the SELECT key down for two seconds in order to return to the Normal Mode screen.
* Press the RUN key to start automatic turn-on/off running.
* Press the RESET key to terminate running at that point.

* For key operation during running, see Page 8.

3.3.5 Programmed running (patterns settable as Patterns 1 to 6)



<PV/SV桁>

PV/SV画面	PV桁				測定温度			END	測定温度
	SV桁	0℃表示	ｽﾃｯﾌﾟ1設定温度	ｽﾃｯﾌﾟ2設定温度	----------	ｽﾃｯﾌﾟ15設定温度	ｽﾃｯﾌﾟ16設定温度	0℃表示	
残時間画面	PV桁	<非表示>	ｽﾃｯﾌﾟ1残時間	ｽﾃｯﾌﾟ2残時間	----------	ｽﾃｯﾌﾟ15残時間	ｽﾃｯﾌﾟ16残時間	0:00	<非表示>
	SV桁	<非表示>	ｽﾃｯﾌﾟ1設定時間	ｽﾃｯﾌﾟ2設定時間	----------	ｽﾃｯﾌﾟ15設定時間	ｽﾃｯﾌﾟ16設定時間	0:00	<非表示>
操作量画面	PV桁	<非表示>			MV1				<非表示>
	SV桁	<非表示>			現操作量				<非表示>

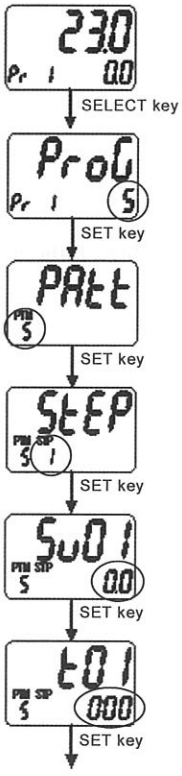
<他ｾｸﾞﾒﾝﾄ桁>

パターン桁	現ﾊﾟﾀｰﾝ番号			運転ﾊﾟﾀｰﾝ番号				現ﾊﾟﾀｰﾝ番号
ステップ桁	現ｽﾃｯﾌﾟ数	01	02	----------	15	16	現ｽﾃｯﾌﾟ数	現ｽﾃｯﾌﾟ数
運転状態	消灯			状態表示			消灯	

<ﾗﾝﾌﾟ>

RUNﾗﾝﾌﾟ	消灯			点灯			消灯	
OUTﾗﾝﾌﾟ	消灯			制御出力中は点灯			消灯	

< Setting method >



* Press the SELECT key on the Normal Mode screen.

* Set "5" with the Up/Down key.
* Press the SET key and open the next screen.

* Set Pattern (1 to 6) with the Up/Down key.
* Press the SET key and open the next screen.

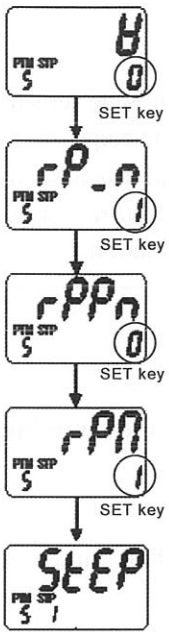
* Select a step No. targeted for setting with the Up/Down key.
* Press the SET key and open the next screen.

* Set a temperature for Step 1 with the Up/Down key.
* The setting range is from 0.0°C to [maximum temperature settable on the unit (SLH)]°C.
* Press the SET key and open the next screen.

* Set time for Step 1 with the Up/Down key.
* The setting range is 00 hours 00 minutes to 99 hours 59 minutes.
  If time for the step is set at more than the maximum time (99 hours and 59 minutes) of the setting time range (displayed as " ¯"), continuous running starts from said step and continues until the RESET key is pressed.
* Press the SET key and open the next screen.

Up to Step 16, perform the same operation.
(In case of skipping program steps → Section 3.4.4)

Go to the next page.



* Set a Wait Pattern No. (0 to 4) with the Up/Down key.
* Press the SET key and open the next screen.
  (How to set the wait function → Section 3.4.5)

* Set the repeat count with the Up/Down key.
* The setting range is 1 to 99 counts; "1" indicates no repeat.
* Press the SET key and open the next screen.

* Set a Link Destination Pattern No. (0 to 6) with the Up/Down key.
* The Link Destination Pattern No. of "0" indicates no link.
* Press the SET key and open the next screen.
  (How to set the link → Section 3.4.3)

* Set a link execution count (1 to 99 counts) with the Up/Down key.
* Press the SET key to return to the Step No. Select screen.
* Hold the SELECT key down for two seconds in order to return to the Normal Mode screen.
* Press the RUN key to start program running.
* Press the RESET key to terminate running at that point.

List of key operations during running

Key name	Description
RUN key	During running stop status, starts running.
RESET key	Stops running.
SELECT key	Changes to program setting mode.
SELECT key for 3 seconds	Changes to user setting mode.
DSP key	Changes screen display: Temperature Measured Value, Remaining Time and Manipulated Variable screens.
△ key	Used for increasing preset values on respective screens.
△ key for 3 seconds	Changes to the next step on the Temperature Measured Value screen.
▽ key	Used for decreasing preset values on respective screens.
▽ key for 3 seconds	Changes to the next step on the Temperature Measured Value screen.
◁ key	Shifts the digit leftward during setting operation.
SET key for 2 seconds	Halts counting time.

* During running, changing settings of step temperature and time in process is not possible.
* The SV display is for the preset temperature of the step in process. However, the temperature is internally rising from the start temperature of the step in process toward the preset temperature of said step along the preset time.
* With PV start in selection, if the preset temperature of Step 1 is set at the minimum value ("–" display) of the preset temperature range, the preset time of Step 1 is valid (normal PV start is executed from Step 2). In this case, "TIME" is displayed in the SV display frame. (See Section 3.4.7 "PV/SV start.")

3.4 Various functions

3.4.1 Step feed/return function

- Holding the Up key down for three seconds on the Temperature Measured Value screen during programmed running enables steps to be forcibly advanced from the current step.
- Holding the Down key down for three seconds on the Temperature Measured Value screen during programmed running enables steps to be forcibly retreated from the current step. Still, the step return is not possible with the first step arrived from the link destination.

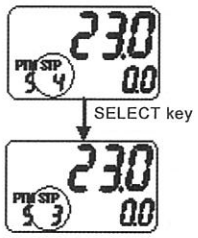
* For the link function, see Section 3.4.3.

< How to operate step feed >

* Hold the Up key down for three seconds on the Temperature Measured Value screen during programmed running.

* The No. for the step digit turns from "4" to "5." This indicates that the step advanced to Step 5.

< How to operate step return >



* Hold the Down key down for three seconds on the Temperature Measured Value screen during programmed running.

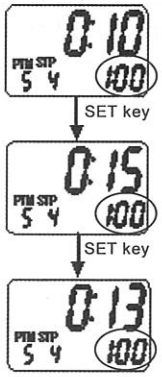
* The No. for the step digit turns from "4" to "3." This indicates that the step retreated to Step 3.

3.4.2 Remaining time increase/decrease

- Remaining time is increased/decreased by pressing the Up/Down key on the Remaining Time screen during running (excluding continuous running).
- Remaining time is displayed in the unit of minute.
- The changeable range of remaining time is from the preset time to 1 minute.
- Remaining time is changed in the unit of minute. The digit of second remains as is.

  Example: With the remaining time of 2 minutes 30 seconds, shortening it by 2 minutes results in a new remaining time of 30 seconds.

< How to increase/decrease remaining time >



* Open the Remaining Time screen with the DSP key.
* For increasing five minutes on this screen (ten minutes remaining), press the Down key five times.
* Press the SET key to confirm the setting.

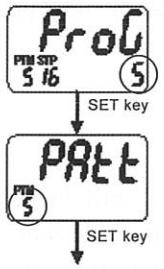
* For decreasing two minutes on this screen (15 minutes remaining), press the Up key twice.
* Press the SET key to confirm the setting.

* Press the DSP key twice to return to the Temperature Measured Value screen.

3.4.3 Link function

- Patterns can be linked one another for programmed running.
- Upon completing a final step in programmed running and the running of corresponding pattern for its repeat count, the pattern changes to the linked one and running starts. If "0" is set for a linked Pattern No. in this operation, no link is established and running terminates.
- For repetitive running with a series of linked patterns, set the first Pattern No. as the link destination of the final pattern.
- Each of repeat and link execution counts of a pattern is settable in the range of 1 to 99.
- Link execution count is only valid in setting of the linked final pattern.
- [Link execution count = 1] indicates no repeat, or running terminates without repeat.

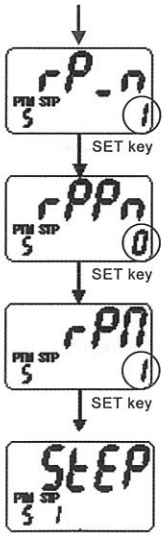
< How to set the link function >



* Select "5" on the Running Mode Select screen and press the SET key.

* Select a Pattern No. targeted for setting the link function and press the SET key.

Press the SET key to open the Link Count Setting screen.



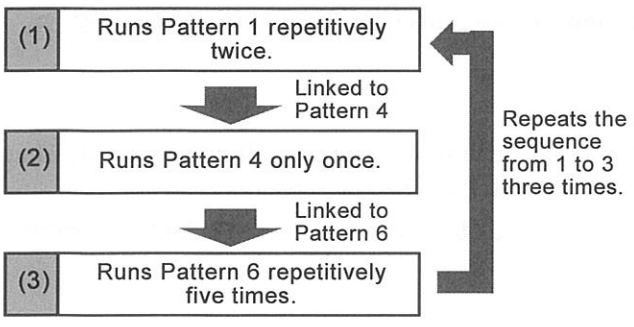
* Set the repeat count with the Up/Down key.
* Setting range: 1 to 99 ("1" for no repeat.)
* Press the SET key and open the next screen.

* Set a Link Destination Pattern No. (0 to 6) with the Up/Down key.
* The Link Destination Pattern No. of "0" indicates no link.
* Press the SET key and open the next screen.

* Set a link execution count with the Up/Down key.
Setting range: 1 to 99 ("1" for no repeat.)
* Link execution count is only valid in setting of the linked final pattern.

* Press the SET key to return to the Step No. Select screen.
* Hold the SET key down for two seconds to open the Normal Mode screen.

Example of program execution using the link function



Preset values for executing the programmed running shown left

Pattern	Preset items	Preset values
Pattern 1	Repeat execution count (RP_N)	2
	Link destination Pattern No. (RPPN)	4
	Link execution count (RPM)	*1
Pattern 4	Repeat execution count (RP_N)	1
	Link destination Pattern No. (RPPN)	6
	Link execution count (RPM)	*1
Pattern 6	Repeat execution count (RP_N)	5
	Link destination Pattern No. (RPPN)	1
	Link execution count (RPM)	3

* For link execution count, the preset values of the final pattern (Pattern 6, in this case) apply.
Set arbitrary numbers other than "0" (1 to 99) as link execution counts for Patterns 1 and 4.

* If, in the above-mentioned case of link running, "4" is set as link destination of Pattern 6 and a number other than "0" is set as link execution count for Pattern 6, Patterns 4 and 6 are continuously linked and running continues until the RESET key is pressed to stop the running.

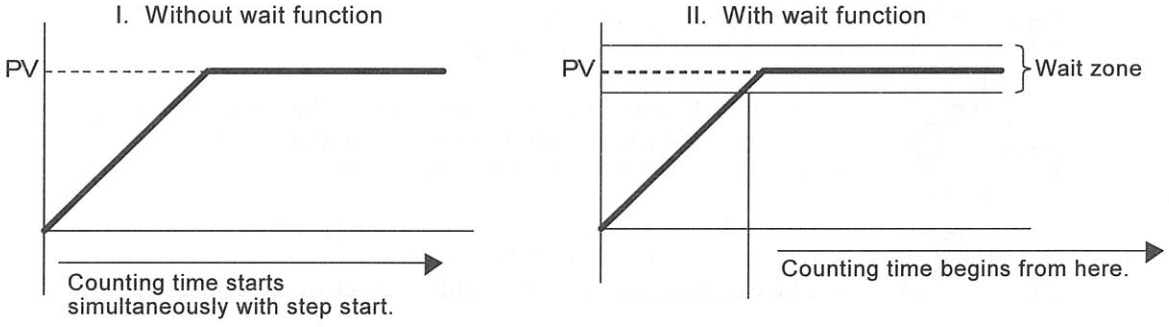
3.4.4 Program step skip

– To stop pattern running before a step, set the preset temperature of said step to be lower than the minimum value ("–"display) of the setting range in program setting.

For example, running targets to be terminated after completing Steps 1 to 3, set the temperature to "–" on the Temperature Setting screen of Step 4. Then, the Setting screens of Step 5 and thereafter are skipped by pressing the Setting key, opening the Wait Function Setting screen.

3.4.5 Wait function

The wait function is for establishing a wait status without time being counted until the measured temperature reaches close to the preset temperature, where running is executed by establishing correlation between temperature and time, for example, automatic turn-off or turn-on/off running and programmed running. Without the wait function being set, counting time starts simultaneously with step start. Thus, the setting of the wait function is essential for running only with targeted temperature but without any other factor.



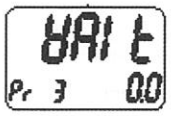
◆ Wait setting for automatic turn-off/turn-on running

– For automatic turn-off or turn-on/off running, set a repeat count and then wait zone (temperature width). The wait zone can be set in the range of 0.0°C to 99.0°C.

The wait zone set for 1.0°C indicates the zone of [preset temperature ± 1.0°C] and counting time starts when the measured temperature reaches the zone.

– Setting the wait zone for 0°C results in simultaneous starts of counting time and running.

< How to set wait zone >



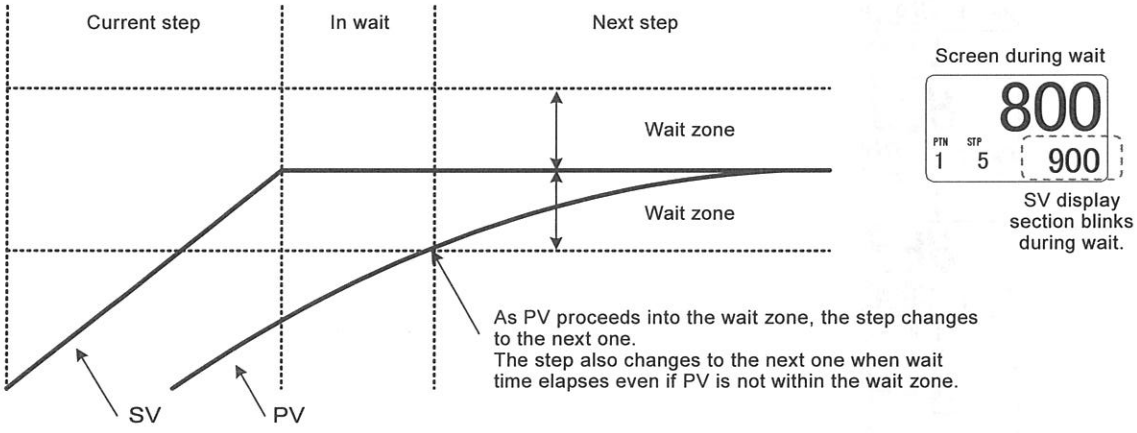
* Set a wait zone for automatic turn-off or turn-on/off running by pressing the Up/Down key on the Wait Zone Setting screen.

→ See Sections 3.3.3 "Automatic turn-off running" and 3.3.4 "Automatic turn-on/off running."

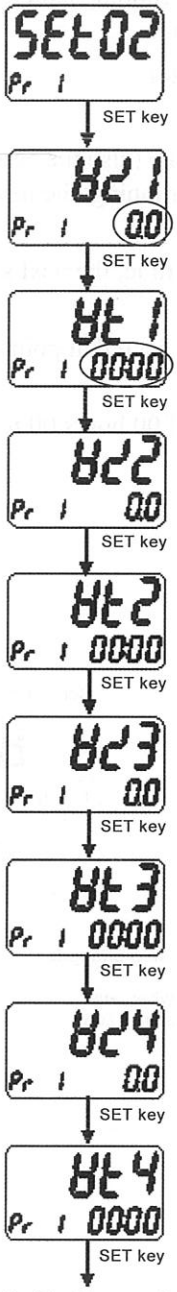
◆ Wait setting for programmed running

- Wait Patterns 1 to 4 or no wait function as "0" can be selected for each running pattern. The selected wait pattern applies for all steps of wait-set pattern running.
- Wait Patterns 1 to 4 are set on the User Setting screen (see the next page).
- In Wait Patterns 1 to 4, wait time and wait zone (temperature) are set.
- In case a measured temperature (PV) does not reach within the wait zone (also the case of reaching beyond the zone) after step time elapses during programmed running, the next step does not start and wait time starts being counted from that point.
- When the measured temperature reaches the wait zone within the wait time, the next step starts from that point.
- In case [step time + wait time] elapses, the next step is forcibly started from that point even if the measured temperature is not within the wait zone.
- A wait zone is settable in the range of 0.0°C to 99.0°C and wait time of 00 hours 00 minutes to 99 hours 59 minutes.

Schematic illustration of wait function in programmed running



< How to set wait pattern >



0. To Preset Item Select screen

* Hold the SELECT key down for three seconds in normal mode.
* Select "SET02" with the Up/Down key.
* Press the SET key.

* Set a temperature wait zone for Wait Pattern 1 with the Up/Down key (0.0°C to 99.0°C).
* Press the SET key.

* Set wait time for Wait Pattern 1 with the Up/Down key (00 hours 00 minutes to 99 hours 59 minutes).
* Press the SET key.

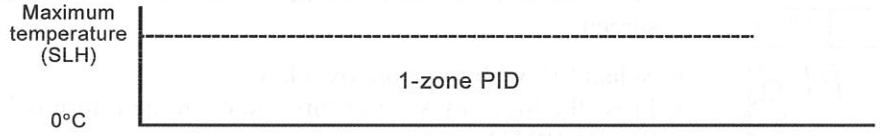
* Similarly perform the setting for Wait Patterns 1 to 4.
* As to how to set wait in program setting, see Section 3.3.5 "Programmed running."

3.4.6 1-zone/3-zone PID function

- An ideal automatic temperature control can be obtained by combining three behavioral elements, i.e., proportional (P), integral (I) and derivative (D) behavioral elements, in their optimal states. This control method is referred to as PID control method.
- This product provides a PID control with either 1-zone or 3-zone.

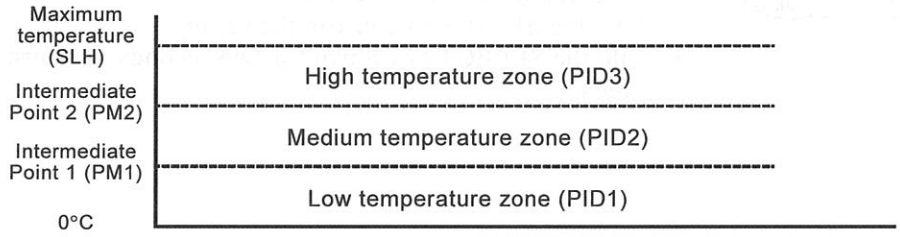
1-zone PID control

The PID control is executed in one zone, which is set as [0°C to the maximum temperature on the unit (SLH)]. (There is only one PID control value.)

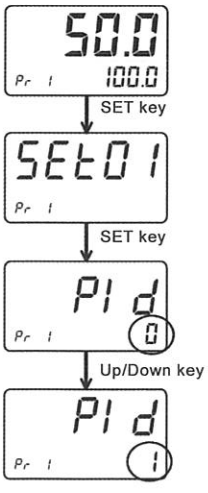


3-zone PID control

The temperature zone is divided into three zones, i.e., low, medium and high temperature zones, and the PID control best suited for each zone is executed. (PID control value is automatically switched for each zone.)



< How to switch 1-zone/3-zone PID control >



* Hold the SELECT key down for three seconds in normal mode.

* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the PID Setting (PID) screen.

* Select "0" if executing 1-zone PID control.
* Press the SET key to confirm the setting.
* Hold the SELECT key down for two seconds to return to the Normal screen.

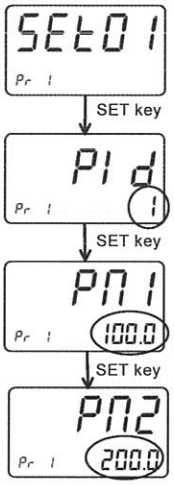
* For executing 3-zone PID control, select "1" with the Up/Down key.
* Press the SET key to confirm the setting.
* Hold the SELECT key down for two seconds to return to the Normal screen.

For executing 3-zone PID control, set Intermediate Point 1 (PM1) and 2 (PM2) in order to divide the temperature layer into three.

Settable range

Intermediate Point 1 (PM1)	0.0°C to [maximum temperature on the unit (SLH) – 5.0°C] Example: 0.0°C to 255.0°C on a unit having the maximum temperature of 260°C
Intermediate Point 2 (PM2)	PM1 value to maximum temperature on the unit (SLH)

< How to set intermediate points for 3-zone PID control >



* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the PID Setting (PID) screen.
* Select "1" with the Up/Down key.
* Press the SET key several times to open the Intermediate Point 1 Setting (PM1) screen.
* Set the temperature of Intermediate Point 1 with the Up/Down key. As an example, set it at 100.0°C.
* Press the SET key.
* Set the temperature of Intermediate Point 2 (PM2) with the Up/Down key. As an example, set it at 200.0°C.
* Press the SET key to confirm the setting.
* Hold the SELECT key down for two seconds to return to the Normal screen.

3.4.7 Auto-tuning function

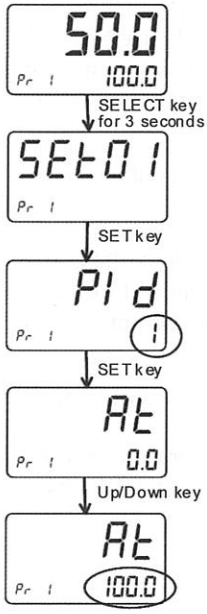
- Advanced level of skill and experience is required for a human to select respective values for PID control constants P, I and D. Auto-tuning is a function where optimal PID control values are automatically calculated and set by a computer.
- This product incorporates auto-tuning functions for 1-zone and 3-zone.

Auto-tuning can only be executed during running.

◆ 1-zone auto-tuning

Auto-tuning is executed such that PID control is optimized at a temperature set as a target.

< How to execute 1-zone auto-tuning >



* Hold the SELECT key down for three seconds during running.

* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the PID Setting (PID) screen.

* Select "0" with the Up/Down key.
* Press the SET key.

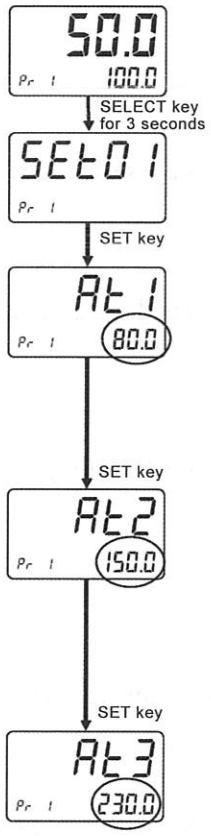
* The Auto-tuning (AT) Temperature Setting screen appears.

* Set a temperature targeted for executing auto-tuning by pressing the Up/Down key.
  The setting range is 0.0°C to the maximum temperature on the unit (SLH).
  As an example, set it at 100.0°C.
* By pressing the RUN key, auto-tuning starts.
* While auto-tuning being in process, "AT" and "PV" are alternately displayed.
* Upon completing auto-tuning, a PID value is automatically set.
* Press the RESET key to stop auto-tuning.
* In case auto-tuning does not end in three hours after starting, an error is generated to stop running and display "ERR 8."

◆ 3-zone auto-tuning

The temperature zone is divided into three, and auto-tuning is executed at a temperature targeted in each zone.

< How to execute 3-zone auto-tuning >



* Hold the SELECT key down for three seconds during running.

* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the Low-temperature Auto-tuning Startup (AT1) screen.

* Set an auto-tuning execution temperature for the low-temperature zone by pressing the Up/Down key.
  Setting range: 0.0°C to Intermediate Point 1 (PM1)
* Upon completing the temperature setting, press the RUN key for executing auto-tuning at low temperature (low-temperature auto-tuning start).
* For executing auto-tuning at a medium or high temperature, do not press the RUN key but the SET key.

* Set an auto-tuning execution temperature for the medium-temperature zone by pressing the Up/Down key.
  Setting range: PM1 to PM2 values
* Upon completing the temperature setting, press the RUN key for executing auto-tuning at medium temperature (medium-temperature auto-tuning start).
* For executing auto-tuning at a high temperature, do not press the RUN key but the SET key.

* Set an auto-tuning execution temperature for the high-temperature zone by pressing the Up/Down key.
  Setting range: PM2 value to the maximum temperature on the unit (SLH)
* For executing auto-tuning at a high temperature, press the RUN key on this screen (high-temperature auto-tuning start).

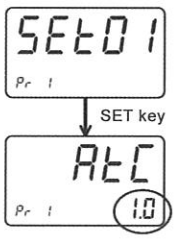
* While auto-tuning being in process, "AT" (1 to 3) and "PV" are alternately displayed.
* Upon completing auto-tuning, a PID value is automatically set.
* Press the RESET key to stop auto-tuning.
* In case auto-tuning does not end in three hours after starting, an error is generated to stop running and display "ERR 17."

Regarding auto-tuning sensitivity (ATC)

– In auto-tuning, calculation is executed by turning on or off the heater output near the set temperature, where the timing of the turn-on/off is settable by setting an auto-tuning sensitivity (or temperature width) (setting range: 0.0°C to 2.0°C).

– If the auto-tuning sensitivity is set at 1.0°C, the heater output is turned on or off within ±0.5°C of the set temperature for calculating the PID control value.

< How to set auto-tuning sensitivity >



* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the Auto-tuning Sensitivity Setting (ATC) screen.

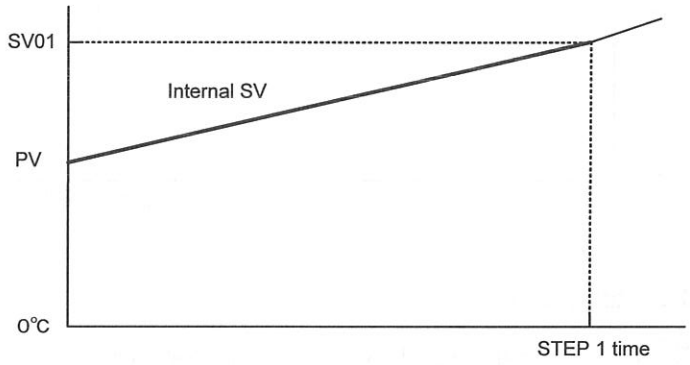
* Set the auto-tuning sensitivity with the Up/Down key.
* Press the SET key to confirm the setting.

3.4.8 PV and SV Starts

- A starting method of programmed running is selectable from three patterns: PV Starts 1 and 2 and SV Start.
- Make a selection and set it on the User Setting screen. (Default setting is PV Start 2).

< PV Start 1 >

The program execution starts at the current measured temperature (PV) (counting time begins from "0" minute).

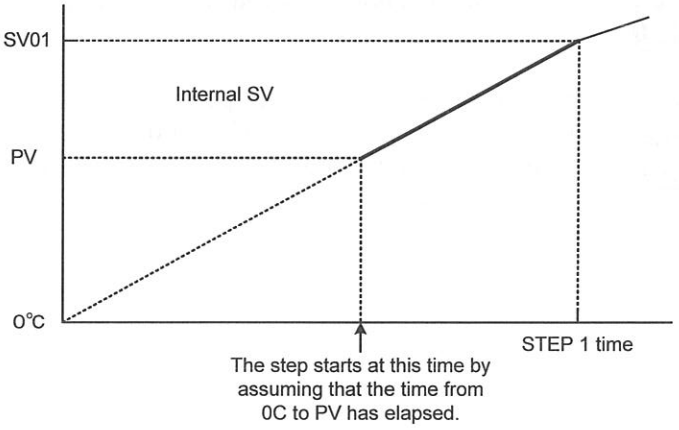


< PV Start 2 >

Running starts at the ramp step containing the current measured temperature (PV).

In addition, time is counted from remaining time by assuming that time has elapsed to the start point.

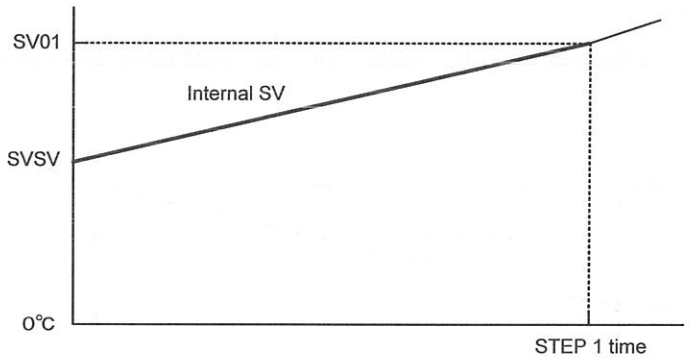
Example: For the case of PV at 50°C, SV at 100°C and STEP time of 10 minutes, a control is executed in a way that five minutes is assumed as already elapsed for temperature to rise from 0°C to 50°C and five minutes is taken for a temperature to rise from 50°C to 100°C.



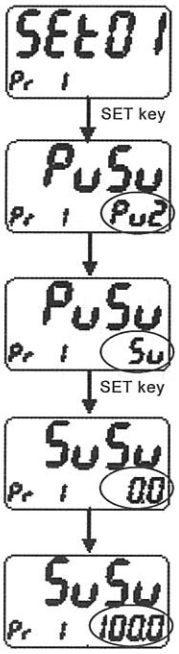
< SV Start >

Programmed running starts at the SV Start preset temperature.

The control is executed for raising or lowering the temperature from the SV Start preset temperature toward the SV (preset temperature) in the STEP time, disregarding the current measured temperature (PV).



< How to set SV temperature >



* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key.

* Select PV Start 1 (PV1), PV Start 2 (PV2) or SV Start (SV) with the Up/Down key.

* As an example, select SV Start for setting.
* Press the SET key.

* Set a start temperature for SV Start with the Up/Down key. (This item is not displayed when selecting PV Start 1 or 2.)

* As an example, set the temperature at 100°C.
* Press the SET key for confirmation.
* To return to the Normal screen, hold the SELECT key down for two seconds.

3.4.9 Temperature correction function

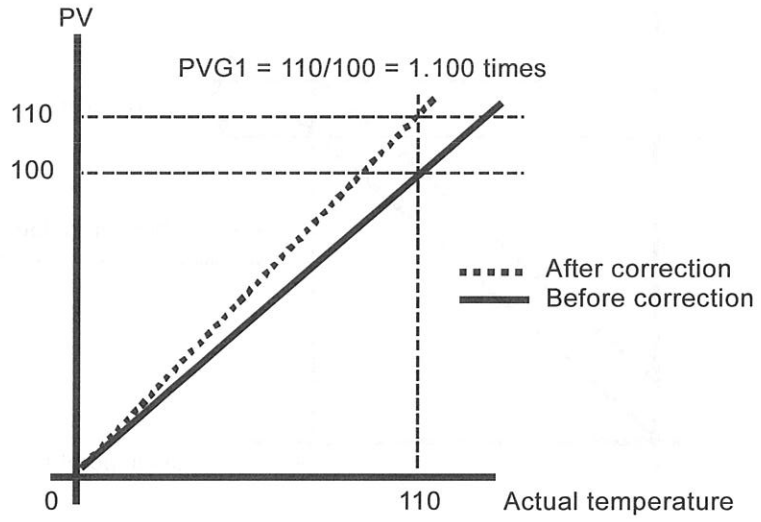
3.4.9.1 Gain setting correction

- To correct the gain, the measured value (PV) is multiplied by a correction value (or coefficient).
- Correctable range: 0.500 to 2.000 (times)

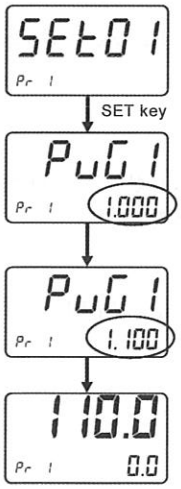
< Example >

In the case the measured value is displayed as 110°C and the actual temperature is 100°C:

Measured value (110°C)/actual temperature (100°C) = correction value (1.100)



< How to correct gain setting >



* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the Gain Setting Correction (PVG1) screen.

* Set a correction value (0.500 to 2.000) with the Up/Down key.

* "1.100" is set from "1.000."
* Press the SET key for confirmation.
* To return to the Normal screen after setting, hold the SELECT key down for two seconds.

* Check that the measured value is 1.1 times the one before setting.

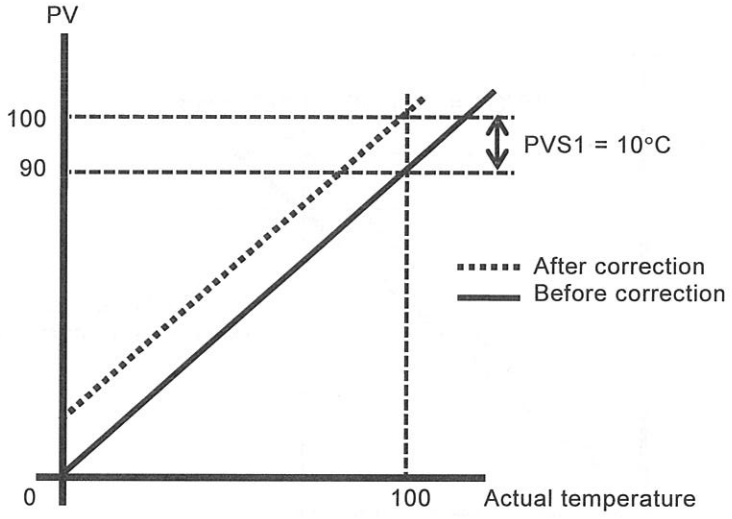
3.4.9.2 Zero setting correction

- To correct the zero setting, a correction value is added to the measured value (PV).
- Correctable range: Measured value (PV) ± 999.9°C

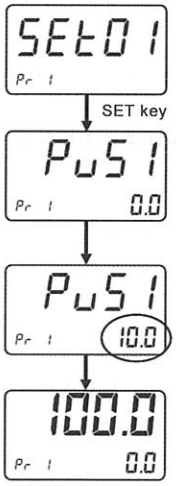
< Example >

In the case the measured value is displayed as 90°C and the actual temperature is 100°C, and correction is thus to be made with +10°C:

Actual temperature (100°C) – measured value (90°C) = correction value (+10°C)



< How to correct zero setting >



* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the Zero Setting Correction (PVS1) screen.

* Set a correction value (difference between the measured value and actual temperature) with the Up/Down key.
* As an example, + 10°C is set.
* Press the SET key for confirmation.
* To return to the Normal screen after setting, hold the SELECT key down for two seconds.
* Check that the measured value is + 10°C of the one before setting.

* The following equation is used for calculating a correction value for combining "PV gain setting correction" and "PV zero setting correction."

PV after correction = gain correction value + zero correction value

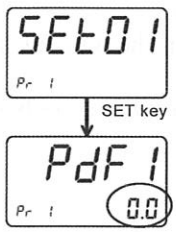
3.4.10 PV filter function

By using the PV filter function, a first-order lag can be calculated for the measured value (PV). Filtering effect is settable via a time constant (t) (setting range: 0.0 to 99.9 seconds).

[Application of a PV filter]

- Removes influence of electric noise on the measured value (PV).
- Delays response to a drastic change of input.

< How to set PV filter >



* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the PV Filter Setting (PDF1) screen.
* Set a time constant (0.0 to 99.9) with the Up/Down key.
* Press the SET key for confirmation.
* To return to the Normal screen, hold the SELECT key down for two seconds.

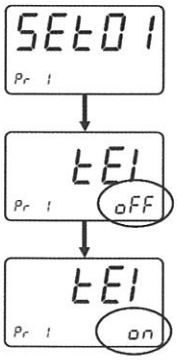
3.4.11 Power outage recovery function

- In case power is lost during running, the following behaviors are taken in accordance with the outage recovery setting.

Running status	Outage recovery setting: ON	Outage recovery setting: OFF
During stop	Recovered for the status of running stop.	Recovered for the status of running stop.
During running	Recovered for the status of running. (*1)	Recovered for the status of running stop

*1: Recovered for the execution step and remaining time before outage. In addition, "Err 14" is displayed.

< How to set power outage recovery function >

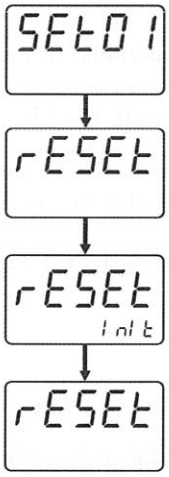


* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the Power Outage Recovery Function Setting (TEI) screen.
* Press the Up/Down key to set OFF/ON.
* "OFF" is changed to "ON."
* Press the SET key for confirmation.
* To return to the Normal screen, hold the SELECT key down for two seconds.

3.4.12 Initialization setting

- Various setting values can be initialized to those at shipment from the manufacturer.
- Hold both Up and Down keys down for two seconds in order to start initializing the user initialization setting items.
- While the initialization being in process, "InIt" is displayed and, upon completion, the display goes off.

< How to execute initialization >



* Hold the SELECT key down for three seconds in normal mode.
* Select "SET01" with the Up/Down key.
* Press the SET key several times to open the RESET screen.

* Hold both Up and Down keys down for two seconds on this screen to start initialization.

* While the initialization being in process, "InIt" is displayed.

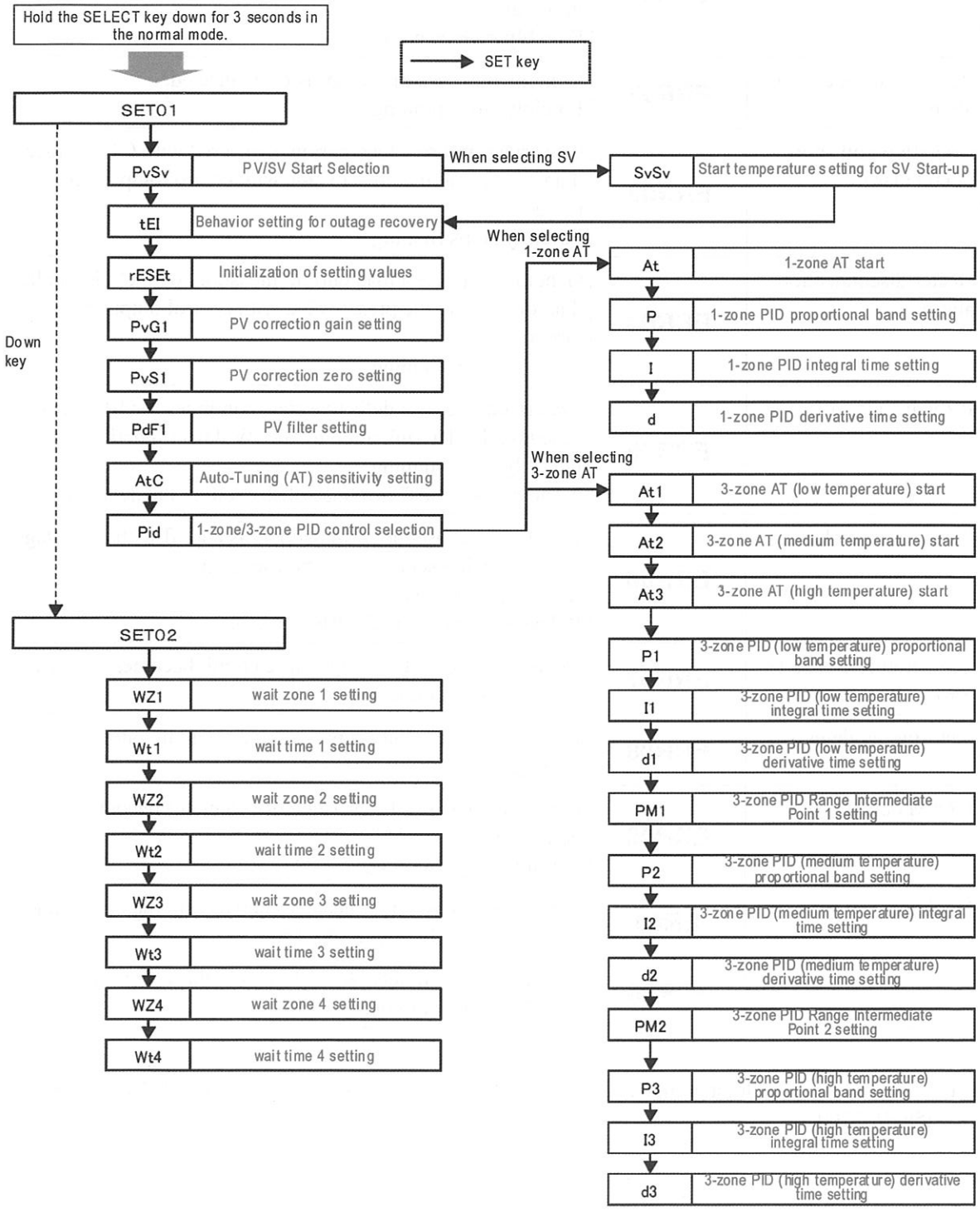
* Upon completing initialization, the SV display digits go off to open the previous screen.

4. User Setting

– The following is settable in the user setting mode.

SET 01	
- PV/SV Start Selection - Behavior setting for outage recovery - Initialization of setting values - PV correction gain setting - PV correction zero setting	- PV filter setting - Auto-Tuning (AT) sensitivity - 1-zone/3-zone PID control selection - 1-zone auto-tuning setting (startup and PID setting) - 3-zone auto-tuning setting (startup, intermediate point and PID)
SET 02	
- Temperature wait zone setting (4 patterns)	- Wait time setting (4 patterns)

< Setting sequence >



5. Error Display

- In case any defect occurs on this unit, the error content is displayed.
- The following describes methods for displaying various defects.
- With a defect in occurrence, corresponding characters are displayed in the PV digits; with multiple defects in occurrence, corresponding characters are alternately displayed every one second.
- All errors except for the power outage alarm are released by turning off the power supply.

Name	Display	Occurrence condition
Preset value defect	**ERR01**	Generated in case data outside the setting range is stored. Displays the defect, and automatically changes the data to the limit value. Forcibly stops running.
Sensor disconnection alarm	**ERR02**	Generated in case the sensor is disconnected. Forcibly stops running.
Operating unit short circuit alarm	**ERR03**	Generated in case a load current measured with CT is larger than or equal to the preset value with control output being turned off. Forcibly stops running.
Heater disconnection alarm	**ERR04**	Generated in case a load current measured with CT is smaller than or equal to the preset value with control output being turned on. Forcibly stops running.
PV value alarm	**ERR05**	Generated in case a defective state continues for 10 seconds based on the determination by the PV defect function. Forcibly stops running. * The "10 seconds" is adjustable by setting the delay timer.
Power outage alarm	**ERR06**	Generated in case the power supply is cut off with the outage recovery being set to ON in the user setting. Running continues. Released by pressing the RESET key.
Temperature controller error	**ERR07**	Generated in case the temperature circuit becomes defective. Forcibly stops running.
Auto-tuning defect	**ERR08**	Generated in case auto-tuning does not end in 3 hours after starting.
FRAM defect	**ERR09**	Generated in case FRAM (memory element) becomes defective. Forcibly stops running.
DI alarm	**ER00**	Generated in case input becomes active with the alarm function being selected for any of DIs 1 to 6.
	~ER99	Displays one of defect Nos. 00 to 99 in this alarm case. Forcibly stops running.

In case of confusion, including impossible error release, call Isuzu Seisakusho's ISUZU CAP call center at +81-256-46-2200.

6. Specification

List of setting values

Setting parameters for continuous (constant value) running; automatic turn-on, turn-off and turn-on/off running

	Indication symbol	Name	Setting content	Default value
1	Sv01	Setting temperature	0 to SLH (responded to each product)	0.0
2	t Str	Automatic turn-on time setting	0:00 to 99:59 (hour: minute)	0:00
3	t StP	Automatic turn-off time setting	0:00 to 99:59 (hour: minute)	0:00
4	rEP	Repeat count setting (*2)	1 to 99 counts	1
5	WAIt	Wait zone setting	0.0 to 999.9 (°C) or 0 to 999 (°C)	0.0

Setting parameters for programmed running Patterns 1 to 6

	Indication symbol	Name	Setting content	Default value
1	PAtt	Pattern No. (*2)	1 to 6 (displayed in the pattern digit)	1
2	StEP	Jumping Destination Step No. Select screen	1 to 16 (displayed in the step digits; non-memorized)	1
3	Sv *	Preset temperature (*1)	0 to SLH (corresponds to each product)	0.0
4	t *	Preset time (*1)	0:00 to 99:59 (hour: minute)	0:00
5	W	Wait function setting (*3)	0 to 4 ("0" indicates no function.)	0
6	rP_n	Repeat count (*3)	1 to 99 counts	1
7	rPPn	Link destination Pattern No. setting (*3)	0 to 6 ("0" indicating no destination = ending)	0
8	rPM	Link repeat count (*2)	1 to 99 counts (common to all patterns)	1

Setting parameters for SET 01 (user setting)

	Indication symbol	Name	Setting content		Default value
1	PvSv	PV/SV Start select (*2)	Pv1	PV Start 1	Pv2
			Pv2	PV Start 2	
			Sv	SV Start	
2	SvSv	SV Start temperature setting (*2)	0 to SLH (responded to each product)		0.0
3	tEI	Behavior setting for outage recovery	OFF	Absence of outage recovery	OFF
			ON	Presence of outage recovery	
4	rESEt	Preset value initialization (*2)	Initialization for the values at manufacturer shipment starts by holding both Up and Down keys down for 2 seconds. "InIt" is displayed during initialization and goes off when completed.		
5	PvG1	PV correction gain setting	0.500 to 2.000 (times)		1.000
6	PvS1	PV correction zero setting	(*4) -999.9 to 999.9 (°C) or -999 to 999 (°C)		0.0
7	PdF1	PV filter setting	0.0 to 99.9 (seconds)		0.0
8	AtC	AT (auto-tuning) sensitivity	0.0 to 2.0 (°C) or 0 to 2 (°C)		1.0
9	Pid	1-zone/3-zone PID select (*2)	0	1-zone AT select	0
			1	3-zone AT select	

	Indication symbol	Name	Setting content	Default value
10	At	1-zone AT Startup screen	Startup operation starts by pressing the RUN key after setting a SV and stops by pressing the RESET key. During AT, character and PV are alternately displayed in the PV digits. SV range: 0 to SLH (responded to each product)	0.0
11	P	1-zone PID proportional band setting	0.1 to 200.0 (%)	Default value varies depending on the model.
12	I	1-zone PID integral time setting	0 to 3600 (seconds)	
13	d	1-zone PID derivative time setting	0 to 3600 (seconds)	
14	At1	3-zone AT No. 1 (low temperature) Startup screen	Startup operation starts by pressing the RUN key after setting a SV and stops by pressing the RESET key. During AT, character and PV are alternately displayed in the PV digits. SV range: 0 to PM1	0.0
15	At2	3-zone AT No. 2 (medium temperature) Startup screen	Startup operation starts by pressing the RUN key after setting a SV and stops by pressing the RESET key. During AT, character and PV are alternately displayed in the PV digits. SV range: PM1 to PM2	0.0
16	At3	3-zone AT No. 3 (high temperature) Startup screen	Startup operation starts by pressing the RUN key after setting a SV and stops by pressing the RESET key. During AT, character and PV are alternately displayed in the PV digits. SV range: PM2 to SLH (responded to each product)	100.0
17	P1	3-zone PID No. 1 (low temperature) proportional band setting	0.1 to 200.0 (%)	3.0
18	I1	3-zone PID No. 1 (low temperature) integral time setting	0 to 3600 (seconds)	0
19	d1	3-zone PID No. 1 (low temperature) derivative time setting	0 to 3600 (seconds)	0
20	PM1	3-zone PID Range Intermediate Point 1 setting	SLL to SLH (responded to each product) -5.0 (°C)	0.0
21	P2	3-zone PID No. 2 (medium temperature) proportional band setting	0.1 to 200.0 (%)	3.0
22	I2	3-zone PID No. 2 (medium temperature) integral time setting	0 to 3600 (seconds)	0
23	d2	3-zone PID No. 2 (medium temperature) derivative time setting	0 to 3600 (seconds)	0
24	PM2	3-zone PID Range Intermediate Point 2 setting	PM1 to SLH (responded to each product) (°C)	100.0
25	P3	3-zone PID No. 3 (high temperature) proportional band setting	0.1 to 200.0 (%)	3.0
26	I3	3-zone PID No. 3 (high temperature) integral time setting	0 to 3600 (seconds)	0
27	d3	3-zone PID No. 3 (high temperature) derivative time setting	0 to 3600 (seconds)	0

Setting parameters for SET 02 (user setting)

	SEt02	Name	Setting content	Default value
1	WZ1	Wait zone 1 setting	0.0 to 999.9 (°C) or 0 to 999 (°C)	0.0
2	Wt1	Wait time 1 setting	0:00 to 99:59 (hour: minute)	0:00
3	WZ2	Wait zone 2 setting	0.0 to 999.9 (°C) or 0 to 999 (°C)	0.0
4	Wt2	Wait time 2 setting	0:00 to 99:59 (hour: minute)	0:00
5	WZ3	Wait zone 3 setting	0.0 to 999.9 (°C) or 0 to 999 (°C)	0.0
6	Wt3	Wait time 3 setting	0:00 to 99:59 (hour: minute)	0:00
7	WZ4	Wait zone 4 setting	0.0 to 999.9 (°C) or 0 to 999 (°C)	0.0
8	Wt4	Wait time 4 setting	0:00 to 99:59 (hour: minute)	0:00

*1 and *3: Change to any setting pertaining to steps for running in process is not possible.
*2: Change is not possible during running.

Temperature controller functions

Temperature control method	PID control (with auto-tuning function)
Temperature detection probe	Thermocouples (K), (T) and (R)
Temperature measuring range	0 to SLH (corresponds to each product)
Temperature setting range	0 to SLH (corresponds to each product)
Sampling cycle	0.2 seconds
Temperature indication resolution	1°C/0.1°C
Primary control output	SSR drive voltage output: 1 point 4 to 20 DCmA current output: 1 point Open collector output: 3 points Relay contact output: 4 points

Temperature controller specification

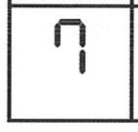
Power supply voltage		100 to 240 VAC; 50/60 Hz
Memory backup		EEPROM
Use environmental conditions	Temperature range	0 to 50°C
	Humidity range	20 to 90% RH (No condensation)
	Mounting angle	Reference surface ± 10°

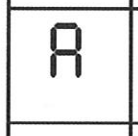
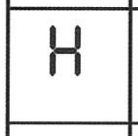
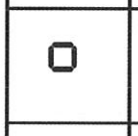
Communications function (* RS-485 and loader communications cannot concurrently be used.)

	RS-485	Loader communication
Communications standard	RS-485 (1:31)	TTL (1:1)
Communications method	Half duplex	
Communications terminal	Terminal dedicated for RS-485	Terminal dedicated for loader communications
Protocol	TOHO protocol/MODBUS (RTU)/MODBUS (ASCII)	
Interface	RS-485 (2-wire)	TTL level
Communications speed	2400 / 4800 / 9600 / 19200 / 38400 bps	
Response delay time	0 to 250 ms	
Isolation	Power supply and CPU circuits and insulation	Insulated with the power supply circuit; non-insulated with the CPU circuit
Connecting method	Terminal block	ϕ2.5 3-pin mini jack

7. Character Interpretation

See the following table. (Default is for 7-segment display.)

0	1	2	3	4	5	6
						
7	8	9	Minus	Period		
						

A	B	C	D	E	F	G
						
H	I	J	K	L	M	N
						
O	P	Q	R	S	T(t)	U
						
V	W	X	Y	Z		
						

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- General-purpose scientific instrument
- Weather observation equipment

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