Product Specifications

Model: TTM-P Series
Designation: Program Controller
Job number: K182/K183

Customer confirmation stamp		
Sales	Person responsible	Originator

We have prepared a set of product specifications.
Please confirm it and return one of the copies to us by

Date:

APPROVED	APPROVED	CHECKED	DESIGNED	DATE May 23, 2007	Job. No. K182/K183	TITLE Program controller Product specifications	
				MODEL TTM-P Series		DWG. No. 47-3730-A	PAGE 1/19
				TOHO ELECTRONICS INC.			

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1. Scope

This set of product specifications applies to Toho Electronics Inc.'s Standard Programming Controller "TTM-P Series."

2. Model and designation

2.1 Model

1) TTM-P4 Series (48 x 48)
   a) Model: TTM-P4-0-R (relay output, option: ABE)
   b) Model: TTM-P4-0-P (SSR output, option: ABE)
2) TTM-P9 Series (96 x 96)
   a) Model: TTM-P9-0-R (relay output, option: ABE)
   b) Model: TTM-P9-0-P (SSR output, option: ABE)

* Option: ABE ... The following specifications will certainly be selected.
  A: Time signal output/alarm output
  B: Operating signal output
  E: DI (external input)

2.2 Designation: Programming controller

3. Scope of delivery

3.1 Programming controller proper: 1 unit
3.2 Attachment: 1 pce (TTM-P4 series)
3.3 Fittings: 1 set (TTM-P9 series)
3.4 Operating manual: 1 copy

4. Appearance and structure

4.1 TTM-P4 series: See "DWG No. 30-5915-A."
4.2 TTM-P9 series: See "DWG No. 30-5916-A."

5. Overview

This product will be a programming controller with up to 15 patterns and up to 64 steps.

6. Ratings and performance

6.1 Temperature input

1) Input type: Thermocouple (K, J, R: JIS C1602-1995)
2) Effects of external resistance: About 0.5μV/1Ω or less
3) Indication range:
   K: -40 to 1326°C
   J: -31 to + 850°C
   R: -20 to + 1755°C
4) Indication resolution: 1°C
5) Display precision: The indicated value ±(0.3% + 1 digit) or ±2°C, whichever the larger (the ambient temperature 23±10°C).
6) Out-of-range indication: When downscale, the display will indicate "LLLL"
   When upscale, the display will indicate "----" (The same will apply when the sensor has a wire break.)

6.2 Temperature controller

1) Setting range: K thermocouple: 0 to 1,200°C
J thermocouple: 0 to 800°C
R thermocouple: 0 to 1,300°C
(Provided that the difference between the upper and the lower limits is at least 50°C.)

2) Setting system: Digital setting by using the △／▽ key
(Holding either key down for at least 1 second will scroll the display up and down automatically.)

3) Control system: PID control (with automatic tuning)
Proportional band (P): 0.1 to 200.0% (of the temperature setting range)
Integration time (I): 0 to 3,600 seconds (0 will turn off the integration)
Differentiation time (D): 0 to 3,600 seconds (0 will turn off the differentiation)
Proportional period (T): 1 to 120 seconds

4) Control output:

a) Relay contact output
Contact type: Contact 1a
Contact capacity: 250VAC, 3A (resistance load)
Minimum load: 5VDC, 100mA

b) Voltage pressure for driving the SSR
Output voltage: 0/12VDC
Output voltage precision: ±1V (ambient temperature 0 to 50°C)
Load resistance: 600Ω or more

5) Other: If the input deviates from the indication range, the control output will be turned off.

6.3 Programming unit

1) Number of patterns: Selectable from among 1 to 15 patterns
2) Number of steps: Up to 64 steps (the number of steps fixed according to the number of patterns)
Number of patterns set to 1: 64 steps
Number of patterns set to 2: 32 steps
Number of patterns set to 3: 21 steps
Number of patterns set to 4: 16 steps
Number of patterns set to 5: 12 steps
Number of patterns set to 6: 10 steps
Number of patterns set to 7: 9 steps
Number of patterns set to 8: 8 steps
Number of patterns set to 9: 7 steps
Number of patterns set to 10: 6 steps
Number of patterns set to 11: 5 steps
Number of patterns set to 12: 5 steps
Number of patterns set to 13: 4 steps
Number of patterns set to 14: 4 steps
Number of patterns set to 15: 4 steps

3) Step time: 0 to 99 hours 59 minutes
4) Step feed: Executable in pattern step check mode, operation mode, pause mode
5) Frequency: 1 (fixed)
6) Wait zone: 0 to 100°C; invalid while operating in step 1
7) Wait time: 0 to 99 hours 59 minutes; invalid while operating in step 1
8) PID setting:

Number of points stored: 3 points (cold/medium/hot)

PID range setting

Cold (PID No. 1): [Minimum in the temperature setting range] to [intermediate point 1]

Medium (PID No. 2): [Intermediate point 1] to [intermediate point 2]

Hot (PID No. 3): [Intermediate point 2] to [maximum in the temperature setting range]

Intermediate point setting

Intermediate point 1 setting: [Minimum in the temperature setting range] to [maximum in the temperature setting range -50°C]

Intermediate point 2 setting: [intermediate point 1 setting] to [maximum in the setting temperature range]

9) Operating signal output:

Output system: Relay contact (1a) output (250VAC, 2.4A, resistance load)

Output action: Pattern operation in action, contact output closed (ON)

10) Time signal output:

Number of points stored: 1 point (common to all steps)

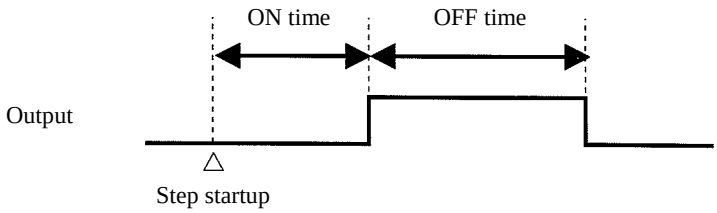
Number of output points: 1 point

Output system: Relay contact (1a) output (250VAC, 2.4A, resistance load)

ON time: 0 to 99 hours 59 minutes (time from step startup to output ON)

OFF time: 0 to 99 hours 59 minutes (time from output ON to output OFF)

Action chart:



* The time signal output will be shared with an alarm output, so that it will be invalid when an alarm output is selected.

11) DI (external input):

Valid only when external operation is selected

Input system: No-voltage contact input

Input action: Operated when the external contact is closed (ON), and stopped (reset) when the contact is open (OFF). Stoppage will not be possible by using the RUN/RESET key while being operated by an external input.

12) Time setting precision: Time setting ±(1.5% + 0.5 seconds)

6.4 Time signal output/alarm output

1) Operation types:
   0: Nil (this selects time signal output)
   1: Deviation upper and lower limit alarm
   2: Deviation upper limit alarm
   3: Deviation lower limit alarm
   4: Deviation upper and lower limit range alarm
   5: Absolute value upper and lower limit alarm
   6: Absolute value upper limit alarm
   7: Absolute value lower limit alarm
   8: Absolute value upper and lower limit range alarm
2) Additional functions:
   0: No additional functions
   1: Output held
   2: Standby sequence
   3: Output held + standby sequence
3) Setting range: -1999 to + 9999°C
4) Output system: Relay contact (1a) output (250VAC, 0.5A, resistance load)
5) Action sensitivity: 0 to 199°C
6) Output operation: When in action, the contact will be closed (ON) and the AL lamp will go on. Provided that the product will function only during operation or pause.
7) Other: When the input deviates from the display range, the contact will be closed (ON) (when the alarm output is selected).

6.5 Display unit

1) PV display: TTM-P4 --- 4-digit, 7-segment LED (green), character height 10 mm
   TTM-P9 --- 4-digit, 7-segment LED (green), character height 14 mm
2) SV display: 4-digit, 7-segment LED (red), character height 8 mm
3) Display lamp: RUN, OUT, SET, AL -- Red LED

6.6 Key switches

1) △ key
2) ▽ key
3) PATT./STEP key
4) RUN/RESET key

6.7 Standard functions

1) PV correction zero setting: -199 to +199°C
2) PV correction gain setting: 0.50 to 2.00
3) Control switchover: Forward action (cooling)/reverse action (heating)
4) Sensor switchover: K/J/R thermocouple
5) Key lock: Locks or unlocks the parameters. Trying to change a locked parameter will cause the SV display to indicate "LOC"
   Locking will be valid only in parameters in the common parameter setting mode.
6) DI (external input) selection:
   External operation: Operated or reset in response to a DI (external input) signal
   Internal operation: Operated or reset by using the key switches on the front panel

7) PV/SV start selection: PV start: Initiates a programmed run from the temperature measured.
SV start: Initiates a programmed run from a starting temperature setting.
SV start temperature setting = lower to upper limit in the temperature setting range

8) Power restoration:
- If PV start is conducted, step 1 is set to a minimum temperature setting, and step 1 is activated as a timer function, and when an outage occurs during step 1, then the system will store the time elapsed at increments of 8 minutes and will resume its operation at that time.
- If an outage occurs during SV start, the system will resume its operation, starting at step 1.
- If PV start is caused during an external operation, and if an outage occurs while the system displays "End" after it finishes its operation, then the system will continue to display "End" even after it restores its operation. Setting DI to OFF (open) once will cause the system to resume its operation.

6.8 Input power supply: 100 to 240VAC ±10%, 50/60Hz (free power supply)

6.9 Storage cell: Settings will be stored on the EEPROM.

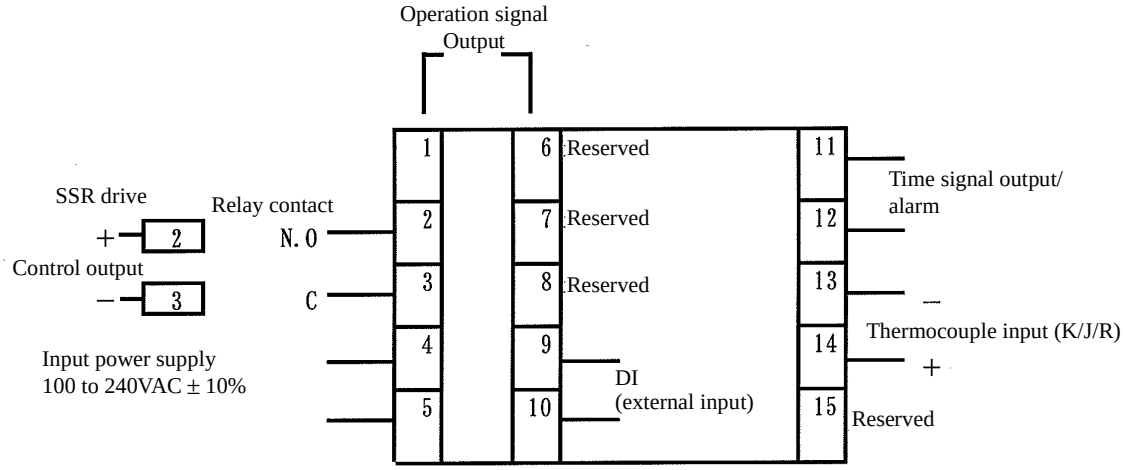
6.10 Error display: Err0: Memory error (EEPROM error)
Err1: A/D conversion error (A/D conversion error)
Err2: Automatic tuning error
(Automatic tuning does not come to an end 3 hours later. Or the sensor develops a wire break during automatic tuning.)
Any error will stop the control.

6.11 Ambient temperature
1) Operating ambient temperature: 0 to 50°C
2) Storage ambient temperature: -25 to +70°C (non-freezing, non-condensing)
3) Operating ambient humidity: 20 to 90%RH (non-condensing)
4) Storage ambient humidity: 5 to 95%RH (non-condensing)

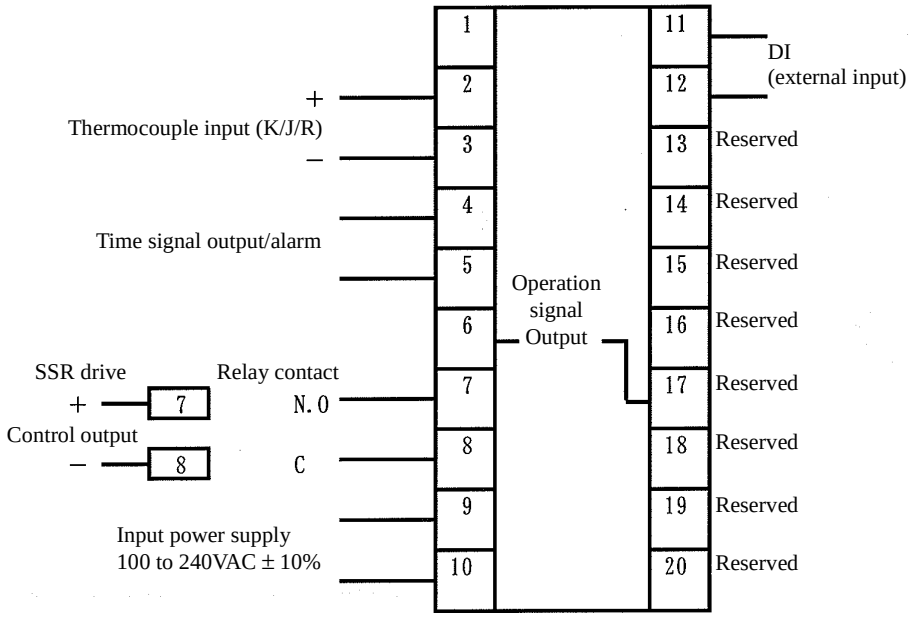
7. External standards: CE standards, UL standards, cUL standards acquired

8. Terminal arrangement

8.1 TTM-P4 series



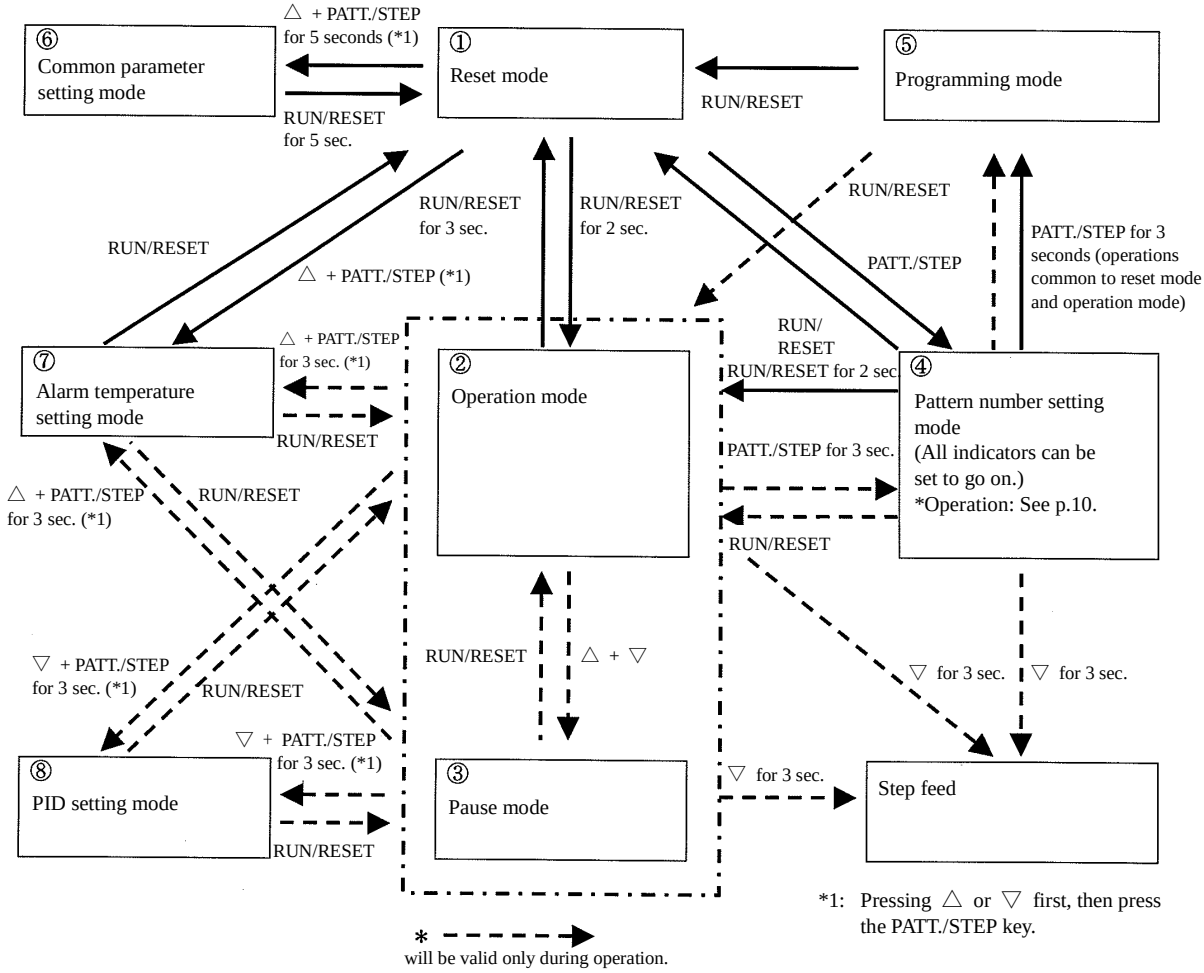
8.2 TTM-P9 series



9. Function description

9.1 State transitions between modes

Operation keys will be used to switch between modes.

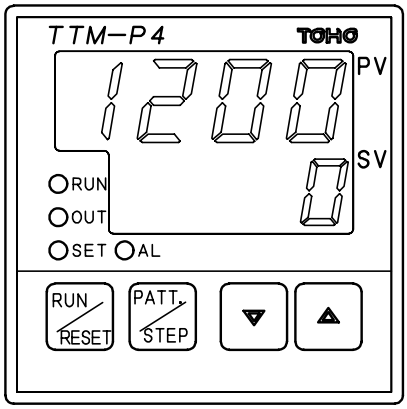


State	Overview
① Reset mode	Reset state mode (this mode will be entered when the power is turned on)
② Operation mode	Mode for executing a programmed run (holding the ▽ key for 3 seconds during operation will enable step feed)
③ Pause mode	Mode for pausing a programmed run (in terms of time)
④ Pattern number setting mode	Mode for setting the pattern number of the program to be executed. If the product goes out of the operation mode, the product will display the pattern step number being operated. (While the pattern step number is displayed, holding the ▽ key for 3 seconds will enable step feed.)
⑤ Programming mode	Mode for setting the program for each pattern
⑥ Common parameter setting mode	Mode for setting parameters common to each pattern and step
⑦ Alarm temperature setting mode	Mode for setting an alarm temperature
⑧ PID setting mode	Mode for changing the setting of the PID constant (only during operation)

9.2 Detailed description of modes

① Reset mode

- This mode will stop control.
- Holding the RUN/RESET key down for 2 seconds will switch the product to "operation mode," thus initiating operation.
- Pressing the PATT./STEP key will switch the product to "pattern number setting mode."
- Pressing the △ key and the PATT./STEP key will switch the product to "alarm temperature setting mode."
- Holding the △ key and the PATT./STEP key down for 5 seconds simultaneously will switch the product to "common parameter setting mode."

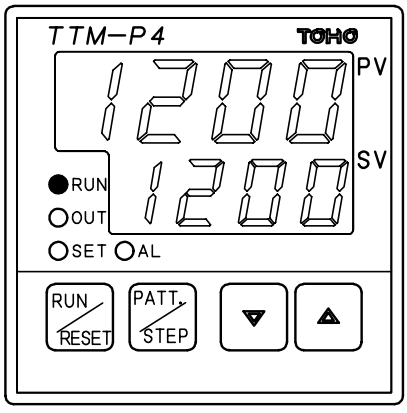


PV: Displays the temperature measured.

SV: Displays"0".

② Operation mode

- This mode will conduct programmed run control.
- Holding the RUN/RESET key down for 3 seconds in the "reset mode" will enter the product into "operation mode," thus initiating pattern operation.
- Holding the RUN/RESET key down for 2 seconds in the "pattern number setting mode" will enter the product into "operation mode," thus initiating pattern operation.
- Pressing the △ key and the ▽ key will switch the product to "pause mode."
- Holding the RUN/RESET key down for 3 seconds will switch the product to "reset mode."
- Holding the △ key and the PATT./STEP key down for 3 seconds simultaneously will switch the product to "alarm temperature setting mode."
- Holding the ▽ key and the PATT./STEP key down for 3 seconds will switch the product to "PID setting mode."
- Holding the PATT./STEP key down for 3 seconds will switch the product to "pattern number setting mode."
- Holding the ▽ key down for 3 seconds during operation will enable step feed.
- The SV display will blink while a wait operation is in process in the wait zone or wait time.
- After a patterned operation is complete, the SV display will display "End" and stop the control. The PV display will display the current temperature. Holding the RUN/RESET key down for 3 seconds will switch the product to "reset mode."



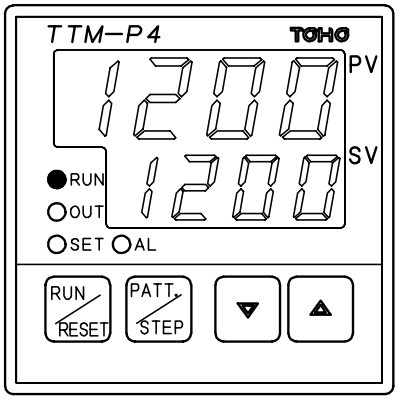
PV: Displays the temperature measured.

SV: Displays the temperature setting for the step being executed.

Lamp: The RUN lamp will go on.

③ Pause mode

- Pressing the △ key and the ▽ key simultaneously in "operation mode" will enter the product into "pause mode."
- This mode will pause programmed run control. It will stop the time and maintain the control temperature measured at that point in time.
- Pressing the RUN/RESET key will switch the product to "operation mode."
- Holding the △ key and the PATT./STEP key down for 3 seconds simultaneously will switch the product to "alarm temperature setting mode."
- Holding the ▽ key and the PATT./STEP key down for 3 seconds will switch the product into "PID setting mode."



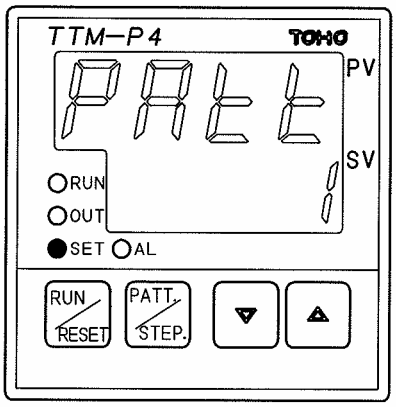
PV: Displays the temperature measured.

SV: Displays the temperature setting of the step being executed.

Lamp: Blinks the RUN lamp.

④ Pattern number setting mode

- Pressing the PATT./STEP key in "reset mode" will switch the product into "pattern number setting mode."
- Holding the PATT./STEP key down for 3 seconds in "operation mode" will enter the product into "pattern number setting mode."
- Use the △ and ▽ keys to set a pattern number.
- When the system shiffed from "operation mode," holding the ▽ key down for 3 seconds will enable step feed.
- When the system shifted from "operation mode," pressing the PATT./STEP key will display the time elapsed and time setting.
  PV screen: time elapsed, SV screen: time setting
- Pressing the RUN/RESET key again while in the "pattern number setting mode" will switch the product back to the earlier mode.
- If you have come out of the "pattern number setting mode," holding the RUN/RESET key down for 2 seconds will initiate the programmed run.
- Holding the PATT./STEP key down for 3 seconds will switch the product back to the "programming mode."
- Pressing the △ and ▽ simultaneously while holding down the PATT./STEP will turn on all the indicators.

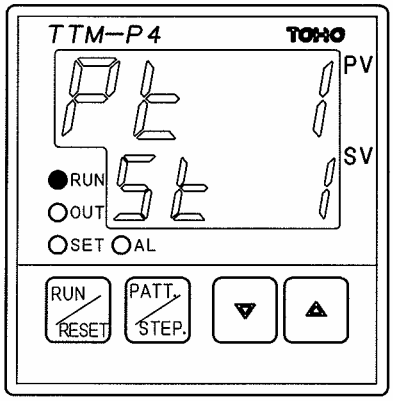


<Display when shifted from reset mode>

PV: Displays the pattern number selection character.

SV: Displays the pattern number setting.

Lamp: Turns on the SET lamp.



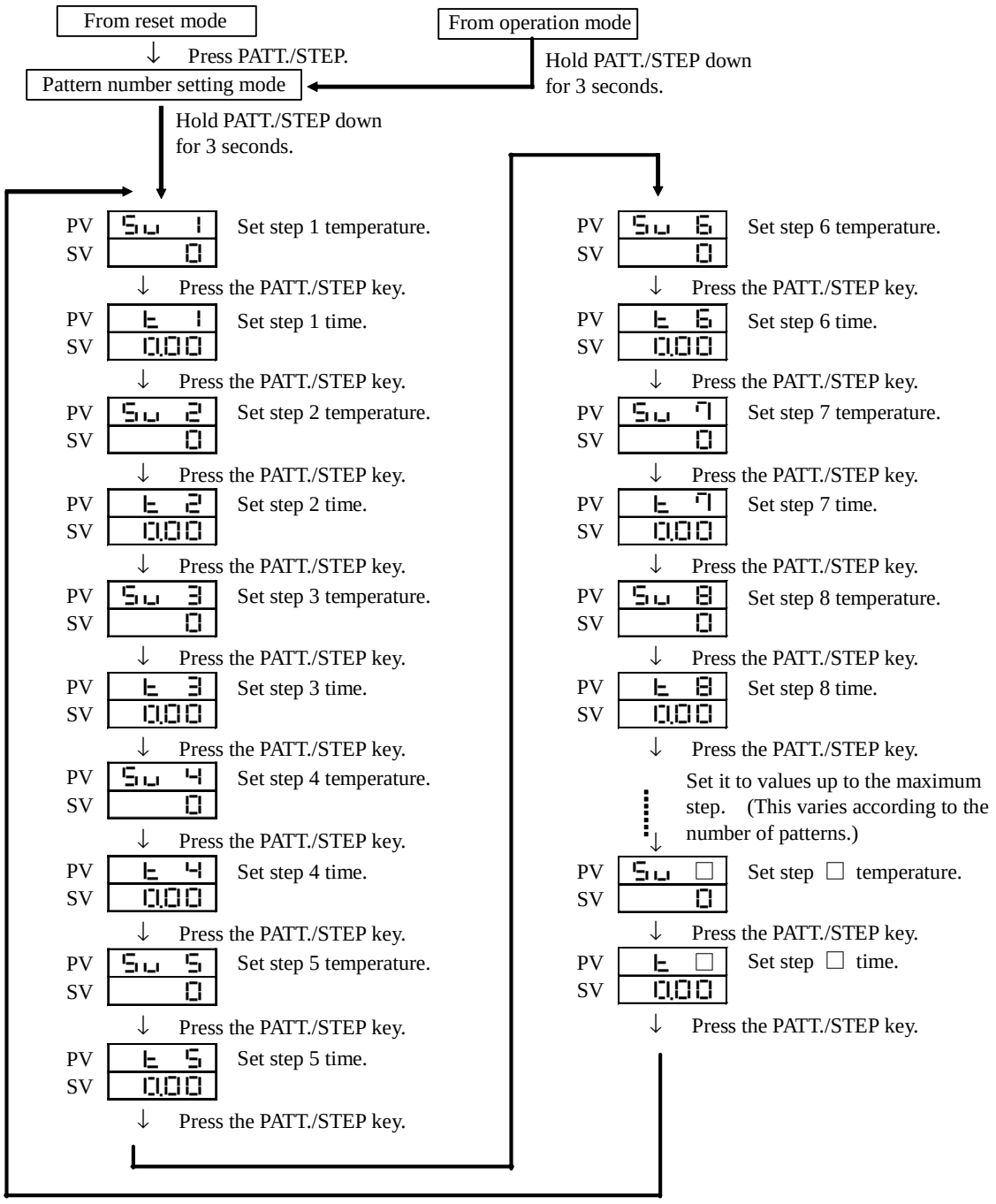
<Display when shifted from operation mode>

PV: Displays the pattern number being executed or the time elapsed.

SV: Displays the step number being executed or the time setting.

⑤ Programming mode

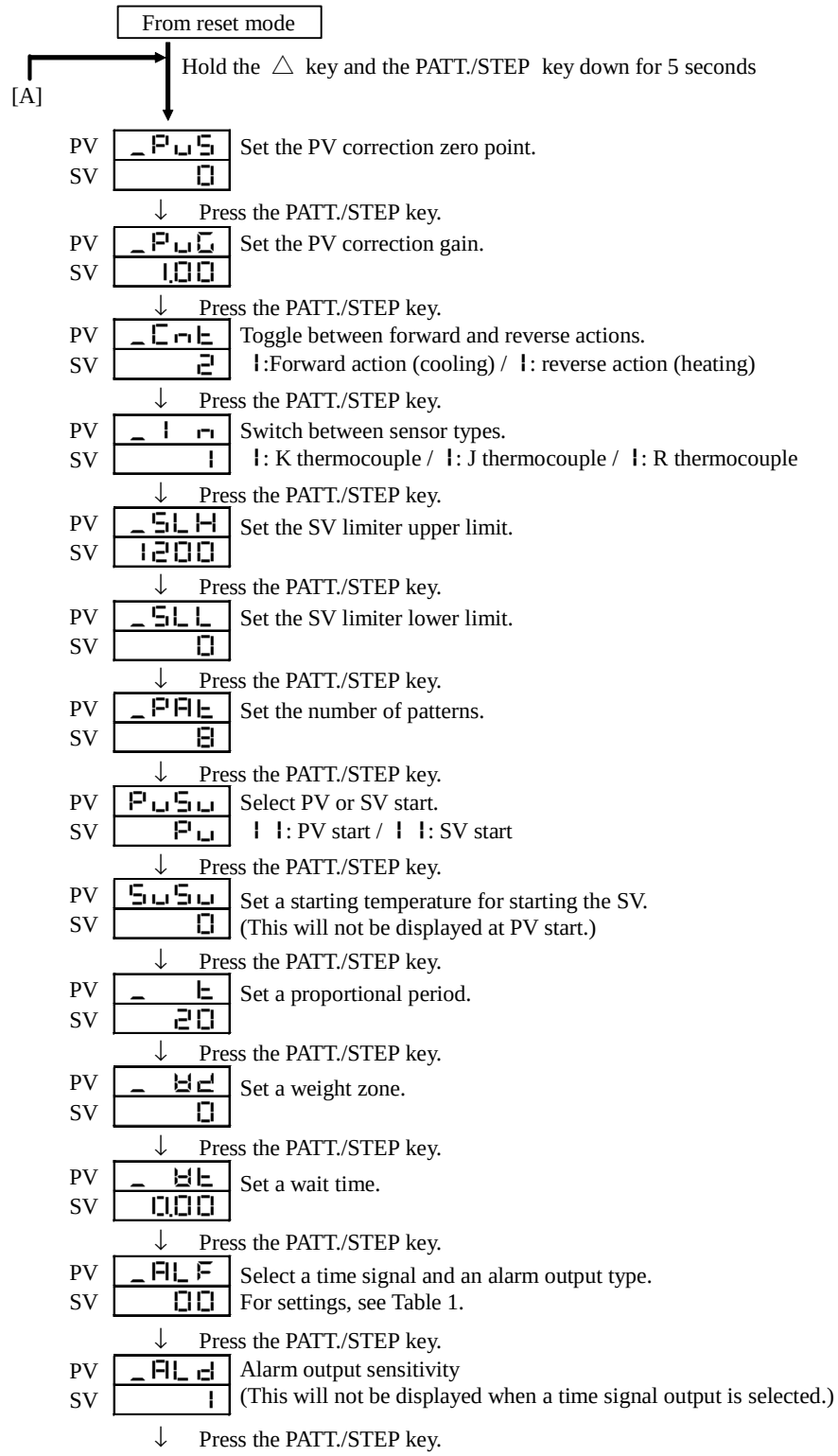
- Holding the PATT./STEP key down for 3 seconds in "pattern number setting mode" will enter the product into "program setting mode."
- The SET lamp will go on.
- Parameters will be set by using the △ and ▽ keys.
- Setting the time to 0 minutes will invalidate that particular step.
- Pressing the RUN/RESET key will switch the product to "reset mode" if it is in a reset state, and to "operation mode" if it is in operation.



- If, in setting a temperature for a specific step, you set it to a value lower than the minimum in the setting range (displayed as " – "), then the steps following that particular step will be invalid and the setting parameter will not be displayed. The patterned run will come to an end in the step before the one set as " – "
- In changing a setting during operation, you cannot change the step temperature or step time during operation.
- If, when starting the PV, you set the temperature setting in step 1 to the minimum in the temperature setting range, the time for step 1 will be valid. (The PV will be normally started in and after step 2.)
- If all steps are set to their initial values (0°C), setting a temperature will automatically set the next step to the same temperature as well.
- Setting a step time to a value higher than the maximum in the setting range (displayed as " – ") will cause the product to run continuously at the set temperature in that particular step.

⑥ Common parameter setting mode

- Holding the △ key and the PATT./STEP key down for 5 seconds simultaneously in "reset mode" will enter the product into "common parameter setting mode."
- Parameters will be set by using the △ and ▽ keys.
- Holding the RUN/RESET key down for 5 seconds will switch the product to "reset mode."
- While in "common parameter setting mode," the SET lamp will remain on.



↓

PV tSon
SV 0.00 Set a time signal ON time. (This will not be displayed when an alarm output is selected.)

↓ Press the PATT./STEP key.

PV tSoF
SV 0.00 Set a time signal OFF time. (This will not be displayed when an alarm output is selected.) (The time signal will be invalid when set to 0 minutes.)

↓ Press the PATT./STEP key.

PV t 1. 1
SV oFF Select a time signal for pattern 1 and step 1. ON/OFF (This will not be displayed when an alarm output is selected or the time signal is invalid.)

↓ Press the PATT./STEP key.

PV t 1. 2
SV oFF Select a time signal for pattern 1 and step 2. ON/OFF (This will not be displayed when an alarm output is selected or the time signal is invalid.)

↓ Press the PATT./STEP key.

From this time on, time signal selections will be set similarly up to pattern □ and step □.
(This will not be displayed when an alarm output is selected.)
* The number of steps will vary according to a setting concerning the number of patterns.

↓ Press the PATT./STEP key.

PV Erun
SV oFF Select an external operation. 1: External operation / 1 1 1: Internal operation

↓ Press the PATT./STEP key.

PV LoC
SV oFF Lock the key. 1: Locked / 1 1 1 1: Unlocked

↓ Press the PATT./STEP key.

PV P 1
SV 3.0 Set a proportional band for PID No. 1 (cold).

↓ Press the PATT./STEP key.

PV I 1
SV 0 Set an integration time for PID No. 1 (cold).

↓ Press the PATT./STEP key.

PV d 1
SV 0 Set a differentiation time for PID No. 1 (cold)

↓ Press the PATT./STEP key.

PV PM 1
SV 0 PID range Set intermediate point 1.

↓ Press the PATT./STEP key.

PV P2
SV 3.0 Set a proportional band for PID No. 2 (medium).

↓ Press the PATT./STEP key.

PV I 2
SV 0 Set an integration time for PID No. 2 (medium).

↓ Press the PATT./STEP key.

PV d2
SV 0 Set a differentiation time for PID No. 2 (medium)

↓ Press the PATT./STEP key.

PV PM2
SV 0 PID range Set intermediate point 2.

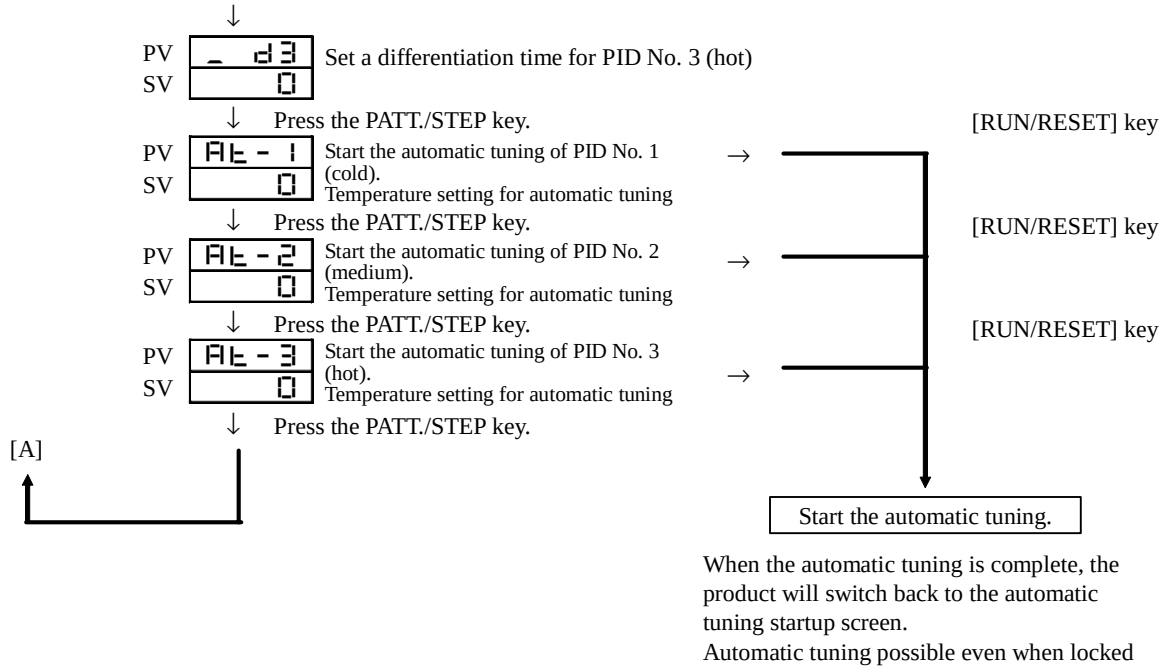
↓ Press the PATT./STEP key.

PV P3
SV 3.0 Set a proportional band for PID No. 3 (hot).

↓ Press the PATT./STEP key.

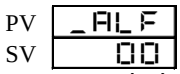
PV I 3
SV 0 Set an integration time for PID No. 3 (hot).

↓ Press the PATT./STEP key.



* Changing the setting concerning the number of patterns will switch the settings for the temperature settings for pattern parameters, time settings, and time signal selections for common parameters back to the initial settings.

Table 1. Selecting time signals and alarm outputs



Action types (to be set by using the ▽ key)

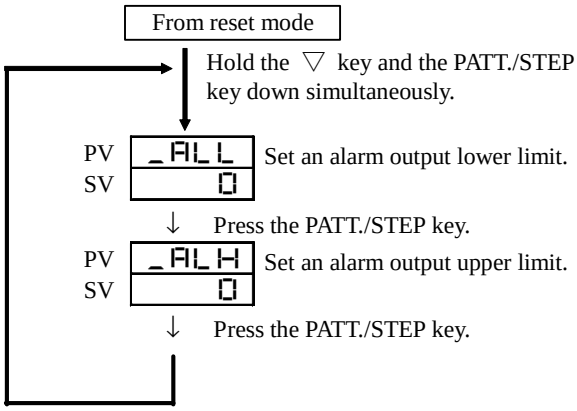
0	Nil (this selects a time signal)
1	Deviation upper and lower limit alarm
2	Deviation upper limit alarm
3	Deviation lower limit alarm
4	Deviation upper and lower limit range alarm
5	Absolute value upper and lower limit alarm
6	Absolute value upper limit alarm
7	Absolute value lower limit alarm
8	Absolute value upper and lower limit range alarm

Additional functions (to be set by using the △ key)

0	No additional functions
1	Output held
2	Standby sequence
3	Output held + standby sequence

⑦ Alarm temperature setting mode

- If you hold the △ key and the PATT./STEP key down simultaneously in "reset mode," or if you hold the △ key and the PATT./STEP key down for 3 seconds simultaneously in "operation mode," then the product will switch to "alarm temperature setting mode."
- Use the PATT./STEP key to select an alarm output lower limit "_AlL" and an alarm output upper limit "_AlH" (This may not be displayed depending on the type of action selected for an alarm output.)
- The temperature setting will be changed by using the △ key and the ▽ key.
- Pressing the RUN/RESET key will switch the product back to the earlier mode.
  * If no key is pressed for 10 seconds after the temperature setting is changed, then the product will switch automatically to "reset mode."
- While in "alarm temperature setting mode," the SET lamp will remain on.



⑧ PID setting mode

- Holding the ▽ key and the PATT./STEP key down for 3 seconds in "operation mode" or "pause mode" will switch the product to "PID setting mode."
- The SET lamp will go on.
- Parameters will be set by using the △ and ▽ keys.
- Pressing the RUN/RESET key will switch the product to the earlier mode.

Program setting mode parameters

Description	Initial value	Setting range	Setting unit
Set a step □ temperature	0	Setting range (K: 0 to 1200 °C/J: 0 to 800°C/R: 0 to 1300°C	1°C
Set a step □ time	0.00	0 to 99 hours 59 minutes	1 minute

Common parameter setting mode prameters

Description	Initial value	Setting range	Setting unit
Set the PV correction zero point	0	-199 to +199°C	1°C
Set the PV correction gain	1.00	0.50 to 2.00 times	0.01 times
Forward/reverse switchover	2	1: Forward action (cooling)/2: reverse action (heating)	
Sensor switchover	1	1: K thermocouple/2: J thermocouple/3: R thermocouple	
SV limiter upper limit	1200	SLL + 50°C to setting range upper limit	1°C
SV limiter lower limit	0	0°C to SLH-50°C	1°C
Set the number of patterns	8	1 to 15 patterns	
Select PV/SV start	PV	PV: PV start/SV: SV start	
Set an SV start temperature	0	Lower limit to upper limit of the temperature setting range	1°C
Proportional period	R (relay output): 20 S (SSR output): 2	1 to 120 seconds	1 second
Wait zone	0	0 to 100°C	1°C
Wait time	0.00	0 to 99 hours 59 minutes	1 minute
Time signal/alarm output type	00 (time signal)	0: Nil (time signal) 1: Deviation upper and lower limit 2: Deviation upper limit 3: Deviation lower limit 4: Deviation upper and lower limit range 5: Absolute value upper and lower limit 6: Absolute value upper limit 7: Absolute value lower limit 8: Absolute value upper and lower limit range 0: No additional functions 1: Output held 2: Standby sequence 3: Output held + standby sequence	
Alarm output lower and upper limits	Upper limit: 0 Lower limit: 0	-1999 to +9999°C	1°C
Alarm output sensitivity	1	0 to 199°C	1°C
Time signal ON time	0.00	0 to 99 hours 59 minutes	1 minute
Time signal OFF time	0.00	0 to 99 hours 59 minutes	1 minute
Select an external operation	OFF	ON: external operation /OFF: internal operation	
Lock the key	OFF	ON/OFF	

PID setting parameters

Description	Initial value			Setting range	Setting unit
PID No.	1 (cold)	2 (medium)	3 (hot)		
Proportional band P	3.0%	3.0%	3.0%	0.1 to 200.0 %	0.1%
Integration time I	0 second	0 second	0 second	0 to 3600 seconds	1 second
Differentiation time D	0 second	0 second	0 second	0 to 3600 seconds	1 second
AT temperature setting	0°C	0°C	0°C	As per the PID range setting	1°C
PID range intermediate point 1	0°C			Between minimum and maximum in the temperature setting range -50°C	1°C
PID range intermediate point 2	0°C			Intermediate point 1 to the maximum in the temperature setting range	1°C

Alarm temperature setting mode parameters

Description	Initial value	Setting range	Setting unit
Alarm output lower and upper limits	Upper limit: 0 Lower limit: 0	-1999 to +9999°C	1°C

10. Other

10.1 Conform to the following environmental requirements:

1) Conformity to the RoHS Directive

11. History

Revision A: June 8, 2007, Sato

Page 2: External view (TTM-P4 series); "30-5915" changed to "30-5915-A."

Page 2: External view (TTM-P9 series); "30-5916" changed to "30-5916-A."

Page 3: 4.1 "Drawing number: 30-5915" changed to "Drawing number: 30-5915-A."

Page 3: 4.2 "Drawing number: 30-5916" changed to "Drawing number: 30-5916-A."

Page 4: 6.3 Programming unit, 3) Setting the number of patterns: The following statement was deleted: "Parameters can be set to change to 2 patterns, 8 steps."

Page 6: 6.7 Standard function, 8) Adding power restoration

Page 8: 9.1 State transition in each mode; diagram revised

Pages 8-16: Key operations changed (initial values changed).

Page 17: "Program setting mode parameter" and other tables revised