

DIGITAL PROGRAM CONTROLLER

REX-P90 SERIES

INSTRUCTION MANUAL

IM90P01-E2

Notes:

Make sure that this Instruction Manual is always readily available to personnel who use the REX-P90 series. The contents of the Instruction Manual are subject to change without notice. If you have any questions regarding the manual, contact one of our sales people, our nearest sales office, or the place where you have purchased this controller.

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1. REX-P90 MODEL CODE TABLE

REX-P90 Model Code Table

Specifications	Specification Code							
	P90		□	□	□	□	□	□
Control operations	PID reverse action	F						
	PID normal action	D						
	Level PID reverse action	L						
	Level PID normal action	M						
Input type	See the "Input and Range Code Table".	□						
Range	See the "Input and Range Code Table".	□						
Control output	Relay contact output					M		
	Voltage pulse output for SSR driving					V		
	Continuous current output (0 to 20mA)					7		
	Continuous current output (4 to 20mA)					8		
Alarm function	No alarm function						N	
	See the Alarm Code Table.						□	
External contact input	External contact input function not supported							N
	External contact input function supported							Y
Instrument type	Standard instrument							N
	Pattern end output function supported							1
	Time signal output function supported							2

Note:

If no options are supplied, the code after an asterisk (*) is not required. However, if any one of options is used, the entire codes after the asterisk are required.

Range Code Table

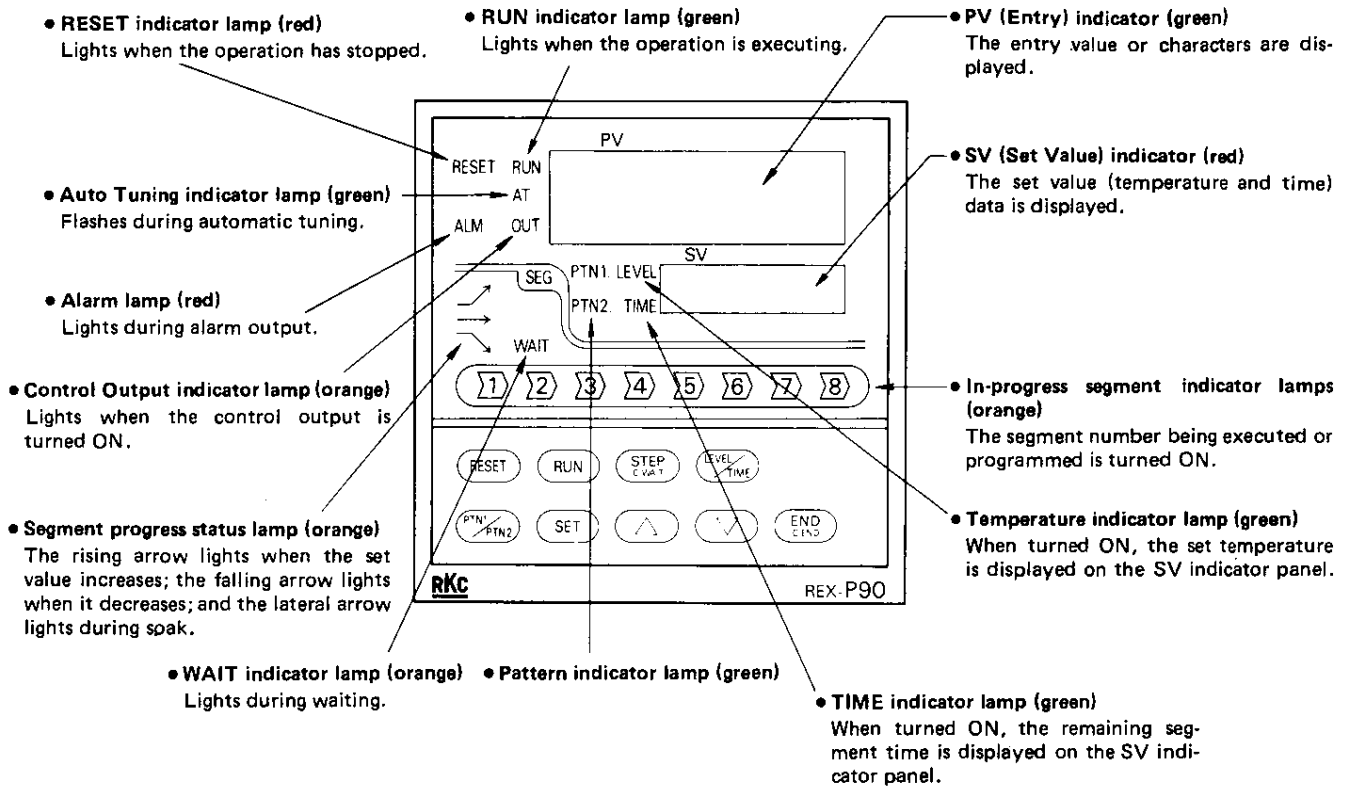
Material	No.	Range	No.	Range
K	K16	-200 to 1372°C	KA8	-300 to 2502°F
J	J06	0 to 1200°C	JA3	0 to 2192°F
R	R02	0 to 1769°C	RA2	0 to 3216°F
S	S02	0 to 1769°C	SA2	0 to 3216°F
B	B02	0 to 1820°C	BA2	0 to 3308°F
E	E02	0 to 1000°C	EA2	0 to 1832°F
U	U01	-199.9 to 600.0°C	UA1	-199.9 to 999.9°F
T	T01	-199.9 to 400.0°C	TA1	-199.9 to 752.0°F
N	N02	0 to 1300°C	NA2	0 to 2372°F
PLII	A01	0 to 1300°C	AA4	0 to 2372°F
L	L05	0 to 900°C	LA3	0 to 1652°F
W5Re/W26Re	W02	0 to 2320°C	WA2	0 to 4200°F
Pt100	D15	-199.9 to 650.0°C	DA1	-199.9 to 999.9°F
JPt100	P11	-199.9 to 500.0°C		

Alarm Code Table

A	Upper limit deviation alarm	B	Lower limit deviation alarm	C	Upper/lower limit deviation alarm
D	Deviation band alarm	E	Upper limit deviation alarm with hold function	F	Lower limit deviation alarm with hold function
G	Upper/lower limit deviation alarm hold function	H	Upper limit process alarm	J	Lower limit process alarm
K	Upper limit process alarm with hold function	L	Lower limit process alarm with hold function		

2. SYSTEM COMPONENT NAMES

2-1 Display Section



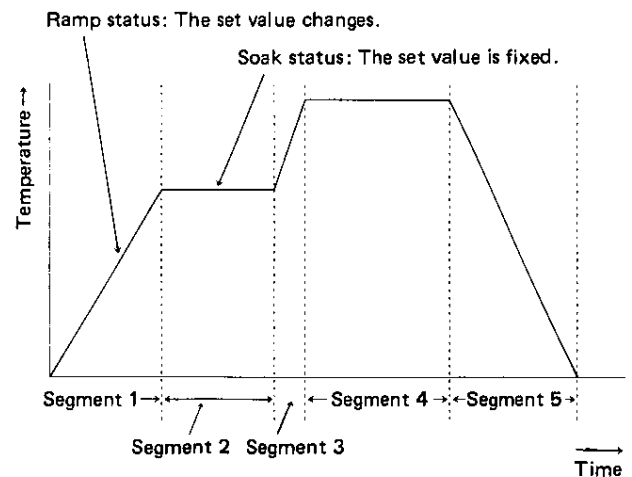
2-2 Key Switches

[RESET] key	Stops the current operation.	[PTN1/PTN2] key	Switches Pattern 1 and Pattern 2.
[RUN] key	Starts the operation.	[SET] key	Sets the entered program or parameters.
[STEP (C.WAIT)] key	Forcibly transfers to the next segment during operation.	[DOWN] key	Decreases the numerical value. Keep pressing this key to quickly decrement the value.
[LEVEL/TIME] key	Alternately displays the set temperature and the remaining time on the SV indicator.	[UP] key	Increases the numerical value. Keep pressing this key to quickly increment the value.
		[END (C.END)] key	Sets or cancels the entry registration at program setup.

2.3 Terminologies

- Monitor mode**
 The measured value is indicated during operation after reset.
- Operator level 1**
 The operator can set a program. When the [SET] key is pressed, the Operator Level 1 mode is selected. (see P. 3)
- Operator level 2**
 The operator can set various parameters such as Auto Tuning and PID constants. When the [SET] key is pressed for 5 sec, the Operator Level 2 mode is selected. (see P. 6)
- Pattern**
 A program consisting of segments is called a pattern.
- Segment**
 A line configuring a pattern is called a segment.

Pattern programming example:

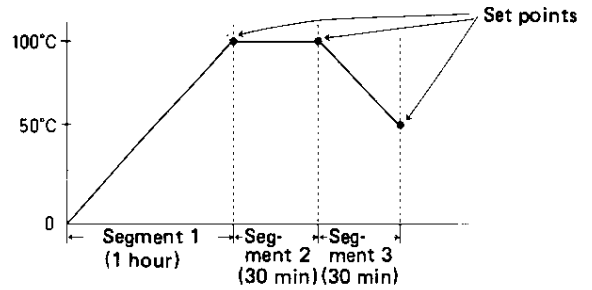


3. OPERATIONS (Operator Level 1)

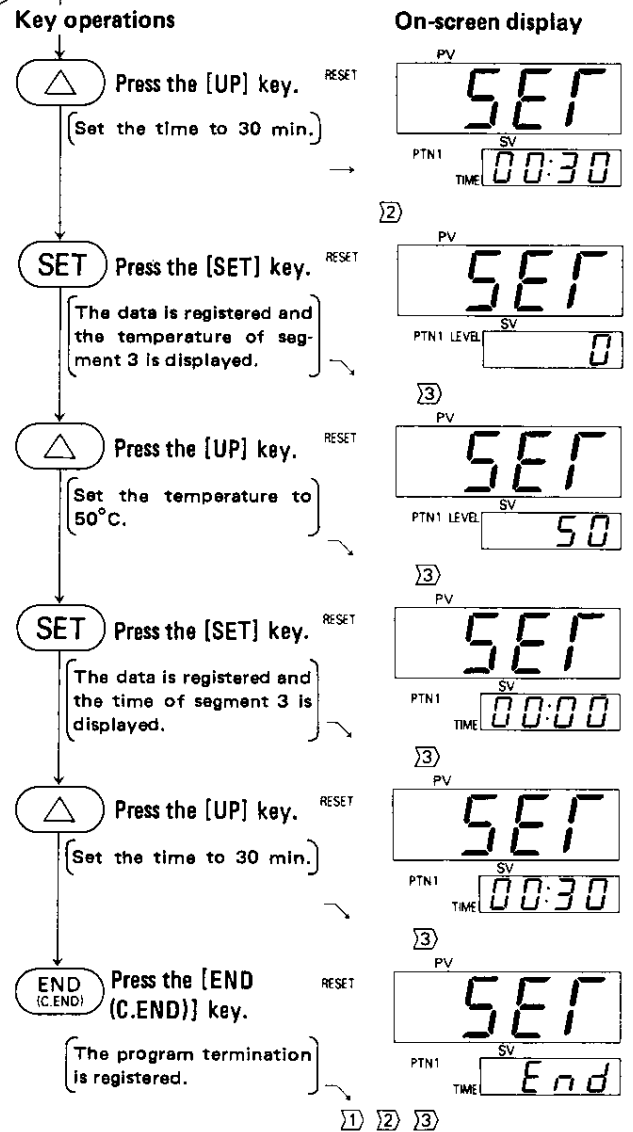
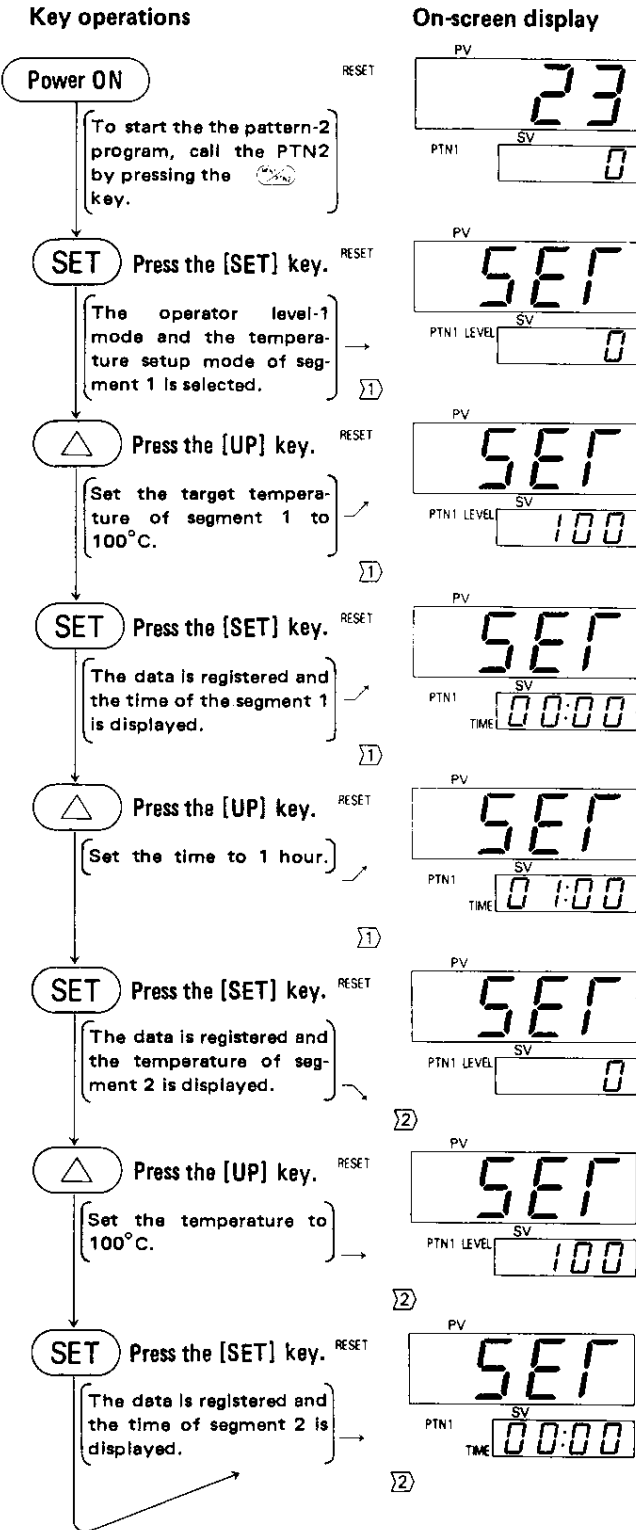
3-1 Programming Procedure

This section uses an example for programming of the trapezoid as shown in the figure. In the operator level-1 mode, the target temperature and time of each segment must be set.

This example uses three segments in pattern 1 as shown.



Segment	1	2	3
Temperature	100	100	50
Time	01 : 00	00 : 30	00 : 30



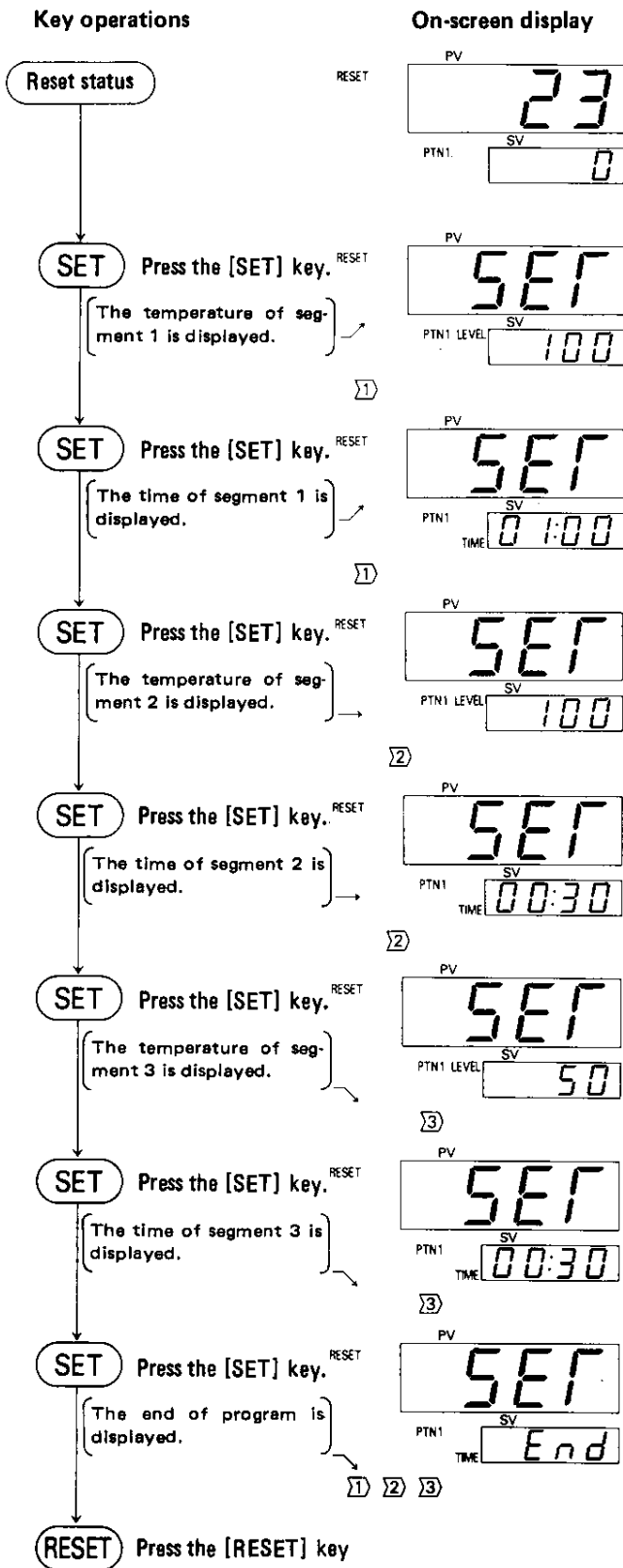
To return to the monitor display, press the **RESET** key.
To run the program, press the **RUN** key.

Notes:

- The set value is registered only when the **SET** or **END (C.END)** key is pressed. No value is registered if these keys are not pressed.
- When the standard model is used, the recently set temperature is kept after the end of program.
- At operator level-1, you can perform the same operation by pressing the **SET** key or **LEVEL/TIME** key.
- A screen at operator level-1 returns to the monitor screen if you do not press any key within 60 seconds.

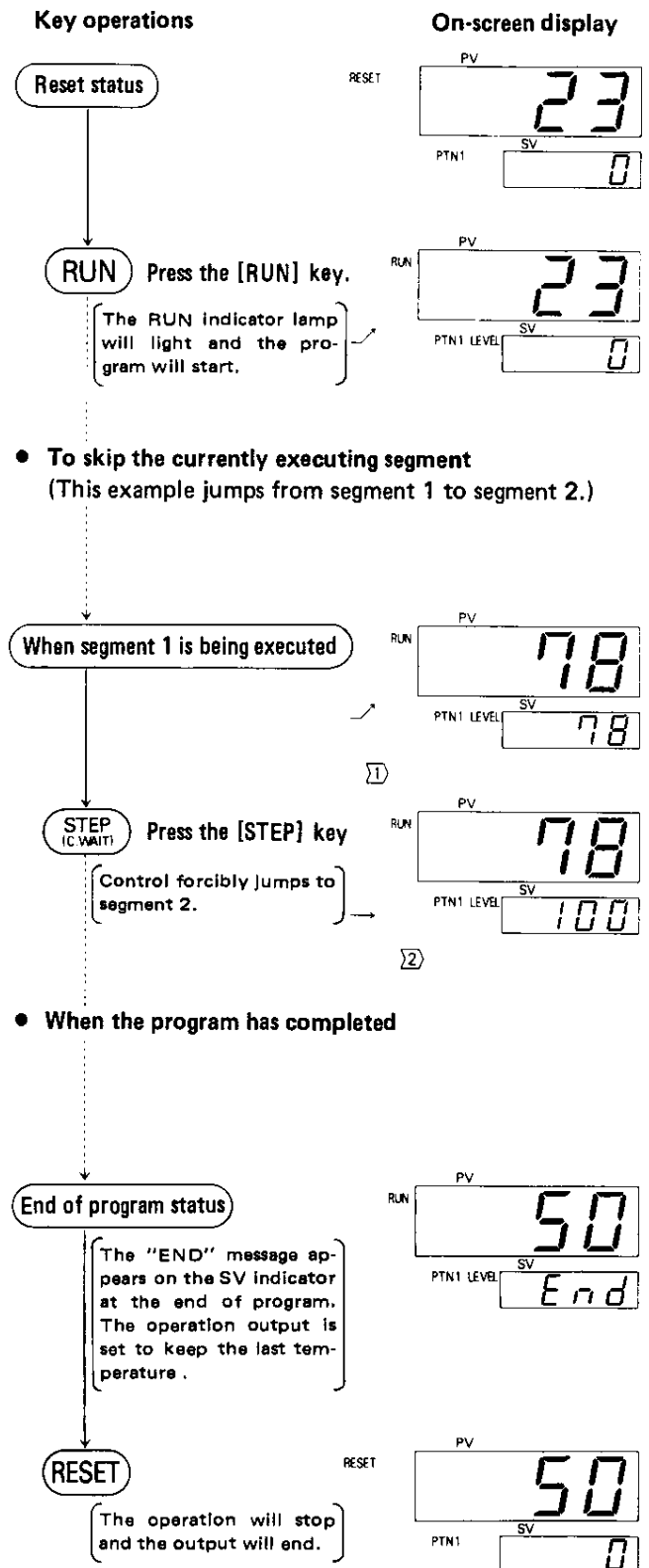
3-2 Checking the Program

After the program has been set, you must check it for an error in the following procedure. You can check the program any time when the program is reset or when it is running.

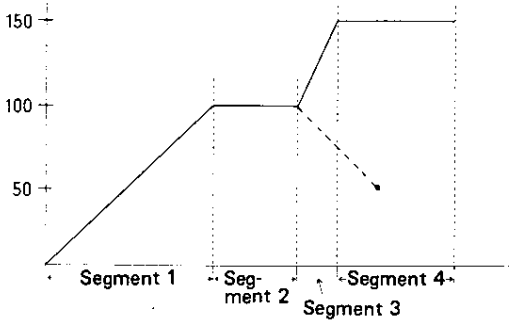


3-3 Executing the Program

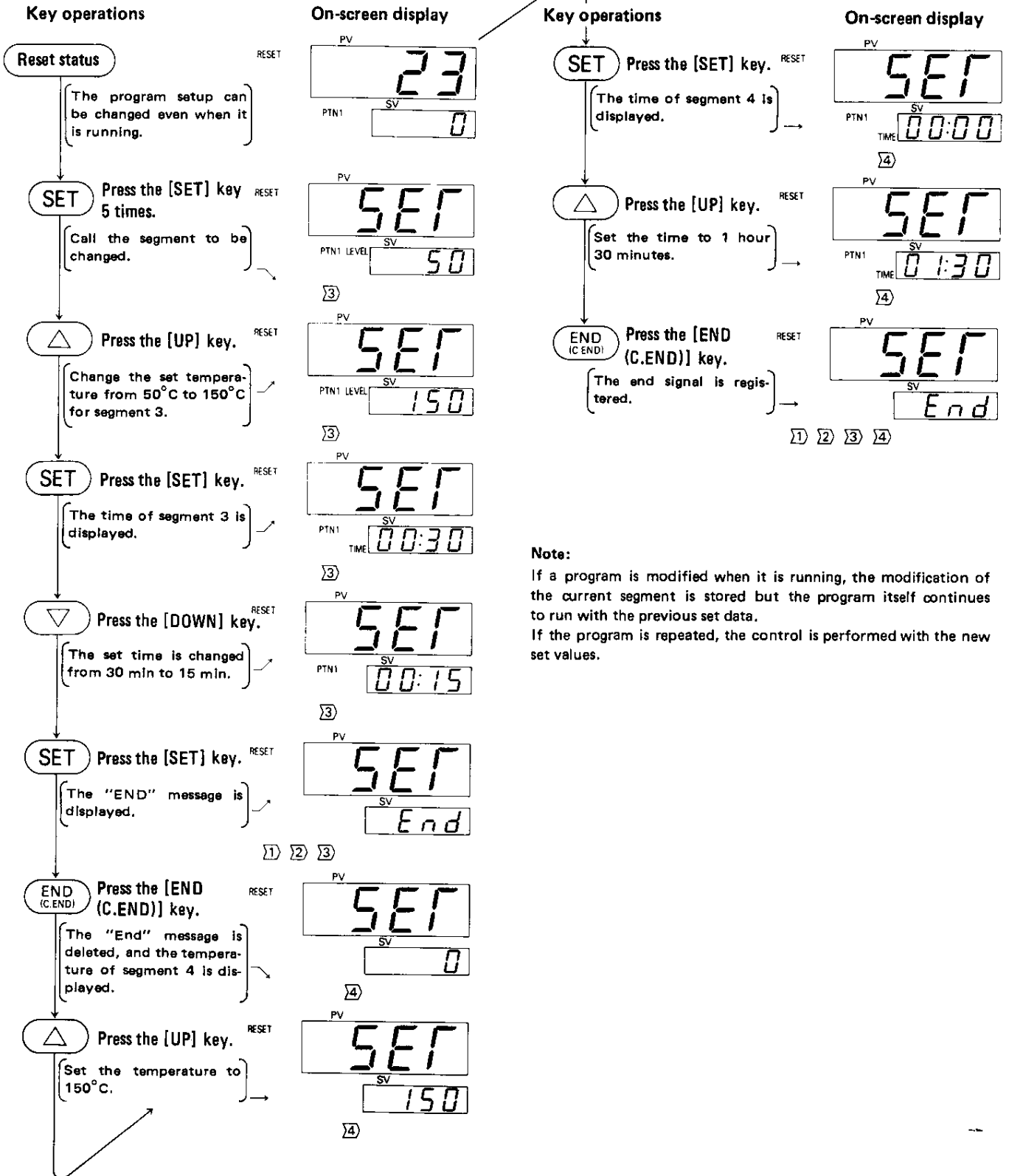
After program checkout, run the program in the following procedure.



3-4 Changing the Program



Example:
Modify the program given in Section 3-1 and set it as follows.



Note:

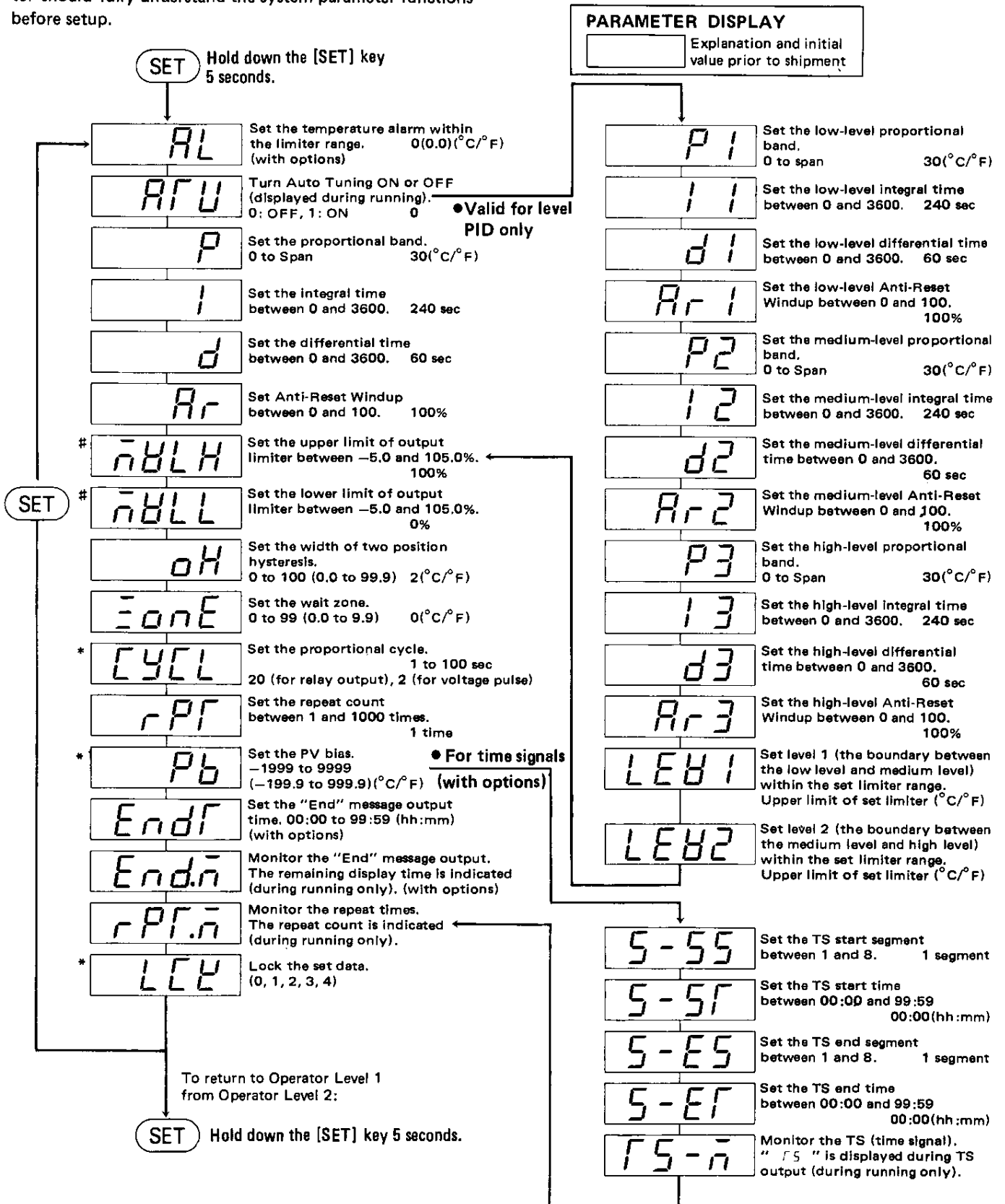
If a program is modified when it is running, the modification of the current segment is stored but the program itself continues to run with the previous set data. If the program is repeated, the control is performed with the new set values.

4. PARAMETER SETUP (Operator Level 2)

4-1 Parameters at Operator Level 2

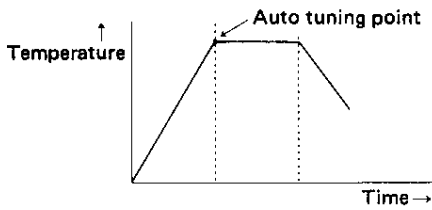
Select the Operator Level-2 mode to set various control parameters and functions. If an error is made during parameter setup, a system malfunction may result. The operator should fully understand the system parameter functions before setup.

Parameters can be set for pattern 1 and pattern 2 separately. The common parameter setup is identified by an asterisk (*). Setting items marked with # are only for current output types. (Next parameter is called by pressing SET key)



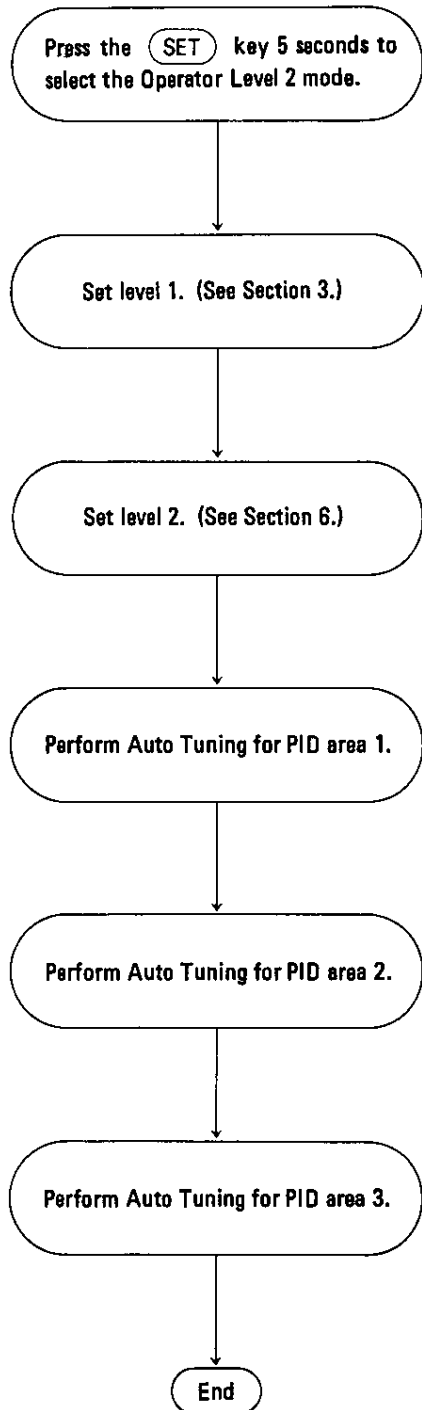
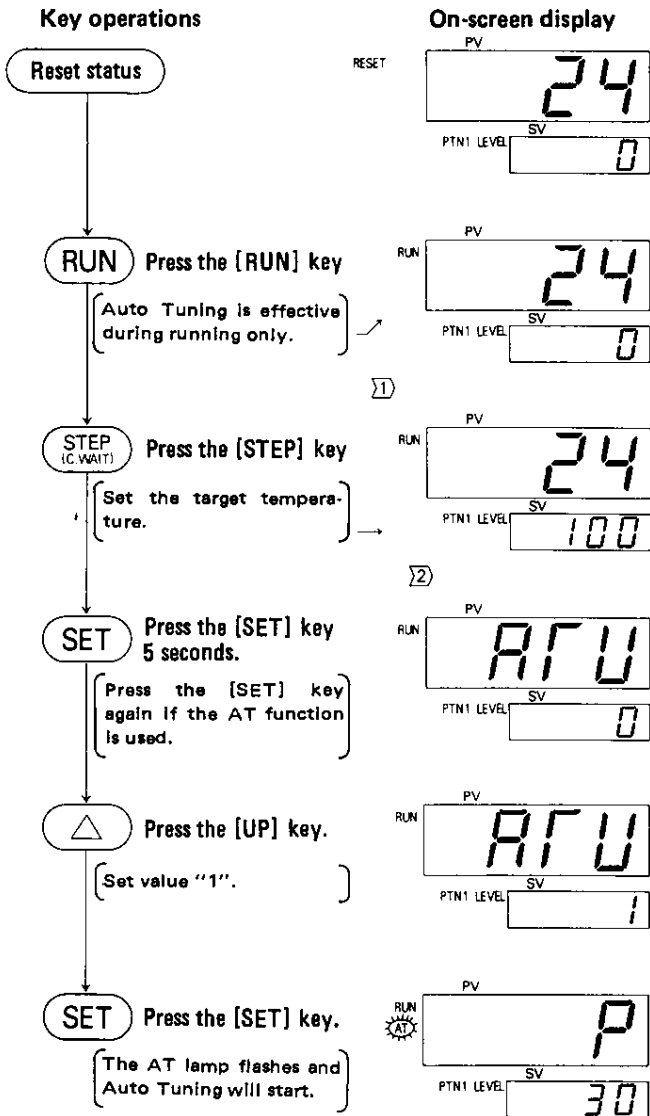
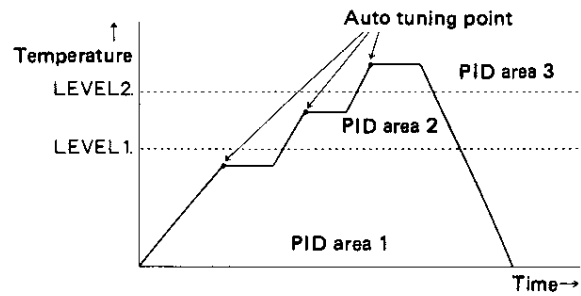
4-2 Auto Tuning

During PID operation (on the REX-P90F or REX-P90D): An optimum PID constant is automatically calculated and set during Auto Tuning. Use the following procedure when the operator uses the system first time or when the system control is unstable.

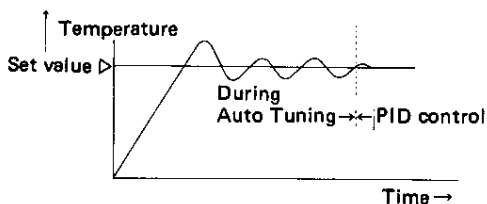


4-3 Auto Tuning for Level PID

Up to three PID constants can be set according to the temperature level. The level PID is useful if the load characteristics change due to the temperature.



After Auto Tuning, the signal waves are generated for three cycles around the set value as shown in the figure. Then, PID control starts automatically.

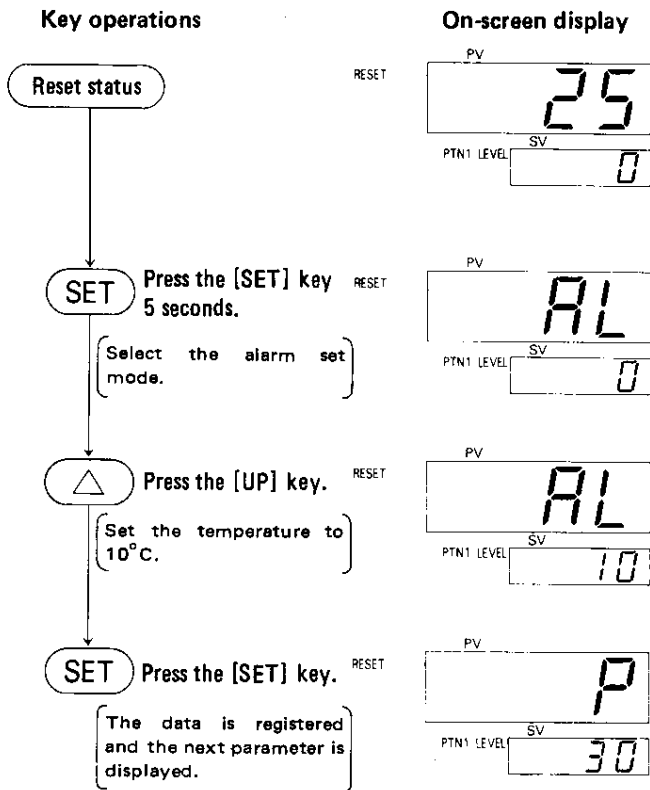


Note:

If you start Auto Tuning when the set value is being changed (during ramp control), the change of set value stops immediately and the appropriate PID constant is calculated at this point.

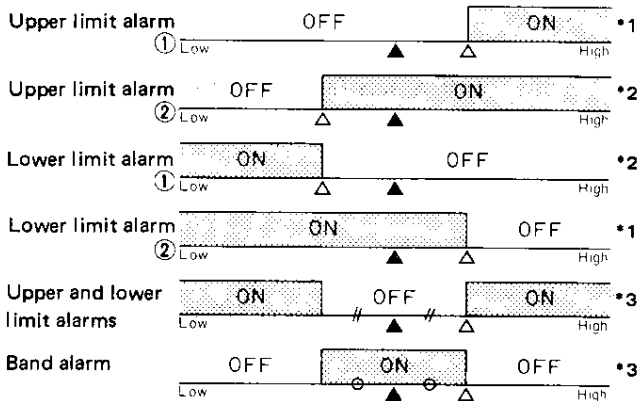
4.4 Temperature Alarm Setup

Up to eight levels of temperature alarm can be set as follows. Check your REX-P90 specifications and set the desired alarm level. (This setup is valid if the option is provided.)

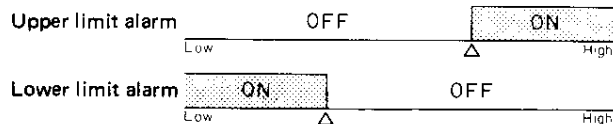


(△ : Set value (SV), ▲ : Alarm setup)

◎ Deviation alarm



◎ Process alarm



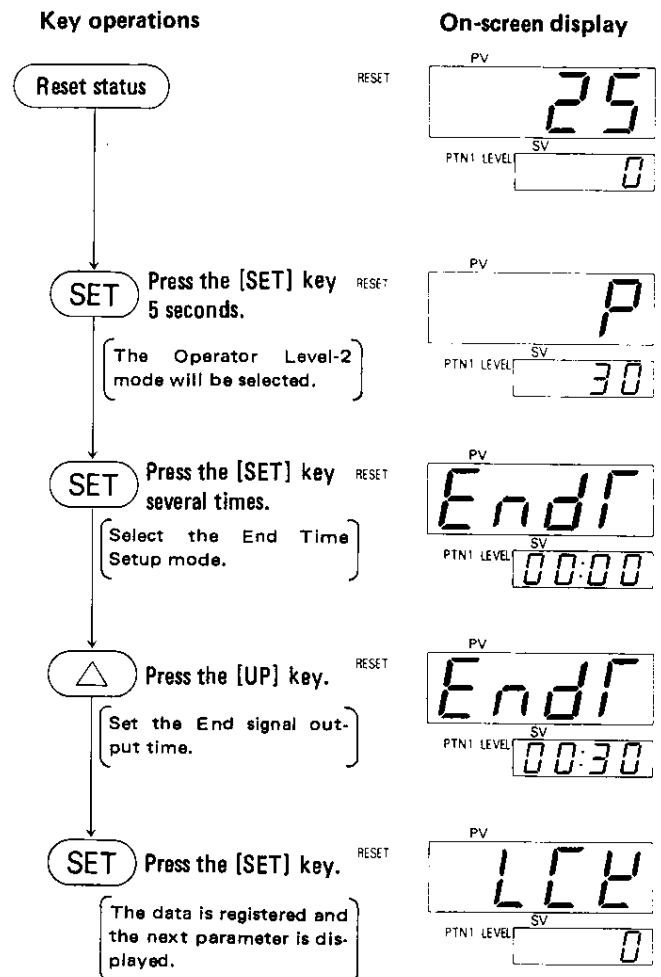
- *1 Alarm status if a positive alarm value is set.
- *2 Alarm status if a negative alarm value is set.
- *3 If an alarm value (absolute deviation) is set, the alarm starts at 2 points having the equal deviation from the set value (SV).

Note:

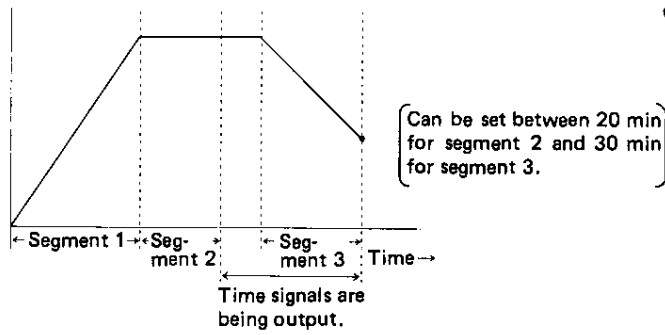
If an external interlock circuit is connected via the alarm contact, the contact signal may be output during power on. The 1- to 2-second idle time must be set.

4.5 Setting the End Signal Output Time

When a program has completed, the output time of the relay contact signal can be set (between 0 minute and 99 hours 59 minutes). (This function is valid only when the option is provided. This signal and the time signal cannot be output simultaneously.)

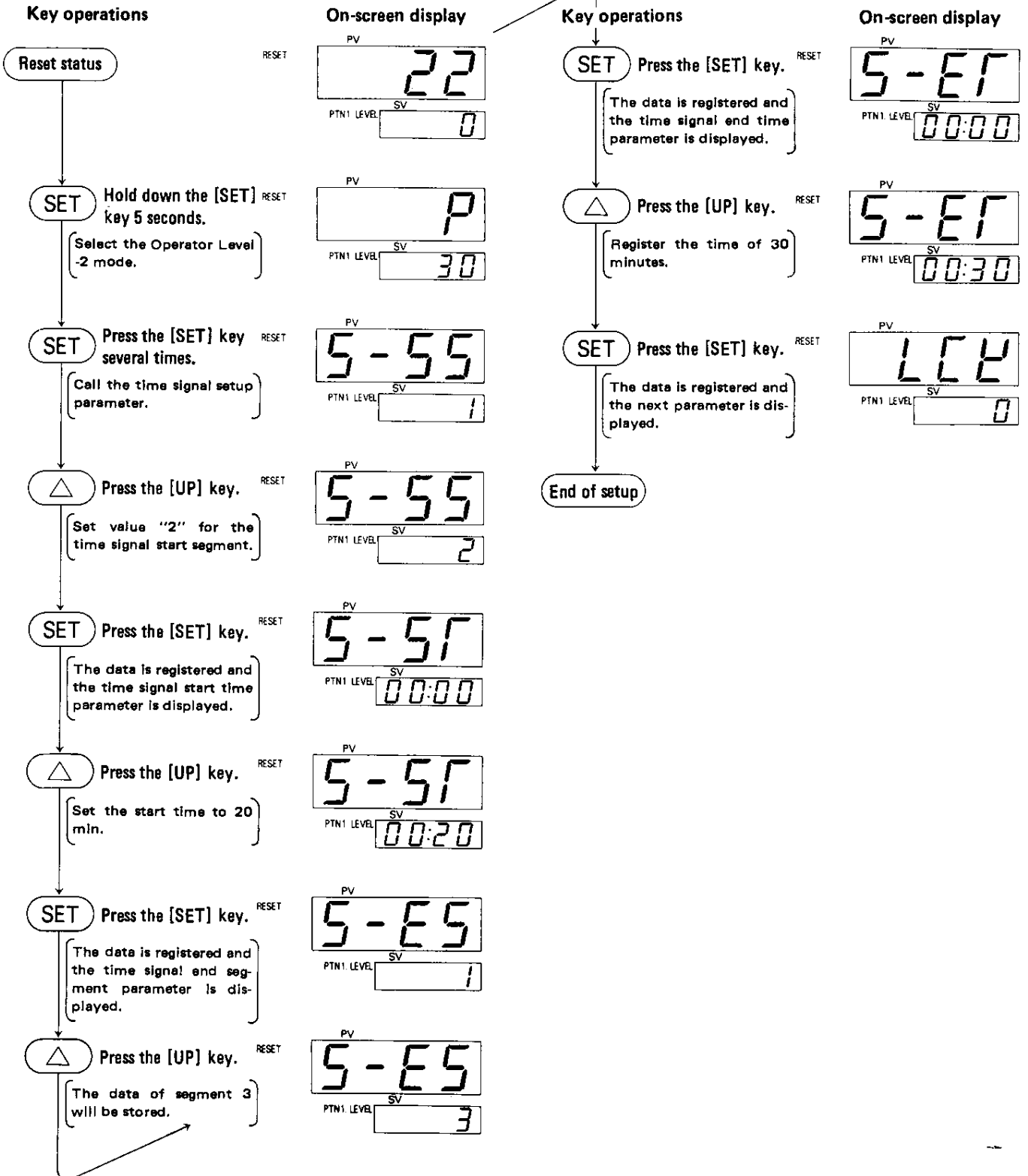


4-6 Setting the Time Signals



- **Time Signal**

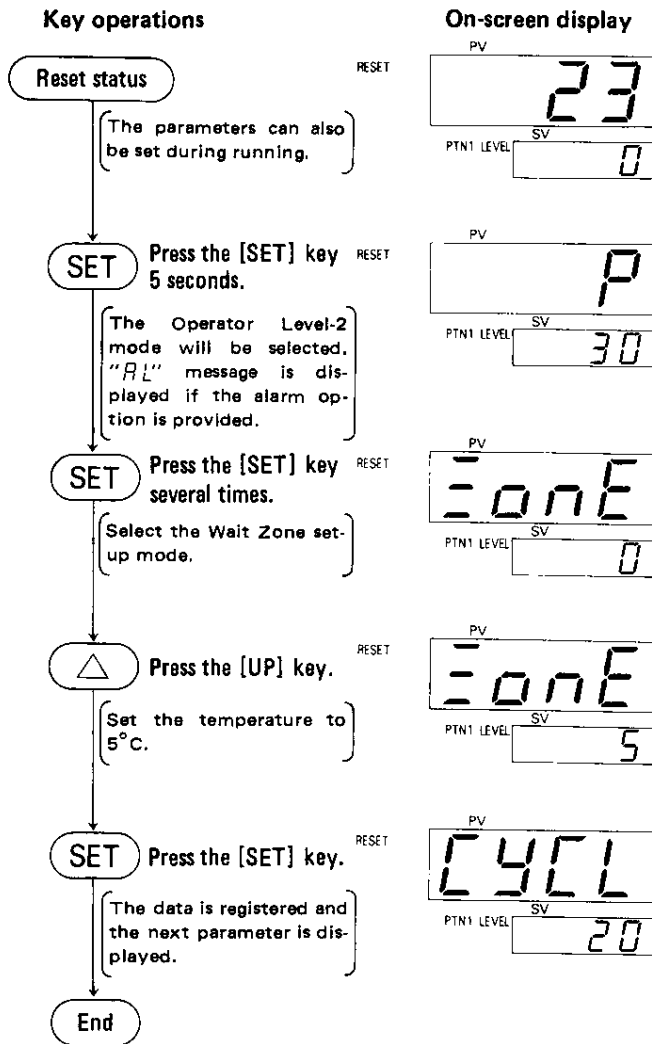
Contact output is produced for a certain period during program execution.



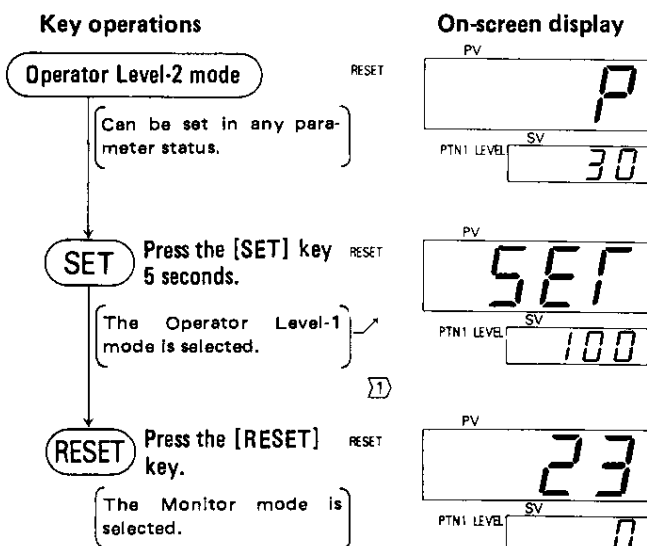
4-7 Other Parameter Setup

Set the PID constants and other parameters in the following procedure. For the parameters that you can set, see Section 4-1.

Example: Set the wait zone to 5°C.



4-8 Returning to Monitor Mode from Operator Level-2



5. OTHER FUNCTIONS

Wait function

If the measured value (PV) cannot be traced during program control, the program is suspended from being transferred to the next segment. If the measured value cannot reach the wait zone, the program does not transfer to the next segment. See the figure left for its setup.

Repeat function

The program execution can be repeated for the specified number of times. The repeat count can be set within the range of 1 to 999 times. If it is set to 1000 times, the program is repeated continuously. The End signal is output approximately 0.5 second during repeat. It must be considered when an external sequence circuit is connected. See the figure left for its setup.

Step function

The program execution can be jumped from the current segment to the beginning of the next segment during program control. To do so, just press the [STEP(C.WAIT)] key. See Section 3-3 for details.

PV bias function

If the sensor temperature must be corrected due to time deterioration or if the sensor position differs from the actual measuring position, the input value can be biased. Set the bias within the range of -1999 to 9999°C/°F or -199.9 to 999.9°C/°F. See the figure left for its setup.

External contact input function

The Run and Reset operations can be controlled using the contact input from the rear panel terminals. The contact input is valid for a signal pulse (0.5 sec or more). If the Run and Reset signals are entered simultaneously, the Reset signal has the priority and it is used.

Output limiter function

If the power output is used for control signal output, the maximum and minimum output level can be limited. They can be set within the range of -5.0 to 105.0%. See the figure left for its setup.

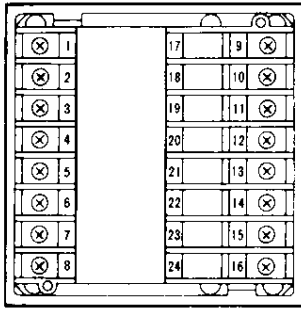
Data lock function

Each set data can be locked so that they are not changed. Select one of the following options for lockout.

- 0: Cancels the data lock function.
- 1: Locks the set values in the Initial Setup mode only.
- 2: Locks the initial setup and the values set in the Operator Level-2 mode.
- 3: Locks values set in all modes.
- 4: Locks the RUN, RESET, and STEP keys and all setup modes. However, the external contact is valid.

See the figure left for setup.

6. REAR-PANEL TERMINALS AND WIRINGS

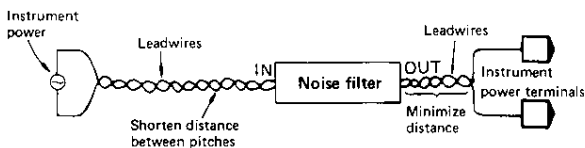


Terminal	Wiring information	Terminal	Wiring information	Terminal	Wiring information
1	GND terminal	17		9	Alarm output
2	100 to 240V AC	18		10	Relay contact output
3		19		11	External contact input
4	Time signal or pattern end output	20		12	
5	Relay contact output	21		13	
6	Control output terminal	22		14	Input terminal
7	Relay contact output Voltage pulse output Current output	23		15	Thermocouple input Thermoresistance input
8		24		16	

Note *All unused terminals are covered with the blind patch.
*The temperature compensation element is connected to terminal 14 for thermocouple input.

● Wiring Notes:

- To prevent the noise induction on the input signal lines, keep the cables and wirings away from the instrument power lines, motor power lines and load lines as much as possible.
- Route the instrument power line not to be affected by the noise generated by the motor power line. Use a noise filter (depending on the instrument power voltage) if the power line is routed close to the noise source and the instrument may be affected by the noise.
*Check the filter frequency characteristics and select an appropriate filter. Some filters cannot eliminate the noise.
 - Use the short twisting pitch of the instrument power cables if they may be affected by the noise. (The shorter twisting pitch of the cables have the higher noise resistance.)
 - Always mount the noise filter on the panel which has been grounded. The cable distance between the noise filter output and the instrument power terminal must be minimized. If this distance is too long, the filtering effects may be lost.
 - Do not connect the fuse and switch to the noise filter output cables. If done, the filtering effects may drop.



- Use the power cables satisfying the applicable laws. (Use the instrument ground having the nominal conductor section of 1.25 to 2.0 mm square with the minimum distance to the ground.)
- The 1- to 2-second idle time is required for the contact output during power ON. Use a delay relay when the contact output signal is used for the external interlock circuit and others.

7. TROUBLESHOOTING GUIDE

Check the following points before calling the service.

● Power supply

Problem	Checkpoints
Power supply does not turn ON.	> Incorrect wiring > Blown fuse on the control panel > Breaker already operated
Power turns ON but heater does not turn ON. (If OUT lamp lights)	> Incorrect wiring to the controller > Incorrect controller operation > Open circuit of heater
(If OUT lamp does not light)	> System has been reset. > Incorrect value setup

● Operations

Problem	Checkpoints
No key operates on instrument panel	> Locked key setup
Impossible pattern No. switching	> RUN screen displayed
Inoperable RUN and RESET keys on instrument panel	> The external selector switch has been closed.

● Display

Problem	Checkpoints
" oooo " message displays.	> Open circuit of sensor > The set value exceeds the limit.
" uuuu " message display	> The measured value is below the input range. > No jumper of sensor or leads for thermoresistance input type
The indicated temperature differs from the actual one.	> RV bias has been turned ON.

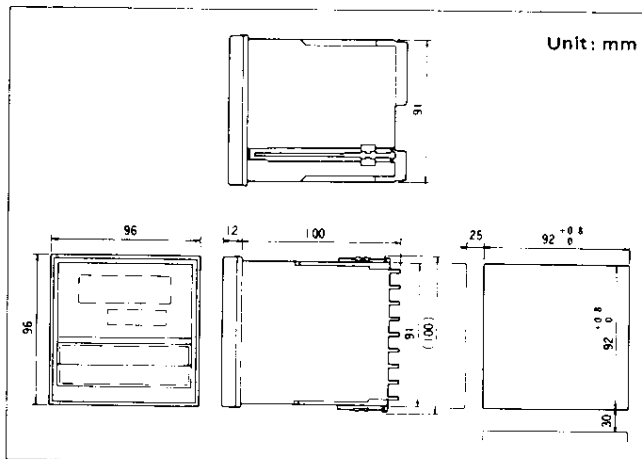
● Control

Problem	Checkpoints
Heater is turned ON by controller but the temperature does not increase.	> Open circuit of heater > Insufficient heater capacity > Abnormal controller operation > The output limiter has been set (for continuous control output).
The next segment is not selected after the set time.	> The wait status has been set.
Auto Tuning does not end.	> The control system has the very slow thermal response. (It takes much time for Auto Tuning when thermal response is slow.)
An appropriate constant was not determined during Auto Tuning.	> If the Auto Tuning does not complete within 4 hours, the constants set before Auto Tuning are used. > If the control system has the very unique temperature characteristics, an appropriate constant may not be determined through Auto Tuning.

● Others

Problem	Checkpoints
The alarm function does not operate correctly.	> Check the alarm type and the set value input method.

8. EXTERNAL DIMENSIONS AND PANEL CUT DIMENSIONS



9. SPECIFICATIONS

(1) Input

Input Impedance	Thermocouple input	Approx. 1M Ω
Affection by external resistance	Approx. 0.35 μ V/ Ω (for thermocouple input)	
Affection by input conductor resistance	Approx. 0.0075%/ Ω of the reading (for thermoresistance input)	
Contact input	Input method	Non-voltage contact input: 500K Ω or more open, 10 Ω or less close
	Contact current	4mA or less (when jumpered between external control and common terminals)
	Open voltage	9V DC or less (built-in power supply)
	Wiring distance	10m or less (depending on system environment including noise)
Sampling cycle	0.5 sec	

(2) Output

Control output	Relay contact output	250V AC, 3A (with resistance load), "1c" contact; Electrical service life: 300,000 times or more at rated load;
	Voltage pulse output	0 to 12V DC (with 600 Ω or higher load resistance)
	Current output	20mA for 0V DC; 20mA for 4V DC (with 600 Ω or less load resistance)
Pattern end output	Relay contact output: 250V AC, 1A (resistance load), "1a" contact	
Time signal output	Relay contact output: 250V AC, 1A (resistance load), "1a" contact	
Alarm output	Relay contact output: 250V AC, 1A (resistance load), "1a" contact	

(3) Performance

Accuracy	Level	① Thermocouple input Within $\pm(0.5\%$ of set value + 1 digit) or within $\pm 2^{\circ}\text{C}$ ($\pm 4^{\circ}\text{F}$), whichever larger; *For R, S and B thermocouple inputs • R, S Within $\pm 6^{\circ}\text{C}$ (12°F) for 0 to 399 $^{\circ}\text{C}$ (0 to 750 $^{\circ}\text{F}$) • B Out of accuracy assurance for 0 to 399 $^{\circ}\text{C}$ (0 to 750 $^{\circ}\text{F}$) ② Thermoresistance input Within $\pm(0.5\%$ of set value + 1 digit) or $\pm 0.8^{\circ}\text{C}$ ($\pm 1.6^{\circ}\text{F}$), whichever larger
	Segment time	Within $\pm 0.01\%$ of set value or 50 msec, whichever larger (except for the processing time during segment switching); Same as when a time signal or pattern end signal is output
	Proportional band	Thermocouple or thermoresistance input Within $\pm 0.5\%$ of set limiter span or $\pm 0.5^{\circ}\text{C}$ ($^{\circ}\text{F}$), whichever larger
	Others	Within $\pm 0.5\%$ of setting range
Input display accuracy	Thermocouple	Within $\pm(0.5\%$ of displayed value + 1 digit) or $\pm 2^{\circ}\text{C}$ ($\pm 4^{\circ}\text{F}$), whichever larger; *For R, S and B thermocouple inputs • R, S Within $\pm 6^{\circ}\text{C}$ (12°F) for 0 to 399 $^{\circ}\text{C}$ (0 to 750 $^{\circ}\text{F}$) • B Out of accuracy assurance for 0 to 399 $^{\circ}\text{C}$ (0 to 750 $^{\circ}\text{F}$)
	Thermoresistance	Within $\pm(0.5\%$ of displayed value + 1 digit) or $\pm 0.8^{\circ}\text{C}$ ($\pm 1.6^{\circ}\text{F}$), whichever larger
Insulation resistance	500V DC, 20M Ω or more between the measuring terminal and ground	
	500V DC, 20M Ω or more between the power terminal and ground	
Dielectric strength	1 minute at 1000V AC between the measuring terminal and ground	
	1 minute at 1500V AC between the power terminal and ground	

(4) Others

Source voltage	90 to 264V AC (50/60Hz common) including source voltage variation
Power consumption	10V A or less
Installation conditions	Free from the environment where the operator needs a protection or from a corrosive atmosphere.
Allowable ambient temperature	0 to 50 $^{\circ}\text{C}$ (32 to 122 $^{\circ}\text{F}$)
Allowable ambient humidity	45 to 85% RH
Weight	Approx. 400g

RKC RKC INSTRUMENT INC.

IM90P01-E2

HEAD OFFICE: 16-6, KUGAHARA 5-CHOME, OHTA-KU TOKYO JAPAN
PHONE: 03-3751-9799 (+81 3 3751 9799)
TELEX : 0246-8818 RKCTOK J
CABLE : RKCRKAROL
FAX : 03-3751-8585 (+81 3 3751 8585)

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