

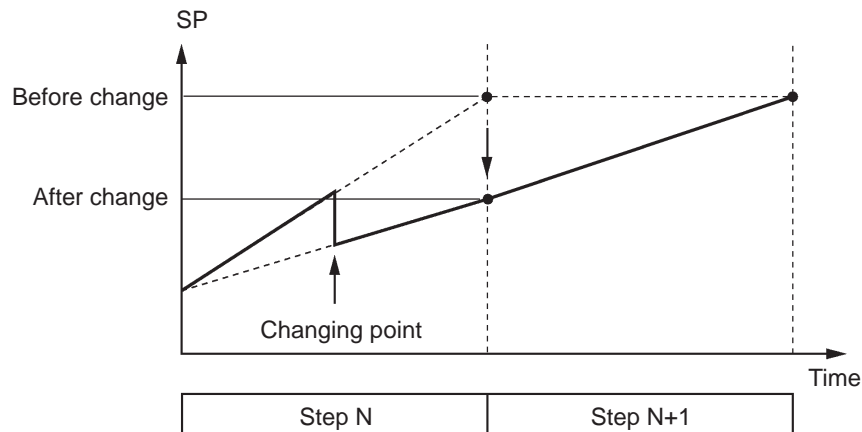
# Adjusting Control Operation

## Changing programs

- Programs are changed in the program mode. Note that pattern Nos. cannot be changed during program operation. So, only the pattern that is currently running can be changed.
- You cannot change the program when the “security” parameter (protect mode) is set to “5” or “6”.

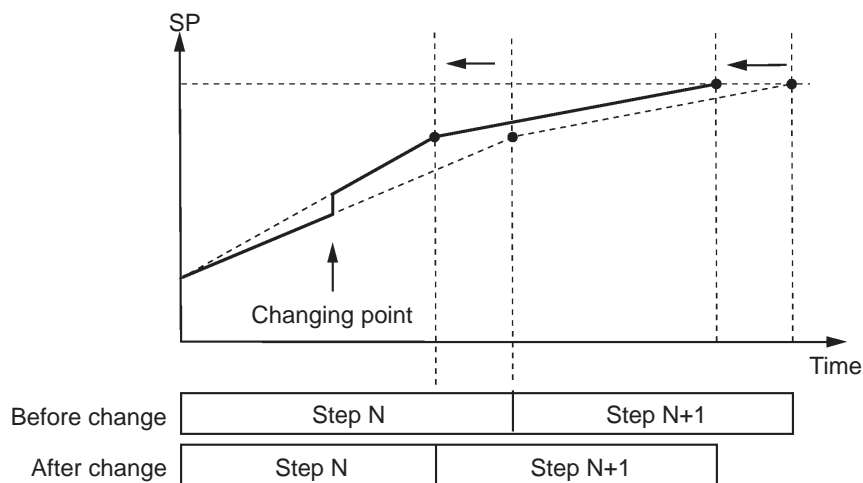
## Changing the SP

- Change the SP of steps 0 to 15 in “step 0 to 15 SP” parameters (program mode).
- When the SP is changed midway through a step, the Present SP is shifted on a line obtained by taking the new SP as the target point.



## Changing the time value

- Change the time value of steps 0 to 15 in “step 0 to 15 time” parameters (program mode).
- When the time value is changed midway through a step, the step time changes. The gradient of the line by which SP shifts also changes.

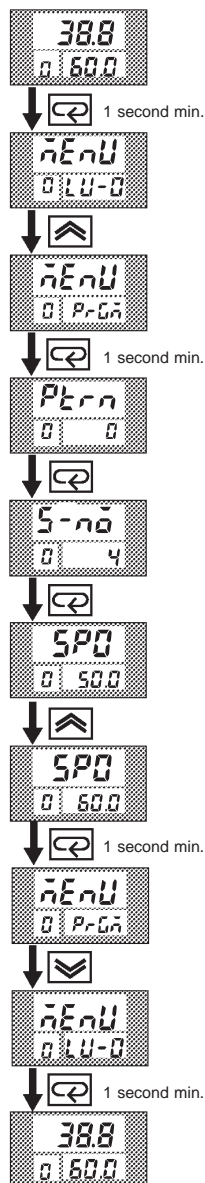



About Changing  
the Number of  
Steps

If you set the “number of steps” parameter (program mode) to a value smaller than the current number of steps during program operation, program operation is immediately exited.

## Setting Example


In the following example, let's change the temperature set point to "60°C" from "50°C".





- (1) Press the  key for 1 second minimum at the currently executing "PV/Present SP" display.


The display changes to the menu display.

Set the parameter to "Pr-Gr : program" pressing the  or  keys.




Press the  key to enter the program mode. The top parameter in the program mode "Pr-Gr : pattern" is displayed.

Press the  key to display the [5-Gr] ("number of steps" parameter).





Press the  key. [5SP] ("step 0 SP" parameter) is displayed, and the No.2 display indicates "50.0".

Press the  key to set the parameter to "60.0".



Press the  key for 1 second minimum. The menu display ("Pr-Gr : program" parameter) is redisplayed.

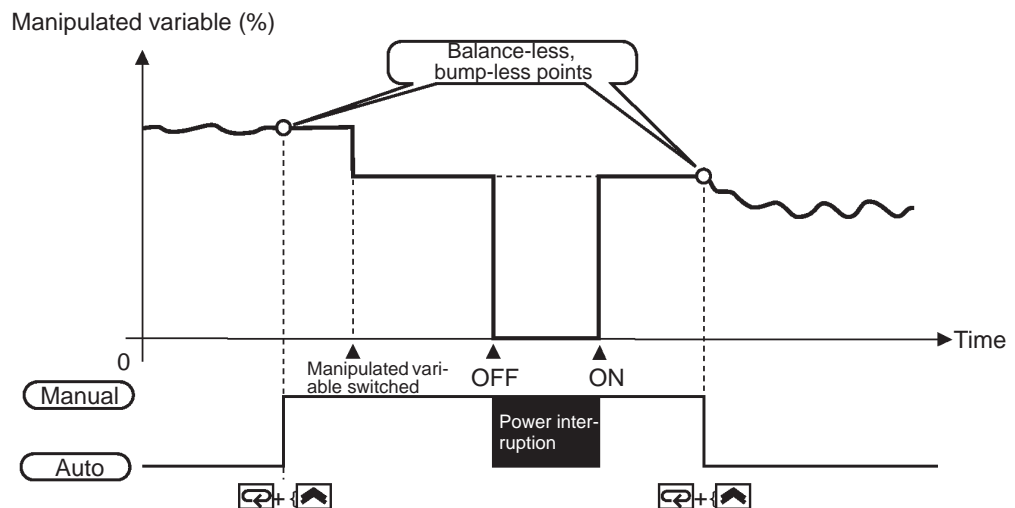
Select "LU-0 : level 0 mode" pressing the  or  keys, and press the  key for 1 second minimum. The "PV/Present SP" display is redisplayed.

## Manual operation



- On a standard type controller, the manipulated variable is controlled, and on a position-proportional type controller, the valve opening is controlled.
- To set manual operation and manually set the manipulated variable or the valve opening, press the  key and  key simultaneously for 1 second minimum. Then the controller enters the manual mode. To quit the manual mode, press the  key and  key again simultaneously for 1 second minimum. The controller enters the level 0 mode without entering the menu display.
- Though the control shifts to manual operation if the controller is set to the manual mode during program operation, the program advances. When program operation is started in the manual mode, program also advances.
- In the manual mode, the automatic return of display mode does not work.

## Standard type

- The process value is displayed on the No.1 display, and the manipulated variable is displayed on the No.2 display.
- To change the manipulated variable, press the  or  keys. After two seconds, the manipulated variable is updated to the new setting.
- When switching between manual and auto operation, the manipulated variable is subject to balance-less, bump-less operation.
- If the power is interrupted during manual operation, manual operation is resumed at the manipulated variable that was active at power interruption when the power is reset.



## Position-proportional type

- When a potentiometer is connected to the controller, the process value is displayed on the No.1 display, and the valve opening is displayed on the No.2 display.
- When you press the  key, the open side becomes ON. When you press the  key, the close side becomes ON.

## Auto-tuning (A.T.)



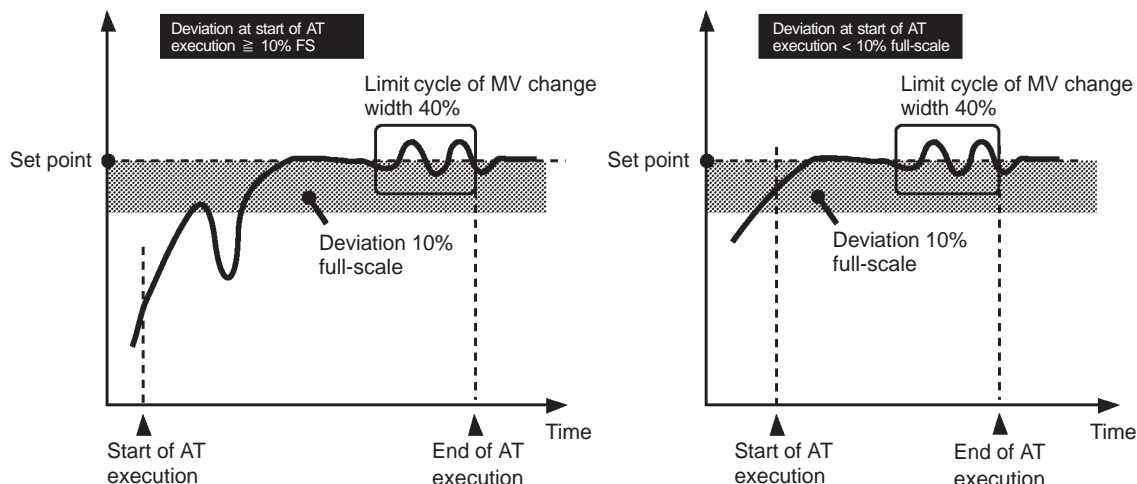
- AT (auto-tuning) cannot be executed while operation is reset or during ON/OFF control.
- When you execute auto-tuning, the optimum PID parameters are automatically set by forcibly changing the manipulated variable to calculate the characteristics (called the “limit cycle method”) of the control target. During auto-tuning, time counting is stopped and the “AT” LED flashes.
- 40%AT or 100%AT can be selected by the limit cycle of MV change width. Specify [At - 1] or [At - 2], respectively, in the “AT execute/cancel” parameter (level 1 mode).
- During heating and cooling control on a standard type controller, and on a position-proportional type controller, only 100%AT can be executed. (So, “At - 1 : 40%AT” is not displayed.)
- To cancel AT execution, specify “OFF : AT cancel”.

### 40%AT



In order to set the limit cycle of MV change width to 40%, select 40%AT to execute auto-tuning with fluctuations in the process value kept to a minimum. However, note that auto-tuning takes longer to execute compared with 100%AT.

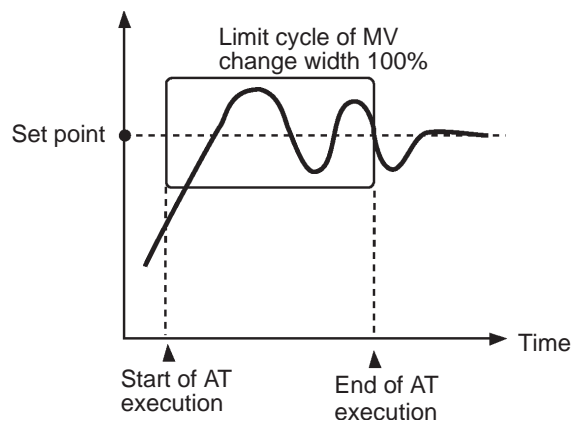
The timing by which limit cycles are generated varies according to whether or not the deviation (DV) at the start of AT execution is 10% full-scale or less.



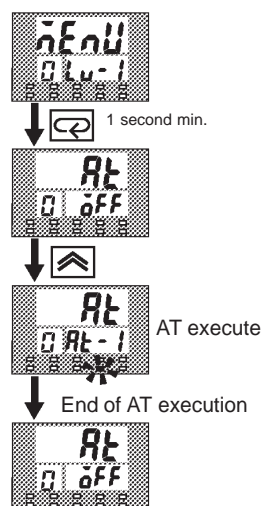
### 100%AT



In order to set the limit cycle of MV change width to 100%, select 100%AT to shorten the AT execution time without worrying about fluctuations in the process value.



## Setting Example



In this example, let's execute 40%AT.

- (1) Select the menu display, and select “ $\text{L} \text{U} - \text{I}$  : level 1 mode” using the  $\text{L} \text{U} - \text{I}$  or  $\text{L} \text{U} - \text{I}$  keys. For details on selecting the menu display, see page 1-10.

Press the  $\text{L} \text{U} - \text{I}$  key to enter the level 1 mode. The top parameter in the setup mode “ $\text{At}$  : AT execute/cancel” is displayed. In this example, the parameter setting is “ $\text{0FF}$  : AT cancel”.

Press the  $\text{L} \text{U} - \text{I}$  key to specify [ $\text{At} - \text{I}$ ].

The AT LED flashes, and AT execution starts. When the AT LED goes out (end of AT execution), the parameter automatically returns to “ $\text{0FF}$  : AT cancel”.



## About PID Parameters

When control characteristics are already known, the PID parameters can be set directly to adjust control.

PID parameters are set in the “proportional band” (P), “integrated time” (I) “derivative time” (D) parameters (level 1 mode).

For details on the setting ranges of these parameters, see chapter 5 Level 1 Mode (page 5-18).



## AT Execution Timing

The E5EK-T differs from fixed-value type controllers in that the SP changes automatically. So, the timing of AT execution is the most important factor in control. To obtain PID parameters for a specific SP, make a fixed-value program as follows and execute AT.

