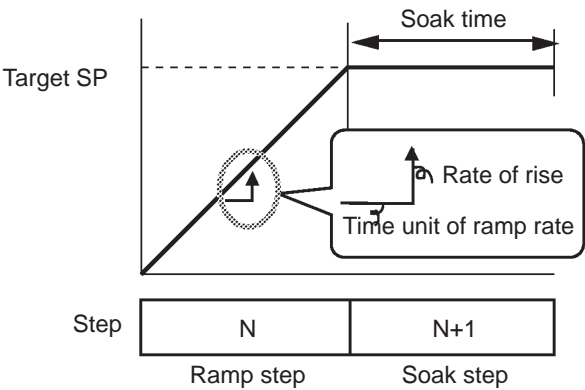


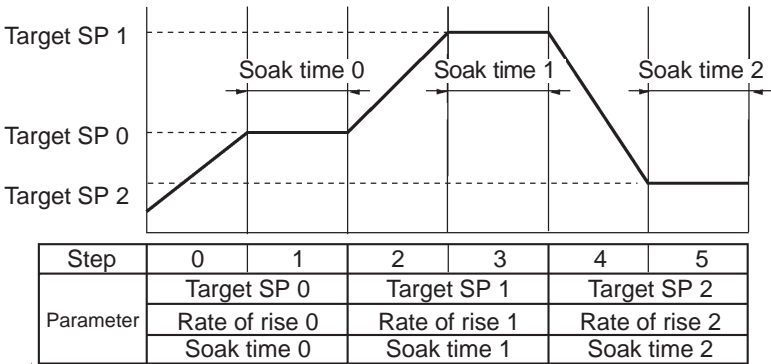
# Ramp Rise Rate Setup Program

Chapter 3 described programs that used the “time setup method.” Programs were executed using a combination of SPs and step time values. The E5AK-T also supports the “ramp rise rate setup method.” By this method, programs are executed using three program elements: “target SP”, “rate of rise” and “soak time.” To select a ramp rise rate program, set the “Step time/rate of rise programming” parameter (expansion mode) to “Pr : rate of rise.”



Set each of the above program elements in the “target SP 0 to 7”, “rate of rise 0 to 7” and “soak time 0 to 7” parameters.

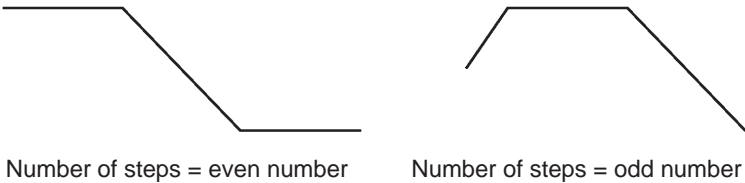
In a ramp rise rate program, parameters are set to two steps as shown in the figure above. The following figure shows the relationship between the program and parameters.



**Relationship with the number of steps**

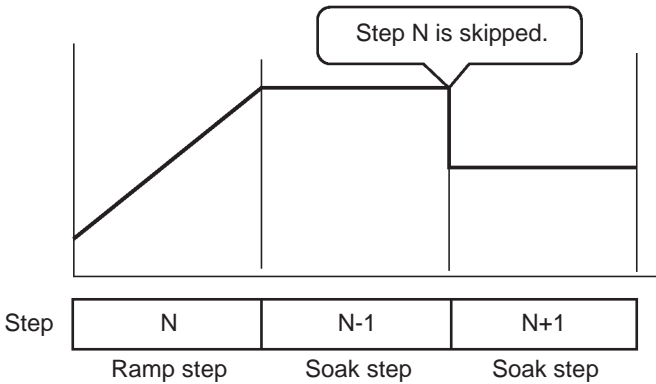
When the number of steps is set to an odd number, the final soak time cannot be set. For example, if we set the “number of steps” parameter to “7”, the “soak time 3” parameter cannot be set even though the “target SP 3” and “rate of rise 3” parameters can be set.

Accordingly, when the number of steps are set to an even number, the final step is a soak step. When it is set to an odd number, the final step is a ramp step.



**When the rate of rise is set to “0”**

When “rate of rise 0 to 7” parameter is set to “0”, the ramp step is skipped and the soak step appears to be continuous.

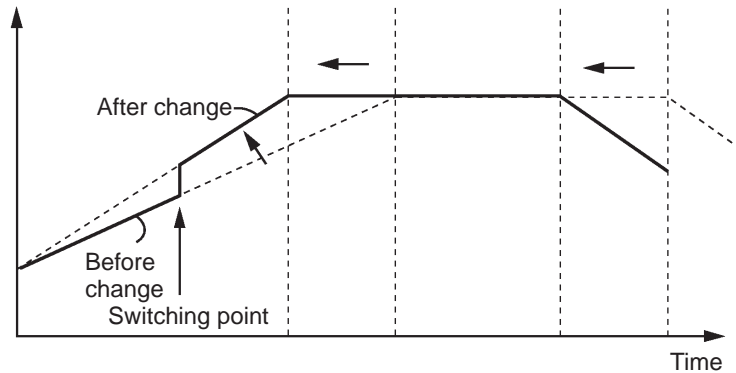


## Running the ramp rise rate setup program

### Changing parameters

Ramp rise rate setup programs take the PV at start of program operation as the SP (PV start) when they are started.

When the rate of rise is changed midway during operation, the SP rate of rise and the step time in the ramp cycle both change.

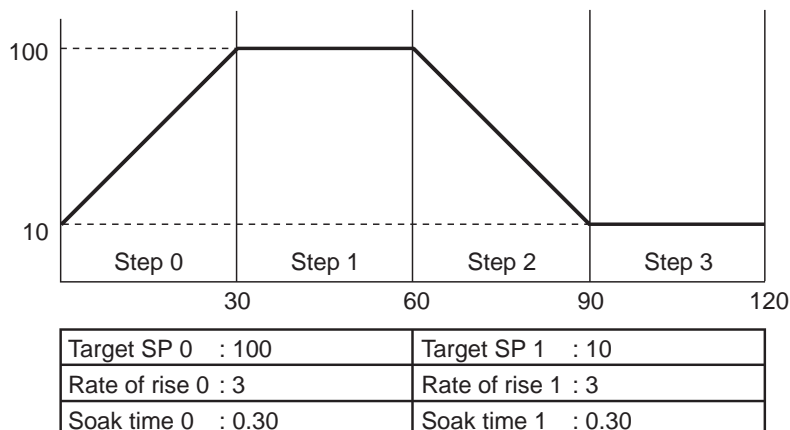


Before change	Step N	Step N+1
After change	Step N	Step N+1

- In the above figure, increasing the rate of rise results in a shorter target step time. Likewise, when the SP is changed, the step time of the ramp cycle also changes.
- When the soak time is changed, only the step time in the soak cycle changes.

## Program example

Let's describe a typical example of a ramp rise rate setup program. In an actual program, set the parameters to match the application.



"Number of steps" = 4, "Time unit of ramp rate" = minutes, "PV start" = 10

## Program structure

In a program comprising four steps, steps 0 and 1 follow the settings of the "target SP 0", "rate of rise 0" and "soak time 0" parameters. Steps 2 and 3 follow the settings of the "target SP 1", "rate of rise 1" and "soak time 1" parameters.

## How the program works

- (1) As the program starts at PV (PV start), the program starts operation from "10" in this example.
- (2) As the rate of rise is set to "3", the Present SP takes 30 minutes ( $100-10/3=30$ ) to reach the target SP value "100" in step 0. If the PV is "40" when the program is started, this time then becomes 20 minutes using the same formula.
- (3) In step 1, the Present SP does not change, and the step time is the value set to the "soak time 0" parameter (in this example, "30 minutes").
- (4) In step 2, the Present SP changes according to the value of "rate of rise 1" parameter from that of "target SP 0" parameter to that of "target SP 1" parameter. It takes 30 minutes in this example.
- (5) In step 3, the Present SP does not change, and the step time is the value set to the "soak time 1" parameter (in this example, "30 minutes").

## Parameters

Symbol	Parameter Name: Mode	Description
$t - Pr$	Step time/Rate of rise programming : Expansion	Ramp rise rate
$SP *$	Target SP 0 to 7 : Program	Ramp rise rate



Operation  
at Input Error

By ramp rise rate setup method, starting at input error, the program start step i "step 1".

Symbol	Parameter Name: Mode	Description
$P_r$ *	Rate of rise 0 to 7 : Pro-gram	Ramp rise rate
$t_L$ *	Soak time 0 to 7 : Pro-gram	Ramp rise rate

\* : 0 to 7