Appendix C
Manually Setting PID Constants

Refer to the information provided here on the operation of the proportional band (P constant), integral time (I constant), and derivative time (D constant) when setting the PID constants manually.

Proportional Band (P Constant)

If the proportional band is too wide, overshooting the set point can be suppressed but the startup time will be slow.

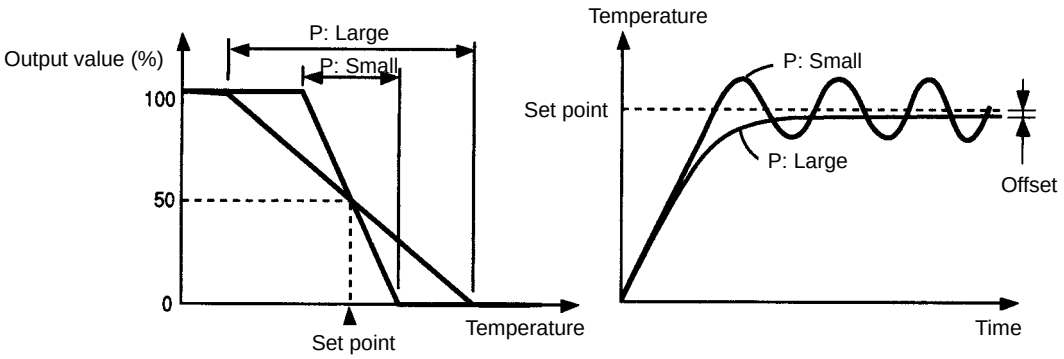
If the proportional band is too narrow, the startup time will be quicker but overshooting and hunting for the set point will result.

An offset from the set point will result in P or PD control operation.

Adjustments

Adjust the width of the proportional band from a large value to a smaller value.

If there is slow temperature hunting, increase the width of the proportional band.



Integral Time (I Constant)

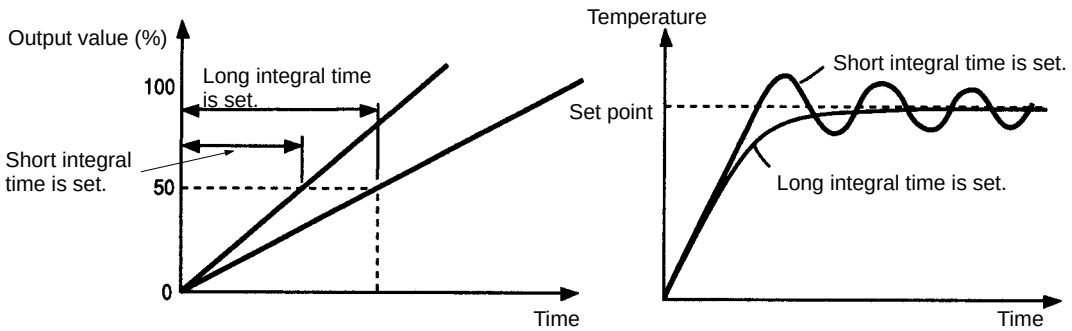
Integral operation is used to gradually eliminate the offset of the temperature that is caused by proportional control.

Do not set the value of the integral time to too small a value in attempt to quickly eliminate the offset of the temperature. Doing so will result in hunting of the temperature.

Adjustments

Adjust the value of the integral time from a larger value (longer time) to a smaller value (shorter time) to find the optimum integral time.

If there is slow temperature hunting or the temperature is stabilized after repeated temperature overshooting, the integral time of the E5ZE is too short.



Derivative Time (D Constant)

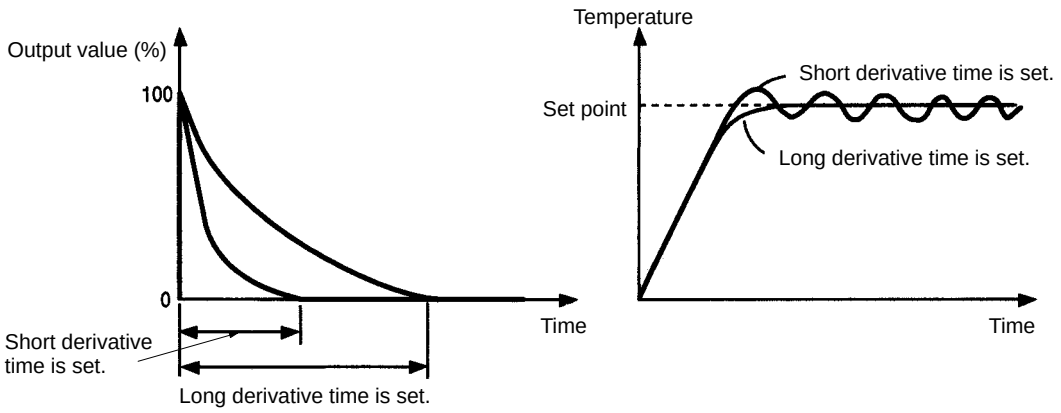
Derivative operation is used to quickly return the temperature to its original value by providing a large output value even if there is radical external disturbance.

Do not set the derivative time to be too long, otherwise a large temperature output value will continue to be output and the temperature will not be stabilized. At this time, hunting of the temperature, with a cycle shorter than hunting caused by incorrect proportional band or integral time values, will result.

Adjustment

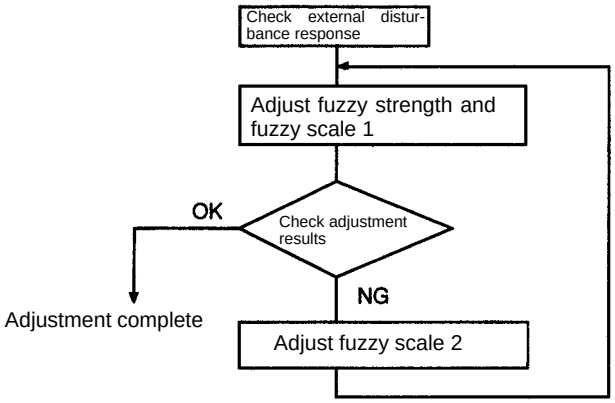
Adjust the value of the derivative time from the larger value (longer time) to a smaller value (shorter time) to find the optimum derivative time.

If there is hunting of the temperature with a short cycle, the derivative time may be set too long and the temperature control response may be too fast.



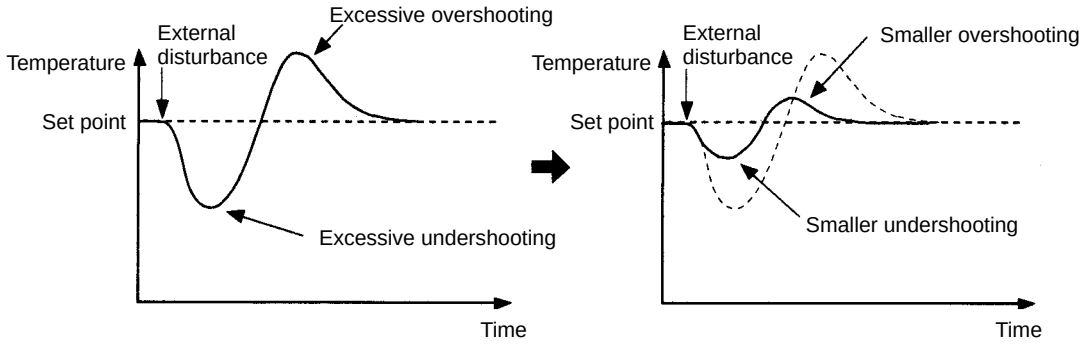
Fuzzy Constants

Fuzzy constants are normally adjusted automatically. If, however, the results of automatic adjustment are not satisfactory, or the response to external disturbance needs further improvement, the fuzzy constants can be manually adjusted. The following flowchart shows how to manually adjust fuzzy constants.

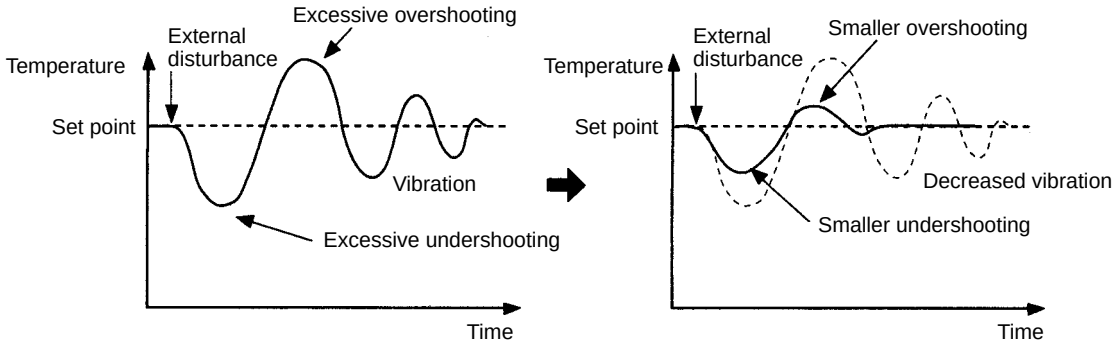


Adjust fuzzy scale 2 only when fuzzy strength and fuzzy scale 1 adjustments are unsatisfactory.

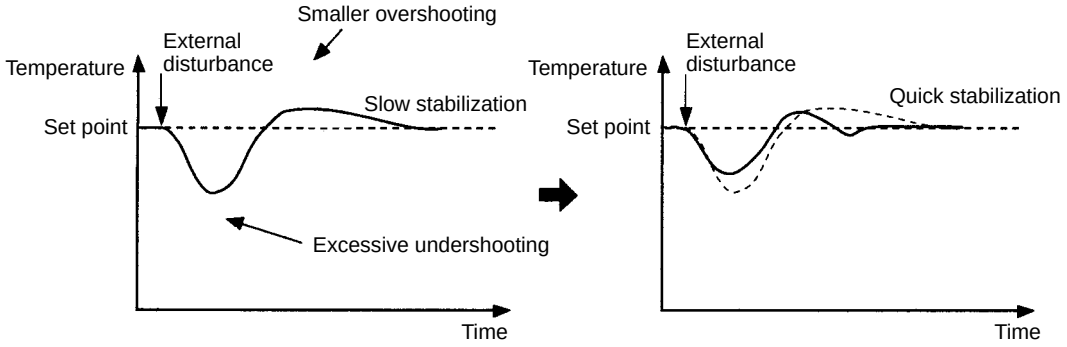
Increasing Fuzzy Strength



Increasing Fuzzy Scale 1



Reducing Fuzzy Scale 1



The following table shows the tendency of external disturbance response when fuzzy constants are adjusted.

Fuzzy constants		External disturbance response		
		Excessive value	**Oscillation**	**Stabilization time**
Fuzzy strength	Larger	Decreases	Increases	---
	Smaller	Increases	Decreases	
Fuzzy scale 1 and fuzzy scale 2	Larger	Increases	Decreases	Long
	Smaller	Decreases	Increases	Short

Excessive value: Overshooting or undershooting

Oscillation: Hunting