

Selecting the Control Method

Heating and cooling control

When selecting the control method, set the parameters according to the following table. (Parameters are factory-set to heating control.)

Control Method \ Parameter	Control Output 1 Assignment	Control Output 2 Assignment	Direct/Reverse operations
Heating control (Standard)	Control output (heat)	-	Reverse operation
Cooling control (Standard)	Control output (heat)	-	Direct operation
Heating and cooling control	Control output (heat)	Control output (cool)	Reverse operation

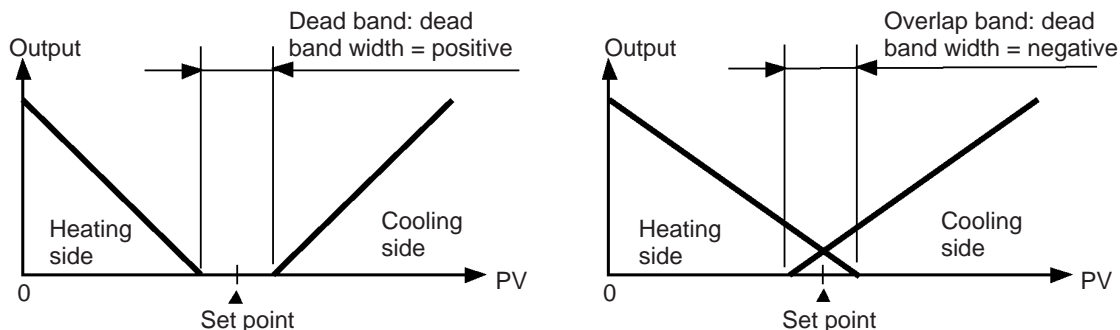
(Parameters are factory-set to heating control.)

- For details on how to assign outputs, see Section 3.3 Setting Output Specifications
- When heating and cooling control is selected, the “dead band” and “cooling coefficient” parameters can be used.

Dead band

The dead band is set with the set point as its center. The dead band width is the set value of the “dead band” parameter (level 1 mode). Setting a positive value produces a dead band, while setting a negative value produces an overlap band.

The dead band is factory-set to “0.00:0.00%FS.”



Cooling coefficient

If the heating and cooling characteristics of the control target greatly differ, preventing satisfactory control characteristics from being obtained by the same PID parameters, adjust the proportional band (P at cooling side) using the cooling coefficient to balance control between the heating and cooling sides. In heating and cooling control, P at the heating or cooling side is calculated by the following formula:

$$\text{Heating side } P = P; \text{ Cooling side } P = \text{cooling coefficient} \times P$$

Manipulated variable at reset

- In heating and cooling control, the manipulated variable output that is output when controller operation is stopped is dependent on the set value of the “MV at reset” parameter (level 2 mode) in the same way as for standard control.
- However, note that in heating and cooling control, the manipulated variable at the cooling side is treated as a negative value for the sake of convenience. When the manipulated variable at reset is a negative value, the manipulated variable is output to only the cooling side, and when a positive value, the manipulated variable is output to only the heating side.

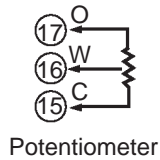
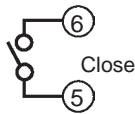
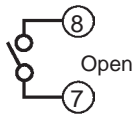
Default is “0”. If the controller is operated with default, the manipulated variable is not output to both the heating and cooling sides.



Switching with Manual Operation

When the overlap band is set, the bumpless function that operates when switching between manual and automatic operation may not work.

Position-proportional control



- Use the position-proportional type controller for position-proportional control.
- On a position-proportional type controller, control output 1 is used for open output, and control output 2 is used for closed output. Accordingly, control outputs 1 and 2 cannot be used as output assignments. Special output units are already set on position-proportional type controllers.
- On a position-proportional type controller, the following functions are disabled:
 - MV limiter
 - P and PD control
 - 40% AT
 - LBA
 - HBA
 - ON/OFF control

Travel time

- To change the travel time, either set in the “travel time” parameter (option mode), or execute motor calibration in the “motor calibration” parameter (option mode).
- Default is “30:30 seconds.”

Valve opening monitor

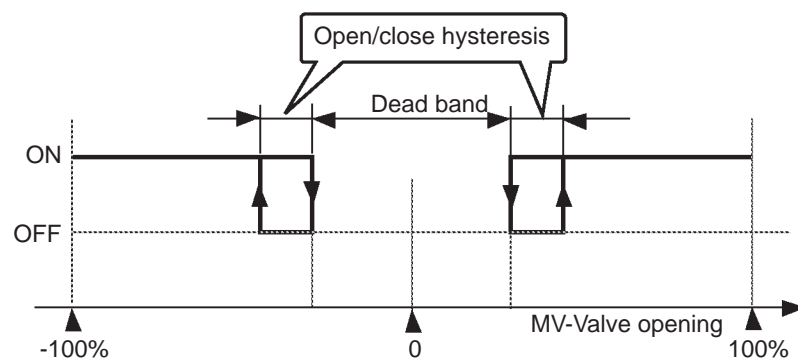
- The valve opening can be monitored when a potentiometer is connected to the controller. However, be sure to execute motor calibration after connecting the potentiometer.

Manipulated variable at reset/PV error

- Open, closed or hold can be selected as output at reset or PV error. Set these outputs in the “MV at reset” or “MV at PV error” parameters (level 2 mode).

Other functions

- Set the dead band in the “position-proportional dead band” parameter (level 1 mode). Default is “2.0:2.0%”.
- Set the open/close hysteresis in the “open/close hysteresis” parameter (level 2 mode).

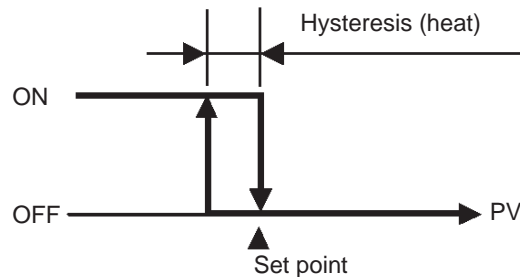


ON/OFF control

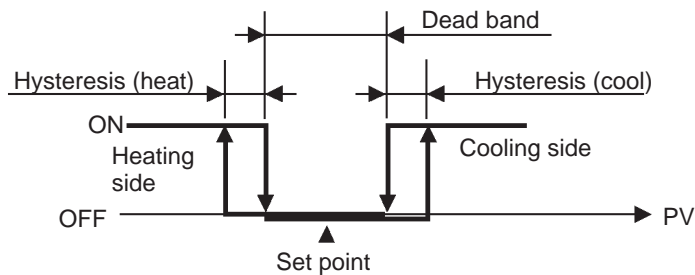
- ON/OFF control is selected by the “PID/ON/OFF” parameter (expansion mode). When this parameter is set to [$P\bar{L}d$], advanced PID control is selected, and when set to [$\bar{a}n\bar{o}f$], ON/OFF control is selected. The “ON/OFF control” parameter is factory-set to [$P\bar{L}d$].
- During position-proportional control, ON/OFF control cannot be selected.

Hysteresis

- In ON/OFF control, hysteresis is provided in the program when switching between ON and OFF to stabilize operation. The hysteresis width provided during ON/OFF control is simply referred to as “hysteresis.” Control output (heat) and control output (cool) functions are set in the “hysteresis (heat)” and “hysteresis (cool)” parameters, respectively.
- In standard control (heating or cooling control), hysteresis can be set only for the heating side.



- In heating and cooling control, a dead band can be set. So, 3-position control is made possible.



Parameters

Symbol	Parameter Name: Mode	Description
$\tilde{out} 1$	Control output 1 assignment : Setup	For specifying control method
$\tilde{out} 2$	Control output 2 assignment : Setup	For specifying control method
\tilde{rev}	Direct/reverse operation : Setup	For specifying control method
$\zeta - db$	Dead band : Level 1	Heating and cooling control
$\zeta - SC$	Cooling coefficient : Level 1	Heating and cooling control
$\tilde{u} - r$	MV at reset : Level 2	Manipulated variable when control operation is stopped
$\tilde{u} - E$	MV at PV error : Level 2	Manipulated variable when control operation is PV error
$\tilde{\alpha} t$	Travel time : Option	Position-proportional control
ζALb	Motor calibration : Option	Position-proportional control
db	Positional-proportional dead band : Level 1	Position-proportional control
$\tilde{\alpha} \zeta - H$	Open/close hysteresis : Level 2	Position-proportional control
HYS	Hysteresis (heat) : Level 1	ON/OFF control
ζHYS	Hysteresis (cool) : Level 1	ON/OFF control
$\zeta n t L$	PID / ON/OFF Expansion :	ON/OFF control