CHAPTER 5

CONTROL MODES

In This Chapter...

The SOLO controller can be configured for any of the following control modes.

- PID control
- On / Off control
- Ramp / Soak control
- Manual control

PID Control

All of the SOLO controllers can store up to four PID parameter groups (PID parameter groups 0 - 3)

	Group 0	Group 1	Group 2	Group 3
Set Value	SV0	SV1	SV2	SV3
Proportion Band	P0	P1	P2	P3
Integral Time	I0	I1	I2	I3
Derivative Time	d0	d1	d2	d3
Integral Offset	IoF0	IoF1	IoF2	IoF3

Note: Other parameters are shared among all PID parameter groups.

The operator can select any of the parameter groups for PID control. The SOLO controller also supports the PID parameter group 4. However, this is not an actual parameter group. When the PID parameter group 4 is selected, the controller checks the SV of each parameter group and uses the parameter group which has a SV that is the closest to the SVset by the operator. If there are two or more PID parameter groups that have SV values equally close to the SV, the controller uses the lowest number parameter group (eg. If parameter groups 0 - 3 have the same SV, the controller uses the parameter group 0).

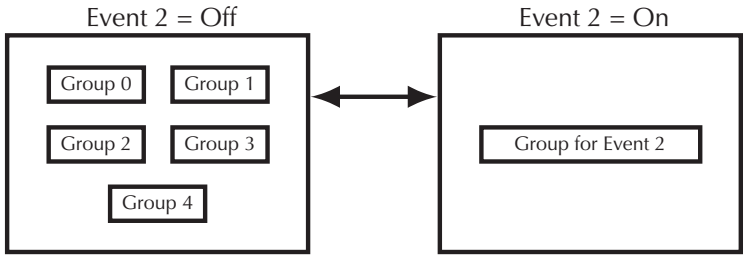
Group 0	Group 1	Group 2	Group 3
SV0	SV1	SV2	SV3
P0	P1	P2	P3
I0	I1	I2	I3
d0	d1	d2	d3
IoF0	IoF1	IoF2	IoF3

Group 4 ⟷ SV

When the PID parameter group 4 is selected, the controller compares SV0 - SV3 with the PV. Then it uses the parameter group which has a SV that is the closest to the SV set by the operator..

Once the controller selects one of the PID parameter groups (group 0 - 3), the setup parameters of the selected parameter group are displayed on th controller.

The SL4896 and SL9696 series controller also support an additional PID parameter group. The parameter group is used with the Event2 input. When Event2 input is on, the SOLO controller uses the additional PID group for the PID control.

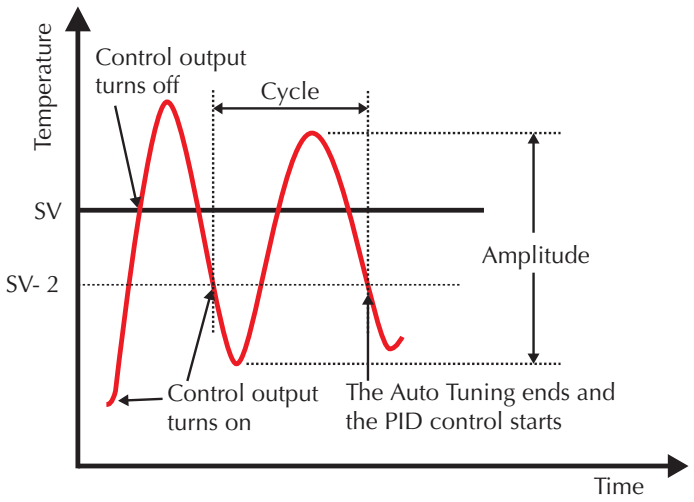


Auto Tuning

All SOLO controllers support the Auto Tuning feature to set up the following PID parameters automatically.

- P — Proportional Band (Pn, P1-4)
- I — Integral Time (In, P1-5)
- d — Derivative Time (dn, P1-6)
- CoF — Integral Offset (CoFn, P1-8)
- CoEF — Proportional Band Coefficient (CoEF, P1-14)

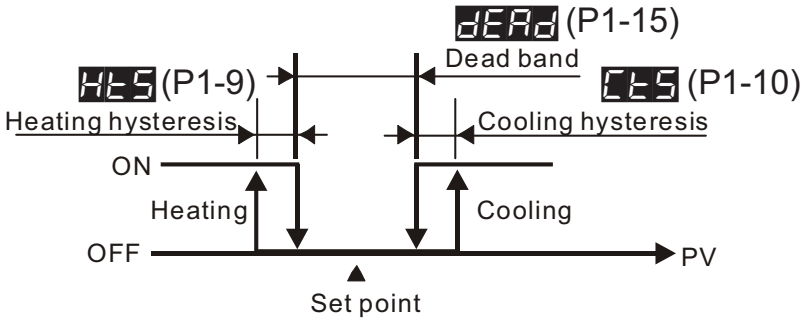
To start the Auto Tuning, set the parameter Auto Tuning (At, P1-1) to on. the controller automatically controls the output to change the PV as shown below.



Once the Auto Tuning process is completed, the SOLO controller calculates the above PID parameters and starts the PID control with the new parameter values immediately.

On / Off Control

In the On / Off control mode the output is controlled according to the difference between the SV and the PV. If the PV is lower than the SV, the heating output is turned on. If the PV is higher than the SV, the cooling output is turned on. The Heating / Cooling Hysteresis and the Dead Band setups can be used to avoid output chatter.



Hysteresis

There are two types of hysteresis, heating and cooling. If the heating hysteresis is set, the heating output turns on using the following formula.

PV < SV - (dEAd / 2) - HyS

If the cooling hysteresis is set, the cooling output turns on using the following formula.

PV > SV + (dEAd / 2) + CyS

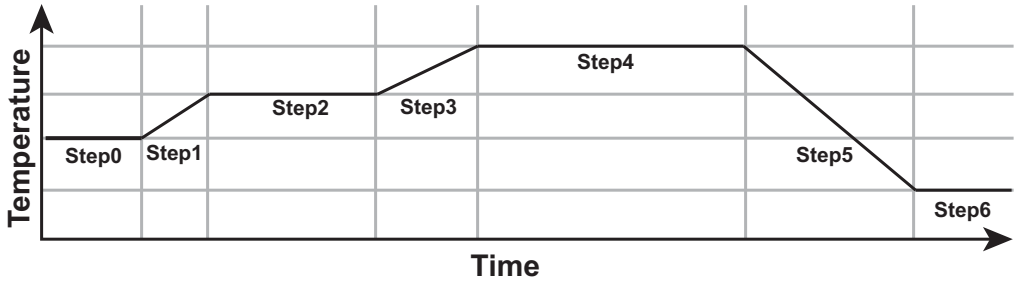
Dead Band

The Dead Band is the range around the PV in which the heating / cooling outputs remain off. The Dead Band is defined by the formula.

SV ± (dEAd / 2)

Ramp / Soak Control

The Ramp / Soak control mode is used to control the outputs according to the preprogrammed SV patterns with the PID control method. The SOLO controllers support up to eight Ramp / Soak patterns. Each Ramp / Soak pattern can store up to eight steps. Each step has its target SV and the time duration setups. You can set up each Ramp / Soak step.



You can select which Ramp / Soak pattern the SOLO controller will execute first. The Ramp / Soak patterns can be executed in series, so the Ramp / Soak control can execute up to 64 steps (8 steps x 8 patterns). You can select which Ramp / Soak pattern will execute next or the controller stops after executing the current pattern.

The SOLO controller can execute the same Ramp / Soak pattern up to 200 times before it stops or moves to the next Ramp / Soak pattern.

Ramp / Soak Display

There are three Ramp / Soak display modes possible with the SOLO controller. From the controller main screen press the ▲ and ▼ buttons to choose from these three optional display modes.

P-St - Pattern Number - Step Number

SP - Set Point

r-tL - Remaining time in current step

Press the SET button to save the selection.

Manual Control

In the Manual control mode, the outputs of the controller are manipulated manually by the operator. Adjust the values of the parameters Output 1 Level (oUt1, P2-11) and / or Output 2 Level (oUt2, P2-12) to control the output levels. Output 2 Level is only available when you select a dual output mode.

Error Display Information

The chart below illustrates the possible error displays shown on the SOLO Temperature controller.

Controller Error Display				
Display Position	**Display**	**Meaning**	**Cause**	**Corrective Action**
PV SV	b160 Cr	Initialization PV = Firmware version SV = Module type	The controller is in the initialization process.	The SOLO controller displays this information for a few seconds after power up. If the controller continues displaying this information, check the input wiring. If the problem still exists, replace the sensor or the controller.
PV SV	no Cont	No sensor input	The input terminals are open.	Check the input wiring. If the problem still exists, replace the sensor or the controller.
PV SV	Err InPt	Input error	The controller cannot read the input value	Check the sensor and the input wiring. If the problem still exists, replace the sensor or the controller.
PV SV	Err Prom	EEPROM error	There is an error with the EEPROM	Cycle the power to the SOLO controller. If the problem still exists, replace the controller.
PV SV	Flashing PV	PV out of range	The PV is out of range	Check the PV range. The Input Range High (inP-H, P3-3) and the Input Range Low (inP-L, P3-4) parameters define the range. Refer to section 12-1, 12-2 or 12-3 for directions on how to access these parameters.