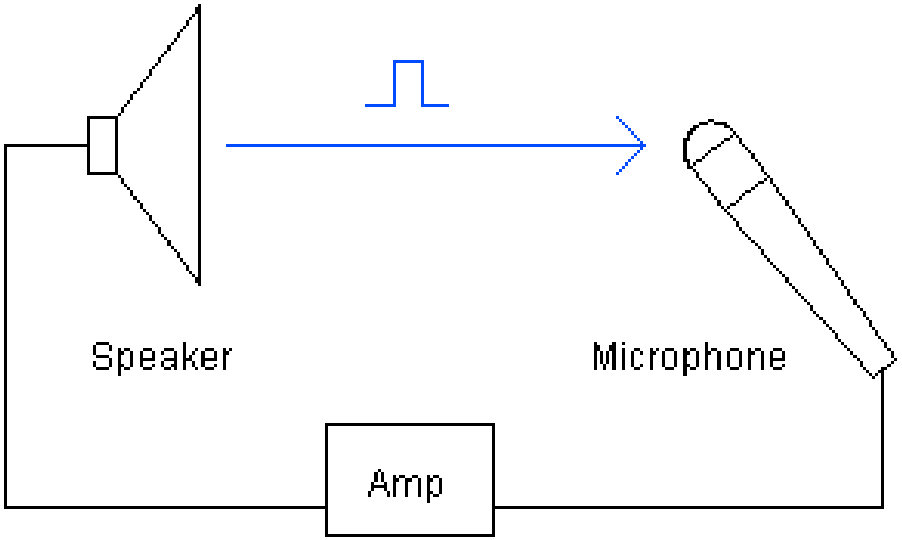
PID Controllers

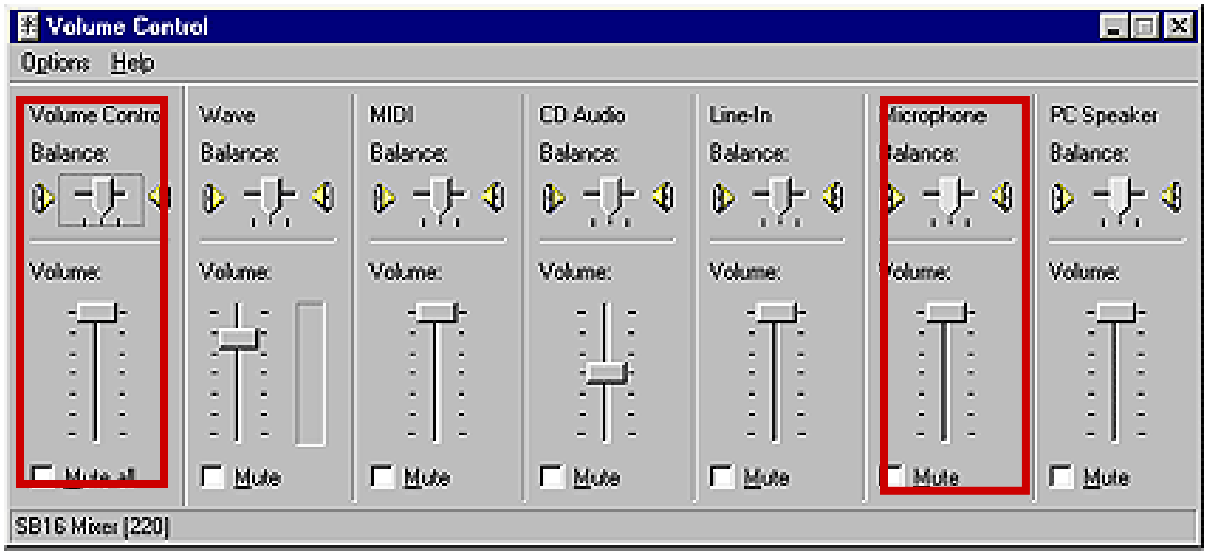
Dedicated Control System

Feedback Control – Why Should You Care?



- Microphone ⇨ Amplifier ⇨ Speaker ⇨ Microphone
- This loop happens so fast that it generates its own frequency
- Microphone-to-speaker distance dictates the frequency
  - Decides how quickly sound "feedback" occurs through the system
- This feedback problem happens in public address systems

Feedback Control – Why Should You Care?



- Attach a set of speakers to your computer
- "Un-mute" and set microphone and speakers to maximum volume
- Tap microphone and hear it in the speakers
- Place speakers near microphone, turn up the volume and hear feedback
- Change distance between microphone and speakers to see the effect
- Caution: Not to be used as revenge on instructors, labmates, etc.

Specification of PID

- Relay Type Output –
  DTC 1000R – [Contact]
- Current type Output –
  DTC 1000C [4~20 mA]
- Voltage Type Output –
  DTC 1000V [0 ~ 10 VDC]

■ Model Name Explanation

DTC [1] [2] [3] [4] [5]

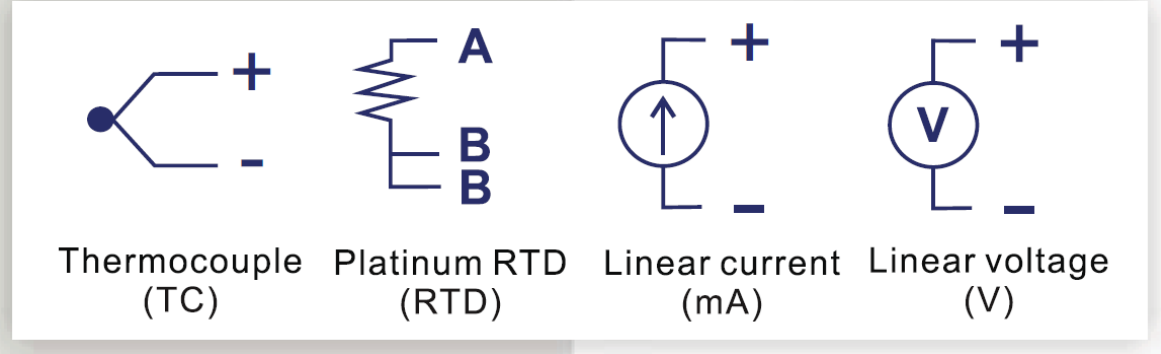
Series name	DTC: Delta C series temperature controller	
[1] Controller position	1: First controller	2: Controller connected in parallel
[2] Auxiliary output groups	0: standard, 2 outputs, no auxiliary output 1: 1 auxiliary output. Not available now.	2: 2 auxiliary outputs. Not available now
[3] [4] Optional	00: Standard 01: CT input	02: EVENT input. Not available now
[5] Main output type	R: Relay output SPST, 250VAC, 3A V: Voltage pulse output 12V +10% ~ -20%	C: Current output 4 ~ 20mA L: Linear voltage output 0 ~ 10V

Specification of PID

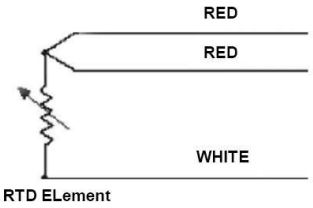
Input sensors	Thermocouple: K, J, T, E, N, R, S, B, L, U, TXK
	Platinum RTD: Pt100, JPt100
	Linear DC input: 0 ~ 5V, 0 ~ 10V, 0 ~ 20mA, 4 ~ 20mA, 0 ~ 50mV
Sampling rate	Analog input: 0.15 sec. Thermocouple or platinum RTD: 0.4 sec.
Control method	PID , programmable PID, Manual, ON/OFF
Output types	Relay: SPST, Max. load 250VAC, 3A resistive load
	Voltage pulse: 12VDC, Max. output current: 40mA
	Current: DC 4 ~ 20mA (Load resistance: < 500Ω)
	Analog voltage: 0 ~ 10V (Load resistance: > 1,000Ω)

Supports Various Sensors:

- Built-in various sensor input modes: Thermocouple, platinum RTD or linear voltage/current.

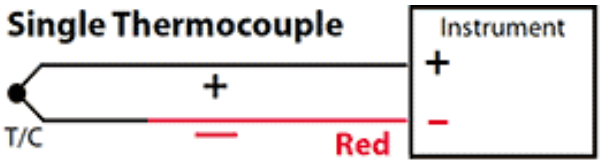


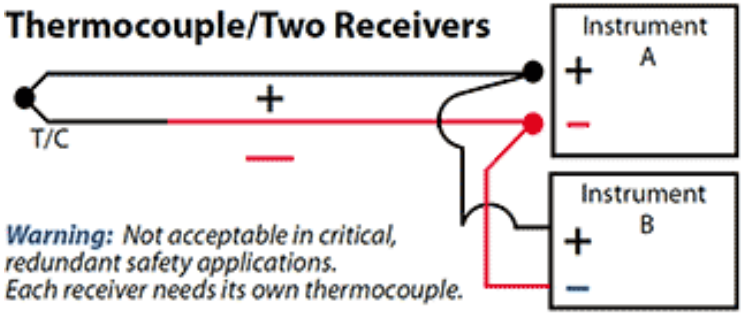
Input Sensors

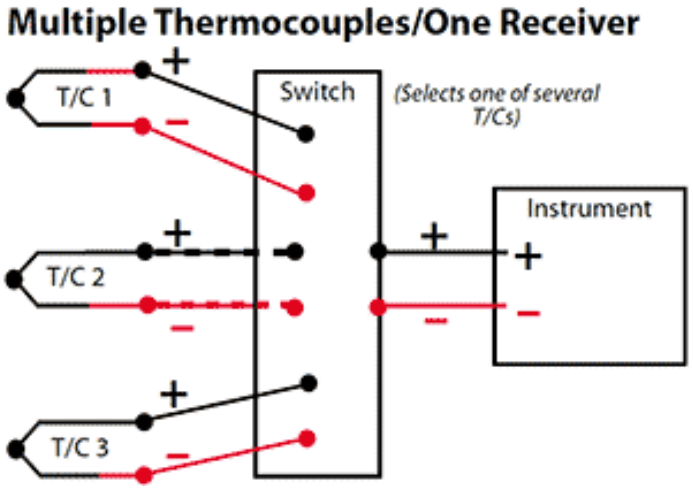


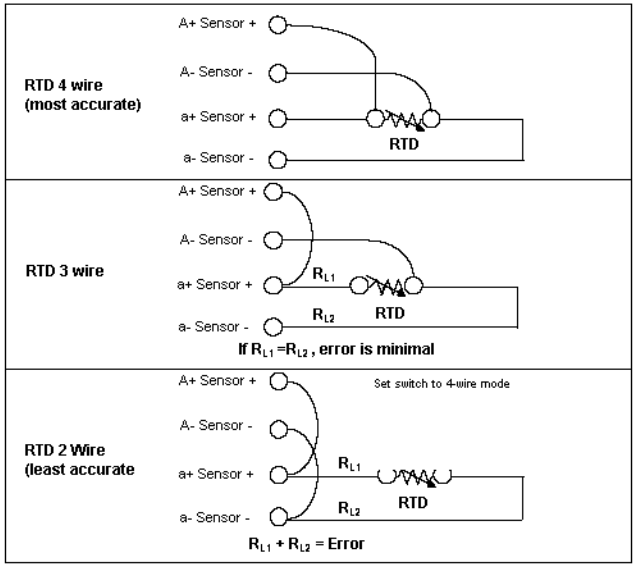
Input Sensor	Register Value	Available Range
0 ~ 50mV linear voltage input	17	0 ~ 50mV
4 ~ 20mA linear current input	16	4 ~ 20mA
0 ~ 20mA linear current input	15	0 ~ 20mA
0 ~ 10V linear voltage input	14	0 ~ 10V
0 ~ 5V linear voltage input	13	0 ~ 5V
Platinum RTD (Pt100)	12	-200 ~ 600°C (-328 ~ 1,112°F)
Platinum RTD (JPt100)	11	-20 ~ 400°C (-4 ~ 752°F)
Thermocouple TXK type	10	-200 ~ 800°C (-328 ~ 1,472°F)
Thermocouple U type	9	-200 ~ 500°C (-328 ~ 932°F)
Thermocouple L type	8	-200 ~ 850°C (-328 ~ 1562°F)
Thermocouple B type	7	100 ~ 1,800°C (212 ~ 3,272°F)
Thermocouple S type	6	0 ~ 1,700°C (32 ~ 3,092°F)
Thermocouple R type	5	0 ~ 1,700°C (32 ~ 3,092°F)
Thermocouple N type	4	-200 ~ 1,300°C (-328 ~ 2,372°F)
Thermocouple E type	3	0 ~ 600°C (32 ~1,112°F)
Thermocouple T type	2	-200 ~ 400°C (-328 ~ 752°F)
Thermocouple J type	1	-100 ~ 1,200°C (-148 ~ 2,192°F)
Thermocouple K type	0	-200 ~ 1,300°C (-328 ~ 2,372°F)

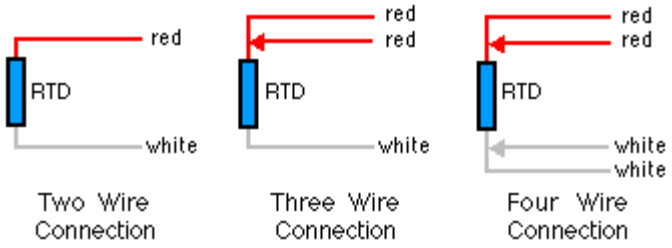
Input Sensors





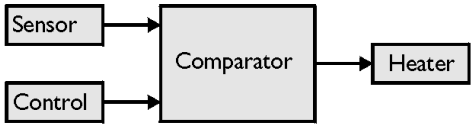


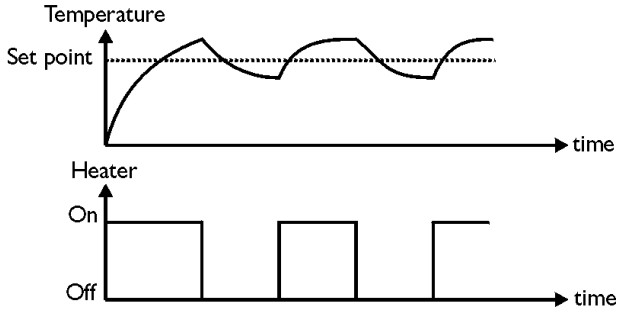




Relay Type Output

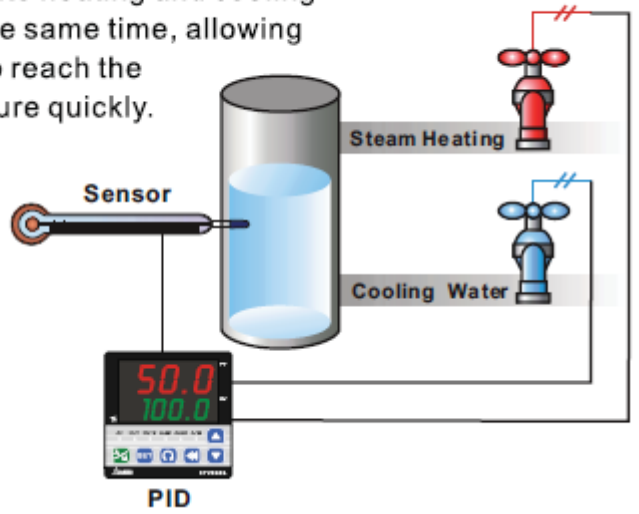
On- Off Control



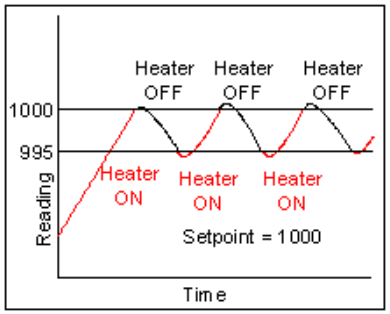


Dual Output Control:

- Able to execute heating and cooling controls at the same time, allowing the system to reach the set temperature quickly.



On- Off Control with Hysteresis



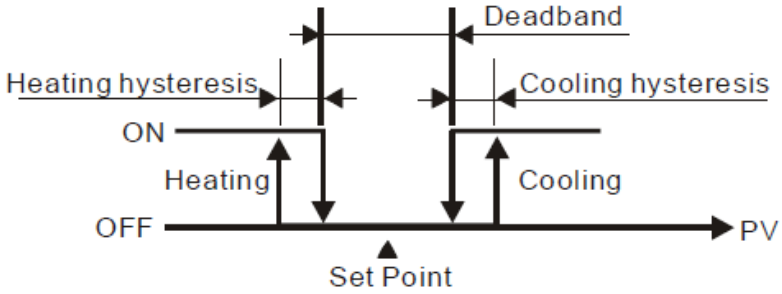
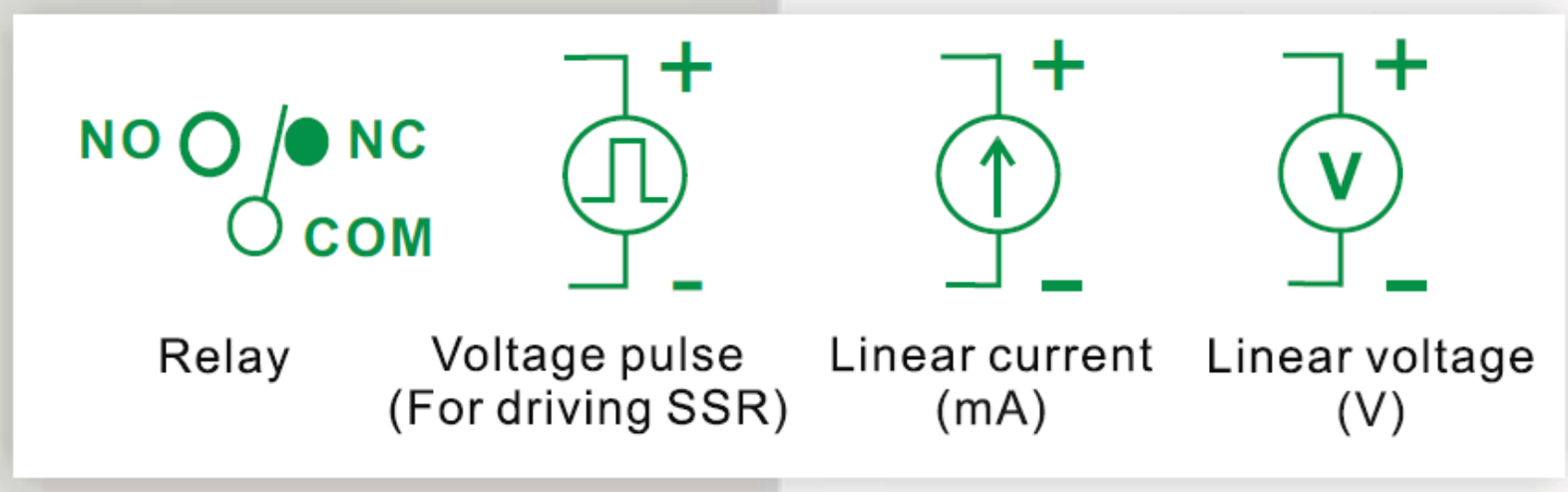


Figure 4: ON/OFF Control

Types of Output Controls

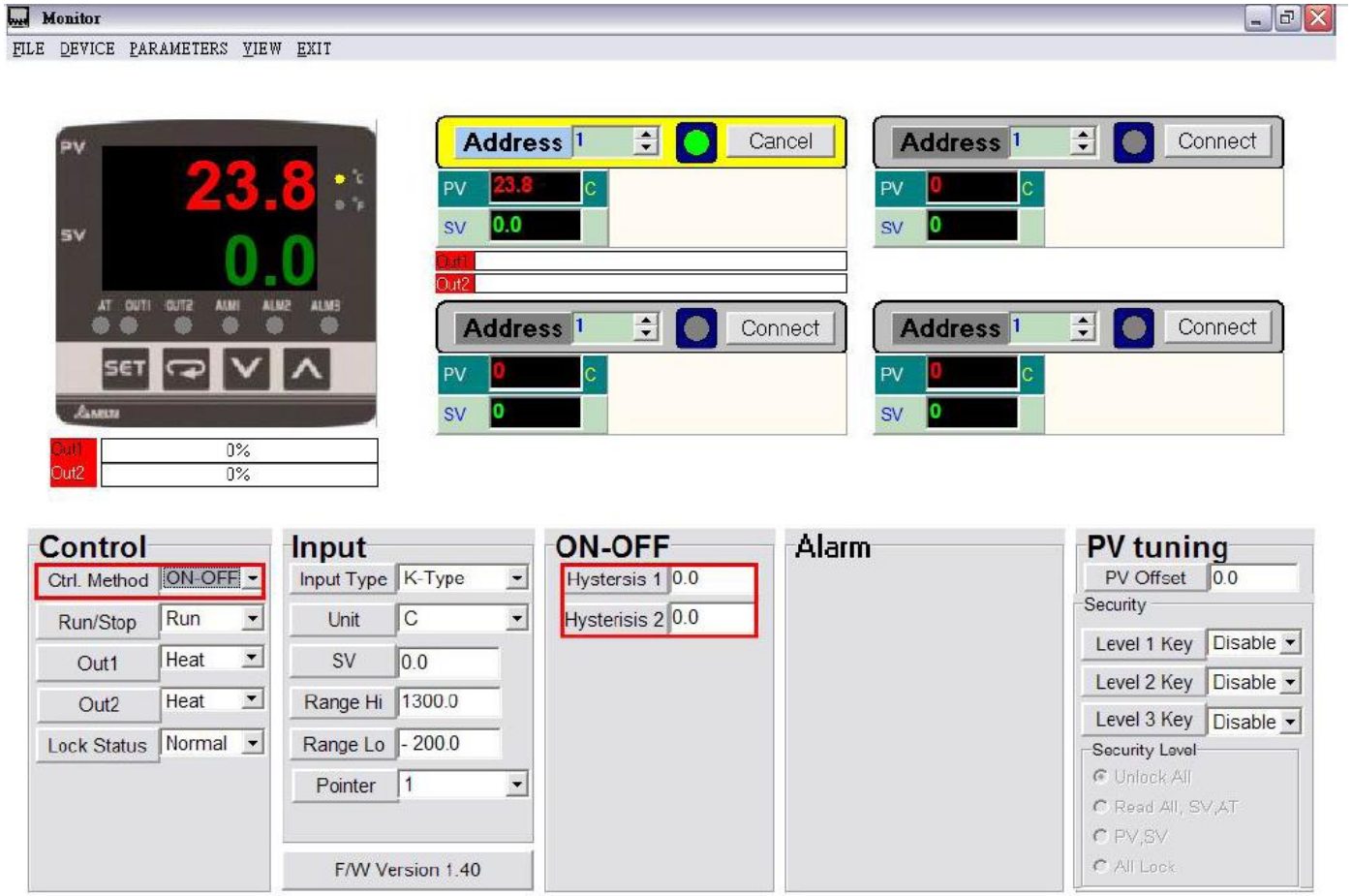
Various Output Modes:

- Relay, voltage pulse, linear voltage, and current



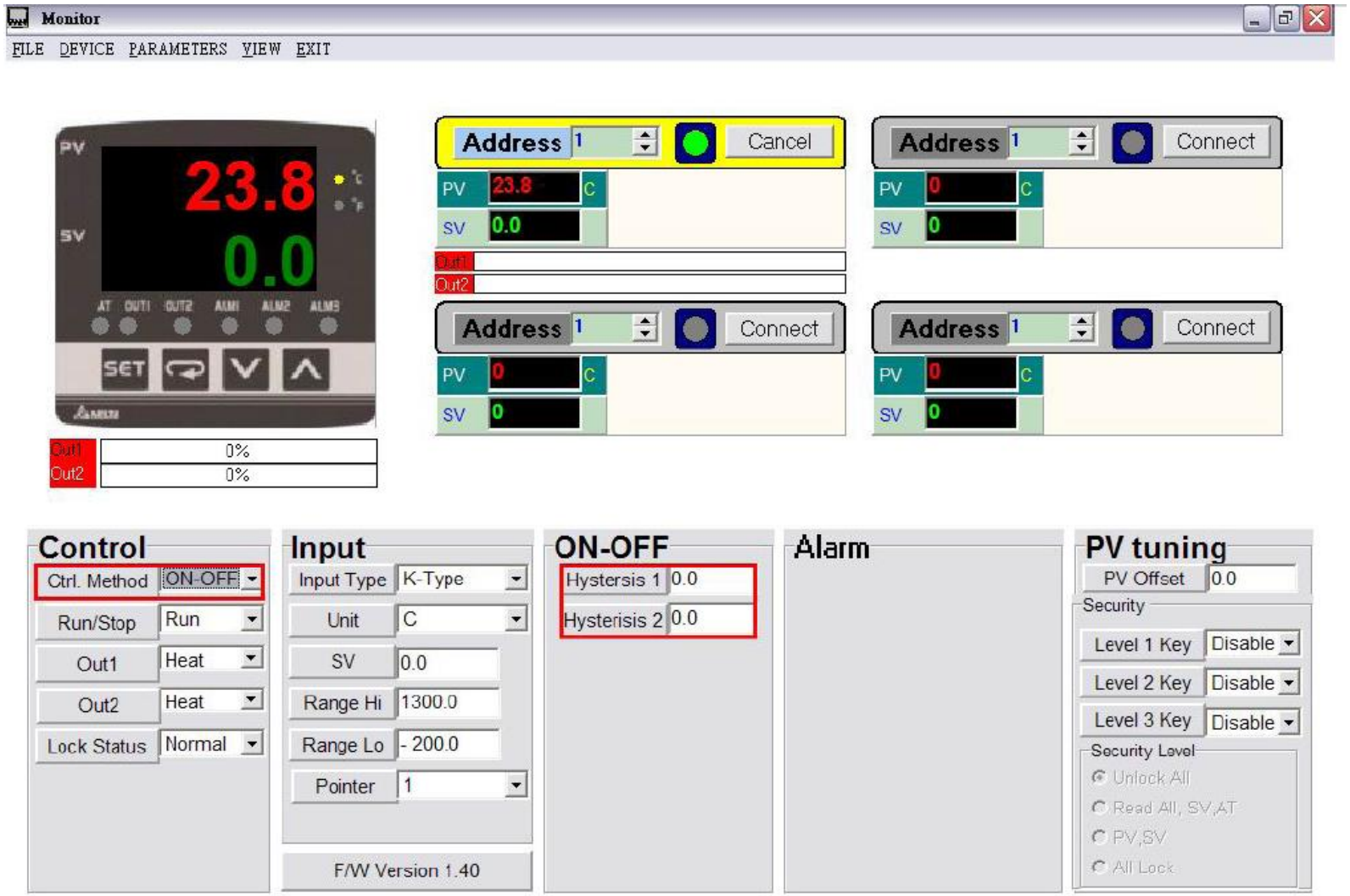
Types of Output Controls

On- Off Control

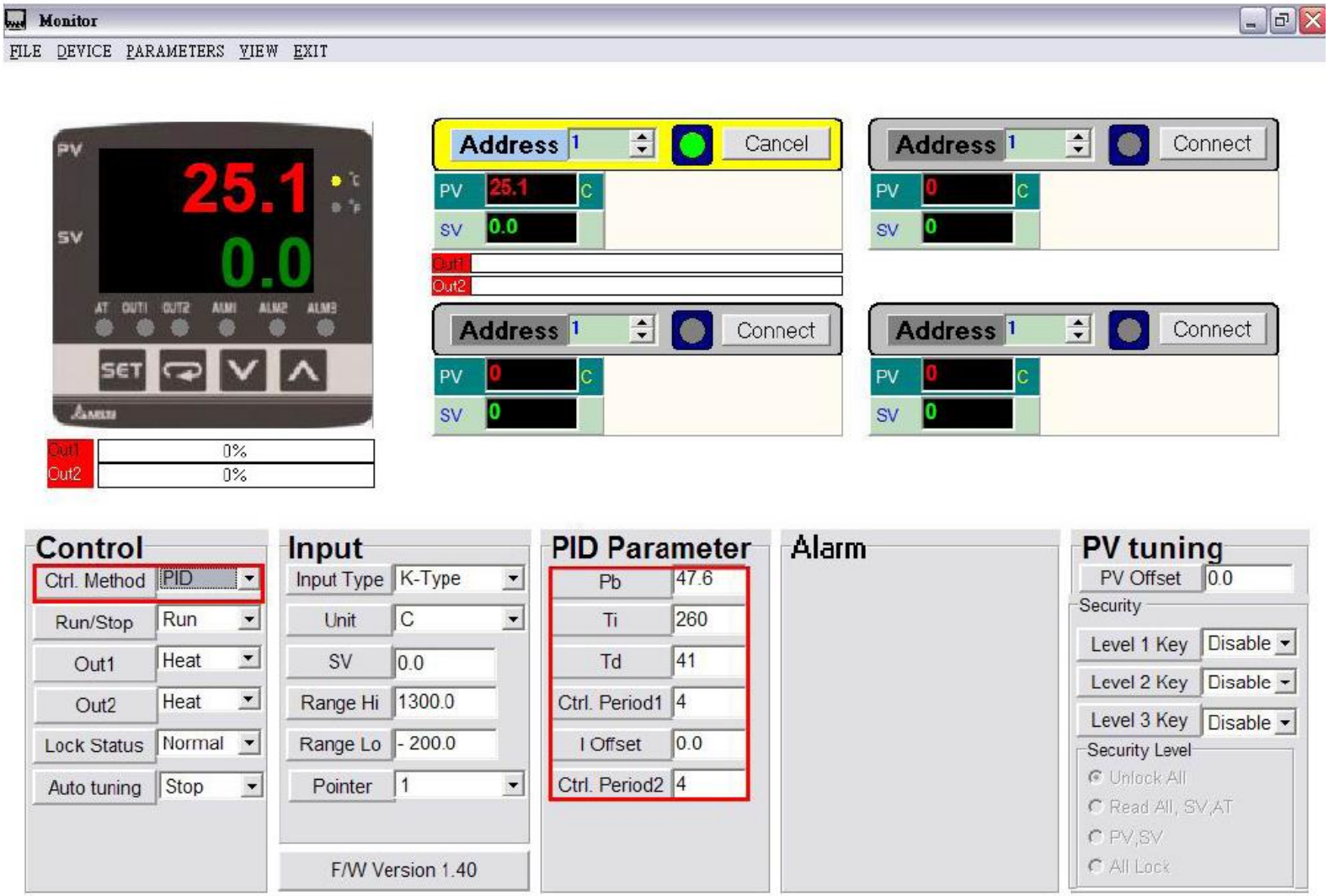


PID Control

Manual Control



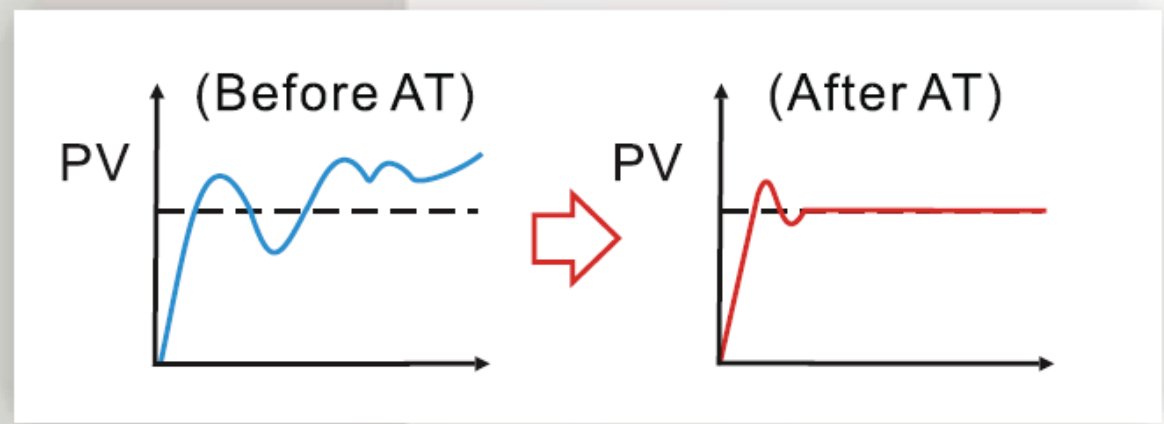
PID Control


Monitor
FILE DEVICE PARAMETERS VIEW EXIT
PV
SV
25.1
0.0
AT OUT1 OUT2 ALM1 ALM2 ALM3
SET
Out1 0%
Out2 0%
Address 1 Cancel
PV 25.1 C
SV 0.0
Out1
Out2
Address 1 Connect
PV 0 C
SV 0
Address 1 Connect
PV 0 C
SV 0
Address 1 Connect
PV 0 C
SV 0
Control
Ctrl. Method PID
Run/Stop Run
Out1 Heat
Out2 Heat
Lock Status Normal
Auto tuning Stop
Input
Input Type K-Type
Unit C
SV 0.0
Range Hi 1300.0
Range Lo - 200.0
Pointer 1
F/W Version 1.40
PID Parameter
Pb 47.6
Ti 260
Td 41
Ctrl. Period1 4
I Offset 0.0
Ctrl. Period2 4
Alarm
PV tuning
PV Offset 0.0
Security
Level 1 Key Disable
Level 2 Key Disable
Level 3 Key Disable
Security Level
Unlock All
Read All, SV,AT
PV,SV
All Lock

PID Control

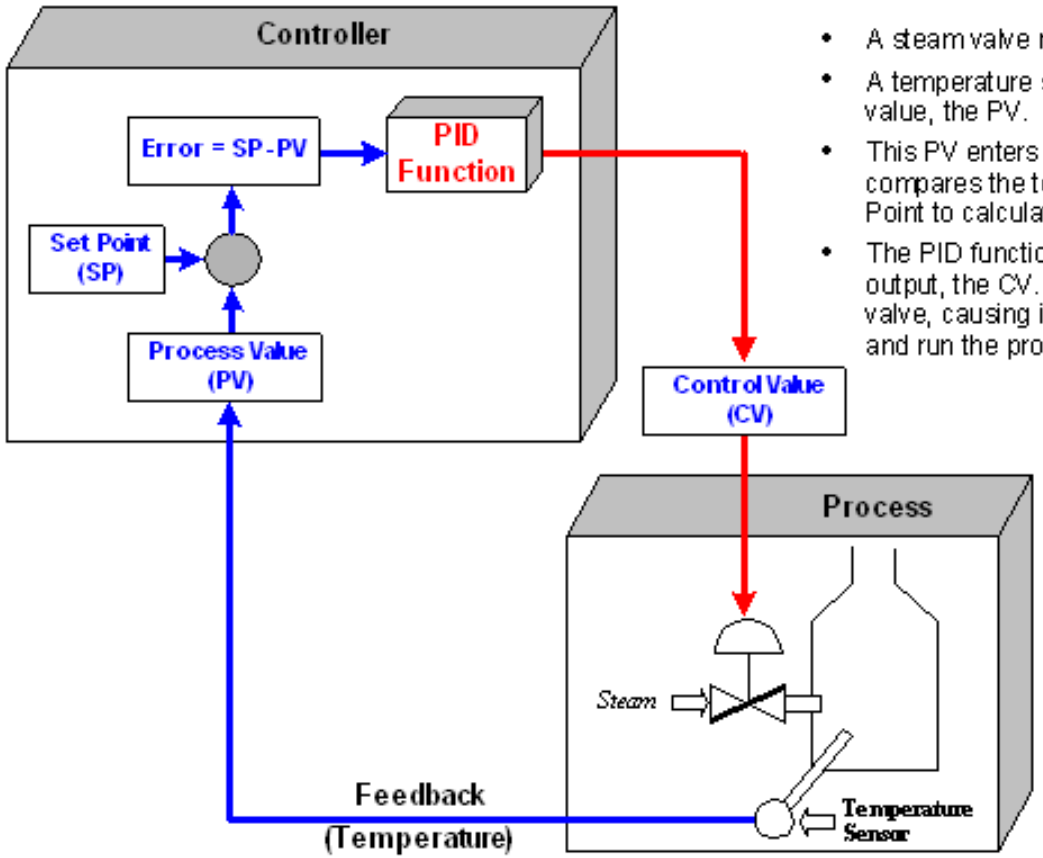
Stable Control:

- Built-in PID control function, with accurate auto-tuning (AT).
- PID parameters are automatically calculated, which enhances the stability of the system and accuracy of control.



Basic PID Control

- Proportional Current/ Voltage Output



- A steam valve releases heat into the system.
- A temperature sensor outputs a temperature value, the PV.
- This PV enters the controller. The PID function compares the temperature value with the Set Point to calculate the Error signal.
- The PID function regulates the controller output, the CV. This output controls the steam valve, causing it to vary the release of steam and run the process at the desired Set Point.

Basic PID Control

- Proportional Current/ Voltage Output

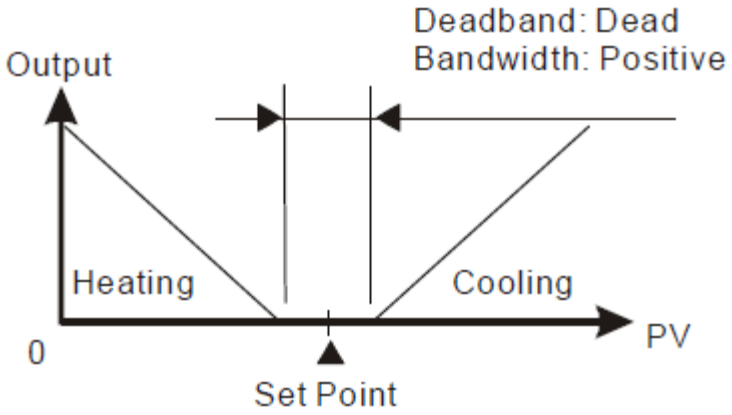


Figure 5: PID control

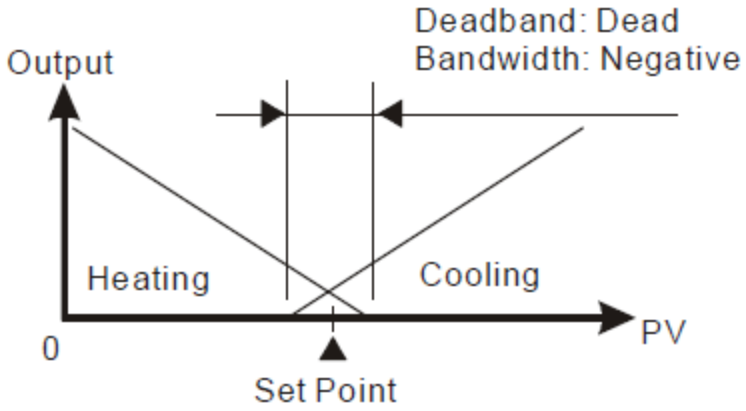


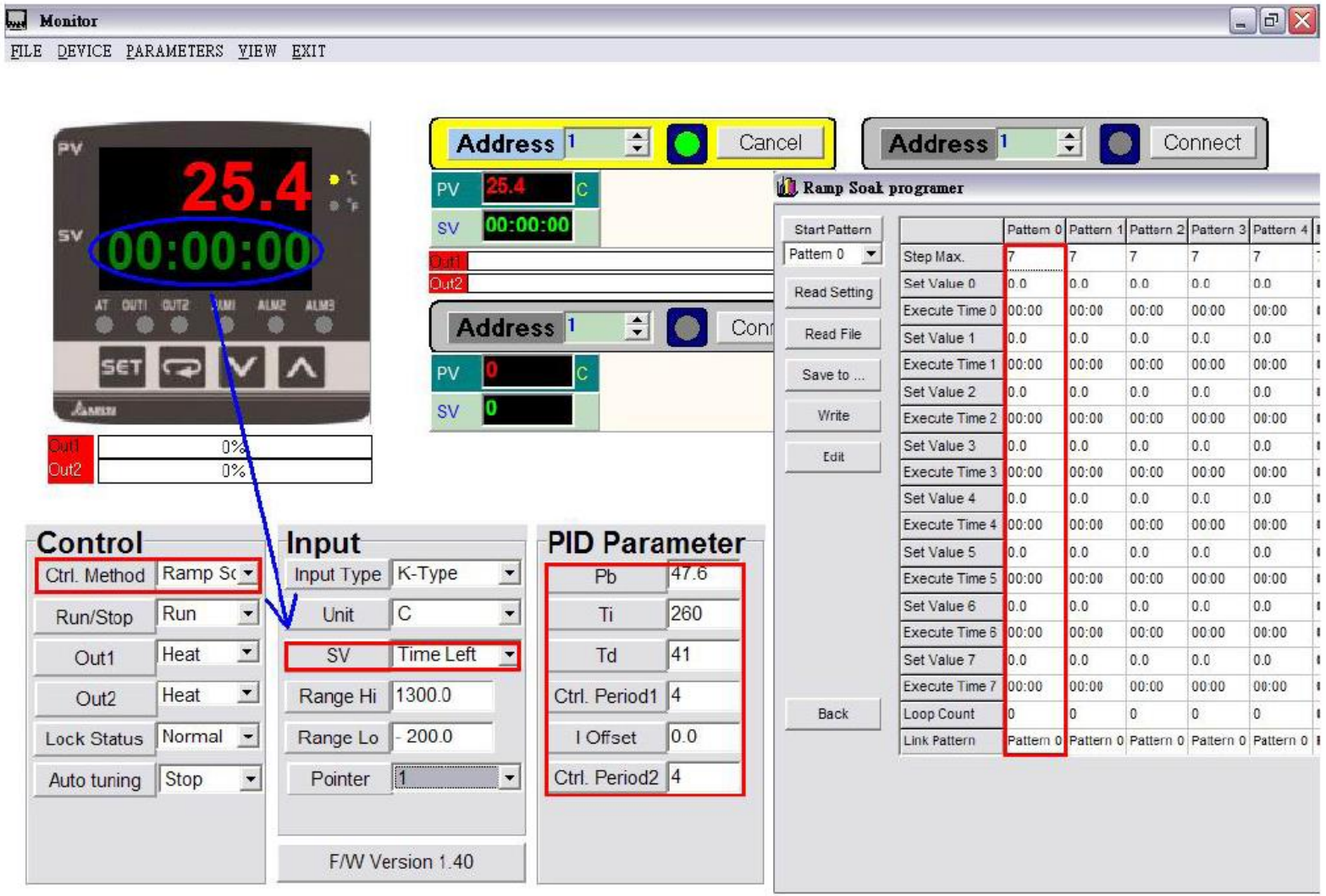
Figure 6: PID Control

Automation Studio Example

Robot Simulator

PID Control

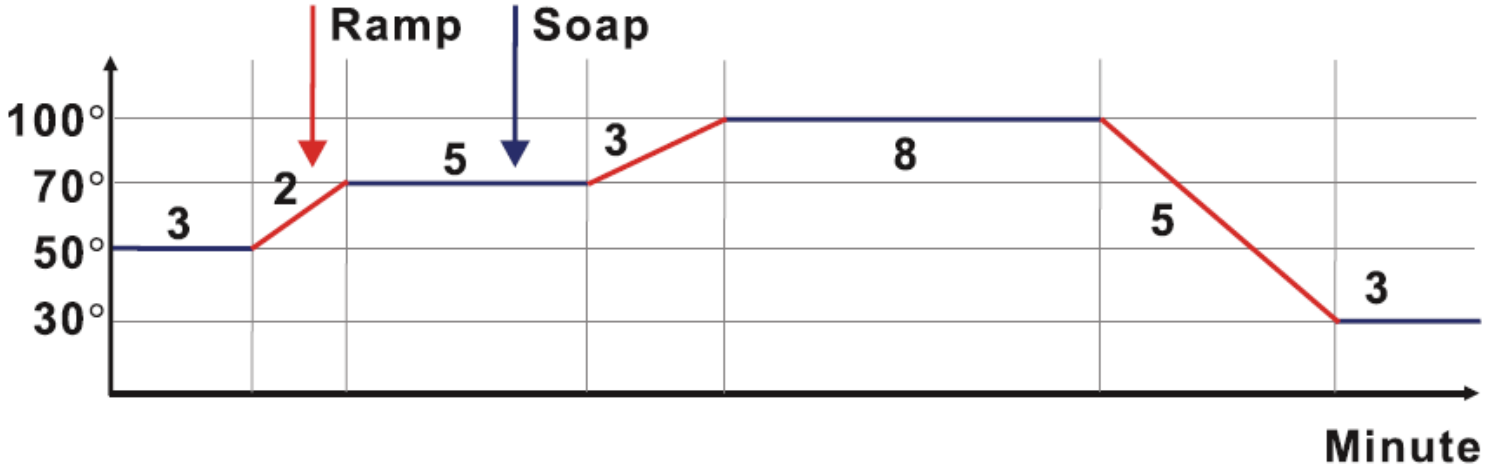
Ramp/Soak Control



Ramp/Soak Control

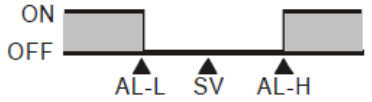
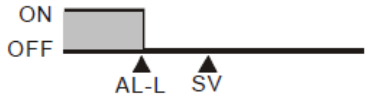
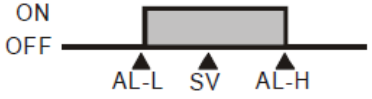
Programmable Control:

- Max. 8 patterns available, with 8 steps in each pattern. No master controller is required for planning all kinds of temperature control curves.



PID Alarms

- Proportional Current/ Voltage Output

Mode	Alarm Type	Alarm Output Operation
0	No alarm	OFF
1	Alarm output will be enabled when the temperature reaches upper and lower limits. • Alarm will be enabled when the PV exceeds SV + AL-H or falls below SV – AL-L.	
2	Alarm output will be enabled when the temperature reaches the upper limit. • Alarm will be enabled when the PV exceeds SV + AL-H.	
3	Alarm output will be enabled when the temperature reaches the lower limit. • Alarm will be enabled when the PV falls below SV – AL-L.	
4	• Alarm will be enabled when the PV is between SV + AL-L and SV – AL-L.	

Thank You

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