PID Tuning in BruControl

Mission:
To control cooling water to achieve stable temperature inside a distillation reflux condenser, and be able to change setpoint/target via automation. (Think of it as a cooling version of a herms-type coil sitting in a mash tun)

Components:

- BruControl
- Arduino MEGA
- BruControl Analog amplifier board
- 2 Johnson Proportional valves (VA9104-GGA-2S, these valves have previously worked with Sestos PID controllers, and

Settings:

- Amplifier board tuned to 0-10v output
- Valves set for proper direction and 0-10v operation via jumpers.
- Temperature probe is sitting at 70
- script to alternate the target between 69F and 71F

  Script:

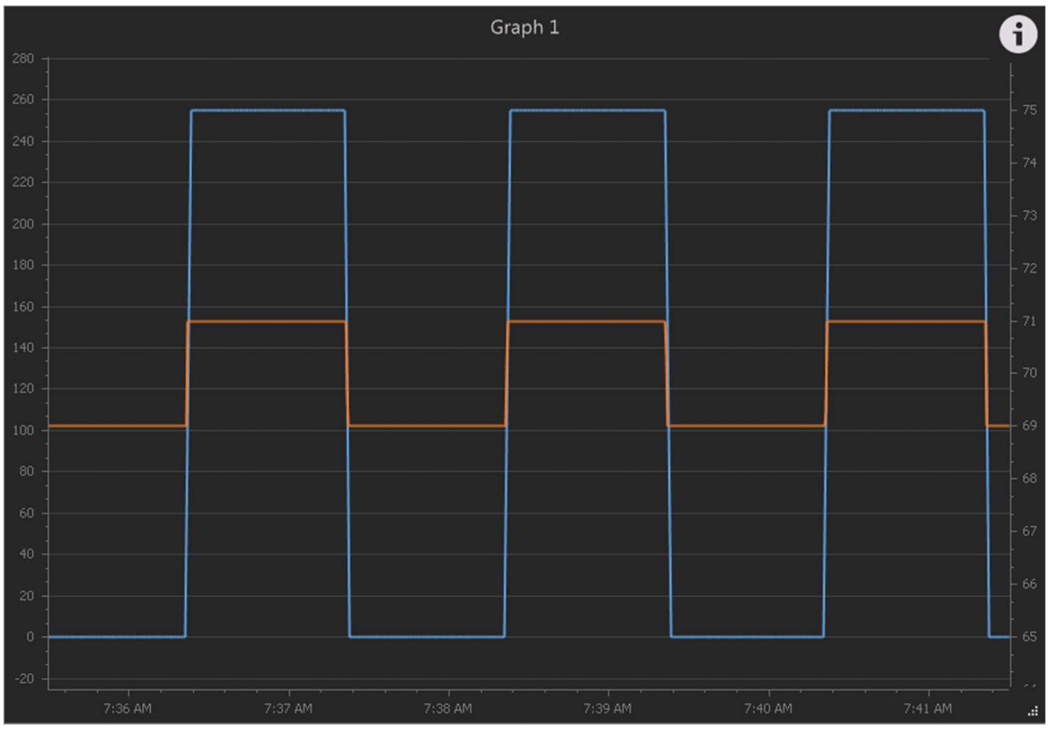
```
new value TempTarget
[start]
TempTarget = 69
"PID 1" target = 69
sleep 60000
TempTarget = 71
"PID 1" target = 71
sleep 60000
goto start
```

Starting with the recommended values in the BruControl manual

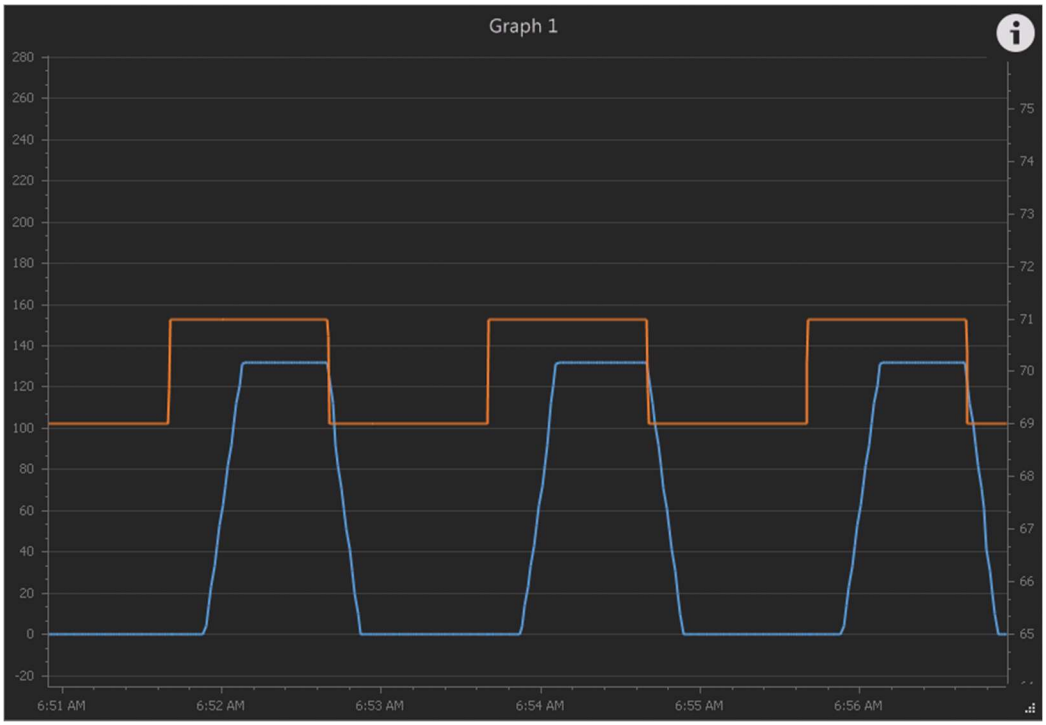
BruControl Version 1.0, build 28106 & Firmware v42 Updated 12/8/2017

Kp = 30.00
Ki = 1.00
Kd = 5.00

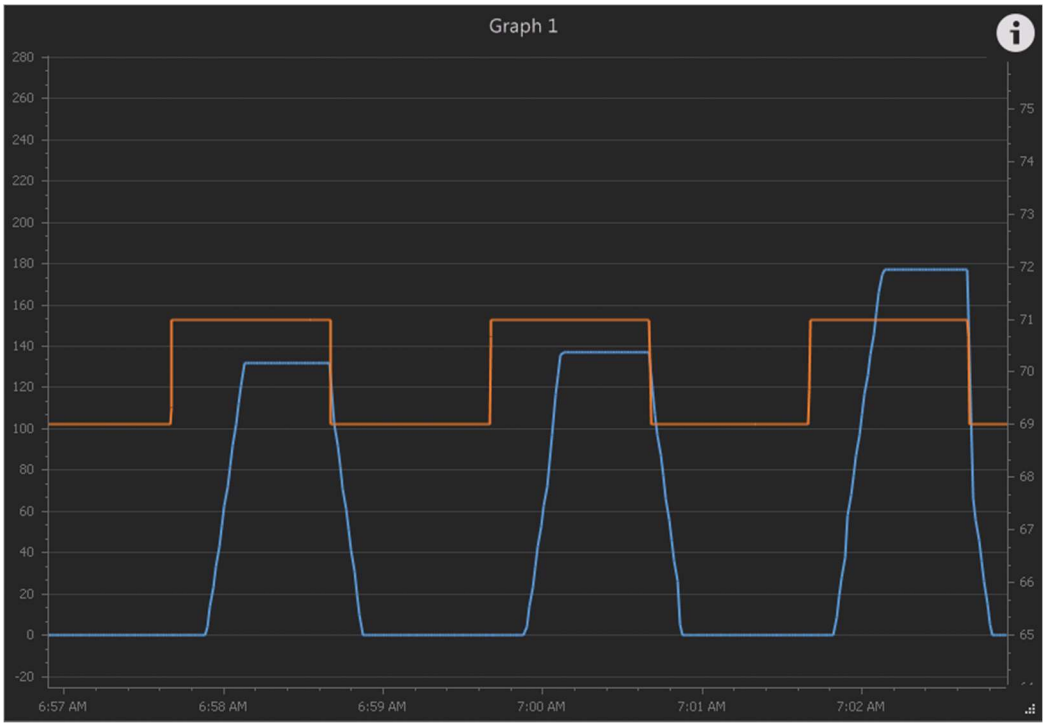
The result is pretty much hysteresis, not PID:


Graph 1
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
75
74
73
72
71
70
69
68
67
66
65
7:36 AM
7:37 AM
7:38 AM
7:39 AM
7:40 AM
7:41 AM

To first address this, I quickly tested values much lower:
Kp = 0.05
Ki = 0.10
Kd = 0.05

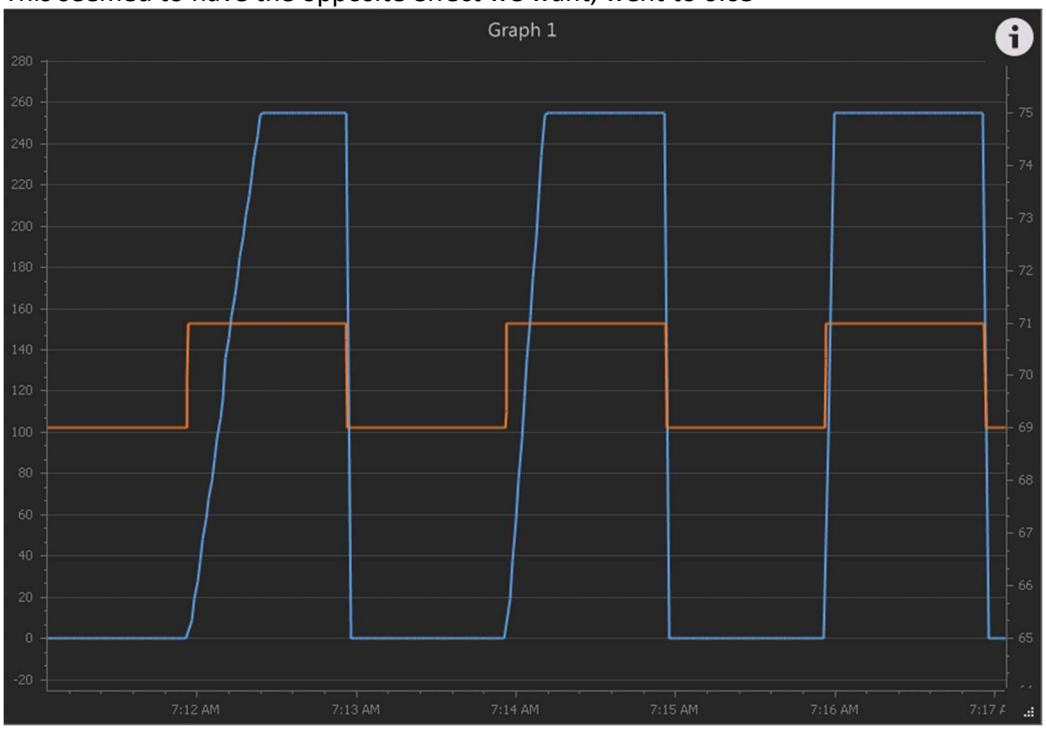


Increase Kp 2x, then 10x
Kp = 0.05, then 0.10, then 0.50
Ki = 0.10
Kd = 0.05

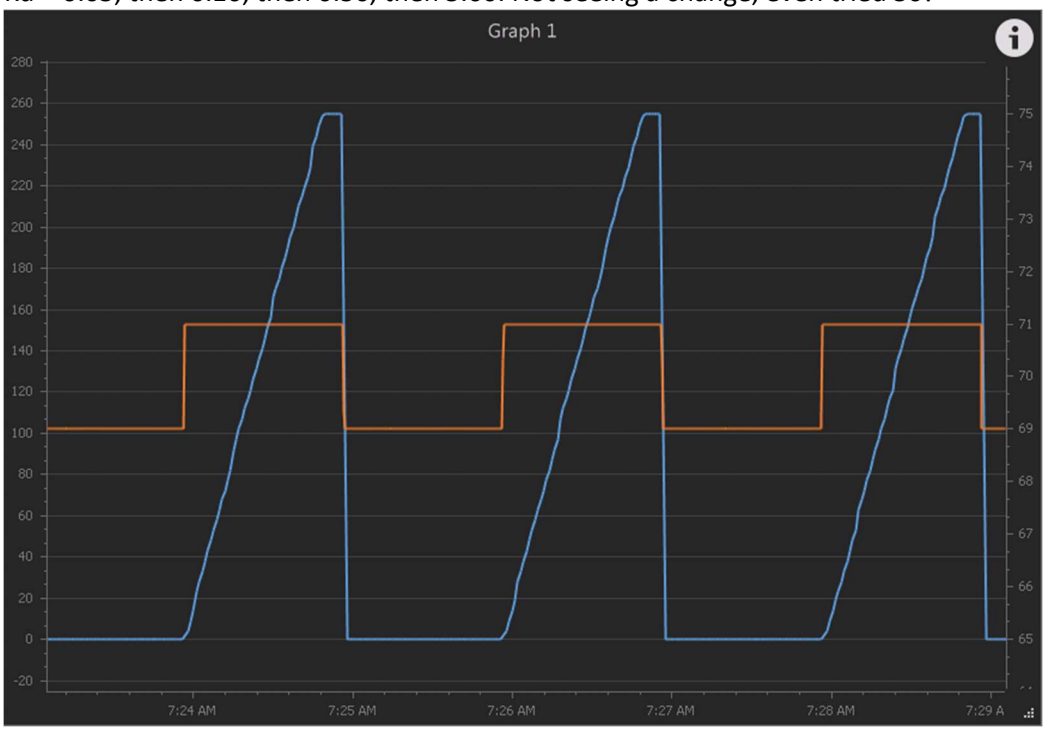


It takes changing Kp to 1.30 to get full 255 swing…

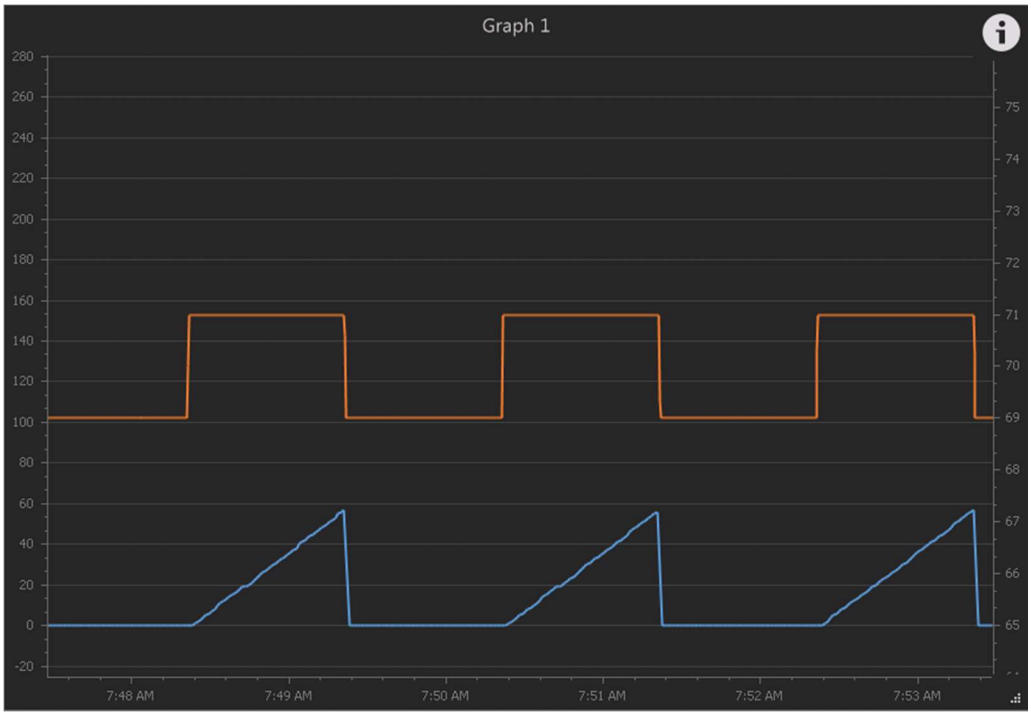
Next, Ki was increased 2x, then 10x
Kp = 1.30
Ki = 0.10, then 0.20, then 1.0
Kd = 0.05
This seemed to have the opposite effect we want, went to 0.05



Kp = 1.3
Ki = 0.05
Kd = 0.05, then 0.10, then 0.50, then 5.00. Not seeing a change, even tried 50!



Kp = 1.3
Ki = 0.01
Kd = 5.00, then 50, then 500:



With a large increase in the Derivative, we should not see such rapid changes in direction, D of this PID is not working as expected… we should be able to get a sine wave, but we cannot even change the downward slope…