SZ1025b Analog Output is “Hunting”

TCS Technical Bulletin

Symptom:
The SZ1025B with firmware version 3.01 may not control your damper (AO1) properly with factory default PID setting.

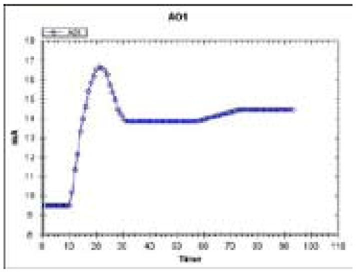
Cause:
In some cases, the factory default makes the AO1 output “hunt” depending on the motor speed, damper size and CFM being achieved

Solution:
Tune the PID. The PID algorithm developed for the SZ1025B is similar to many conventional PID algorithms with a few additional features and unique qualities.

- The proportional factor dictates how much gain the input signal error should be given with respect to the derivative and the integral error terms.
- A large integral factor will cause the output to respond quickly to changes on the input however the output could oscillate and overshoot the setpoint.
- A large derivative factor will cause the output response to be sluggish and slow to change and the output will settle above the desired setpoint. The derivative term is divided by the PID delay.
- The PID delay parameter specifies how quickly the SZ1025B should evaluate error between the current output and the desired output. The PID delay can be used to offset a slow moving motor allowing the motor to catch up to its input signal before the error term is reevaluated.

The following graph shows the AO1 (connected to the CFM generator) it is the step response triggered by changing the setpoint to below the current room temp. The PID parameters are as follows:

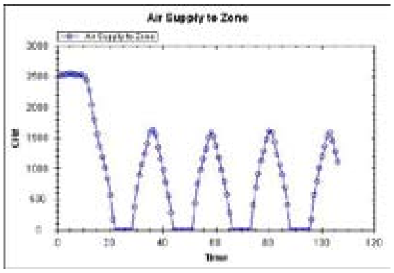
Proportional Factor = 10 Integral Factor = 20
Derivative Factor = 200 PID delay = 10
PID Error DB = 0



The graph levels off above the CFM setpoint because the Derivative factor is so high. The graph also does not oscillate very much to a step response, but is “over damped”. Note the CFM graph tracks the AO1 graph almost exactly.

The next graph has the Integral factor and the proportional factor reversed.

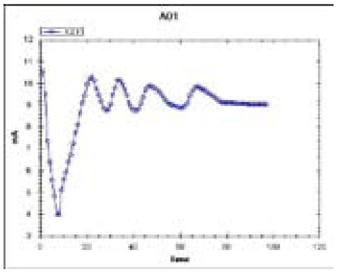
Proportional Factor = 10 Integral Factor = 200
Derivative Factor = 20 PID delay = 10
PID Error DB = 0



The graph continues to oscillate forever! An integral factor that is too large can cause oscillations, by increasing the PID delay it is possible to minimize the oscillations but they will still happen.

The next graph shows the step response with the derivative factor of 100.

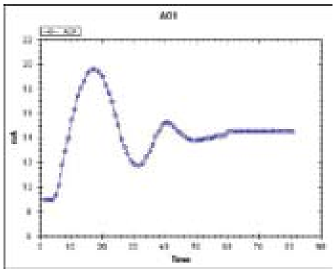
Integral Factor = 20 Proportional Factor = 10
Derivative Factor = 100 PID delay = 10
PID Error DB = 0



The graph still oscillates a little but ultimately settles down and does not continue to oscillate. Since the derivative factor is smaller it gets closer to the setpoint although it takes a little longer.

The final graph has the derivative factor increased to 150.

Integral Factor = 20 Proportional Factor = 10
Derivative Factor = 150 PID delay = 10
PID Error DB = 0



The oscillations settle down much quicker but the AO is slightly above setpoint although much closer to setpoints than the other graphs.

Conclusion:
The integral factor when increased causes a snappier response to a step change, but if the integral factor is too large then oscillations will occur.

The derivative factor has a dampening effect on the output though if the derivative factor is too high then the output will take a long time to reach the setpoint and will ultimately settle on a point above the actual setpoint.

The proportional factor amplifies the effect of the error.

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