Lab 4

Autotune the Process that Uses LM35, the Sensor in the Middle of the Chamber.

Purpose:

Autotune a process very much slower than the process autotuned in Lab 2.

Compare the ZNOL tuning constants for this process.

Compare the response to a Step Change in Set Point

Procedure:

1) Download Arduino IDE and load the code Complete Temperature Control C/C++ Code
2) Make sure 12 VDC power supply plugged in. Connecting the computer USB port to the Arduino Nano will power up the LCD Display and Nano , however the power to the heater requires the 12VDC power supply.
3) On the Arduino IDE menu, go to Tools and click on Serial Plotter. This will open up the serial plotter screen on the PC.
4) Set the Disturbance potentiometer to 100%. This setting will not change throughout this lab. It is part of the process and will not be used as a disturbance. Its effect is to create a more rapid step response (faster process dynamic).
5) Using the remote, observing the mapping diagram, and aiming the remote at the remote receiver mounted on the interface board:
    a) Click on the LM35L key to change the process and sensor for which autotune will operate
    b) Click on the manual key.
    c) Click on Step Increase 8 times (this increases the step change from 50 to 90%
    d) Click on 0 (zero) to create the 90 % step and start the Autotuning algorithm
    e) Observe the Slope indication on the LCD display.
    f) After the slope has reached its peak and begins falling, click on Trans PID to transfer the ZNOL tuning constants to the PID controller.
    g) Click on Stop ZNOL to remove the step.
    h) Click on Auto to place the control system in Automatic Mode
    i) Click on PID Tuning to display the ZNOL tuning constants on the LCD display.
6) The Set Point should be set to 0%.
7) Wait until the temperature drops to ambient (approximate 20 deg C) and steady state.
8) Adjust the Set Point Pot to 35 deg C. Try to do this in a step wise manner rather than incremental adjusting the Set Point.
9) Note the peak value of the temperature and the peak value of the 2nd overshoot and calculate the approximate decay ratio. Wait until the Temperature has reached steady state.

    Peak value ~ 100 deg C, 2nd overshoot almost 35 deg C.
    Temperature reaches stead state in approximately 1500 secs.
    Very stable response