# Ziegler-Nichols Loop Tuning

The Ziegler-Nichols loop tuning protocol[1)] is a simple method to establishing the loop parameter values for a PI or PID control loop. This protocol is designed to optimize the loop for disturbance rejection.

## Links

Click here for the SLICE-QT Manual.
Click here for the SLICE-QT Quick Start Guide.
Click here for the SLICE-QT API.
Click here for the SLICE-QT web page.

## Instructions

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|---|---|
|  | There is the possibility for the loop to go unstable at too high gain. Use caution as gain is increased. |

1. From the Home Screen, touch the Channel icon for the loop to be tuned
2. Touch Settings > PID Params
3. Choose a Set Point temperature
4. Set Proportional Gain ($K_P$) to 0
5. Turn off Integral and Differential portions of the loop ($T_I$ & $T_D$, respectively)
6. While monitoring the error in temperature on rolling graph on the SLICE-QT display or an external oscilloscope, **slowly** increase $K_P$ until the error begins to oscillate
7. Use the  and  icons, to scale displayed response appropriately
8. Use the  icon to pause the graph
    1. Note: the pause icon only pauses the graph, not the servo control
9. Note $K_P$ where oscillation begins, $K_{P,\,cr}$
10. Use the Cursors enabled by touching the  icon to measure the period of oscillation, $T_{cr}$
    1. You can use the two rotary knobs or touch & drag the cursors on the touch screen
11. Use the following table to set the values of $K_P$, $T_I$, and $T_D$

| **Type of Control Loop** | $K_P$ | $T_I$ | $T_D$ |
|---|---|---|---|
| **PI** | $0.45 \cdot K_{P,\,cr}$ | $0.83 \cdot T_{cr}$ | 0 |
| **PID** | $0.6 \cdot K_{P,\,cr}$ | $0.5 \cdot T_{cr}$ | $0.125 \cdot T_{cr}$ |

Tab. 1: Ziegler-Nichols loop values

1)
Optimum Settings for Automatic Controllers, by J.G. Zieger and N. B. Nichols and

Wikipedia