MANTRA PID BLOCKS

PID Block Series
P Gain (Gain * 1)
I Time Constant (Sec * 1)
D Time Constant (Sec * 1)

PID Block Parallel
P Gain (Gain * 1)
I Reset Rate (Repeats/sec * 1)
D Gain (Gain * 1)

PID Block Non-Interacting
P Gain (Gain * 1)
I Time Constant (Sec * 1)
D Time Constant (Sec * 1)

MODICON PID BLOCKS

KPID Block
P Gain (Gain * 1)
I Time Constant (Sec * 1)
D Time Constant (Sec * 1)

PID Block
P Gain (Gain * 1)
I Time Constant (Sec * 1)
D Time Constant (Sec * 1)

PID2 Block
P Band (Gain * 1)
I Reset Rate (Repeats/min * 100)
D Time Constant (Min * 100)

OMRON PID BLOCKS

PID Block
P Gain (Gain * 1)
I Time Constant (Sec * 10)
D Time Constant (Sec * 10)

SIEMENS TI PID BLOCKS

PID Block
P Gain (Gain * 1)
I Time Constant (Min * 1)
D Time Constant (Min * 1)

SQUARE D PID BLOCKS

PID Block
P Gain (Gain * 100)
I Reset Rate (Repeats/min * 100)
D Time Constant (Min * 6000)

WESTINGHOUSE

WFDP PID Block
P Gain (Gain * 100)
I Time Constant (Sec * 1)
D Gain (Gain * 1)

Ovation PID Block
P Gain (Gain *1)
I Time Constant (Sec *1)
D Gain (Gain *1)

INTUNE

Process Loop Performance Monitoring, Tuning, & Diagnostic Software

INTUNE is designed to assist engineers in tuning, maintaining, and monitoring their PID loops.

Major Features

- Multiloop Package - Tunes up to 8 loops simultaneously.
- Online Tuning - INTUNE communicates directly to your control system.
- Offline Tuning - INTUNE can tune your PID loop using data files.

Tuning Methods Supported

- Open Loop Tuning - Move the output and calculate the PID tuning values.
- Closed Loop Tuning - Move the setpoint and calculate the PID tuning values.
- Adaptive Tuning - Monitor the process and calculate the PID tuning values.

PID Loop Performance Monitoring & Diagnostics

- Error Distribution
- Alarm/Saturation Analysis
- Manual Mode Analysis
- Event Log
- Report Generation

E-MAIL info@controlsoftinc.com
WEB www.controlsoftinc.com
PHONE 440-443-3900
FAX 440-443-0249
5387 AVION PARK DRIVE
HIGHLAND HEIGHTS OH 44143

PID Loop Tuning Tips

Pocket Guide

DESCRIPTION OF PROCESSES

Fast Loops (flow, pressure)
P - Little [Too much will cause cycling]
I - More
D - Not needed

Slow Loops (temperature)
P - More
I - Some [Too much will cause cycling]
D - Some

Integrating (level & insulated temp)
P - More
I - Little [Will cause cycling]
D- Must [If D is not used, the loop will cycle.]

Noisy Loops (any PID loop where the measurement is constantly changing)
P - Low [Will cause cycling]
I - Most [Accumulated error]
D - Off [Will cause cycling]

CONTROLSOFT
ADVANCED PROCESS CONTROL MADE EASY

CLOSED LOOP STEP 1: KNOW THE PROCESS

Identify the loop you intend to tune and determine the speed of the loop. A rough categorization is as follows:

Fast loop has response time from less than one second to about 10 seconds, such as a flow loop. Use of PI controller is sufficient.

Medium loop has response time of several seconds up to about 30 seconds, such as flow, temperature, and pressure. Use either PI or PID controller

Slow loop has response time of more than 30 seconds, such as many temperature loops and level loops. Use of PID controller is recommended.

CLOSED LOOP STEP 2: KNOW THE CONTROLLER

Identify the units of your PID controller,

Proportional term (P-Term) is either a Proportional Gain (P-Gain) or Proportional Band (P-Band).

Integral term (I-Term) can be a Time Constant (in minutes or seconds), Reset Rate (1/second or 1/minute), or I-Gain (Reset rate * Proportional gain).

Derivative term (D-Term) can be Time Constant (in seconds or minutes) or Derivative Gain (derivative time constant * proportional gain).

In this document, Proportional Gain, Integral Reset Rate, and Derivative Gain are assumed.

Convert back to your controller units if necessary.

The Reference section is a summary of many of the more common controllers available on the market.

For units of other controllers, please contact ControlSoft.

CLOSED LOOP STEP 3: WATCH THE RESPONSE

Make a small change of setpoint (say 5%) or wait for a disturbance in the process. Then watch for process variable (PV) and control output (CO) responses.

-- If no visible instantaneous change of CO upon the change of setpoint or no apparent overshoot (over damped), increase your proportional gain by 50%.

-- If the PV is unstable or has sustained oscillation, with overshoot greater than 25%, reduce Proportional Gain by 50% and reduce Integral Reset Rate by 50%.

-- If PV oscillation persists with tolerable overshoot, reduce Proportional Gain by 20% and reduce Integral Reset Rate by 50%.

-- If 3 or more consecutive peaks occur upon the change of setpoint, reduce Integral Reset Rate by 30% and increase Derivative Gain by 50%.

-- If PV stays fairly flat and below (or above) the setpoint for a long time, after change of setpoint or beginning of disturbance (long tail scenario), increase Integral Reset Rate by 100%.

Repeat step 3 until the closed-loop response is satisfactory to you.

DESCRIPTION OF PID UNITS

Proportional Term is the amount added to the output based on the current error.

Proportional Gain is a Multiplier.

If the error is 10 and the Gain is .8, then the output will move 8%

Proportional Band is a Divider as a percentage.

If the error is 10 and the Band is 125%, then the output is (10*(100/125))=8%

Conversion between P-Gain and P-Band:

P-Band = 100/P-Gain

Integral Term is the amount added to the output based on the sum of the error.

Time Constant is the time for one full repeat of P-Term.

If the P-Term is 8% and the Time Constant is 10 seconds, then the output will ramp up 8% every 10 seconds

Reset Rate is amount the output will move in one second.

If the P-Term is 8% and the Reset Rate is .1 repeats/sec, then the output will move .1*8 every second and take 10 seconds for the full repeat of the P-Term of 8%.

Integral Gain is the same as the Reset Rate multiplied by the P-Gain.

Conversion between Time and Reset Rate:

Reset Rate = 1/ Time Constant

I-Gain = (1/Time Constant)*P-Gain

Derivative Term is the amount subtracted from the output based on the rate of change of the error.

Time Constant is the amount of time the Controller will look forward.

Derivative Gain is the amount of time the controller looks forward multiplied by the P-Gain.

REFERENCE

AB PID Blocks

PLC5 Integer Block ISA
- P Gain (Gain * 100)
- I Time Constant (Min * 100)
- D Time Constant (Min * 100)

PLC5 Integer Block Independent Gains
- P Gain (Gain * 100)
- I Reset Rate (Repeats/sec * 1000)
- D Gain (Gain * 100)

PLC5 PD Block ISA
- P (Gain *1)
- I Time Constant (Min * 1)
- D Time Constant (Min * 1)

PLC5 PD Block Independent Gains
- P Gain (Gain * 1)
- I Reset Rate (Repeats/sec * 1)
- D Gain (Gain * 1)

PLC5 PCO Block Dependent Gains
- P Gain (Gain * 1)
- I Time Constant (Min * 1)
- D Time Constant (Min * 1)

PLC5 PCO Block Independent Gains
- P Gain (Gain * 1)
- I Reset Rate (Repeats/sec * 1)
- D Gain (Gain * 1)

SLC PID Block with RG bit on
- P Gain (Gain *100)
- I Time Constant (Min * 100)
- D Time Constant (Min * 100)

SLC PID Block with RG bit off
- P Gain (Gain *10)
- I Time Constant (Min * 10)
- D Time Constant (Min * 10)

ControlLogix PID Block Independent
- P Gain (Gain * 1)
- I Time Constant (Min * 1)
- D Time Constant (Min * 1)

ControlLogix PID Block Dependent
- P Gain (Gain * 100)
- I Reset Rate (Repeats/sec * 1)
- D Gain (Gain * 1)

ControlLogix PIDE Block Independent
- P Gain (Gain * 1)
- I Time Constant (Min * 1)
- D Time Constant (Min * 1)

ControlLogix PIDE Block Dependent
- P Gain (Gain * 100)
- I Reset Rate (Repeats/sec * 1)
- D Gain (Gain * 1)

Bailey Infi90 PID Blocks

156,0 PID Block
- P Gain (Gain *1)
- I Reset Rate (Repeats/min * 1)
- D Time Constant (Min * 1)

156,1 PID Block
- P Gain (Gain * 1)
- I Reset Rate (Repeats/min * 1)
- D Time Constant (Min * 1)

156,2 PID Block
- P Gain (Gain * 1)
- I Reset Rate (Repeats/min * 1)
- D Time Constant (Min * 1)

156,3 PID Block
- P Gain (Gain * 1)
- I Time Constant (Min * 1)
- D Time Constant (Min * 1)

GE PID Blocks

Series 90/30/70 PID Block ISA
- P Gain (Gain * 100)
- I Reset Rate (Repeats/sec * 1000)
- D Time Constant (Sec * 100)

Series 90/30/70 PID Block Independent
- P Gain (Gain * 100)
- I Reset Rate (Repeats/sec * 1000)
- D Gain (Gain * 100)