Purchasing software for commercial applications can be a challenge. That can be especially true when it comes to PID controller tuning software. So much can go wrong after the purchase, but the software itself is not always the culprit. Control Station offers a perspective on the #1 mistake and thoughts on how to avoid it.
The #1 Mistake

Analyzes live and historical data – check. Accurately models a process’ dynamics – got it. Calculates tuning parameters – uh-huh. Allows adjustments to a controller’s responsiveness – right. Documents the decision-making process – you bet. With these capabilities and more, what could possibly go wrong when purchasing PID controller tuning software?

Most tuning software packages perform each of these steps and more. Variations have been marketed commercially for decades. They have been offered either as an auto-tune function within a given controller (i.e. PLC or DCS) or as an add-on product from third-party suppliers like Control Station. Equipped with powerful data analysis and process modeling capabilities, commercial software packages empower end-users to tune their business-critical controllers far more efficiently than through the application of manual methods.

The benefits of tuning PID controllers are widely accepted across the process industries. Although financial benefits may vary from industry to industry and even from application to application, sufficient economic gains exist to dwarf the associated software cost. Considering that studies have shown a potential increase in throughput of 5%-10% and a possible 10% - 20% reduction in energy consumption, the magnitude of these improvements suggest meaningful gains to both top-line Revenue and bottom-line profitability. Ask any software company and they’ll express envy over such a value proposition even if it’s generalized.

In spite of software’s ability to help improve both the performance of a controller and the economics of a production facility, mistakes are consistently made during the purchasing process. Those mistakes hinder the software’s effectiveness, and they regularly result in end-user frustration. The single biggest mistake is thinking that software alone can tune a plant’s PID controllers for optimal performance.
Every control loop is designed for a specific purpose – a unique control objective. For a chemical reactor it may involve holding batch temperature at a fixed value with variation of no more than +/- 2 degrees. For this particular control loop accurate tracking of Set Point is critical to successfully completing the batch. For a brewery it may require the level within a surge tank to absorb “wild” liquid flows without exceeding upper or lower limits. That both protects expensive downstream analytical instrumentation and prevents the beer from losing carbonation. For this loop the smooth rejection of disturbances is key to control. Adjustments to a controller’s responsiveness allow for important performance attributes such as Settling Percent Overshoot, and others to be achieved.

It’s essential that ‘good’ bump test data is collected and used while tuning PID controllers. As an example, best-practice requires the use of 1-second data when tuning pressure and flow loops whereas 5-second data is sufficient when tuning level and temperature loops. In this case ‘good’ means data that is not prone to aliasing. Depending on the software, the process itself must be kept quiet before performing any type of bump test. Regardless, all tests should be conducted within the control loop’s Design Level of Operation (DLO) with each step producing data that is clearly distinct from any process noise. Here ‘good’ denotes data that reveals a process’ true dynamics and that can be used to calculate an accurate model. A rule of thumb is to perform tests that are at least 4-times the size of the associated noise band.
Faulty, incomplete, or otherwise imprecise data will prevent software from producing quality results just like it will stop practitioners from doing the same. As the old computing adage goes: Garbage in, garbage out.

At the heart of PID controller tuning software is the modeling function – the software’s ability to interpret a process’ dynamics and pattern its behavior. With an accurate model, tuning parameters can be calculated that permit the PID controller to respond effectively to process disruptions. A model’s accuracy is often represented statistically through use of the R-squared (R2) coefficient with acceptable values ranging between 0.8 and 1.0. Restrictions on the size and duration of the bump tests performed on noisy and oscillatory processes may produce a model with a lower R2 where the end-user’s judgment is needed. Regardless of the R2 value, the restriction within auto-tune software to verify the model fit before calculating and implementing new tuning parameters represents a significant and detrimental flaw.

Statistics aside, a model can often be characterized as accurate through simple visual validation – the contours of the model should clearly emulate the underlying process data. A model’s accuracy should always pass the eye test.

PID controller tuning software doesn’t have the answers – you do.

When purchasing PID tuning software it is essential for end-users to draw upon their understanding of the process and to apply it accordingly. Software provides significant advantages over traditional, manual tuning methods. Software is capable of performing higher-order analysis of process data and of producing optimal models based on the same. Similarly, control loops that might take a practitioner days to improve marginally can be optimized in a flash through the use of software. And subtle adjustments that result in meaningful gains can be performed by software with virtually no effort. In spite of these advantages tuning software remains wholly dependent on the end-user’s knowledge of the process.

PID controller tuning software can provide valuable information but, ultimately, it requires you to provide the answers.
PID Controller Tuning Software Checklist:

When purchasing software for PID controller tuning, be sure to consider the following capabilities. This simple PID Controller Tuning Software Checklist will help you assess the type of tool that will help you achieve your process optimization objectives.

1. Processes Live and Historical Process Data
2. Supports Open-Loop and Closed-Loop Data
3. Supports Multiple and Concurrent Tuning Sessions
4. Permits Adjustments to Start/End of Data Analyzed
5. Models Non-Steady State (NSS) Data from IntegratingProcesses (e.g. Level, Batch Temperature)
6. Models Non-Steady State (NSS) Data from Non-Integrating Processes (e.g. Flow, Temperature, Pressure)
7. Calculates Model with Highest R² Value
8. Allows Creation of Multiple Process Models
9. Permits Manual Adjustment to Individual Model Parameters
10. Provides Statistical Details of Individual and Composite Process Models
11. Alerts Users to Issues Associated with the Process Data and/or Process Model
12. Generates Tuning Parameters for Any Major OEM Controller (i.e. DCS and PLC)
13. Generates Tuning Parameters for P-Only, PI, and PID Controller Forms
14. Simulates Existing Controller Performance
15. Compares Proposed Controller Performance with Existing Controller Performance
16. Provides Descriptive Statics for All Controller Forms (e.g. Settling Time, Percent Overshoot, etc.)
17. Provides Graphic Depiction of Control Loop Stability
18. Maintains Record of All Tuning Sessions
19. Produces Detailed Report of Each Controller Tuning Session

Control Station’s suite of Loop-Pro™ process modeling and PID controller tuning software is award-winning for a reason. Equipped with a patent-pending data modeling capability, it is the only software that accurately models oscillatory and noisy process data. It handles long dead-time with ease. It functions equally well in open-loop as it does in closed-loop. Loop-Pro has proven its value time and again in all manner of industrial applications — not just level control. It is industrial-grade technology for real-world applications.
Contact Us Today and Learn About Our Industrial Grade Controller Tuning Solutions

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