Practical Process Control and PID Loop Optimization Training Course



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4100 € (Per Person)

Ref: #ERE7148_273928

Course Introduction / Overview:

This comprehensive training course provides an in-depth exploration of process control instrumentation and Proportional-Integral-Derivative (PID) loop tuning, essential for ensuring operational stability, efficiency, and safety in modern industrial environments. Moving from foundational principles to advanced optimization techniques, the curriculum is designed to empower participants with the practical skills needed to manage and enhance automated processes. The course delves into the core concepts championed by experts like F.G. Shinskey in his seminal work, "Process Control Systems: Application, Design, and Tuning," bridging theoretical knowledge with real-world application. Participants will learn to analyze process dynamics, select appropriate control strategies, and master various tuning methodologies to resolve instability and improve performance. At BIG BEN Training Center, we focus on delivering a hands-on learning experience that equips professionals to troubleshoot complex control loops, reduce process variability, and contribute significantly to their organization's operational excellence. This program is the definitive guide for anyone looking to master the art and science of industrial process control and achieve optimal system performance.

Target Audience / This training course is suitable for:

- Process Control Engineers.
- Instrumentation and Control Technicians.
- Chemical and Process Engineers.
- Automation Engineers and Specialists.
- Plant and Operations Managers.
- Maintenance Supervisors and Technicians.
- Electrical Engineers working in industrial automation.
- System Integrators.
- Junior engineers seeking to specialize in process control.
- Experienced operators looking to deepen their technical knowledge.

Target Sectors and Industries:

- Oil and Gas Production and Refining.
- Chemical and Petrochemical Manufacturing.
- Pharmaceutical and Biotechnology Industries.
- Power Generation and Utilities.
- Water and Wastewater Treatment Facilities.
- Food and Beverage Processing.
- Pulp and Paper Manufacturing.
- Mining and Mineral Processing.
- Governmental bodies and regulatory agencies overseeing industrial operations.

Target Organizations Departments:

- Operations and Production.
- Engineering and Design.
- Maintenance and Reliability.
- Process Safety Management.
- Quality Assurance and Quality Control.
- Research and Development.
- Technical Services.
- Plant Management.
- Automation and Control Systems.

Course Offerings:

By the end of this course, the participants will have able to:

- Identify and describe the function of all components within a process control loop.
- Interpret Piping and Instrumentation Diagrams (P&IDs) to understand process flow and control schemes.
- Analyze the dynamic behavior of various industrial processes.
- Explain the individual and combined effects of Proportional, Integral, and Derivative control actions.
- Apply systematic tuning methods, including Ziegler-Nichols and trial-and-error, to optimize PID controllers.
- Diagnose and troubleshoot common control loop problems such as cycling, sluggishness, and instability.
- Implement and tune advanced control strategies like cascade, feedforward, and ratio control.
- Evaluate control loop performance using key performance indicators.
- Understand the impact of control valve characteristics on loop stability.
- Develop a structured approach to improving overall plant process stability and efficiency.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive, experiential, and focused on practical application. We believe that adult learning is most effective when it combines theoretical knowledge with hands-on practice. This course moves beyond traditional lectures to immerse participants in a dynamic learning environment. Sessions will feature a blend of expert-led instruction, detailed case studies from various industries, and interactive group discussions to facilitate peer-to-peer learning and knowledge sharing. A significant portion of the training will be dedicated to practical exercises and computer-based simulations that allow participants to apply PID tuning techniques in a safe, controlled setting and observe the immediate impact of their adjustments. This approach ensures that attendees not only understand the "what" and "why" of process control but also master the "how." Our instructors provide continuous feedback and facilitate problem-solving workshops, ensuring that every participant can confidently translate the skills learned in the classroom directly to their workplace challenges, fostering a deep and lasting understanding of process control optimization.

Course Agenda (Course Units):

Unit One: Fundamentals of Process Control and Instrumentation

- Introduction to industrial process control and its importance.
- Understanding process variables: pressure, level, flow, and temperature.
- Components of a control loop: sensors, transmitters, controllers, and final control elements.
- Reading and interpreting Piping and Instrumentation Diagrams (P&IDs).
- Sensor and transmitter technologies and calibration principles.
- Control valve types, characteristics, and sizing fundamentals.
- Introduction to PLC and DCS based control systems.

Unit Two: Process Dynamics and Controller Behavior

- Understanding process dynamics: gain, time constant, and dead time.
- Self-regulating vs. non-self-regulating processes.
- The concept of feedback and feedforward control.
- Proportional (P) control: action, gain, and offset.
- Integral (I) control: eliminating offset and understanding reset windup.
- Derivative (D) control: predictive action and noise sensitivity.
- Combining P, I, and D actions for optimal PID control.

Unit Three: Classic PID Controller Tuning Methods

- The objectives of controller tuning: stability and performance.
- Systematic tuning approaches vs. ad-hoc adjustments.
- The trial-and-error tuning method.
- The Ziegler-Nichols open-loop (reaction curve) tuning method.
- The Ziegler-Nichols closed-loop (continuous cycling) tuning method.
- The Cohen-Coon tuning method for processes with long dead time.
- Comparing different tuning rules and their applications.

Unit Four: Advanced Control Strategies and Modern Tuning

- Limitations of standard PID control.
- Cascade control strategy: principles, applications, and tuning.
- Feedforward control for disturbance rejection.
- Ratio control for blending and formulation processes.
- Split-range control for parallel final control elements.
- Introduction to model-based tuning techniques like Lambda tuning.
- Understanding controller algorithms and structures (e.g., Series, Parallel).

Unit Five: Control Loop Troubleshooting and Performance Optimization

- A systematic approach to troubleshooting control loops.
- Diagnosing common problems: valve stiction, sensor failure, and process noise.
- Identifying issues caused by poor controller tuning.
- Using process data and trends for performance analysis.
- Key performance indicators (KPIs) for control loop monitoring.
- Strategies for continuous process improvement and optimization.
- Documenting changes and maintaining loop performance.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

Considering the rise of AI and machine learning, how might traditional PID tuning methodologies evolve to incorporate self-tuning and predictive optimization algorithms in complex, non-linear processes?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by focusing intensely on the practical application of process control theory in real-world industrial settings. While many courses cover the mathematical foundations, our curriculum, inspired by the practical wisdom of pioneers like F.G. Shinskey, emphasizes the art and science of tuning and troubleshooting. We bridge the gap between theoretical knowledge and the complex, dynamic challenges faced on the plant floor. The program is built around a problem-solving methodology, using extensive case studies and interactive simulations that challenge participants to diagnose and resolve realistic control loop issues. Unlike purely academic courses, we prioritize the development of intuitive understanding, enabling attendees to "feel" how a process responds and make informed decisions beyond simply applying formulas. The emphasis on advanced strategies like cascade and feedforward control is not just theoretical; it is taught with a focus on identifying the right opportunities for implementation to achieve significant gains in efficiency and stability. This pragmatic, hands-on approach ensures that participants leave not just with knowledge, but with the confidence and competence to optimize their plant's control systems immediately.