Verwer Training and Consultancy Ltd

Professional Training and Consultancy for the Automation and Control Industry

Three-Term Controller training courses

Staged training courses covering the application, operation, tuning and implementation of three-term or PID (Proportional+Integral+Derivative) controllers.

Who should attend this training?

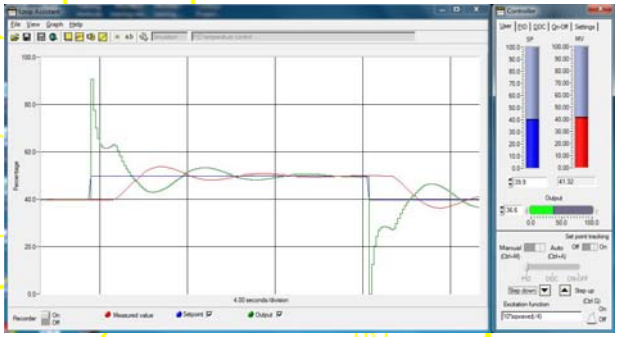
This training is aimed at technicians, engineers and programmers who are involved in the operation, implementation and tuning of feedback controllers in a wide variety of applications and industries. Many different aspects of feedback control systems are covered so that the training will benefit a wide range of needs. For example if you need to:

- Apply quantitative feedback control to real processes and machinery;
- Improve the performance or tune controllers in their plant;
- Implement three-term controllers in their programmable control systems (PLCs and DCS systems)
- Identify problems and the causes of poor control performance.

How is the training delivered?

The training is delivered as a series of modules that can be taken separately or can be joined together into a customised training programme. The modules available include:

- ***Basic three-term control module***
  A two-day course provided for those who have little or no previous experience with feedback control. This module takes the trainee up to the stage where they can tune a simple feedback control system and identify the basic reasons for poor control performance.
- ***Advanced controller tuning module***
  A 2½-day course that extends the material in the basic module to cover advanced tools and techniques that can be used to identify system characteristics and help to optimise and improve performance.
- ***Implementation module***
  A two-day course that covers how the programmer or software engineer can incorporate and use control elements into the programmable PLC and DCS systems.



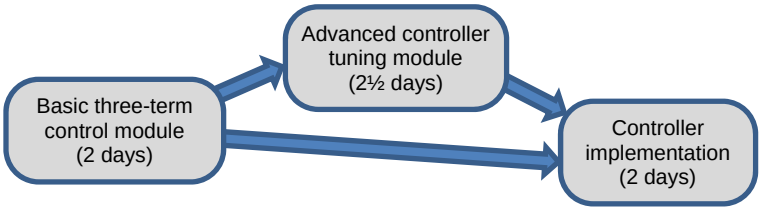
Loop Assistant software used in the training

All modules are highly practical and are delivered in hands-on manner using a combination of simulation software and real processes. The material in the basic and advanced courses are delivered in a manufacturer independent way. However, the implementation course is necessarily manufacturer dependent and is currently based on the Rockwell Controllogix environment (although other programming environments are possible).

What do the modules cover?

The ***Basic module*** provides an introduction to control system terminology and technology and introduces three-term control using a practical, hands-on approach. The basic course teaches how the controller terms operate and interact and how to use simple but practical techniques to select and adjust a controller for a range of applications. The training also covers the various causes of poor performance, which are often not concerned with controller tuning.

The ***Advanced module*** builds on the basic module material to cover the use of system modelling tools and techniques that can identify the static and dynamic characteristics of a process so that optimum controller settings can be found for a range of processes and performance criteria. The advanced course also covers the use of more advanced techniques such as cascade, feed-forward, gain scheduling and other compensation methods.



The ***Implementation module*** can be taken after either the basic or advanced modules. The implementation module uses a modern PLC or DCS programming environment and a real PLCs and SCADA system to show how implement a variety of control architectures.

The modules are designed to be taken in series to provide a structured but flexible route to competence. The basic course can be bypassed for those with a good basic understanding of PID control and terminology. The advanced tuning course and/or the control implementation courses can be taken individually, or can be combined for those that need to develop both implementation and tuning skills. All modules incorporate significant practical content using both simulation and real processes.

Flow controller tuning and performance

Course content

Basic module content

- Feedback control system architecture and terminology. Features of real controllers. Typical control systems for level, pressure, temperature and flow control. Hands-on practical operation of a control system.
- Common control actions. Simple process dynamics. Common problems associated with feedback control. Hands-on simulation exercises System load performance, reset windup. Control performance measures. Modelling of process dynamics and nonlinearities. Control valve characteristics and problems. Simple controller tuning methods. Practical tuning exercises for flow, level and pressure control.

Advanced module content

- Control performance measures. Process modelling and transfer functions. Practical exercise: simulation of typical process characteristics. Practical: process modelling exercise on flow, level and pressure control rigs.
- Control loop stability and gain/delay trade off. Common causes of poor control performance.
- Software-based tools for tuning. Connectivity Requirements. Practical exercise: monitoring values using OPC browser and using a PROFIBUS analyser. Step testing and process modelling exercises.
- Performance Criteria Selection, robustness plots, hysteresis and stiction testing. Filtering tools and statistical analysis. Practical exercises using software based tuning tools to tune and optimise control loop performance.
- Advanced control strategies including cascade and feed forward control. Typical applications and tuning.

Implementation module content

- The IEC61131-3 programming standard. The Rockwell Logix programming environment. Practical exercise getting started.
- Incremental and positional algorithms for PID control. Bumpless transfer and anti-reset windup. Feedforward and cascade control schemes.
- Sample rate selection criteria and the effects of jitter. The effects of fieldbus on cycle time and jitter. Problems of quantisation and rapid sampling.
- The PID Function block and its parameters. Programming considerations for PID control. Practical exercise programming and configuration of a simple PID control loop.
- HMI / SCADA faceplate design considerations. Access to engineering parameters. Practical exercises.
- Implementation of cascade control and feedforward compensation. Practical exercises.

A sample of comments received

- “Excellent course … extensive knowledge and experience of the tutor.”
- “Excellent practical set-up, hands-on with real devices.”
- “By far the best technical course I have ever attended … excellent but intensive”
- “Very well structured course. Really enjoyed the week.”
- “Excellent course: will be recommending that individual site engineers attend.”
- “…would like to thank you for one of the most valuable learning opportunities I have had…”

Booking Information

For dates, costs and booking information contact:

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