

**Training Title**

**ADVANCED TROUBLESHOOTING OF INSTRUMENTATION AND CONTROL SYSTEM**

**Training Duration**

**5 days**

**Training Date & Venue**

REF IC021	Advanced Troubleshooting of Instrumentation & Control System	5	19 - 23 May 2025	\$5,500	Dubai, UAE
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In any of the 4 or 5-star hotels. The exact venue will be informed upon finalizing.

**Training Fees**

- \$5,500 per participant for Public Training includes Materials/Handouts, tea/coffee breaks, refreshments & Lunch

**Training Certificate**

Define Management Consultancy & Training Certificate of course completion will be issued to all attendees.

**TRAINING DESCRIPTION:**

These 5 days course teaches a systematic approach to troubleshooting and start-up as they apply to single and multi-loop control loops. Covers how pressure, level, flow, and temperature loops operate to maintain good process control systems. Knowledge of instrumentation and control is assumed.

**TRAINING OBJECTIVES:**

Upon completion of this course, participants will gain the following:

- Understand why a systematic approach to troubleshooting is most effective
- Follow specified procedures for proper loop check-out
- Verify, locate, and identify performance problems and the causes of the problems
- Take or recommend appropriate follow-up procedures to minimize problem recurrence
- Identify the common causes of sensor, transmitter, controller, and final control element problems
- Troubleshoot control systems
- Apply DCS functions for troubleshooting
- Understand pneumatic and electronic loops
- Apply safety practices for start-up
- Check and utilize control loop documentation
- Diagnose and solve problems related to single loop control loops.
- Diagnose and solve problems with ratio, cascade and three-element control loops.
- Diagnose problems using DCS displays for information.
- Construct and tune a feedback control loop.
- Troubleshoot several single loop controls systems.

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**THIS COURSE WILL COVER:**

- Introduction: Purpose of Troubleshooting | Reasons for Troubleshooting
- Approaches to Troubleshooting: Equipment History | Input/Output (Serial) | Shotgun Approach | Logical Analysis
- Logical Analysis Troubleshooting: Verify | Identify | Repair | Test | Follow-up on Problems
- Review Standard Diagrams and Symbols: Process and Instrument Drawings | Loop Drawings | Safety Logic
- Single-Loop Feedback Control Troubleshooting: Measurement Concerns | Controller Operations | Signal Conditioners | Troubleshooting Simulation
- Multi-Loop Control Systems Troubleshooting: Ratio (Two Controlled Streams, Wild Stream) | Cascade | Three-Element Control | Troubleshooting Simulation
- Introduction to Digital Control Systems: Advantages | Digital Control (DDC) | Supervisory DC | Supervisory Plus DDC | Analog Back-up
- Distributed Control Functions for Troubleshooting: Elements | Displays (Graphic, Trend, Alarm) Start-up Concerns: Safety | Documentation | Tuning Review

**WHO SHOULD ATTEND?**

- Instrumentation and control engineers and technicians
- Design, installation and maintenance engineers and technicians in the process industries
- System integrators
- System consultants

**TRAINING METHODOLOGY**

Highly Interactive program with exercises, individual approach and group role playing alternate with practical statements based on theory and supplemented with practical tips based on actual experience. During the course the first draft of a strategic plan at company or department levels will be made by the participants. Power point presentation will be presenting the main points with appropriate time for discussions. Videos will be watched, Exercises to provide practical experience, and case studies to support different ideas will be supporting the learning. Participants will be encouraged to bring their own experiences and challenge the learned concepts and practices. The course is based on a combination of interactive activities - group and individual exercises, case studies, role plays and discussions - along with formal inputs.

**COURSE OUTLINES:**

**Chapter 1: Troubleshooting**

- 1.1) Purpose of Troubleshooting
- 1.2) Troubleshooting Reasons
- 1.3) Bottom Line

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- 1.4) What Are You Expected to Troubleshoot?
- 1.5) Troubleshooting Skills Dependent On
- 1.6) Approaches to Troubleshooting
- 1.7) Equipment History Approach
- 1.8) Input/Output (Serial) Approach
- 1.9) Input/Output Approach
- 1.10) Shotgun Approach
- 1.11) Steps to Logical Analysis Troubleshooting
- 1.12) Verify Something Is Wrong
- 1.13) Identify and Locate the Cause of the Problem
- 1.14) Fix the Problem
- 1.15) Verify the Problem Is Corrected
- 1.16) Follow Up to Minimize Future Problems
- 1.17) Pneumatic Test Equipment
- 1.18) Electronic Test Equipment
- 1.19) Digital Test Equipment

## Chapter 2: Review of Diagrams & Symbols

- 2.1) Process Control Defined
- 2.2) Other Instruments in a Feedback Control Loop
- 2.3) Instrument Line Symbols
- 2.4) General Instrument or Function Symbols
- 2.5) Identification Letters
- 2.6) Control Valve Body Symbols
- 2.7) Actuator Symbols
- 2.8) Typical Tag Numbers
- 2.9) Actuator Symbols Fail Safe
- 2.10) Instrument Identification

## Chapter 3: Common Problems

- 3.1) Pressure Measurement-Common Problems
- 3.2) Level Measurement-Common Problems
- 3.3) Flow Measurement-Common Problems
- 3.4) Temperature Measurement-Common Problems
- 3.5) Common Problems: Pneumatic Transmitters
- 3.6) Common Problems: Transmitter Installation
- 3.7) Common Problems: Electronic Transmitters
- 3.8) Common Problems: Control Valves
- 3.9) Flow Problem Discussion
- 3.10) Temperature Problem Discussion

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- 3.11) Level Loop Problem Discussion
- 3.12) Pressure Loop Problem Discussion

#### Chapter 4: System Tuning Review

- 4.1) Ziegler/Nichols Closed Loop Tuning
- 4.2) Formulas for Open Loop (in Manual)
- 4.3) Alternate Process for Open Loop
- 4.4) Procedure 1 (Closed Loop) Discussion
- 4.5) Procedure 2 (Closed Loop) Discussion
- 4.6) Procedure 3 (Open Loop) Discussion

#### Chapter 5: Start-Up

- 5.1) Safety Start-up Concerns
- 5.2) Start Up Documentation
- 5.3) Process Start-Up Familiarity

#### Chapter 6: Multi-Loop Control Systems

- 6.1) Ratio Control Defined
- 6.2) Ratio Control (Two Controlled Streams)
- 6.3) Wild Stream Ratio Control
- 6.4) General Features of a Cascade Control System
- 6.5) Heat Exchanger: Single Loop
- 6.6) Heat Exchanger: Cascade Control
- 6.7) Ratio Control Problem Discussion
- 6.8) Cascade Control Problem Discussion
- 6.9) Three Element System Problem Discussion

#### Chapter 7: Digital Control Introduction

- 7.1) How the Computer Works....
- 7.2) Electronic Language - The Binary System
- 7.3) A Comparison!
- 7.4) Advantages of Digital Control Systems
- 7.5) Direct Digital Control (DDC)

#### Chapter 8: Troubleshooting DCS

- 8.1) Distributed Control System
- 8.2) Elements of a Distributed Control System
- 8.3) DCS Graphic Display
- 8.4) DCS Trend Display
- 8.5) DCS Alarm Summary

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- 8.6) DCS Distillation Control Problem Discussion
- 8.7) DCS Batch Control Problem Discussion
- 8.8) DCS Reactor Control Problem Discussion
- 8.9) DCS Pressurized Vessel Problem Discussion

**NOTE:**

**Pre & Post Tests will be conducted**

**Case Studies, Group Exercises, Group Discussions, Last Day Review & Assessments will be carried out.**



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