Distributed Control System (DCS): Configuration, Integration, Maintenance and Migration

1 – 12 August 2027
Jeddah - Corniche four-star



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Introduction:

A distributed control system DCS ages in ways operators rarely see: controllers creep towards full load, redundant pairs stop synchronising, function block strategies drift from their design, alarm attributes are edited without records and backups go untested until a failure. This Core Concept course gives control engineers and senior technicians a vendor-neutral method to engineer, configure, maintain, secure and migrate a DCS across its whole lifecycle. Participants produce a DCS Configuration and Alarm Rationalisation Review for a process unit from their own plant.

Course Objectives:

- Map a plant's DCS architecture across controllers, I/O, control networks, servers and operator stations and verify its redundancy and failover behaviour
- Configure control strategies from function blocks for single-loop, cascade, ratio and feedforward control with correct execution order and controller loading
- Structure the DCS configuration database, operator graphics, alarm attributes and historian tags so that they stay consistent and traceable
- Integrate the DCS with safety instrumented systems, package PLCs and business systems through defined interfaces and data mapping tables
- Protect the DCS through IEC 62443 zones and conduits, tested backups and controlled configuration changes
- Plan DCS maintenance, diagnostics, performance benchmarking and migration from an obsolete platform with minimum production risk

Target Audience:

- DCS and control system engineers responsible for configuring control strategies, graphics and alarms
- Instrument and control leads responsible for DCS maintenance plans, spares and system health
- Senior control technicians responsible for diagnostics, backups and fault finding on controllers, I/O and networks
- Project engineers responsible for DCS expansions, upgrades and migration cutovers
- OT network and automation specialists responsible for securing and integrating control system nodes

Course Outline:

Day 1: DCS Architecture, Functional Levels and System Components

- Functional Levels 0 to 4: Field Devices, I/O, Supervisory Computers, Production Monitoring and Scheduling
- DCS Evolution from Early Platforms Such as CENTUM, I/A Series and PROVoX to Current Systems
- Controller, I/O Subsystem, Engineering Station, Operator Station and Server Roles
- Control Network Topologies, Industrial Switches and Time Synchronisation Across Nodes
- DCS Versus PLC and SCADA: Selection Criteria for Continuous Process Plants

Day 2: Redundancy, Field Communication and the Batch Control Model

- Redundant Controller Pairs, Automatic Failover and Standby Synchronisation Checks
- Redundant Control Networks, Power Supplies and I/O Card Configuration
- Field Communication in the DCS: HART, Foundation Fieldbus, PROFIBUS and Modbus Interfaces
- ANSI/ISA-88 IEC 61512-1 Physical Model from Process Cell to Control Module
- ANSI/ISA-88 Procedural Model: Procedure, Unit Procedure, Operation and Phase

Day 3: Control Strategy Configuration with Function Blocks

- Function Block Libraries: Analog Input, PID, Analog Output and Signal Selector Blocks
- Control Module Templates and Bulk Instantiation from an Instrument Index
- Cascade and Ratio Strategies Wired as Linked Function Block Diagrams
- Feedforward Summing, Override Selection and Anti-Reset Windup Handling in Configuration
- Execution Scan Rates, Controller Loading and Block Execution Order Checks

Day 4: Operator Graphics, DCS Alarm Attributes and Historian Data

- Operator Graphic Hierarchy, Faceplates and Trend Display Configuration
- Alarm Attributes in the DCS Database: Priority, Deadband, Delay and Suppression Fields
- ISA-18.2 and EEMUA 191 Expectations Applied to DCS Alarm Configuration
- Process Historian Tag Configuration, Compression and Data Retention Settings
- OPC Interfaces from the DCS to the Historian and Business Systems

Day 5: Week-One Guided Case: Fired Heater Control Configuration

- Guided Case: Heater Outlet Temperature to Fuel Flow Cascade Configured End to End
- Guided Case: Air to Fuel Ratio Strategy with Cross-Limiting Logic Review
- Guided Case: Operator Graphic and Faceplate Set for the Heater Unit
- Guided Case: Alarm Attribute Table and Historian Tag List for the Heater
- Week-One Configuration Test Record and Simulation Walkthrough

Day 6: Sequence Control, Batch Execution and System Integration

- Sequential Function Charts and State-Based Control for Unit Start-Up and Shutdown
- Batch Recipe Management and Phase Logic Execution at Overview
- DCS to Safety Instrumented System Interfaces: Trip Status, Bypass Indication and Separation
- DCS to Package PLC Integration: Modbus and OPC Data Exchange with Mapping Tables
- Advanced Process Control Interfaces and Setpoint Handshake Logic at Overview

Day 7: OT Cybersecurity, Backups and Configuration Change Control

- IEC 62443 Zones and Conduits Applied to DCS Network Architecture
- IEC 62443 Security Levels and IEC 62443-2-4 Patch and User Management Requirements
- Configuration Database Backup, Restore Testing and Offline Image Storage
- Management of Change for DCS Configuration: Version Control, Approval and Download Records
- Engineering Workstation Access Control and Removable Media Rules

Day 8: DCS Maintenance, Diagnostics and the Operations Interface

- DCS Preventive Maintenance Plan: Controller, Power Supply, Cooling and Network Health Checks
- System Diagnostics: Controller Load, Network Error Counters and I/O Card Fault Logs
- Online Download Risk Assessment and Operations Handover Before Configuration Changes
- DCS Spares Strategy, Firmware Compatibility and Vendor Support Lifecycle Status
- Shift Handover Notes and Change Briefings Between Control Engineers and Operators

Day 9: DCS Performance Benchmarking, Alarm Review and Migration Planning

- DCS Health KPIs: Availability, Controller Loading, Loops in Manual and Alarm Rate
- Alarm Rationalisation Review Method: Cause, Consequence, Response Time and Priority
- Obsolescence Assessment and Migration Strategy: Phased, Hot Cutover or Full Replacement
- Configuration Conversion, I/O Retention and Factory Acceptance Test Planning for Migration
- Site Acceptance Testing, Cutover Checklist and Post-Migration Performance Review

Day 10: Capstone: DCS Configuration and Alarm Rationalisation Review

- Capstone Brief: Unit Configuration Export, Alarm List and Network Drawings
- Capstone Analysis: Function Block Strategy and Redundancy Findings Log
- Capstone Analysis: Rationalisation of the Most Frequent Alarms from the Unit Alarm List
- Capstone Build: Cybersecurity, Backup and Change Control Gap Register
- DCS Configuration and Alarm Rationalisation Review Presentation and Peer Critique

Skills You Will Gain:

- DCS Architecture Mapping
- Redundancy and Failover Testing
- Function Block Strategy Design
- Configuration Database Management
- DCS Alarm Attribute Configuration
- Control System Integration
- OT Network Segmentation
- DCS Migration Planning

Why Attend This Course:

- Return with a DCS Configuration and Alarm Rationalisation Review for a process unit at your own plant
- Find overloaded controllers, untested redundancy and undocumented configuration edits before they cause an unplanned trip
- Move in week two from configuring strategies to integrating, securing, maintaining and migrating the whole system
- Compare DCS engineering practice with peers from oil and gas, petrochemicals, power, water and pharmaceutical plants

Conclusion:

A distributed control system stays dependable only when its architecture is understood, its redundancy is proven, its configuration is traceable and every change is controlled. The first week covers architecture, redundancy, field communication, function block strategies, graphics, alarm attributes and historian data. The second week adds sequence and batch control, integration with safety systems and PLCs, IEC 62443 security, backups, maintenance, diagnostics, benchmarking and migration. The capstone turns both weeks into a DCS Configuration and Alarm Rationalisation Review ready for the participant's next system audit.