# CCC Learning Course Catalog

**Expertise in Turbomachinery Controls™**
**learning.cccglobal.com**

For more information, click each box below to explore CCC's training services

## CCC Learning Homepage

http://learning.cccglobal.com

## Regional Training

http://learning.cccglobal.com/ProductSubCats.aspx?SubCatID=33

## Instructor-Led Training

http://learning.cccglobal.com/productdetails.aspx?ProductID=225

## Online Training

http://learning.cccglobal.com/ProductSubCats.aspx?SubCatID=23

# Introduction

# This is the **Value of Training**

Our focus is designing and executing training solutions that equip customers and improve organizations. Whether protecting systems, optimizing process controls, or enhancing value, we use decades of experience to develop self-sufficient teams that reduce downtime and operating costs.

**GREETINGS, AND THANK YOU** for considering Compressor Controls Corporation as your training partner.

For more than forty years, CCC has provided many types of trainings, for many different customers, with many unique needs. And even though every customer is distinct, their training requests consistently fall into one of three areas of interest. In general, our customers tell us they want to:

- **OPTIMIZE THEIR CCC CONTROL SYSTEM**
- **IMPROVE THEIR SKILLS AND PERFORMANCE**
- **LEARN MORE ABOUT SPECIFIC CCC APPLICATIONS**

Training **answers questions** that a learner may not know to ask. Training **eases frustrations** that naturally occur when a valuable piece of yo**ur plant's process is complex and requires education and experience** to protect your system and optimize process control. Training **develops teams to become self-sufficient and diagnostic**, so that downtime and operating **costs are reduced**. ***Training makes "system efficiency" a task to be achieved, instead of a goal to be discussed.***

# INTRODUCTION

For organizations, training represents many possible outcomes – which is why CCC specializes our trainings to maximize the effectiveness and productivity of the learner, which has the greatest direct impact upon the profitability of the organization. ***Training achieves this result consistently because it is a cycle of investments.*** As the organization invests in their workforce of individual assets, the learner invests into advancing their own theoretical and practical capabilities to increase productivity. This **increased return on assets ratio** – if planned, managed, and executed with proper intentionality and care – leads to marked profitability gains. Those gains fuel further reinvestment into organizational growth.

For the learner, CCC's training serves two great purposes: it equips advantageous **skills and knowledge directly from our experts**, and **enriches the learner's value** to their organization and industry. This drives engagement, retention, and unity. It also **supports an environment of mutual growth and benefit**. Learners can share best practices and lessons learned, as well as gain fresh perspectives, which often reinvigorates a workforce that faces high expectations and a tremendous workload.

Again, thank you for considering CCC as a partner in your training needs. If you have further questions, or special requests**, please visit learning.cccglobal.com**, or feel free to contact me directly. My email is listed below.

Regards;

**STEVE LEDO**
*Director, Global Training and Development*
*training@cccglobal.com*

***"TRAINING MAKES 'SYSTEM EFFICIENCY' A TASK TO BE ACHIEVED, INSTEAD OF A GOAL TO BE DISCUSSED."***

# Table of Contents

Talk to us today and rediscover what your machines are capable of.

Section 1

# I want to **Optimize my CCC Control System**

Consider optimizing your control solution's performance with Instructor-Led Training, which leverages CCC's extensive technical expertise through custom-tailored courses. Coursework is strategically designed to provide personalized content based on your industry, CCC platform, and application

## INSTRUCTOR-LED TRAINING

**Instructor-Led Training** is one of the most efficient and effective ways to bring yourself up to speed on your CCC control system.

You'll learn the fundamental design, terminology, and principles of your control system, as well as system diagnostic techniques allowing quick troubleshooting of issues or irregularities.

These learning objectives help maximize efficiency, minimize risk and unplanned downtime, lower costs, and increase productivity. This knowledge improves understanding of system capabilities and limitations, as well as control environment interactions and processes.

## INDUSTRY-FOCUSED EXPERTISE

CCC understands and serves your industry. A CCC training specialist will work with you in a pre-course assessment to determine CCC training solutions specially tailored to optimize your control systems performance.

Coursework includes the **Core Curriculum,** which represents the **CCC control applications** found at your facility and the **Expanded Curriculum** that focuses on **specific CCC controller platform(s) and associated interfaces.**

SECTION 1

# 5 Industries
## CCC is proud to serve

**DOWNSTREAM**
Petrochemical (Ammonia, Ethylene), Refining, and Research

**MIDSTREAM**
Coal to Gas, Gas Production, Liquified Natural Gas, and NGL

**UPSTREAM**
FPSO, Gas Production, GOSP, NGL, and Offshore (Subsea)

**INDUSTRIAL**
Agricultural, Air Separation, Automotive, Chemical, Food & Beverage, Manufacturing, Marine, Pharmaceutical, Pulp & Paper, Steel, and Textiles

**PIPELINE & POWER GENERATION**
Pipeline includes: Gas Storage and Gas Transmission; Power Generation includes: CO2 Sequestration, Commercial Utility, Power Generation, and IGCC

**As an example**, your system may be in an **Ethylene plant** (down-stream industry) with a **cracked gas compressor, propylene and ethylene refrigeration compressors** that are driven by **steam turbines**. The control system is a **simplex CCC Series 3++ platform**.

**Based on the industry and process applications,** take the following courses: **ASC-01/02/03, PFC-01 & STC-01/02**. **Based on the control-ler platform,** the following course would he applicable: **S3P-MN.**

Your **CCC Training Specialist** can work with you to further refine the training courses that will **op-timize system efficiency, security, and productivity**, while **improving learners' skills and performances**.

## INDUSTRY/COURSE REFERENCE TABLE

[*Find training courses in Section 3 pf this document or click here: http://learning.cccglobal.com/content/Optimize-Performance.aspx]

| COURSE NUMBER * | DOWN | MID | UP | IND. | P & P |
|---|---|---|---|---|---|
| ASC-01 | ✓ | ✓ | ✓ | ✓ | ✓ |
| ASC-02 | ✓ | ✓ | ✓ | ✓ | ✓ |
| ASC-03 | ✓ | ✓ | - | - | ✓ |
| DPM-01 | ✓ | ✓ | ✓ | - | ✓ |
| EXC-01 | ✓ | ✓ | - | ✓ | ✓ |
| GTC-01 | ✓ | ✓ | - | ✓ | ✓ |
| PFC-01 | ✓ | ✓ | ✓ | ✓ | ✓ |
| PFC-02 | ✓ | ✓ | ✓ | ✓ | ✓ |
| PFC-03 | ✓ | ✓ | - | - | - |
| PGEN-01 | ✓ | - | - | ✓ | ✓ |
| PGEN-02 | ✓ | ✓ | ✓ | - | ✓ |
| QC-01 | ✓ | ✓ | - | - | - |
| STC-01 | ✓ | ✓ | - | ✓ | ✓ |
| STC-02 | ✓ | ✓ | - | ✓ | ✓ |
| UI-01 | ✓ | ✓ | ✓ | ✓ | ✓ |
| UTC-01 | - | - | - | - | ✓ |

✓ = Course applicable to industry

Section 2

# I want to **Improve my Skills & Performance**

Explore flexible Regional Training that can be attended at different global locations throughout the year. Online training can be taken anywhere you have a computer with an internet connection. Combine Regional and Online Training options to enhance your organizational value and earn a CCC Workshop Certificate.

## REGIONAL & ONLINE TRAINING

**Regional Training** sessions offer essential practical and theoretical skill and performance development opportunities, in flexible settings around the world throughout the year. Regional Training Attendees gain a core understanding of the CCC control system, can quickly resolve CCC control system issues, recognize the system capabilities and limitations and will have the opportunity to network with other industry colleagues.

For learners and teams that need full flexibility with time and location, **Online Training** is an excellent match. Each course includes defined objectives, pre- and post-testing, interactive learning content, downloadable supplementary resources, and a certificate of completion.

## WORKSHOP CERTIFICATE PROGRAM

While both Regional and Online training can be taken as independent courses, learners can also create enhanced organizational value through three specially-designed curricula consisting of both Online and Regional training coursework that comprise **CCC's Workshop Certificate Program**.

Trainees who finish the comprehensive blended-training program will receive a CCC Certificate designed for specific roles, which lasts four years.

Workshop Certificates are currently offered for **Series 3 +/++** and **Series 5** platforms (Series 4 and Prodigy workshop certificate sessions can be custom scheduled). Please contact the Training Department for further details.

SECTION 2

# Earn **Workshop Certificates** for greater value

Create enhanced organizational value through three specially-designed curricula of Online and Regional training courses

WORKSHOP CERTIFICATE PROGRAM IN CCC
**COMPRESSOR CONTROL OPERATION**

Designed for those needing a strong fundamental approach to CCC compressor controller operation and basic applications ***(Designed for: Operators, Production Managers).***

**Online Training Component**

- Compressor Maps and Surge
- Basic Antisurge Theory
- Basic Performance Control Theory
- *Optional Trainings: Basic Steam Turbine Control Theory; Basic Extraction Control Theory*

**Regional Training Component**

- **Day 1:** Surge & Anti-Surge Control and Operations

WORKSHOP CERTIFICATE PROGRAM IN CCC
**COMPRESSOR CONTROL MAINTENANCE**

Designed for many varied Maintenance roles, to provide an efficient, thorough education on maintaining and optimizing the control system functions. ***(Designed for: Maintenance Manager, Maintenance Supervisor, Maintenance Technician, Instrument Technician, Reliability Manager, Reliability Engineer, Rotating Equipment Mechanic, Electrician, Unit Maintenance Technician).***

**Online Training Component**

- Compressor Maps and Surge
- Basic Antisurge Theory
- Basic Performance Control Theory
- Piping & Field Instrumentation Best Practices
- *Select 1 course from the following: Basic Steam Turbine Control Theory; Basic Extraction Control Theory; Transmitter and Control Elements*

**Regional Training Component**

- **Day 1:** Surge & Anti-Surge Control and Operations
- **Days 2-3:** Platform-specific Performance, Maintenance, and Configuration

WORKSHOP CERTIFICATE PROGRAM IN CCC
**COMPRESSOR CONTROLS**

This certificate focuses closely on Engineers (including Managers) who require a greater comprehension and more diverse awareness of the overall function of their control system.

**Online Training Component**

- Compressor Maps and Surge
- Basic Antisurge Theory
- Basic Performance Control Theory
- Basic Steam Turbine Control Theory
- Basic Extraction Control Theory
- Transmitter and Control Elements
- Piping & Field Instrumentation Best Practices

**Regional Training Component**

- **Day 1:** Surge & Anti-Surge Control and Operations
- **Days 2-3:** Platform-specific Performance, Maintenance, and Configuration
- **Day 4:** Advanced Tuning and Surge Testing

Section 3

# I want to **Learn More** about **Specific Subjects**

Delve deeper into foundational subjects and applications that turn theoretical concepts into practical improvements. Also discover specialized courses and online training options. You can view all CCC training courses with detailed attributes and synopsis for each offering.

CCC's course offerings are grouped together into **two main categories** – our **Core Curriculum** (which are control application courses that work across all platforms, with relevant industries listed) and the **Expanded Curriculum** (which includes platform-specific courses, advanced application offerings, and online training) which are not industry specific.

Each listing in this section includes the course number, title, duration, industries, operational roles, a general description, and required prerequisites. See below for detailed lists regarding the industry and operational role designations.

## INDUSTRY DEFINITIONS

- **Downstream:** Petrochemical (Ammonia, Ethylene), Refining, and Research
- **Midstream:** Coal to Gas, Gas Production, Liquified Natural Gas, and NGL
- **Upstream:** FPSO, Gas Production, GOSP, NGL, and Offshore (Subsea)
- **Industrial:** Agricultural, Air Separation, Automotive, Chemical, Food & Beverage, Manufacturing, Marine, Pharmaceutical, Pulp & Paper, Steel, and Textiles
- **Pipeline & Power Generation**: Pipeline includes: Gas Storage and Gas Transmission; Power Generation includes: CO2 Sequestration, Commercial Utility, Power Generation, and IGCC

## OPERATIONAL ROLES

- **Operators (O)**: Operators, Production Managers
- **Maintenance Personnel (M)**: Maintenance Managers and Supervisors, Maintenance or Instrument Technicians, Reliability Managers and Engineers, Rotating Equipment Mechanic, Electrician, Unit Maintenance Technician
- **Engineers (E)**: Plant Engineering Manager, Electrical & Instrument Engineer, Process Engineer, Control System Engineer, Project Manager, Project Engineer, Instrument Engineer, Plant Manager, Engineering Manager, E&I Engineer, Instrumentation Engineer, and Commission Lead

SECTION 3: CORE

# Core Curriculum

## Instructor-Led (ILT) courses for all platforms

### ASC-01: COMPRESSOR ANTI-SURGE CONTROLLER OPERATION

**INDUSTRY: ALL**
**OPERATIONAL ROLES: O – M – E**
**8 HOURS**

This course explains the purpose, functionality, and operation of the anti-surge controller. The topics covered include: **Compressor Systems and Classifications**, including positive displacement (Reciprocating, Screw, lobe) and rotating (centrifugal, axial) compressors; **Surge Phenomenon** (compressor maps, system resistance, flow reversal, causes and consequences of surge, reduced coordinates, and invariant coordinate system); **Surge Control** (The 'b' equation, Surge Control Line and PI closed loop control, Derivative Response and Adaptive Gain, Recycle Trip Line and open loop control, Derivative Recycle Trip, Safety On Line, surge detection techniques, limiting, Manual Override (hard manual), Decoupling of anti-surge control loop interactions, Fallback Strategies); and **Operator Interface** (understanding the displays and functionality of the controller faceplate).

***Prerequisites: None***

### ASC-02: SURGE TESTING AND CONTROL LOOP TUNING

**INDUSTRY: ALL**
**OPERATIONAL ROLES: M – E**
**6 HOURS**

This course provides a high-level overview of the activities carried out during system commissioning. The topics include: **System Checkout Procedures** (Inspection of controllers and panel, field equipment checks, wiring loop checks); **Compressor Surge Test Methods** (reasons for testing, testing methods); and **Control Loop Tuning Methods**.

***Prerequisites: ASC-01 Compressor Anti-Surge Controller Operation***

***Note: This training will not qualify trainees to surge test compressors, or tune control loops in the absence of a qualified CCC Field Engineer.***

### ASC-03: COMPRESSOR CHOKE CONTROL

**INDUSTRY: DOWNSTREAM, MIDSTREAM, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**0.5 HOURS**

This course **explains compressor choke control** using the understanding of anti-surge control functionality as a basis. The similarities and differences between choke and anti-surge control will be discussed.

***Prerequisites: ASC-01 Compressor Anti-Surge Controller Operation***

### DPM-01: DPM VALVE POSITIONING APPLICATIONS

**INDUSTRY: DOWNSTREAM, MIDSTREAM, UPSTREAM, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: M – E**
**4 HOURS**

Students will learn the **key features and functionality of the DPM Positioning Module**, including simplex and redundant DPMs, and

# SECTION 3: CORE

DPM interface configuration. The topics covered include Positioner Overview, Operation, Control, System Installation, DPM Configuration and DPM Maintenance.
***Prerequisites: None***

## EXC-01: STEAM TURBINE EXTRACTION CONTROLLER

**INDUSTRY: DOWNSTREAM, MIDSTREAM, INDUSTRIAL, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**2 HOURS**
This course covers **Extraction Controller Operation**, as well as b**asic elements of extraction control**, including: General PID Algorithm, Bumpless Transfers, Dead Zones, Control Variable Fallback, Selected Loop and Set Point, Control Variable Scaling, Flow Control Loop, Mass Flow Rate, Square Root of Flow Measurement, Flow Load Sharing, Pressure Control Loop, and Over-Pressure Protection. The **Extraction Controller Demonstration** covers: Automatic Start Up, Ramping, Manual Extraction and Throttle Valve Management, Extraction Pressure, Extraction Flow, Automatic Shut Down, and Speed Control Priority, as well as various platform-specific topics.
***Prerequisites: STC-01 Steam Turbine Speed Controller***

## GOSP-1 GUARDIAN OVERSPEED PROTECTION

**INDUSTRY: DOWNSTREAM, MIDSTREAM, INDUSTRIAL, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**1 HOUR**
This course covers the features and functionality of the Guardian Overspeed Protection system. The topics covered include: Features and Specifications (enclosure, diagnostics, system maintenance); Speed Measurement (independent sensors, signal selection); Modules (speed, supervisor, power supply, relay board); and Overspeed Trip Testing.
***Prerequisites: STC-01 Steam Turbine Speed Controller***

## GTC-01: GAS TURBINE FUEL CONTROL

**INDUSTRY: DOWNSTREAM, MIDSTREAM, UPSTREAM, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**6 HOURS**
This course covers the **purpose, functionality, and operation of the CCC Gas Turbine Controller**. The topics covered include: Gas Turbine Classifications; Gas Turbine Process Variables; Limiting Control Loops; Operating States; Automatic Start-up/Shut-down Sequencing; Fuel Controller Configuration; Over Temperature Control; Fallback Strategies; Fuel Systems and Valves; nitrous Oxide Control; Speed Measurement; and Inlet Guide Vanes and Variable Stator Vanes.
***Prerequisites: None***

## PFC-01: COMPRESSOR PERFORMANCE CONTROLLER OPERATION

**INDUSTRY: ALL**
**OPERATIONAL ROLES: O – M – E**
**4 HOURS**
This course explains the purpose, functionality, and operation of the compressor performance controller. The topics covered include: **Performance Control Variables** (flow, pressure, and temperature); **Final Control Elements** (recycle valve, discharge throttle valve, suction throttling valve, adjustable inlet guide vanes, rotational speed); **Performance Control** (limiting control,

decoupling of anti-surge and performance control loop interactions, automatic start-up/shut-down sequences, Pressure Override Control (POC)), and **Operator Interface**.
***Prerequisites: None***

## PFC-02: LOADSHARING OF COMPRESSOR NETWORKS

**INDUSTRY: ALL**
**OPERATIONAL ROLES: O – M – E**
**1 HOUR**

This course provides and understanding of **how a network of CCC controllers can be used to regulate the performance while maximizing the efficiency of compressors operating in parallel or in series**. The Course will explain the problems associated with the base loading and equal flow distribution methods of control, and the benefits of CCC load-sharing features including load balancing, and recycle balancing.
***Prerequisites: PFC-01 Compressor Performance Controller Operation***

## PGEN-01: STEAM TURBINE WITH GENERATOR CONTROL

**INDUSTRY: DOWNSTREAM, INDUSTRIAL, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**8 HOURS**

This course addresses five areas of fundamental maintenance and configuration topics. The course begins with an **Overview of Generator Control**, and then moves into **Generator Control Theory**, including Mode Selection, Isochronous Control, and Droop Control. Learners then cover **Overspeed Prevention** (Start-up, Synchronization, Idle, and Shutdown Sequences), **Automatic Sequencing**, and, in applicable situations, the **Operator Interface Station** with Operating Principles. The **Steam Turbine with Generator Control Simulation Demonstration** encompasses: Automatic Start Up, Ramping, Mode Selection, Automatic Shut Down, and Speed Control Priority.
***Prerequisites: STC-01 Steam Turbine Speed Controller***

## PGEN-02: GENERATOR CONTROL USING FUEL CONTROLLER

**INDUSTRY: DOWNSTREAM, MIDSTREAM, UPSTREAM, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**1 HOUR**

This course covers generator control **using the CCC Gas Turbine Fuel Controller**. The topics covered include: Generator Operation; Synchronization; Power Loading; Idling and Shutdown; and Online Droop Testing.
***Prerequisites: GTC-01 Gas Turbine Fuel Control***

## PRT-01: EXPANDER PRT CONTROL

**INDUSTRY: DOWNSTREAM, MIDSTREAM**
**OPERATIONAL ROLES: O – M – E**
**4 HOURS**

This course explains the purpose, and functionality of the Expander Power Recovery Train (PRT) Controller. The topics covered include: **PRT Operation** (start-up/shutdown, load-sharing/ load-balancing, operating states, control modes, communication failure sources, hard manual); **Calculated Variables** (expander power, mass flow rate); **Control Functions** (PID Algorithm, load-sharing/load-balancing, alternate control loops, limiting control, fallback strategies), and **PRT Output Variables.**
***Prerequisites: None***

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## QC-01: QUENCH CONTROL

**INDUSTRY: DOWNSTREAM, MIDSTREAM**
**OPERATIONAL ROLES: O – M – E**
**1 HOUR**

This course explains the purpose, functionality, and operation of the Quench Controller. The topics covered include: **Quench Setpoint** (saturation point, offset); **Quench Control** (loop decoupling, automatic sequencing, operating states, control modes, communication failure sources, limiting control, fallback strategies); and **Operator Interface**.

***Prerequisites: None***

## STC-01: STEAM TURBINE SPEED CONTROLLER

**INDUSTRY: DOWNSTREAM, MIDSTREAM, INDUSTRIAL, PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**3 HOURS**

This course covers the purpose, functionality, and operation of steam turbine speed control using the CCC Speed Controller. The topics covered include: **Steam Turbine Classifications** (mechanical design, steam system); **Speed Measurement** (sensor function, magnetic pickup classifications); **Overspeed Prevention** (requirements, causes of overspeed, methods of prevention); and **Speed Control Algorithms** (break-away control, idle speeds (warm-up), critical speed avoidance, start-up/shut-down sequencing, tuning characterization) and Operator Interface.

***Prerequisites: None***

## UI-01: TRAINVIEW HMI OPERATION

**INDUSTRY: ALL**
**OPERATIONAL ROLES: O – M – E**
**1 HOUR**

This course covers the essential features, functionality, and navigation of the TrainView HMI. The topics covered include: **Control System Diagram (CSD)** (system information); **Compressor Map** (scaling, trace, properties); **Controller Faceplates** (controller operation); **Trends** (navigation, scaling, signal management, diagnostics, exporting archived data); and **Alarms and Events** (management, navigation).

***Prerequisites: None***

## UTC-01: UTILITY TURBINE CONTROL APPLICATIONS

**INDUSTRY: PIPELINE & POWER GENERATION**
**OPERATIONAL ROLES: O – M – E**
**6 HOURS**

This course covers Utility Turbine Control Functions. The topics covered include: Load Control Functions (PID algorithm, load control, speed simulation, start-up sequence); Power Load Unbalance Function (applications and interactions, communication); Intercept Valve Control Function (flow demand control, rate limiter fallbacks, valve management tracking, output compensation); and Valve Management Function (flow demand compensation, valve sequencing, valve characterizing, emergency shut-down tracking, communication).

***Prerequisites: STC-01 Steam Turbine Speed Controller***

# Expanded Curriculum

## Platform-Specific Instructor-Led (ILT) & Online (OLT) courses

## SERIES 3+/++ (ILT)

### DL-01: SERIES 3+ DUAL-LOOP CONTROLLER OPERATION

**OPERATIONAL ROLES: O – M – E**
**11 HOURS**

This course focuses on the combined anti-surge and performance functionality of the dual-loop controller. The main topics for anti-surge control include: **Compressor Systems and Classifications**, including Positive Displacement (Reciprocating, Screw, lobe) and Rotating (Centrifugal, Axial), **Compressor Surge; Surge Phenomenon** (system resistance, flow reversal, causes of surge, and consequences of surge); **Surge Control** (compressor maps, reduced coordinates and invariant coordinate system, surge control line and PI closed-loop control, derivative response and Adaptive Gain, safety margin, Recycle Trip Line and open loop control, derivative Recycle Trip, Safety On Line, surge detection techniques, limiting, Manual Override, decoupling of anti-surge control loop interactions, fallback strategies); and **Antisurge Controller Operator Interface**, as well as various platform-specific topics.

***Prerequisites: ASC-01 Compressor Anti-Surge Controller Operation and PFC-01 Compressor Performance Controller Operation***

### EAS-01: EMERGENCY ANTISURGE STATION

**OPERATIONAL ROLES: O – M – E**
**0.5 HOUR**

This course **covers the functionality of the Emergency Antisurge Station** including use as a Surge Detection Station, an Auto Manual Station, and a Manual Loading Station.

***Prerequisites: ASC-01 Compressor Anti-Surge Controller Operation***

### RCS-01: REDUNDANT CONTROL SELECTOR

**OPERATIONAL ROLES: O – M – E**
**0.25 HOUR**

This course **explains the redundant control selector functionality** including the routing of controller and transmitter signals and the automatic and manual switching between active and backup controllers.

***Prerequisites: None***

### S3-MN: SERIES 3+/++ MAINTENANCE AND BASIC CONFIGURATION WITH HANDS-ON TRAINING

**OPERATIONAL ROLES: M – E**
**8 HOURS**

This day-long course addresses fundamental maintenance and configuration topics. The areas covered inlcude: **Hardware Overview** (front panel, engineering panel, back panel, power supplies, and CPU circuit board); **Diagnostic Test Procedures** (alarms, serial port communications, signal values, operator panel tests, and managing parameter sets); **Transmitter Maintenance; Series 3+ Configurator** (establishing computer

## SECTION 3: S3 & S4

communications, creating projects, parameter set organization, reading, writing, and comparing parameter sets, and downloading controller software); **Controller Change-out** (replace failed controller with spare); and **Trouble-shooting** (power problems, front/engineering panel problems, analog input and output problems, discrete input and output problems, and communication problems).
***Prerequisites: Applicable core courses in the areas of specialization that are in the plant/ facility***

### TT-03: TRAINTOOLS ENGINEERING UTILITIES INTRODUCTION (SERIES 3+/++)

**OPERATIONAL ROLES: M – E**
**4 HOURS**
This introduction to Engineering Utilities covers the Series 3+/++ Configurator, Fast Recorder, and Alarm Monitor
***Prerequisites: None***

# SERIES 4 (ILT)

### S4-MN: SERIES 4 MAINTENANCE AND BASIC CONFIGURATION WITH HANDS-ON TRAINING

**OPERATIONAL ROLES: M – E**
**8 HOURS**
This day-long course addresses six areas of fundamental maintenance and configuration topics. The course begins with an **Introduction to Series 4**, including System Architecture, Physical Implementation, Application Function Modules (AFM), Total Train Control, and System Hardware Components. Next, the F**ault Tolerant Operating System (FTOS)** is examined (including: AFM Databases, Understanding Configuration of I/O, From LTOP to FTA, FTOS versions, I/O Drivers, Communications, External Communication, and Fault Tolerant), and the **FTOS Parameter Configuration** section expands on that knowledge (including: Alarm Configuration, Configuration and Topology Settings, I/O Config, EIOM Configuration, MODBUS Configuration, Pass-Through Communication, Serial Port Configuration, and Parameter Transfer). **Routine Operation and Maintenance Functions** are explored (System Alarm and Status Monitoring, A Procedure for Viewing and Clearing Alarms, Resolving Specific Alarms, Alarm Code Tables, Accessing Alarm and Status Functions, and Switching Active Card to Check for Latent Failures) as well as proper methods for **Handling Non-Routine Cases** and Failures (Basic On-Site Troubleshooting Techniques and Advanced On-Site Trouble shooting Techniques). The course closes with learners practicing **On-line Module Replacement** (Replacement of OIM's and OICM's, Replacement of Simplex AFM's, and Updated Replacement of FT AFM's & LSAM).
***Prerequisites: Applicable core courses in the areas of specialization that are in the plant/ facility***

### TT-04: TRAINTOOLS ENGINEERING UTILITIES INTRODUCTION (SERIES 4)

**OPERATIONAL ROLES: M – E**
**4 HOURS**
This introduction to Engineering Utilities covers the Series 4 Configurator, Fast Recorder, and Alarm Monitor.
***Prerequisites: None***

# SERIES 5 (ILT)

## DSD-01: DSD VALVE POSITIONING APPLICATIONS

**OPERATIONAL ROLES: M – E**
**4 HOURS**

Course delves into the DSD Positioning System, including Digital Servo Drive Features and DSD Configuration.

***Prerequisites: STC-01 Steam Turbine Speed Controller or GTC-01 Gas Turbine Fuel Control***

## LC-05: LOGIC CONTROL PROGRAMS

**OPERATIONAL ROLES: E**
**4 HOURS**

This course is an introduction to the procedures for creating and editing custom logic functions in the Structured Text or Function Block Diagram (FBD) languages. Hands-on exercises will include writing, compiling, downloading, and testing logic.

***Prerequisites: PB-05 TrainTools Project Builder***

## S5-CNTRL: RELIANT OR VANGUARD SIMPLEX/DUPLEX SYSTEM OVERVIEW

**OPERATIONAL ROLES: M – E**
**4 HOURS**

This in-depth course analyzes the various elements of the **Reliant and Vanguard Simplex/Duplex systems**. The course begins with System Hardware Components, Review of the Serial Communication Network, Ethernet Communication, TrainLink Communication, Modbus Communication, and Software Architecture. Students then work with the CCC Configurator program (including how to save and retrieve a layout, Get Diagnostics, Self-learning concept, Read/Write parameter snapshot, Compare parameter snapshots, Edit configuration including NTP configuration, Alarm Monitor, Fast Recorder, and Duplex Supervisor). The course will include the Hot Swap Concept, Healthy States, Healthy State During Faults and Safety Action, Critical Analog Output Failure Mode, and Redundant Output Switching. The course then moves into TrainView, AE Servers, Archival Database (ArcCom) and Export Programs, Check the Local Controller LED Indicators, Replacing Faulty Component, and Returning the System Back to the Normal Operating State, taking backups and recovery. The course will also cover building and testing a sample project using Project Builder.

***Prerequisites: None***

## S5-MN: SERIES 5 MAINTENANCE AND BASIC CONFIGURATION WITH HANDS-ON TRAINING

**OPERATIONAL ROLES: M – E**
**8 HOURS**

This day-long course addresses six areas of fundamental maintenance and configuration topics. The course begins with the **Series 5 Configurator Program (TrainTools)**. This segment analyzes TrainTools elements, including: Adding a Controller to the Controller List, Removing a Controller from the Controller List, Additional Shortcut Menu Commands, Program Version, Program Options, On-Line Program Help, Watch List Configuration Files, Configurator Main Screen, Configurator Toolbar, Status Bar, Opening and Saving Snapshot Files, Reading Parameter Snapshots, Reading Full Snapshot (Menu or Toolbar), Reading Partial Snapshot (Shortcut Menu), Writing Parameter Snapshots, Writing Full Snapshot, Writing Partial Snapshot, Comparing Parameter Snapshots, and Get Diagnostics. The

## SECTION 3: S5 & PRODIGY

course then covers the **Fast Recorder and Alarm Monitor**, before moving into **Maintenance Strategies**, including, Controller Change-Out Procedure, and Transmitter Change-Out Procedure. Students then close with H**ands-On experience** with the Simulator and Configurator.

**Duplex courses include** an additional segment on **Duplex Component Replacement**, which includes additional topics covering: Replacement of Chassis, Chassis Cards and Transition Modules; Power Supplies, & Components; FTA Assembly Replacement; and Local CM Replacement.
***Prerequisites: Applicable core courses in the areas of specialization that are in the plant/facility and S5 CNTRL Reliant or Vanguard Simplex/Duplex System Overview***

### PB-05: TRAINTOOLS PROJECT BUILDER

OPERATIONAL ROLES: M – E
4 HOURS
Course covers **Control System Engineering fundamentals**, including: Project Database, Project Engineering Programs, Project Security, Backups and Revisions, Revision Information, Project Revision Management, Saving Backups and Revisions, Restoring Backups and Revisions, Importing Projects, and Building a sample project.
***Prerequisites: None***

### TT-05: TRAINTOOLS ENGINEERING UTILITIES INTRODUCTION (SERIES 5)

OPERATIONAL ROLES: M – E
4 HOURS
This introduction to Engineering Utilities covers the Series 5 Configurator, Fast Recorder, and Alarm Monitor.
***Prerequisites: None***

## PRODIGY (ILT)

### S6-CNTRL: PRODIGY SYSTEM OVERVIEW

OPERATIONAL ROLES: O – M – E
2 HOURS
The course introduces and familiarizes Prodigy System components, including Software Architecture, Control Application Software, Hardware introduction, and System Integration.
***Prerequisites: None***

### LC-06: PRODIGY LOGIC CONTROL PROGRAMS

OPERATIONAL ROLES: E
8 HOURS
Coursework covers basic knowledge of custom logic implementation, including: How to create a function; make a connection to the inputs and outputs, and connections to other functions; and how to create status, configuration parameters, alarms and events.
***Prerequisites: PB-06 TrainTools Maker Pro/CODESYS Project Builder***

### S6-MN: PRODIGY MAINTENANCE AND BASIC CONFIGURATION WITH HANDS-ON TRAINING

OPERATIONAL ROLES: M – E
12 HOURS
This course addresses key areas of fundamental maintenance and configuration topics on the Prodigy platform, including: **Hardware overview**, with an introduction to CCC part numbers of Prodigy components; **Connections** , which covers TCP/IP, Modbus, and TrainLink protocols connections, as well as making configurations and

testing; and **Backup and Restore**, which includes troubleshooting and replacement procedures.
***Prerequisites: Applicable core courses in the areas of specialization that are in the plant/facility and S6 CNTRL Prodigy System Overview***

### PB-06: TRAINTOOLS MAKER PRO/CODESYS PROJECT BUILDER

**OPERATIONAL ROLES: E**
**4 HOURS**
This course allows the student to build a sample project, practice Project Editing, and work with the Modbus list.
***Prerequisites: None***

### TT-06: TRAINTOOLS ENGINEERING UTILITIES INTRODUCTION (PRODIGY)

**OPERATIONAL ROLES: E**
**4 HOURS**
This course introduces the **CCC Configurator**, including **Fast Recorder and Alarm Monitor**. The students then gain valuable experience, working **Hands-On with the Configurator** through the following topics: Adding a Controller, Program Version, Directories Page, On-Line Program Help, Parameter Snapshot Files, Watch List Configuration Files, Comparing Parameter Snapshots, Get Diagnostics, Fast Recorder, Alarm resolution, Global and application parameters, and Card Replacement.
***Prerequisites: None***

## ADVANCED (ILT)

### CPI-201: COMPRESSOR PERFORMANCE IMPROVEMENTS

**OPERATIONAL ROLES: O – M – E**
**2 HOURS**
This course explains the general performance improvements that can be made to CCC controlled compressor trains that have Antisurge, Performance and optionally Speed/Fuel Control systems. Topics include: understanding compressor resistance/performance curves, understanding compressor mechanical wear, benefits of surge testing and tuning, control interactions of the antisurge and performance control elements, loop decoupling, antisurge control final element impacts (surge control valve positioner accuracy & boosters).
***Prerequisites: None***

### FDI-201: FIELD DEVICE INSTALLATION BEST PRACTICES

**OPERATIONAL ROLES: O – M – E**
**2 HOURS**
This course covers the recommended installation practices for field devices. Topics include: **Piping Arrangements** (learn recommended piping arrangements and appropriate equipment locations and usage), **Valve Selection** (recommended anti-surge valve characteristics and selection criteria); and **Instrumentation** (best practices for selection and use of controller instrumentation for anti-surge, performance, and speed controllers).
***Prerequisites: ASC-01 Compressor Anti-Surge Controller Operation***

# SECTION 3: ADVANCED & ONLINE

### FCE-201: FINAL CONTROL ELEMENTS & OUTPUT VARIABLES

**OPERATIONAL ROLES: O – M – E**
**1 HOUR**

The course considers Valve Compensation, including the Valve Flow Characterizer, Valve Dead-Band Compensation, Output Clamps, Remote Low Clamping, Tight Shutoff, and Antisurge Valve Position Feedback.

***Prerequisites: None***

### VSS-201: VALVE SIZING AND SELECTION

**OPERATIONAL ROLES: O – M – E**
**8 HOURS**

This one-day course explains CCC's basic methods for sizing anti-surge valves for single section compressors and multi-section valve-sharing applications. The topics covered include: **ISA S75.01 Control Valve Sizing Equations** (understand each of the gas, valve, and piping parameters used in the equation and how to apply them); **Valve Specifications** (how to extract necessary information from a valve specification); **Compressor Requirements** (how to relate the valve equation gas conditions to compressor performance, resulting in a proper control system dynamic response to process disturbances); **Conclusions** (criteria used for determining an adequate valve capacity); and **Cold Recycle Valves** (methods and sizing criteria for cold recycle valves).

***Prerequisites: None***

# ONLINE (OLT)

**NOTE: ALL ONLINE TRAINING MODULES ARE DESIGNED TO BE COMPLETED IN APPROXIMATELY 1 HOUR.**

### CMS-01: COMPRESSOR MAPS AND SURGE

**OPERATIONAL ROLES: O – M – E**

Explore the dynamic relationship between compressor operation and surge via CCC's ground-breaking Compressor Map. This course prepares the learner to continue through the rest of our Online Training curriculum, as they dig deeper into the theories of advanced anti-surge, performance and speed control.

***Prerequisites: None***

### BAS-01: BASIC ANTISURGE THEORY 1

**OPERATIONAL ROLES: O – M – E**

Examine the correlation between the Surge Control Line and the PI response, including factors which influence the safety margin, how CCC calculates Deviation, and the advantages of operating closer to the Surge Limit Line.

***Prerequisites: CMS-01 Compressor Maps and Surge***

### BAS-02: BASIC ANTISURGE THEORY 2

**OPERATIONAL ROLES: O – M – E**

Study the CCC Antisurge Controller Recycle Trip response (RT) for medium and large process disturbances; learn how and why RT is necessary to protect the compressor, operator notification methods and additional benefits.

***Prerequisites: BAS-01 Basic Antisurge Theory 1***

# SECTION 3: ONLINE

## BAS-03: BASIC ANTISURGE THEORY 3

**OPERATIONAL ROLES: O – M – E**

Learn how the CCC "Safety On" response detects a surge event, breaks the surge cycle and stabilizes the process, including operator notification and next steps.

***Prerequisites: BAS-02 Basic Antisurge Theory 2***

## BPF-01: BASIC PERFORMANCE CONTROL THEORY 1

**OPERATIONAL ROLES: O – M – E**

An introduction to the CCC Performance Controller, describing the types of process input variables and control elements, how the PID loop keeps the process stable, and impacts on the operating point.

***Prerequisites: CMS-01 Compressor Maps and Surge***

## BPF-02: BASIC PERFORMANCE CONTROL THEORY 2

**OPERATIONAL ROLES: O – M – E**

Explore how CCC's proprietary algorithms share and balance compressor system loads between multiple compressors, controllers, and networks to increase efficiency and enhance protection.

***Prerequisites: BPF-01 Basic Performance Control Theory 1***

## BST-01: BASIC STEAM TURBINE CONTROL THEORY 1

**OPERATIONAL ROLES: O – M – E**

Determine types of turbines CCC can control using the Speed controller, explore signal paths from turbine shaft to steam actuation system, and survey different usable set points.

***Prerequisites: CMS-01 Compressor Maps and Surge***

## BST-02: BASIC STEAM TURBINE CONTROL THEORY 2

**OPERATIONAL ROLES: O – M – E**

Dig deeper into how the speed controller sequences the entire steam turbine process, from start to shut-down, and how the CCC controller prevents turbine overspeed.

***Prerequisites: BST-01 Basic Steam Turbine Control Theory 1***

## BEX-01: BASIC EXTRACTION CONTROL THEORY

**OPERATIONAL ROLES: O – M – E**

Expands upon how the steam turbine speed controller is paired by CCC with the extraction turbine to optimize variables to best meet control and limiting objectives.

***Prerequisites: BST-02: Basic Steam Turbine Control Theory 2***

## TCE-01: TRANSMITTER AND CONTROL ELEMENTS

**OPERATIONAL ROLES: E**

Discover key installation practices from decades of field experience for improved performance & efficiency with your CCC control system and instrumentation equipment.

***Prerequisites: CMS-01 Compressor Maps and Surge***

## PBP-01: PIPING AND FIELD INSTRUMENTATION BEST PRACTICES

**OPERATIONAL ROLES: M – E**

Understand how transmitters and final control elements are best matched to various conditions and equipment arrangements, including instrumentation selection and location criteria.

***Prerequisites: CMS-01 Compressor Maps and Surge***

# 2018 CCC Regional Training Schedule

## USA & North America

| Dates | Location | Course Topics |
|---|---|---|
| **Feb 6-9** | Houston, Texas | Series 3++ |
| **Feb 20-23** | Houston, Texas | ** Series 5/Prodigy Dual Training |
| **Mar 20-23** | Cleveland, Ohio | Series 3++ |
| **June 5-8** | Long Beach, California | **Series 3++/Series 5 Dual Training |
| **T.B.D.** | Edmonton/Albert, Canada | Series 3++ |
| **Sep 11-14** | Des Moines, Iowa | Series 3++ |
| **Sep 18-21** | Des Moines, Iowa | Prodigy |
| **Oct 23-26** | Lake Charles, Louisiana | **Series 3++/Series 5 Dual Training |

**** Participants attend the course for their specific platform on days 2 & 3.**

## Europe & Africa

| Dates | Location | Course Topics |
|---|---|---|
| **Apr 10-13** | Milan, Italy | **Series 3++/Series 5 Dual Training |
| **May 15-18** | Germany, *Köln-Bonn Area* | **Series 3++/Series 5 Dual Training |
| **Jun 5-8** | Aberdeen, UK | Series 3++ |
| **Nov 13-16** | Amsterdam, The Netherlands | Series 3++ |
| **Nov 19-22** | Amsterdam, The Netherlands | Prodigy |

**** Participants attend the course for their specific platform on days 2 & 3.**

## Middle East (These Regional Trainings are special accelerated courses)

| Dates | Location | Course Topics |
|---|---|---|
| **Apr 29-30** | Dubai, UAE | Series 3++ |
| **May 1-3** | Dubai, UAE | Series 5 |
| **Sep 23-24** | Dubai, UAE | Series 3++ |
| **Sep 25-27** | Dubai, UAE | Series 5 |

## Asia Pacific

| Dates | Location | Course Topics |
|---|---|---|
| **Mar 12-15** | Kuala Lumpur, Malaysia | Series 3++ |
| **May 21-24** | Perth, Western Australia | Series 5 |
| **Sep 3-6** | Kuala Lumpur, Malaysia | Series 3++ |

**"Early Bird" Registrations (30 days or more in advance) receive a 10% discount.**

**Each Regional Training consists of three parts: Day 1 covers surge control and operations; Days 2 and 3 are a CCC-platform specific maintenance course; and Day 4 is a one-day engineering, surge testing, and tuning course. You can attend one, two or all three parts. *Locations and dates are subject to change.***

To see the latest schedule and register for regional training, visit CCC Learning Center at https://learning.cccglobal.com or email us at training@cccglobal.com