<u>**DCS450:**</u>
**Function Blocks for APC Implementation in DCS or PLC**

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| **Duration:** | **3 Day Classroom or 20 hours Online** |
| **Audience:** | **Process Control Engineers, DCS Maintenance Technicians, Instrument Engineers** |
| **Prerequisites:** | **Some control room exposure is desirable, but not required.** |
| **Course Material:** | **PowerPoint Slides, DCS screens, Industrial Data, Calculation Procedures and Data Analysis** |

**Course Description and Objectives:**

This course teaches you how to conceive, design and implement process control schemes inside a DCS or even a PLC. There are many DCS and PLC vendors and this course builds skills that are useful for all types and models of any DCS or PLC. Whether you work in a chemical, petrochemical, pharmaceutical, polymer, electric power, paper or really any manufacturing process, this course will teach you the skills to come up with new advanced process control ideas and schemes. The knowledge will also help in the design of controls for safer and smoother plant operation and to run the plant better, smoother and with reduced chance of mistakes, shutdowns and human error. The knowledge will help to maximize production rates, minimize utilities, speed up product grade transitions and improve key performance indicators. In an era of a lot of approaching retirees in industry and the entry of new personnel in the control room, this course is a must for any process control engineer, DCS engineer, PLC engineer or process control technician.

**Learning Outcomes:**

This course teaches the main components of a DCS and even a PLC. It describes the DCS and PLC architecture. It explains all DCS and PLC control functions. It teaches standard and custom DCS logic blocks. It covers batch, sequential, continuous and semi-batch control schemes. It teaches how to design and implement control schemes. It explains how to design and implement various standard function blocks available in most DCSs and PLCs. The various standard function blocks are listed below. With knowledge from PID100, APC200, this course is a perfect continuation to build the process control skills and knowledge and be more in the realm of what is available in DCSs and PLCs. After completion of this course, the student will be ready to build new APC tags inside a DCS or PLC. The following topics are covered in this course:

- Process Control Nomenclature and Basic Definitions
- SAMA Standard Diagrams and Symbols
- PID Control
- PID Related Peripheral Algorithms
- PIDFF - PID with Feedforward
- Transfer Function
- Nonlinearity
- SMOOTH Filtering for Noisy Signals
- Dead Time and TRANSPORT Algorithm
- LEADLAG Algorithm
- Monitoring Algorithms
- Boolean Logic Algorithms
- Timers and Counters
- Input and Output Algorithms
- Multiple Signal Algorithms
- Calculation Algorithms and Programs

- Smith PREDICTOR Algorithm
- PID Tuning Procedures
- Procedures for Testing, Commissioning & Troubleshooting
- DCS/PLC algorithms covered:

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|---|---|---|
| PID | AND | COMPARE |
| MASTATION | OR | TRANSFER |
| MAMODE | NOT | SELECTOR |
| BALANCER | XOR | MEDIANSEL |
| FUNCTION | FLIPFLOP | 2XSELECT |
| FIELD | PULSECNT | GAINBIAS |
| FACEPLATE | COUNTER | SUM |
| KEYBOARD | ONDELAY | INCREMENTAL SUMMER |
| SETPOINT | OFFDELAY | MULTIPLY |
| PIDFF | ONESHOT | DIVIDE |
| SMOOTH | RESETSUM | RATIO CONTROL |
| TRANSPORT | TOTALIZER | RAMP AND SOAK |
| LEADLAG | AVALGEN | SQUAREROOT |
| LOWMON | DVALGEN | CALCBLOCK |
| HIGHMON | ASSIGN | CALCBLOCKD |
| HIGHLOWMON | PACK16 | CALCULATION PROGRAMS |
| QUALITYMON | UNPACK16 | POLYNOMIAL |
| DBEQUALS | TRANSLATOR | RUNAVERAGE |
| RATECHANGE | FLOW COMPENSATION | QAVERAGE |
| RATELIMIT | LOSELECT | DIGCOUNT |
| RATEMON | HISELECT | PREDICTOR |