Training Opportunities for Controls Adjustments and Programming

Energy Manager and Energy Specialist Education Series
November 27 2014 (1:00 – 1:40 pm)
00:01 to 23:59

- Schedules
- Setpoints
- Sequences
Why DDC Training?

• Energy Managers and building operating staff can have a **significant impact** on energy use through DDC scheduling, programming and overrides

• Training or background on controls is often limited

• Controls vendors are contracted for small changes that could be done in-house

• There is a need in our industry for **better training**
Purpose of This Session and Agenda

1. Share what courses are available
2. Provide examples of DDC concepts found in training sources
3. Handout with links for your follow up
# What’s Available?

**DDC Training**
- ASHRAE eLearning
- BOMA e-Energy Training
- Association of Energy Engineers CEM and “24/7” Online University
- BCIT Sustainable Energy Management Advanced Certificate (SEMAC)
- NRCan Custom Dollars to Sense Workshop
- Schneider Electric Energy University
- DDC Online

**Vendor Specific Training**
- ESC Automation
- Reliable Controls
- Johnson Controls
- Honeywell
- Automated Logic
- CopperTree (and other FDD providers)
Overview

Target Audience:
Individuals who need to update their technical knowledge, or meet requirements for licensing and certification, and for companies that seek to provide engineering staff training

• Delivered **online** using exercises to test and apply users' knowledge with instant feedback

• At least **13 different courses** on control systems
<table>
<thead>
<tr>
<th>Course Package</th>
<th>Training Level</th>
<th>Subject</th>
<th>PDHs</th>
<th>Price</th>
<th>ASHRAE</th>
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<td></td>
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<td>47.0</td>
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<td>9 Control Diagrams and Sequences Course</td>
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<td>12 DDC Specification, Installation and Commissioning Course</td>
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<td>4 Integrated Design Course</td>
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# Most Comprehensive

## HVAC Control Systems Course Package

<table>
<thead>
<tr>
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<th>Course Name</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to HVAC Control Systems Course</td>
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<td>DDC Introduction to Hardware and Software Course</td>
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<tr>
<td>11</td>
<td>DDC Networks and Protocols Package Course</td>
</tr>
<tr>
<td>12</td>
<td>DDC Specification, Installation and Commissioning Course</td>
</tr>
</tbody>
</table>
Building Controls

• **Cost:**
  o Course subscriptions are $50
  o Course package subscriptions are $259 for 12
  o Library subscriptions available for multiple packages

• **Time requirements:**
  o Depends on course (ranges from 1.5 – 7.5 hours per course)
  o Controls courses offer over 50 PDHs combined (approximately 50 hours to complete)
Additional Information

- Continuing Education (CE) hours earned from courses may be applied toward maintenance of state-licensed professionals and LEED credentials.

- Training is open to all with a discount for ASHRAE members and for larger groups.

- All ASHRAE eLearning training is approved for PDHs and CEUs.

http://elearning.ashrae.org/
BOMA eEnergy Training for Building Operations
Overview

Target Audience:
An energy management course for building operators and managers of commercial and institutional buildings

- Delivered **online** in a self-learning format
- Highlights **operational** and **capital project opportunities**
- Support available throughout the course
Building Controls

- One of the 11 modules is dedicated to Building Controls
- Includes 40 slides, interactive activities and a chapter quiz
- **Time requirements**: ~ 4-5 hours of 40 hour course
- **Cost**: $750 for all modules (may be available as a stand alone module in 2015)
The control loop is made up by measuring the data, processing the data, and causing a response or action.
Additional Info

- Earn competency credits towards the Energy Management and Controls course as part of the BOMI SMA/SMT program
- The course also qualifies for BOMI Continuing Education Credits

http://www.bomalearning.com/home2
The Association of Energy Engineers

#1 – **Certification** → Certified Energy Manager (CEM)
#2 – **Courses** → “24-7” Online University
Overview

Target Audience:
Professionals seeking a detailed program of instruction covering the technical, economic and regulatory aspects of energy management

- Available in various Canadian cities (5 day course)
- Available online, fast tracked (2 day course)
Controls Content

**Time Requirements:**
Five day course – day 4 offers **2 dedicated hours** to controls and BAS systems

**Cost:** $2,550 (regular fee + certificate/exam fee)
Controls Content

- Many subjects throughout the 5 day course interact with building controls
  - Lighting, HVAC, Boilers, etc.

- Specific subjects covered:
  - **Digital vs. analog** terminology (DI, AI, DO, AO)
  - GUIs, interfaces, BACNET, pneumatic, electric, DDC systems
  - Proportional, integral and derivative algorithms
  - **BAS Strategies**: night setback, optimal start/stop, duty cycling, “reset" strategies (hot/cold deck, hot water, chilled water, static pressure)
“24-7” Online University
Overview

Target Audience:
Professionals seeking training and/or CEUs/PDHs for maintaining professional certification

- Professional courses are accessed online for up to 30 days after they are purchased
- Upon successful completion of a course exam, students earn a certificate of completion
- Two controls courses available
  - Building Automation and Control System Review
  - HVAC Fundamentals: Control Systems
Overview of Course #1 – Building Automation and Control System Review

- Review course for the Building Automation and Control Systems section of the CEM test
- In depth review of material from CEM Training Course
- Includes supplementary material not covered in CEM Course

Additional Information:
- Includes practice problems and examples
- Includes Practice Test and Proficiency Test
- 0.8 CEU or 8 PDH

http://www.energyvortex.com/seminars/seminar_description.cfm?id=83
Building Automation & Control Systems Review for the CEM Exam
Cost: $385.00
Instructor: Barney Capehart, Phd, CEM
Click here for a description of the seminar.

Topics Covered
• Why are we interested in control systems
• Brief history of automatic control systems
• What is a control system
• Manual control systems and automatic control systems
• Open loop and closed loop control systems
• Components in a closed loop control system
• Control system terminology
• Basic control system technologies
• Pneumatic control systems
• Electric or electronic control systems
• Digital control systems
• Sensors
• Controllers
• Actuators
Overview of Course #2 – HVAC Fundamentals: Control Systems (module 10)

- 1 of 10 HVAC Fundamentals courses offered by AEE
- **Time requirements:** ~ 1 hour
- **Cost:** $100

**Controls Topics Covered:**
- HVAC control systems
- Pneumatic control systems – main air, types of pneumatic systems
- Controllers – normally open and normally closed
- Controlled devices – dampers and actuators, valves and actuators
- DDC systems – operations, benefits, direct control, precise control, P, PI and PID

http://www.energyvortex.com/seminars/seminar_description.cfm?id=30
Sustainable Energy Management Advanced Certificate (SEMAC)
Overview

Target Audience:
Those interested in expanding their knowledge and initiatives into sustainable energy management, or are interested in changing careers

• Uses lectures and self-guided learning as the primary method to develop the knowledge and applied skills

• Delivered part time and online (100% online Fall 2014)
Building Controls

- The SEMAC program consists of nine courses
- Courses can be taken in sequence as part of SEMAC program, or taken as “one-off classes” (with permission)
- Students earn an Advanced Certificate upon completion of full 16-month course
- **Two courses** are offered with time dedicated to controls fundamentals and controls strategies
  - Energy Systems
  - Energy Audit
Energy Systems (CESA 5300)

- **Time to complete:**
  - 60 hour course offered over 9 weeks
  - ~ 30% of course time dedicated to controls and BAS

- **Cost:** $837.89

- Course covers fundamentals and control strategies for a building’s lighting, heating, cooling, and ventilation systems

- Students will be able to:
  
  *Outline the various automation and control technology for both building systems and industrial systems*

http://www.bcit.ca/study/courses/cesa5300
Energy Audit (CESA 5600)

- **Time to complete:**
  - 36 hour course offered over 6 weeks
  - ~30% of course time dedicated to controls and BAS

- **Cost:** $551.78

- Students will learn to identify and interpret energy savings opportunities including applying control sequences according to best practices

http://www.bcit.ca/study/courses/cesa5600
NRCan Custom Dollars to $ense Workshop
Overview

Target Audience:
Workshop tailored to building operators, energy managers and energy specialists

- **In-person workshop**, held at your site
- Focuses on identifying opportunities to save on energy use and reduce energy costs
- Examples of real world problems and solutions
- Utilizes interactive tools and activities
Building Controls

- Course includes a session on DDC controls developed for FortisBC on Thermal Opportunities.
- Course can be adapted into full day session on DDC controls with electrical opportunities included.
- **Time:** half day to full day
- **Cost:** ~$150-300 per attendee for class of 20
- **Topics Covered:** Controls basics, DDC strategies and DDC maintenance
Content

Control Basics:
Control components, loop types, action types (two-position, floating, modulating), output signals (proportional, proportional-integral, proportional-integral-derivative)

DDC Strategies:
HVAC – Supply air temperature reset, VAV zone isolation, unoccupied mode shutdown, demand control ventilation
Heating Plant – warm weather shutdown, boiler pump run time, boiler supply water reset

DDC Maintenance:
CO₂ sensor calibration, passing valves, performing end to ends

http://www.nrcan.gc.ca/energy/efficiency/industry/training-awareness/5469
Demand Control Ventilation

*Energy use is proportional to the area under the graph
Overview

Target Audience:
Those who need to identify, monitor and manage energy usage and find new ways to improve building efficiency

• Self paced, **online** format that is available on demand
• Over 200 vendor-neutral courses
• **High level** content
Building Controls

- 8 building controls courses are available
- **Cost**: Free
- **Time Requirements**: ~15 to 50 minutes per course with optional tests
  
  ~ 3 hours to complete all courses
Building Controls I: An Introduction to Building Controls

Building Controls II: Control Sensors

Building Controls III: Introduction to Control Loops

Building Controls IV: Two Position and Floating Responses

Building Controls V: Proportional and PID Responses

Building Controls VI: When to Use Each Response

Building Controls VII: Interactive Illustration of PID Response

Building Controls VIII: Controllers and Controlled Devices
Course Assessment

Number of questions: 10

Question 5

Direct sunlight on an outside air temperature sensor will give the controller a false sense of the actual ambient temperature when making decisions. For buildings located in the northern hemisphere, the _____ side of the building is the best place to locate the outside air temperature sensor.

- North
- South
- East
- West
Direct sunlight on an outside air temperature sensor will give the controller a false sense of the actual ambient temperature when making decisions. For buildings located in the northern hemisphere, the _____ side of the building is the best place to locate the outside air temperature sensor.

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- South
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- West
Additional Information

• Students can gain credit for continuing education credits as recognized by many professional associations and organizations, USGBC among them

• Building Controls courses are part of the recommended course list for those who wish to take the Professional Energy Manager (PEM) certification exam
  

Schneider University Home Page:

Overview

Target Audience:
DDC Online is a tool to help professionals make more informed decisions and increase their knowledge about DDC.

- Contains a generic guide
  - Basic introduction to DDC and terms
  - Detailed publication on input and output processes

- DDC information - manufacturer’s product list
  - Detailed listing of systems from national manufacturers
  - Generic framework of the various components and configurations used in current DDC systems
The Reliable Controls MACH-System

Operator Interfaces

Internet/IT Network
IP Protocol

Communication Interfaces

Primary Network
(Peer-to-Peer)

Primary Control Units

Supervisory Interface
(No I/O)

Secondary Network(s)
(Peer-to-Peer)

Secondary Control Units

Thin Client
Internet Explorer 5.5+

OWS
Windows PC
Running:
RC-Studio
RC-Toolkit
RC-Archive
RC-Webview

Windows 2008 Server
RC-Web View

http/IP

BACnet/IP

[BACnet/IP] [Ethernet @ 100MB]

125 main network
nodes/addresses
(2 million I/O max
configuration)]

MACH-
ProSys
MACH-
ProCom
MACH-
Global
MACH1
MACH2

[124 nodes/addresses
per subnetwork]

[BACnet/MSTP @ 76.8 kbps]
or [Reliable @ 76.8 kbps] over lEA-485

MACH-
Stat
MACH-
Zone
SMART-
Space
MACH-
Air

MACH-Stat
MACH-Stat ND
Space controller

MACH-Zone
Unitary
control application

SMART-Space
Space controller

MACH-AIR
VAV applications
Automated Logic: WebCTRL

Wireless Devices
Web-enabled cell phones, PDAs, etc.

Thin Clients
Internet Explorer

Enterprise System

Operator Interfaces

Internet/IT Network
[IP Protocol]

Communication Interfaces*
(Gateways, PC boards)
*Routers and Repeaters not shown.

Primary Network
(Peer-to-Peer)

Primary Control Units

Supervisory Interface
(No I/O)

Secondary Network(s)

Secondary Control Units

Web Server
PC with WebCTRL

BACnet over ARCNET @ 156 Kbps (primary)
BACnet over MS/TP @ 9.6 Kbps to 76.8 Kbps (alternate)

Maximum System Capacity:
19,000 controllers
Primary/secondary controllers: 100 per LAN
Content

- **Cost**: Free (accessed online)
- **Time requirements**: A few hours worth of reading material in the guide

http://www.ddc-online.org/default.html
Vendor Specific Training Opportunities
ESC Automation

Target Audience:
Building management staff who are ESC customers using Delta’s line of BACnet products and ORCAview software

• **Customized training** tailored to match the technical backgrounds and learning requirements of those who attend

• Training can be delivered at ESC training facilities in various cities across Western Canada (Surrey, Edmonton), or on-site
Course Takeaways From Prism Staff

Gained insight:
• ESC Training provided hands on experience on how the control system gets put together from scratch
• Learned industry best practices for writing and sequencing code.

Gained perspective:
• Training gave the opportunity to learn how these systems work from a ‘technician’s point of view’
• Interactive exercises provided insight into how different controls strategies affect mechanical systems.
Building Controls

Core Courses:
- ORCAview applications for building operators (2 day)
- Controls programming (1 day)
- ORCAview applications for energy management (2 day)

Advanced/Specialized Courses:
- Internet and DDC networks (1 day)
- Zone controller installation and programming (1 day)
- Graphics training (1 day)
- Delta controls applications for lighting management (1 day)

Cost: $300-400 for 1 day courses and $600 for 2 day courses

http://www.escautomation.com/resources/training
Reliable Controls

Target Audience:
Ideal for facility managers and **RC-Studio 2.0** operators who wish to derive maximum benefit from their **MACH-System** installations.

- Offered in US and Canadian cities (Toronto)
- Attendees should have some computer experience and have regular operation of an RC-Studio 2.0 workstation as part of their job description

**Time requirement:** 2 days  
**Cost:** ~ $920
Content

Day 1

08:30 – 09:00 Introduction to Reliable Controls
09:00 – 10:00 MACH-System Hardware, Architecture, Mnemonics
10:00 – 10:15 Break
10:15 – 11:00 MACH-System Software
11:00 – 12:00 Hard and Soft Points, Naming Conventions
12:00 – 12:30 Lunch
12:00 – 12:30 Intro. to RC-Studio, Worksheets, System List, Network Status
12:30 – 13:30 Exercise # 1, Working with a “Sequence of Operation” for a FC
13:30 – 14:00 Exercise # 2, Building the Database (Worksheets) for an FC
14:00 – 14:15 Break
14:15 – 15:00 Exercise # 3, Building the Database (Worksheets) for an FC
15:00 – 15:30 Control Basic Overview
15:30 – 16:00 Exercise # 4, Entering in Control Basic Programs
16:00 – 16:30 Exercise # 5, Backing Up, Delete and Restore Panel File

Day 2

08:30 - 09:45 Modulating Control and PID Controllers
09:45 – 10:00 Exercise # 6, IP connected Network Backup, Descriptors and Direct Access
10:00 – 10:15 Break
10:15 – 10:30 Exercise # 4, Entering in Control Basic programs (continuance)
10:30 – 11:00 Exercise # 7, Working with Control Basic Programs
11:00 – 12:00 Alarms Overview
12:00 – 12:40 Lunch Break
12:40 – 13:00 Exercise # 8, Working with alarms
13:00 – 13:45 Exercise # 9, SSL user interface device
13:45 – 14:00 Security Settings, File Management, Daily Tasks
14:00 – 14:15 Break
14:15 - 14:45 Reliable Graphic Guidelines
14:45 - 16:15 Exercise # 10, Annotate a Graphic
16:15 – 16:30 Evaluation
# Course Dates & Locations

<table>
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<tr>
<th>U.S. Dates:</th>
<th>Washington D.C., MD</th>
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<tbody>
<tr>
<td>November 10-11, 2014</td>
<td>Philadelphia, PA</td>
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<tr>
<td>November 13-14, 2014</td>
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<tr>
<td><strong>Canadian Dates:</strong></td>
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<tr>
<td>November 24-25, 2014</td>
<td>Toronto, ON</td>
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</table>

**NOTE:** Please contact your local Reliable Controls® authorized dealer for pricing information.

Target Audience:
Building owners, managers, operators, etc. who need a working knowledge of environmental and building systems

- Courses are focused on Johnson Controls’ Metasys Building Management System
- Basic operator training course and programming course held approximately every 9 months in Vancouver
- Many other courses available in the U.S.
Metasys system extended architecture for Building Engineers

Course #389 3.0 CEU

This course teaches building personnel how to make the most effective and efficient use of the features of a Metasys system extended architecture facility management system. This course contains additional topics not covered in the Metasys system extended architecture for Building Operators course.

Recommended Prerequisite: Fundamental understanding of Microsoft® Windows™

Course Duration: Monday–Friday
Class ends at 11:30 a.m. on Friday

$1695 per student

COURSE TOPICS

- Metasys system extended architecture Overview
- Help File System
- Basic Navigation of the System with the User Interface
- Commanding Objects
- Scheduling
- Setting Up Alarms
- Responding to Alarms
- Trending
- Totalization
- Graphics
- Setting Up Passwords
- User Views
- Audit Trails
- Sending Reports to Printers, Pagers, Emails, etc.
- Adding Inputs and Outputs to a Controller
- Reviewing Control Strategies
- Backing Up the Data
- Hands-on Labs
- Final Review
Other courses

- Other courses held throughout the U.S.

### BUILDING AUTOMATION SYSTEMS COURSES

<table>
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<th>Course Description</th>
<th>Duration</th>
<th>Days</th>
<th>Fee</th>
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<td>Metasys HVAC ASC Engineering</td>
<td>353</td>
<td>M-F</td>
<td>$1,695</td>
</tr>
<tr>
<td>Metasys HVAC ASC Operations/Troubleshooting</td>
<td>381</td>
<td>M-F</td>
<td>$1,695</td>
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<tr>
<td>Metasys DX-9100 Engineering</td>
<td>364</td>
<td>M-F</td>
<td>$1,805</td>
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<tr>
<td>Metasys DX-9100 Operations/Troubleshooting</td>
<td>365</td>
<td>Tu-Th</td>
<td>$1,395</td>
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<td>Metasys FEC Systems Engineering</td>
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<td>$1,395</td>
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<tr>
<td>Metasys FEC Operations/Troubleshooting</td>
<td>4703</td>
<td>Tu-Th</td>
<td>$1,395</td>
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<tr>
<td>Metasys FEC Custom Programming</td>
<td>4704</td>
<td>Tu-Th</td>
<td>$1,395</td>
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<tr>
<td>Metasys System Extended Architecture for Building Operators</td>
<td>388</td>
<td>M-W</td>
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<td>Metasys System Extended Architecture for Building Engineers</td>
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<tr>
<td>Metasys System Extended Architecture Engineering and Setup</td>
<td>391</td>
<td>M-F</td>
<td>$1,805</td>
</tr>
<tr>
<td>Metasys Extended Architecture Hardware and Troubleshooting</td>
<td>4718</td>
<td>M-F</td>
<td>$1,755</td>
</tr>
<tr>
<td>Metasys System Extended Architecture Advanced Engineering</td>
<td>397</td>
<td>Tu-Th</td>
<td>$1,395</td>
</tr>
<tr>
<td>Facility Explorer (FX) Supervisory Controllers Engineering and Setup</td>
<td>4701</td>
<td>M-F</td>
<td>$1,745</td>
</tr>
<tr>
<td>FX MSTP Field Controller Engineering</td>
<td>4714</td>
<td>M-F</td>
<td>$1,745</td>
</tr>
<tr>
<td>Facility Explorer (LX) Field Controllers Operations/Troubleshooting</td>
<td>4711</td>
<td>Tu-Th</td>
<td>$1,395</td>
</tr>
<tr>
<td>Metasys System Validated Environments (MVE) Operations</td>
<td>4713</td>
<td>Tu-W</td>
<td>$1,045</td>
</tr>
</tbody>
</table>


**Canada:** [http://www.johnsoncontrols.ca/content/ca/en/products/building_efficiency/service0/building_automation.html](http://www.johnsoncontrols.ca/content/ca/en/products/building_efficiency/service0/building_automation.html)
Target Audience:
Technical training courses to provide ACI & BCS contractors with a learning path to increase their technical skill-set in relation to Honeywell Building Automation products

- Training is available at Honeywell’s Training Centre in Minneapolis, MN
- Honeywell also offers on site training as part of each installation project
- Additional site specific training can also be requested
Honeywell Technical Training Program (HTTP)

Upcoming HTTP courses at the Honeywell Learning Center:

- Both are 3 day, hands on courses
- **Cost:** ~ $1,900
- **Included in cost:** Training materials, hotel accommodations, breakfast + lunch, on-site transportation
- Pre-requisite courses may be required

Automated Logic

Target Audience:
Non-technicians with some knowledge of HVAC systems who need to enhance their understanding of the more complex HVAC/DDC systems and processes.

• Training is instructor-led and students will receive textbook and other reference materials
• Local training is held at the Control Solutions (local representative) office located in Coquitlam in the spring and fall
• **Time requirements**: 4.5 days
• **Cost**: $2585
Course Content

Course: HVAC/DDC for non-technicians

Students can expect to gain an excellent working knowledge of the processes, terminology, and systems found in more sophisticated institutional HVAC systems

Main objectives:
- HVAC control fundamentals
- Air handling unit and systems
- Input and output devices
- Variable frequency drives
- DDC/mechanical system troubleshooting
- Field operations and trouble shooting
Additional Information

- Many other courses available covering Automated Logic products such as EIKON, WebCTRL, ViewBuilder
- Courses range from beginner to intermediate
- Many can be taken one on one training with a trainer or in a classroom setting

http://www.controlssolutions.ca/index.html
Fault Detection and Diagnostics (FDD)

CopperTree Analytics

- Offers weekly webinars on their Kaizen analytics engine for FDD

  - Introducing the CopperTree System 1 hour (every Thursday 10:30am)
  - CopperCube and Kaizen set-up: 1 hour (every Monday 10:30am)
  - Introduction to Kaizen: 1 hour (every Wednesday 10:30am)

- We expect further training opportunities in the near future from other FDD providers:
  - Schneider, IFCS Corporation, Cimetrix Inc., SClenergy, Siemens, Accenture, JCI, Skyfoundry
Wrap Up
Fact Sheets Available

Strategies for DDC Optimization

OVERVIEW

Building control systems, also called Direct Digital Control (DDC) Systems or Building Automation Systems (BAS), can be optimized to achieve low cost energy savings. The following list of ten strategies outlines commonly identified opportunities in building control systems. These strategies are all non-capital, operational measures that have relatively quick paybacks of less than three years.

http://prismengineering.com/resources/fact_sheets
# Summary of DDC Training Opportunities: Resources and Details

**Energy Manager and Energy Specialist Education Series**  
November 27, 2014

## DDC Training

<table>
<thead>
<tr>
<th>Target Audience</th>
<th>Content Overview</th>
<th>Costs</th>
<th>Time</th>
<th>Location</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASHRAE eLearning</td>
<td>At least 13 different courses on control systems. Course package topics include: HVAC control systems, DDC controls, and sustainable buildings.</td>
<td>$50 per course, $260 for HVAC package of 12</td>
<td>1.5 – 7.5 hours per course</td>
<td>Online</td>
<td><a href="http://elearning.ashrae.org/">http://elearning.ashrae.org/</a></td>
</tr>
<tr>
<td>BOMA</td>
<td>Building operators and managers of commercial and institutional buildings. One of 11 main modules is dedicated to Building Controls. This module includes 40 slides, interactive activities and a chapter quiz.</td>
<td>$750 for all modules; Building Controls module may be available as a stand-alone module in 2015</td>
<td>~ ½ day</td>
<td>Online</td>
<td><a href="http://www.bomalearning.com/hsa2">http://www.bomalearning.com/hsa2</a></td>
</tr>
</tbody>
</table>
| AEEO | Professionals seeking training and/or CEU/PHDs for maintaining professional certification. | Course #1: Building Automation and Control System Review  
Course #2: HVAC Fundamentals: Control Systems | Course #1: $585  
Course #2: $100 | Online | | [http://www.energyscholar.com/seminars/seminar_description.cfm?id=83](http://www.energyscholar.com/seminars/seminar_description.cfm?id=83)  
[http://www.energyscholar.com/seminars/seminar_description.cfm?id=50](http://www.energyscholar.com/seminars/seminar_description.cfm?id=50) |
| SEMAC | Those that are interested in expanding their knowledge and initiatives into sustainable energy managemen or are interested in changing careers. | Two courses with dedicated to control fundamentals and control strategies.  
Course #1: Energy Systems (CESA 3500)  
Course #2: Energy Audit (CESA 5500) | Course #1: $837.89  
Course #2: $551.78 | Online | [http://www.bct.ca/study/programs/50_79Seminar](http://www.bct.ca/study/programs/50_79Seminar) |
| Custom Dollars to Sense Workshop | Staff who make energy-related decisions within your organization such as building operators, energy managers and specialists. | Focuses on identifying opportunities to save on energy used and reduce energy costs. Main topics include: Control Basics, DDC Strategies and DDC Maintenance | $150-300 per person for a class of 20  
1½ to 1 day workshop | On-site | [http://www.nrcan.gc.ca/energy/efficiency/industry/training-awareness/5489](http://www.nrcan.gc.ca/energy/efficiency/industry/training-awareness/5489) |
| Schneider Electric Energy University | Staff who need to identify, monitor and manage energy usage in any building or structure. | Offers a high level building controls courses with optional tests. | Free | 15 – 50 minutes per course (3 hours total) | Online | [http://www2.schneider-electric.com/sites/corporate/en/products-services/training/energy-university/energy-university.page](http://www2.schneider-electric.com/sites/corporate/en/products-services/training/energy-university/energy-university.page) |
| DDC Online | DDC Online is a tool to help professionals increase their knowledge about DDC. | The tool contains two main parts:  
Part #1: Generic guide to DDC  
Part #2: DDC information - manufacturer's product list | Free | A few hours of reading material | Online | [http://www.ddc-online.org/default.html](http://www.ddc-online.org/default.html) |
Prism Engineering provides consulting services to address technical, behavioural and organizational aspects of Energy Management.

We design and implement cost effective approaches to address comfort, efficiency and reliability.
Thank you.

@Rob_Prism

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